

BHAVNAGAR MUNICIPAL CORPORATION



**Bid Documents For
Redevelopment Of Traffic Island Circle at Nilambag, Bhavnagar**

NOTICE INVITING TENDER & QUALIFICATION CRITERIA

**EXECUTIVE ENGINEER
Building Department
Bhavnagar Municipal Corporation
Mangalsinhji Road,
Bhavnagar – 364 001**

BHAVNAGARMUNICIPALCORPORATION	
NoticeInvitingOn-LineTender	
TenderNoticeNo. BUILDING / Nilambag Circle / 2025-26	
Department Name	: BuildingDepartment
IFB No.	: BUILDING / Nilambag Circle / 2025-26
Name of Project	: SwarnimJayantiMukhyaMantriShaheriVikasYojna GrantOr S.B.I Grant
Name of Work	: Redevelopment Of Traffic Island Circle at Nilambag, Bhavnagar
Tender Type	: Open – Percentage rate Tender
Estimated Contract Value(INR)	: 4610573.00/- (Excl. of GST)
Period of Completion(in month)	: 09 (NINE) Months including Monsoon period
Bidder Nationality	: LCB (Local Competition Bidding)
Qualification Of Bidder	: Duly registered with R&B in Class "E1" Class & Above
Bid Call (Nos)	: 1
Tender Currency Type	: Single
Tender Currency Settings	: Indian Rupee (INR)
Joint Venture/Consortium	: N.A.
Rebate	: N.A.
Amount Details	
Bid Document Fee	: Rs.1770/- Form of DD only/-
Bid Document Fee Payable To	: Commissioner, Municipal Corporation, Bhavnagar
Bid Security /EMD(INR)	: 46106/- (only D.D.)
Bid Security/EMD in favour of	: Commissioner, Municipal Corporation, Bhavnagar
Tender Dates	
Bid Document Downloading Start Date	: 27/03/2025
BidDocumentDownloadin gEndDate	: 11/04/2025
Pre-BidMeeting&Time	: 02/04/2025, 11.00 Am
LastDate&TimeofOnlineBi dSubmission	: 11/04/2025

Physical Submission of EMD Document Fee PQ Bid & Supporting all documents	:	Dt. 27/03/2025 to Dt. 16/04/2025 up to 17:00pm office of the Executive Engineer, Building Department, BMC-Bhavnagar
Opening of PQ Bid (Online) & Technical Bid	:	Dt. 16/04/2025, 17:45
Penalty	:	0.10 % of contract value per day to the maximum amount of 10% of contract value
Opening of Price Bid (Online)	:	Intimation through letter.
Bid Validity Period	:	180 Days

Qualification of Bidder:

Tenderer shall be required to submit the enlisted documents in hard copy along with the Qualification Bid. If documents are insufficient or it does not match the required criteria mentioned below, then the Price Bid of the tenderer shall not be opened.

Mainly tenderers shall fulfill following Technical & Financial pre-qualification criteria as a main contractor. The tenderer shall fulfill the following all points A to Q requirements / experiences for qualification.

- A. The Bidder must have achieved average annual turnover during last three financial years, ending on 31st March 2024 of Rs. **13.85 LACS.**
- B. The Bidder shall have positive Net worth for latest financial year (2023-24) of Rs. **4.60 LACS** as on 31st March 2024.
- C. The Bidder must have experience of successful completion of similar work on its own in India within last 7 years as on date of bid submission
 - (a) One Project of minimum value Rs. 80% of the Project Value
 - OR
 - (b) Two Projects of minimum value Rs. 50% of the Project Value each
 - OR
 - (c) Three Projects of minimum value 40% of the Project Value of each

Note: Similar work as per mentioned in tender documents in any of government organizations only. like **R&B/Govt./Semi Govt./PSUs/Government Undertaking /Government Companies Department**

- D. Available Bid Capacity (ABC) - must be more than the estimated tender cost. Note: Available Bid Capacity (ABC) will be derived by the following method. $ABC = 2 * A * N - B$

Where,

A = Maximum value of works executed in any one year during the last five years (updated to present price level by applying enhancement factor) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which tenders are invited, i.e. 12/12 = 1.00

B = Value of existing commitments and on-going works to be completed during that next Year (period of completion of the works for which tenders are invited.)

Note: The statements/certificate showing the value of existing commitments and on-going works as well as the stipulated period of completion remaining for each of the works listed should

<p>Remarks</p>	<p>: Only Offer of those shall be opened whose EMD & Tender Fee evidence is received electronically along with the bids. However, for the purpose of realization of Demand Draft, bidders shall send them in original through RPAD/Speed Post/Reg.A.D. so as they reach to the office of Executive Engineers</p> <p>- Building Dept., Bhavnagar Municipal Corporation, Bhavnagar during office hours between Dt. 27/03/2025 to Dt. 16/04/2025. Penetrative action shall be imposed for not submitting the supporting documents in original to E.E. by bidder. All the successful bids, if possible, will be physical document opened on 16/04/2025, 17:15 in presence of tender committee at the City Engineer's Office, Commercial stage will be opened after approved tender document Bhavnagar Municipal Corporation, Bhavnagar. FDR FOR EMD OR SD, OR BANK GAURANTEE issued by state bank of India will not be accepted</p>
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General Terms & Conditions

: Bidders who wish to participate in this E-Tender will have to procure valid digital certificate as per information Technology Act 2000. Bidders can procure this certificate from any of the Government approved certifying agency i.e. (n) CodeSolution.

DOWNLOAD OF TENDER DOCUMENT:

The tender document for this work is available only in digital format which can be downloaded free of cost by the bidder.

SUBMISSION OF TENDER:

Tenderer shall submit their offer in electronic format on above mentioned website on or before the scheduled date and time as mentioned, after Digitally Signing the same.

Bidders shall upload the tender documents after submitting the DD details for tender fees and EMD in form of DD/Bank Guarantee detail online. The Demand Draft toward Tender Document fees can be submitted along with Earnest Money Deposit before the due date as specified above.

This should be as per details given online and it should be drawn before last date of the uploading of the tender.

The intending bidders shall have to submit the following documents in Physical form along with the EMD and tender fees.

- (a) Documents required for evaluation as sought in different annexure duly digitally signed.
- (b) Power of attorney.
- (c) Company's profile and certificate of Registration of company under the law.

The Bidder should submit price Bid digitally only. **Price bid in physical form shall Not be accepted** and any such offer if received by Bhavnagar Municipal Corporation same will be outrightly rejected.

Technical bid in physical form is not required to be submitted by all bidders. However, non-submission of technical bid does not absolve bidders from and liability of the tender. Only successful bidders have to submit the technical bid duly signed in physical form upon intimation from BMC.

OPENING OF TENDER:

The Technical Bid will be opened on the specified date online on website www.tender.nprocure.com Bidders or their representative who wish to participate in

<p>Information for online participation</p>	<ol style="list-style-type: none"> 1. Internet site address for e-Tendering activities will be www.tender.nprocure.com 2. Interested bidders can view detailed tender notice and download tender documents from the above-mentioned website. 3. Bidders who wish to participate in online tender have to register with the website through the "New User Registration" link provided on the home page. Bidder will create login id & password on their own in registration process. 4. Bidders who wish to participate in this tender need to procure Digital Certificate as per Information Technology Act-2000 using that they can digitally sign their electronic bids. Bidders can procure the same from many of the CCA approved certifying agencies, or they may contact (n) code Solution at below mentioned address and they will assist them in procuring the same. Bidders who already have a valid Digital Certificate need not to procure the same. In case bidders need any clarification regarding online participation, they can contact M/S (n) code Solution 301, G.N.F.C. Info Tower, Near Grant Bhagwati Hotel, Ahmedabad 380015, India. Tel: +917926857316 Tel: +917926857317 Tel: +917926857318 E-Mail: URL: www.tender.nprocure.com 5. Bidders who wish to participate in e-Tender need to fill data in predefined forms of tender fee, EMD, PQ (Technical) or experienced details and Price bid only. 6. Bidders should upload scan copies of referenced documents in support of their eligibility of the bid. 7. After filling data in predefined forms bidders need to click on final submission link to submit their encrypted bid. <p>Bidder can also submit Document Fees, EMD, Technical bid document & Reference Documents in hard copy if such instructions are given by tendering authority.</p>
<p>Officer Inviting Bids</p>	<p>Executive Engineer, Building Department, Bhavnagar Municipal Corporation, Bhavnagar.</p>

BidOpeningAuthorityMembersincommittee	(1)AdditionalCityEngineer(2)ExecutiveEngineer(BuildingDepartment.)(3)ChiefAccountant(4)ChiefAuditor
Address	BuildingDepartment,MunicipalCorporation,SirMangalsinhjiRoad,Bhavnagar
ContactPerson	Forfurtherdetailsofanyqueryregardingthetender Contactto: ExecutiveEngineer(BuildingDepartment),BhavnagarMunicipal Corporation., SirMangalsinhji Road, Bhavnagar-364001 Mobilen.8128207404 E-mail: building.bmcgujarat@gmail.com

Date :00/11/2024
Place:Bhavnagar

Executive Engineer
Building Department
Bhavnagar Municipal Corporation

STANDARD BIDDING DOCUMENT PROCUREMENT OF BUILDING WORKS

COMPLETE BIDDING DOCUMENT

BHAVNAGAR MUNICIPAL
CORPORATION BUILDING DEPARTMENT
I

Name Of Work :- Redevelopment Of Traffic Island Circle at Nilambag, Bhavnagar



BHAVNAGAR MUNICIPAL
CORPORATION BUILDING DEPARTMENT
BHAVNAGAR

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INVITATIONFORBID
(IFB)

NATIONAL COMPETITIVE BIDDING

1. The Executive Engineer, Building Department, Bhavnagar Municipal Corporation, Bhavnagar invites bids for the construction of works detailed in the table. The bidders may submit bids for any or all of the following works.

TABLE

Package No.	Name of work	Estimated Cost of Works (Rs.)	Bid Security (EMD) (Rs.)	Cost of Document (Tender Fee)	Period of completion	Class of Registration of Contractors & Special Category Building
1	2	3	4	5	6	7
1	Redevelopment of Traffic Island Circle at Nilambag, Bhavnagar	Rs. 46,10,573 (Without GST)	Rs. 46,106.00 Only DD	Rs. 1770/-	09 (NINE Months)	"E-1" Class & Above

2. Prospective/Interested bidder may download the Bid Documents from **Dt. Asper NIT Till 00:00 Hours** website <https://www.tender.nprocure.com> free of cost till the Time and Date as mentioned on online NIT at website <https://www.tender.nprocure.com>.
3. However, Bidder who is submitting the Bid Online will have to pay the Bid Document Fee / Tender Fee through Demand Draft only of any Schedule Bank payable **at Bhavnagar** and in favor of **Commissioner, Bhavnagar Municipal Corporation**. Once the Bid is received online, Bid Document / Tender Fee will not be refundable.

The Demand Draft for Bid Document / Tender fee and FDR / Bank Guarantee against Bid Security / EMD shall be submitted in electronic format through online (by scanning) while uploading the bid, this submission shall mean that bid document / tender fee and Bid Security / EMD has been received. Accordingly, the offer of only those shall be opened whose Bid Document / Tender Fee and Bid Security / EMD have been received electronically. However, for the purpose of realization of Demand Draft, and FDR / Bank Guarantee bidders shall send the same in original through R.P.A.D. so as to reach to **Executive Engineer, Building Dept. Bhavnagar Municipal Corporation (BMC), Bhavnagar**. within stipulated time as per tender NIT.

Penalitive action for not submitting Demand Draft / FDR / Bank Guarantee in original to **Executive Engineer** / Tender Inviting Authority, BMC by bidders shall be initiated.

4. Bids received online, will be opened on the time, date and place as specified in the online NIT at website <https://www.tender.nprocure.com> in the presence of the bidders or their authorized representatives, who wish to remain present. If the office happens to be closed on the day of opening of the bids as specified, the bid will be opened on the next working day at the same time and venue.
5. A pre bid meeting will be held on **Dt. Asper NIT ...hrs. at the office of City Engineer, Office. (BMC) at Bhavnagar** to clarify the issues and to answer

question on any matter that may be raised at that stage as stated in clause 9.2 of 'instructions to Bidders' of the bidding documents.

6. Bid Security (EMD) is equal to 1% i.e. **46,106.00** of Estimated Amount put to bid / tender and should be rounded off to the next thousand rupees.
7. Other Information is as under:
 - A. Agencies can prepare and edit their offers a number of times before the end of the tender submission date and time. After the tender submission date and time, the bidder cannot modify / edit / withdraw their submitted offer in any case. No written or online request in this regard shall be granted.
 - B. Offers in physical form will not be accepted in any case.
 - C. Demand Draft purchased by the other than bidder and issued after the last date of submission of Bids, will not be considered or accepted.
 - D. The cost incurred by the contractor for this offer for clarification or attending discussion, conferences or site visits will not be reimbursed by the Employer or Engineer-in-Charge.
 - E. Conditional tenders shall not be accepted.
 - F. Any changes, addition, alternation made in the prescribed form attached with tender are liable to be rejected.
 - G. Any change in format or conditional Bank Guarantee will not be accepted and the bidder will be considered non-responsive.
 - H. All the bidders are instructed to fill in information strictly in accordance with the format given in the checklist/qualification document/tender document.
 - I. It is mandatory for the bidders to supply each and every information as asked strictly in electronic format at appropriate places only.
 - J. Blank / insufficient information shall be treated as nil information and shall result in disqualification.
 - K. Even if the bidder has been qualified in a similar or larger size of project in the past, it shall not be deemed to be a ground / reason for not giving required information for this work/bid.
 - L. Information supplied for earlier projects shall not be considered while evaluation of this bid. The Government will not ask for any other information, unless it is found absolutely necessary by the competent authority.
 - M. If found necessary, the contractor will be intimated for negotiation,

For the works costing up to 7.5 crore (ROAD), 7.0 crore (BUILDING & BRIDGE) kindly refer to SSR-10-2015-17-C dated 03-02-2017

For the works costing under 7.5 crore for Road Works and 7.0 crore for Building and Bridge Works following documents shall be submitted in electronic format only through online by scanning and the (i) Bid Document Fee / Tender Fee (ii) Bid Security / EMD should be sent in original to the Tender opening authority through RPAD, so as to reach the **Executive Engineer** within 7 days from last day of submission of Bid.

- (i) BidDocumentFee/Tender Fee **From Bidders A/C Only**
- (ii) Bid Security / EMD or Valid EMD Exemption Certificate of Appropriate Class of Registration of Approved Contractors
- (iii) Registration Certificate **"E-1" Class & Above**

- (iv) Registration Certificate
- (v) GST Number & PAN Number
- (vi) Solvency Certificate (for current calendar year)
- (vii) A solvency certificate of an Amount of 20% (Twenty Percent) of estimated cost put to tender will have to be produced along with tender. It shall be of Scheduled Bank or Nationalized Bank or Bank Approved for Government business. Solvency Certificates shall have validity of same calendar year as that of date in which tender is issued.
- (viii) Successful Experience Work Completion Form 3A
- (ix) Anti-Blacklisting Affidavit with notarized (On non-judicial Stamp Paper of Rs. 300, as per Annexure-7)
- (x) Turnover of Last Five years i.e. 2019-20 to 2023-24
- (xi) EPF Registration Number & ESIC Registration Number
- (xii) Bid Capacity
- (xiii) Litigation History

SECTION-1
INSTRUCTIONS TO
BIDDERS(ITB)

Section 1: Instruction to Bidders

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A.GENERAL

1. Scope of Bid

1.1 The Executive Engineer, Building Dept. Bhavnagar Municipal Corporation(BMC), invites bids for the Redevelopment Of Traffic Island Circle at Nilambag, Bhavnagar detailed in the table given in IFB. The bidders may submit bids for any or all of the works detailed in the table given in IFB.

1.2 The successful bidder will be expected to complete the works by the intended completion date specified in the Contract data.

1.3 Throughout these bidding documents, the terms 'bid' and 'tender' and their derivatives (bidder/tenderer, bid/tender, bidding/tendering, etc.) are synonymous.

2. Source of Funds

2.1 SJMMSY Grant OR S.B.I Grant.

3. Eligible Bidders

3.1 This Invitation for Bids is open to all eligible bidders.

3.2 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a statement that the Bidder is neither associated, nor has been associated, directly or indirectly, with the consultant or any other entity that has prepared the design, specifications, and other documents for the Project or being proposed as Project Manager for the Contract. A firm that has been engaged by the Employer to provide consulting services for the preparation or supervision of the works, and any of its affiliates, shall not be eligible to bid.

4. Qualification of the Bidder

4.1 All bidders shall provide in Section 2, Forms of Bid and Qualification Information, a preliminary description of the proposed work method and schedule, including drawings and charts, as necessary. The proposed methodology should include a program of construction backed with equipment planning and deployment duly supported with broad calculations and quality assurance procedures proposed to be adopted justifying their capability of execution and completion of work as per technical specifications, within stipulated period of completion.

4.2 Deleted

4.3 Deleted

4.4 Deleted

#4.5 QUALIFICATION CRITERIA:

Tenderer shall be required to submit the enlisted documents in hard copy along with the Qualification Bid. If documents are insufficient or it does not match the required criteria mentioned below, then the Price Bid of the tenderer shall not be opened.

Mainly tenderer shall fulfill following Technical & Financial pre-qualification criteria as a main contractor. The tenderer shall fulfill the following all points.

The Bidder must have achieved average annual turnover during last three financial years, ending on 31st March 2024, 30% of Estimated cost.

Mainly tenderer shall fulfill following for pre-qualification,

- (a) Experience of having successfully completed "similar works" during last 05 years either of the following:
- (1a) Three similar completed works, each costing not less than an amount equal to 40% of the Estimated Cost.
OR
- (2a) Two similar completed works, each costing not less than an amount equal to 50% of the Estimated Cost.
OR
- (3a) One similar completed works, each costing not less than an amount equal to 80% of the Estimated Cost.

Similar work shall mean "Similar Work" Means completed civil work as main work and other one garden development work of any amount. in R&B /Govt. /Semi Govt. / PSUs / Government Undertaking / Government Companies DEPARTMENT."

E. Available Bid Capacity (ABC) - must be more than the estimated tender cost. Note: Available Bid Capacity (ABC) will be derived by the following method. ABC is calculated as $ABC = 2 * A * N - B$
Where,

A = Maximum value of works executed in any one year during the last five years (updated to present price level by applying enhancement factor) taking into account the completed as well as works in progress.

N = Number of years prescribed for completion of the works for which tenders are invited. i.e. 12/12 =

1.00 B = Value of existing commitments and on-going works to be completed during that next N year (period of completion of the works for the tenders are invited.)

Note: The statements/certificate showing the value of existing commitments and ongoing works as well as the stipulated period of completion remaining for each of the works listed should be signed by the respective Employer or his authorized representative, not below the rank of an Executive Engineer or equivalent.

F. The cost of materials supplied by the Government / Clients shall not be taken into account for experience purpose.

G. An attested copy of registration with R&B etc. Registration required: "E-1" Class & Above. Bank Solvency of 2024-25, amounting 20% of estimated cost put to tender of any Nationalized / Scheduled Bank except Co-operative Bank.

(Applicable for the works which require Post Qualification)

4.5.1 Qualification will be based on Applicant's meeting all the minimum pass/ fail criteria regarding the Applicant's general and particular experience, personnel and equipment capabilities and financial positions, as demonstrated by the applicant's responses in the forms attached to the letter of application (~~specified requirement for joint ventures are given under para 4.6 below~~) Subcontractors experience and resources shall not be taken into account in determining the applicant's compliance with the qualifying criteria

To qualify for more than one contract, the applicant must demonstrate having experience and resources sufficient to meet the aggregate of the qualification criteria for each contract given in paragraphs 4.5.4, 4.5.5 and 4.5.9 below

4.5.2 Base year and Escalation

The base year shall be taken as Current financial year

Following enhancement factors will be used for the costs of works executed and the financial figure to a common base value for works completed in India.

<u>Year</u>	<u>FinancialYear</u>	<u>Multiplyingfactor</u>
Baseyearofinvitingtender	2024-2025	1.00
-1	2023-2024	1.10
-2	2022-2023	1.21
-3	2021-2022	1.33
-4	2020-2021	1.46
-5	2019-2020	1.61

Applicant should indicate actual figures of costs and amount for the work executed by them without accounting for the above-mentioned factors.

In case the financial figures and value of completed works are in foreign currency the above enhanced multiplying factors will not be applied. Instead, the current market exchange rate (State Bank of India BC Selling rate as on the last date of submission of the bid) will be applied for the purpose of conversion of the amount in foreign currency into India rupees.

4.5.3. General Experience.

The Applicants shall meet with the following minimum criteria:

(a) **Annual Turn Over**

Achieved a minimum annual financial turnover (defined as billing for works in progress and completed in all classes of civil engineering construction work only) in any one year, over the last five years of the annual value of contract / contracts applied for.

Annual Turn Over shall be more than 30% of project cost (i.e. AS PER NIT) (for guidance of deriving X the value of X shall be derived by dividing amount put to tender by the time limit expressed in years for the project / work.)

Joint Venture Not Allowed.

4.5.4. Personnel Capabilities.

Availability for his work of personnel with adequate experience as required; as per Appendix.

4.5.5. Equipment Capabilities

Based on the studies carried out by the Engineer, the minimum suggested major equipment to attain the completion of works in accordance with the prescribed construction schedule are shown in the Appendix.

The bidders should, however, undertake their own studies and furnish with their bid, a detailed construction planning and methodology supported with layout and necessary drawings and calculations to allow the employer to review their proposals. The numbers, types and capacities of each plant/equipment shall be shown in the proposals along with the cycle time for each operation for the given production capacity to match the requirements.

4.5.6. Financial Position

The Applicant should give undertaking that he has access to, or has available, liquid assets (aggregate of working capital, cash in hand and uncommitted bank guarantees) and / or credit facilities up to **25 percent of the value of the contract/contracts applied.**

4.5.7. The audited balance sheets for the last five years should be submitted, which must demonstrate the soundness of the applicant's financial position, showing long-term profitability including an estimated financial projection for the next two years, if necessary, the employer will make inquiries with the applicant's bankers.

4.5.8. Litigation History

The Applicant should provide accurate information on any litigation or arbitration resulting from contracts completed or under execution by him over the last five years. A consistent history of awards against the Applicant or any partner of a joint venture may result in failure of the applicant.

4.5.9. Disqualification

Even though the applicants meet the above criteria, they are subject to be disqualified if they have:

Made misleading or false representation in the forms, statements submitted, and / or Record of poor performance such as abandoning the work, rescinding of contract for which the reasons are attributable to the non-performance of the contractor; consistent history of litigation awarded against the applicant or financial failure due to bankruptcy. ~~The rescinding of contract of a joint venture on account of reasons other than non-performance, such as Most Experienced partner of joint venture pulling out, court directions leading to breaking up of a joint venture before the start of work, which are not attributable to the poor performance of the contractor will, however, not affect the qualification of the individual partners.~~

#4.6 JOINT VENTURE: (Maximum 2 Members i.e. 1 Lead & 1 Others)(Applicable only for estimated project cost of 50 Crore and above)

4.6.1. Joint ventures must comply with the

following requirement:(a)

Following are the minimum qualification requirements:

(i) The lead partners shall meet not less than 51 percent of all criteria given in para 4.5.3(a) Annual Turn Over 4.5.3(b) Successful Experience V-I & 4.5.6 above. The joint venture must collectively satisfy the criteria of para 4.5.3 & 4.5.6 above. The experience of the other joint venture partners shall be considered if it is not less than 30 percent of the qualifying criteria in para 4.5.3 & 4.5.6 above.

(ii) Individually each member must satisfy the requirements of para 4.5.3(a), 4.5.3.(b), 4.5.7, 4.5.8 above and 4.7 below.

(b) Bid shall be signed so as to legally bind all partners, jointly and severally, and shall be submitted with a copy of the joint venture agreement providing the joint and severall liabilities with respect to the contract.

4.6.2. Qualification of a joint venture does not necessarily qualify any of its partners individually or as a partner in any other joint venture. In case of dissolution of a joint venture, each one of the constituent firms may qualify if they meet all the qualification requirements, subject to the written approval of the Employer.

4.7. Bid Capacity.

Applicants who meet the minimum qualification criteria will be qualified only if their available bid capacity at the expected time of bidding is more than the total estimated cost of the works. The available bid capacity will be calculated as under:

Assessed Available Bid Capacity = (A * N * 2 - B), where

A = Maximum value of work executed in any one year during the last five financial years i.e. from 2019-20 to 2023-24 (updated to the price level of the year indicated in appendix) taking into account the completed as well as works in Progress.

B = Value at current price level of the existing commitments and ongoing work to be completed during the next **9 Months** (period of completion of work for which bids are invited); and

N = Number of years prescribed for completion of the works for which the bids are invited.

Note :- In Case of joint venture, the available bid capacity will be applied for each partner to the extent of his proposed participation in the execution of the work. Some of the bid capacity of all the members shall be more than 4.7.

4.8 Even though the bidders meet the above qualifying criteria, they are subject to be disqualified if they have:

- Made misleading or false representation in the forms, statements and Attachments submitted in proof of the qualification requirements; and/or
- Record of poor performance such as abandoning the works, not properly completing the contract, inordinate delay in completion, litigation history, or financial failures etc.; and/or
- Participated in the previous bidding for the same work and had quoted unreasonably high bid prices and could not furnish rational justification to the employer.

5. One bid per bidder

5.1. Each bidder shall submit only one bid for one package. A bidder who submits or participates in more than one bid (other than as a subcontractor or in cases of alternatives that have been permitted or requested) will cause all the proposals with the bidder's participation to be disqualified.

6. Cost of Bidding

6.1. The bidder shall bear all costs associated with the preparation and submission of his Bid, and the Employer will in no case be responsible and liable for those costs.

7. Site Visit

7.1. The Bidder, at the Bidder's own responsibility and risk is encouraged to visit and examine the Site of work and its surrounding and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The cost of visiting the sites shall be at the Bidder's own expense.

8. Bidders Registration Class and Building Category

8.1. Registration certificate of R & B Registered in **"E-1" Class and Above** R & B Department / Water Resources Department, The contractors, who are registered in appropriate category of C.P.W.D., M.E.S., Railways and Indian State Governments, can also bid provided the bidder produce such registration certificate at the time of bidding and obtain and submit registration in required class & category from the **BUILDING WORK R & B / Govt. / Semi Govt. / PSUs / Government Undertaking / Government Companies DEPARTMENT** before issue of work order in case they emerge as L-1 Bidder. Bidder will solely be responsible for obtaining and submitting the certificate before issue of work order.

B. BIDDING DOCUMENTS

9. Content of Bidding Documents

9.1 The set of bidding documents comprises the documents listed below and addenda issued in accordance with Clause 10:

Section	Particulars	Volume No.
-	Invitation for Bids	I
1	Instructions to Bidders	
2	Qualification Information, and other forms	
3	Conditions of Contract	
4	Contract Data	
5	Technical Specifications	II
6	Form of Bid	III
7	Bill of Quantities	
8	Securities and other forms	
9	Drawings	IV
10	Documents to be furnished by bidder	V

9.2 Volumes I, II, III and IV are available online and documents to be furnished by the bidder in compliance to section 2 will be prepared by him and furnished as Volume-V in two parts (refer clause 12).

9.3 The bidder is expected to examine carefully all instructions, conditions of contract, contract data, forms, terms, technical specifications, bill of quantities, forms, Annexes and drawings in the Bid Document. Failure to comply with the requirements of Bid Documents shall be at the bidder's own risk. **Pursuant to clause 26 hereof** bids which are not substantially responsive to the requirements of the Bid Documents shall be rejected.

10. Clarification Bidding Documents

10.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or through E-mail at the Employer's address indicated in the invitation to bid. The Employer will respond to any request for clarification which he received earlier than 15 days prior to the deadline for submission of bids. Employer's response will be published on website including a description of the enquiry but without identifying its source.

10.2 Pre-bid meeting

10.2.1 The bidder or his official representative is invited to attend a pre-bid meeting which will take place at the address, venue, time and date as indicated in the NIT.

- 10.2.2. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 10.2.3. The bidder shall be required to submit any questions in writing or e-mail to reach the Employer not later than 03 days before the meeting.
- 10.2.4. Minutes of the meeting, including the question raised (Without identifying the source of enquiry) and the responses given will be published without delay on the tender website i.e. www.tender.nprocure.com. Any modification of the bidding documents listed in sub-Clause 8.1 which may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to Clause 10 and not through the minutes of the pre-bid meeting.
- 10.2.5. Non-attendance at the pre-bid meeting will not be a cause for disqualification of a bidder.

11. Amendment of Bidding Documents

- 11.1. Before the deadline for submission of bids, the Employer may modify the bidding documents by issuing addenda.
- 11.2. Any addendum thus issued shall be part of the bidding documents. The Employer will assume no responsibility for the same.
- 11.3. To give prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at his discretion, extend as necessary the deadline for submission of bids, in accordance with Sub-Clause 20.2 below.

C. PREPARATION OF BIDS

12. Language of the Bid

12.1 All documents relating to the bid shall be in the English language.

13. Documents Comprising the Bid

13.1. The bid to be submitted by the bidder as Volume V of the bid document (refer Clause 8.1) shall be in two separate parts:

Part I shall be named "Technical Bid" and shall comprise

- (i) Bid Security in the form specified in Section 8
- (ii) Qualification Information and supporting documents as specified in Section 2
- (iii) Certificates, undertakings, affidavits as specified in Section 2
- (iv) Any other information pursuant to Clause 4.5 of these instructions
- (v) Undertaking that the bid shall remain valid for the period specified in Clause 15.1

Part II shall be named "Financial Bid" and shall comprise

- (i) Form of Bid as specified in Section 6
- (ii) Priced Bill of Quantities for items specified in Section 7

13.2. The Bidder shall submit the details/information pertaining to each part i.e. technical as well as financial and must be submitted online only.

13.3. Following documents will be deemed to be part of the bid.

Section	Particulars	Volume No.
	Invitation for Bids (IFB)	
1	Instruction to Bidders	Volume I
3	Conditions of Contract	
4	Contract Data	
5	Specifications	Volume II
9	Drawings	Volume IV

14. Bid Prices

14.1 The Contract shall be for the whole works as described in Sub-Clause 1.1, based on the priced Bill of Quantities submitted by the Bidder.

14.2 The bidder shall fill in rates and prices and line item total (both in figures and words) for all items of the Works described in the Bill of Quantities along with total bid price

(Both in figures and words). Items for which no rate or price is entered by the bidder will not be paid for by the Bill of Quantities.

14.3 All duties, taxes, and other levies **except GST** payable by the contractor under the contract, or for any other cause shall be included in the rates, prices and total Bid Prices submitted by the Bidder. **(GST will be paid extra)**

14.4 Deleted

14.5 The rates and prices quoted by the bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 47 of the Condition of Contract **(Irrespective of the time limit and Bid Amount)**

15. Currencies of Bid and Payment

15.1 The unit rates and the prices quoted by the bidder shall be entirely in Indian Rupees. All payments shall be made in Indian Rupees.

16. Bid Validity

16.1 Bid shall remain valid for a period of **not less than 180** days from the date of technical bid opened.

16.2 In exceptional circumstances, prior to expiry of the original time limit, the Employer may request that the bidders may extend the period of validity for a specified period. A bidder may refuse the request without forfeiting his bid security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his security for a period of the extension, and in compliance with Clause 16 in all respects.

#16. Bid Security

16.1 The Bidder shall furnish, as part of his Bid, a Bid security in the amount as shown in column 4 of the table of IFB for this particular work. This Bid security shall be in favor of Employer as named in Appendix and may be in one of the following forms;

a. Bank Guarantee from any scheduled Indian bank, in the format given in Volume III. **(Bank Guarantee is applicable only for Bid Estimated Amount of 01 Crore and above) and Bank Guarantee of Schedule and Private Banks shall be considered as per GoG Finance Department's Circular No. FD/MSM/e-file/4/2023/0057/D.M.O. Date 21/04/2023 or as per their latest amendment.**

b. Fixed Deposit Receipt issued by any Scheduled Indian Bank or a foreign Bank approved by the Reserve Bank of India.

OR

A Valid Bid Security / EMD Exemption Certificate issued by (1) Road & Building Department or (2) Narmada Water Resources, Water Supply and Kalpsar Department of Govt of Gujarat. **Exemption Certificate is applicable only when Registration Certificate of Appropriate Class and Category of Approved Contractors is required as eligible criteria of bidder.**

- 16.2. Bank guarantees (and other instruments having fixed validity) issued as surety for the bid shall be valid for 45 days beyond the validity of the bid i.e. total validity of $180+45=225$ Days
- 16.3. Any bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 16.1 and 16.2 above shall be rejected by the Employer as non-responsive.
- 16.4. The Bid Security of unsuccessful bidders will be returned within 28 days of the end of the bid validity period specified in Sub-Clause 15.1
- 16.5. The Bid Security of the successful bidder will be discharged when the bidder has signed the Agreement and furnished the required Performance Security.
- 16.6. The bid Security may be forfeited
- (a) If the Bidder withdraws the bid after Bid opening during the period of Bid validity.
 - (b) If the Bidder does not accept the correction of the Bid Price, if any or
 - (c) In the case of a successful Bidder, if the Bidder fails to comply with the specified time limit to
 - (i) Sign the Agreement; or
 - (ii) Furnish the required Performance Security.
 - (d) #If found necessary, the bidder will be intimated for negotiation, He will be intimated maximum three times within the validity period for negotiation, If contractor does not respond in time, his Bid Security (EMD) will be forfeited and his tender will be rejected. Punitive action will be taken on such contractors. (As per GoGR & B Dept's Gr.No.S/22/2017/6369/D, Dt.08/06/2018)

17. Alternative Proposals by Bidders.

17.1. Bidders shall submit offers that fully comply with the requirements of the bidding documents, including the conditions of contract (including mobilization advance or time for completion), basic technical designs as indicated in the drawing and specifications. Conditional offers or alternative offers will not be considered further in the process of tender evaluation.

18. Format and Signing of Bid

18.1. The Bidder shall prepare documents comprising the bid as described in Clause 12 of these Instructions to bidder as the "Technical Bid" and "Financial Bid" in separate parts to be uploaded.

D. SUBMISSION OF BIDS

19. Deleted

20. **Deadline for Submission of the Bids**

20.1. Complete Bids must be received online by the Employer at the tender website specified above not later than the date indicated in appendix.

20.2. The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 10, in which case all right and obligation of the Employer and the bidders previously subject to the original deadline will then be subject to the new deadline.

21. Deleted

22. **Modification and Withdrawal of Bids**

22.1. Bidders may modify or withdraw their bids online before the deadline prescribed in Clause 20 or pursuant to Clause 23.

22.2. Deleted

22.3. No bid shall be modified or withdrawn after the deadline for submission of Bid.

22.4. Withdrawal or modification of a bid between the deadline for submission of bids and the expiration of the original period of bid validity specified in Clause 15.1 above or as extended pursuant to Clause 15.2 may result in the forfeiture of the Bid security pursuant to Clause 16.

E. BID OPENING AND EVALUATION

23. Bid Opening

- 23.1. The Employer will open all the Bids received including modifications made pursuant to Clause 22, in the presence of the Bidders or their representatives who choose to attend at time, date and the place specified in Appendix in the manner specified in Clauses 20 and 23.3. In the event of the specified date of Bid opening being declared a holiday for the Employer, the Bids will be opened at the appointed time and location on the next working day.
- 23.2. Deleted.
- 23.3. The "Technical Bid" shall be opened. The amount, form and validity of the bid security furnished with each bid will be announced. If the bid security furnished does not conform to the amount and validity period as specified in the invitation for bid (ref. Column 4 and paragraph 3), and has not been furnished in the form specified in Clause 16, the technical bid will not be opened.
- 23.4. (i) Subject to confirmation of the bid security by the issuing Bank, the bids accompanied with valid bid security will be taken up for evaluation with respect to the Qualification information and other information furnished in part I of the bid pursuant to Clause 12.1.
- (ii) If required, the bidder will be asked in writing to clarify his Qualification Documents with respect to any required clarification.
- (iii) The bidders will respond in not more than 7 days of issue of the clarification letter.
- (iv) Immediately (usually within 3 or 4 days), on receipt of these clarifications the Evaluation Committee will finalize the list of responsive bidders whose financial bids are eligible for consideration.
- 23.5. Deleted
- 23.6. At the time of opening of "Financial Bid", the names of the bidders were found responsive in accordance with Clause 23.4(iv) will be announced. The bids of only these bidders will be opened. The responsive Bidders' names, the Bid prices, the total amount of each bid, any discount and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening.
- 23.7. At the time of opening of "Financial Bid", the names of the bidders were found responsive in accordance with Clause 23.4(iv) will be announced. The bids of only these bidders will be opened. The responsive Bidders' names, the Bid prices, the total amount of each bid, any discount, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening.
- 23.8. In case bids are invited for more than one package, the order for opening of the "Financial Bid" shall be in order of Estimated amount of Bids from highest to lowest.
- 23.9. The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with Sub-Clause 23.6.

24 ProcesstobeConfidential

24.1 Information relating to the examination, clarification, evaluation, and comparison of Bids and recommendations for the award of a contract shall not be disclosed to Bidders or any other persons not officially concerned with such process until the award to the successful Bidder has been announced. Any effort by Bidder to influence the Employer's processing of Bids or award decisions may result in the rejection of his Bid.

25. ClarificationofFinancialBids

~~25.1~~ To assist in the examination, evaluation, and comparison of Bids, the Employer may, at his discretion, ask any Bidder for clarification of his Bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing or by e-mail, but no change in the price or substances of the Bid shall be sought, offered,
or permitted except as required to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids.

25.2 Subject to sub-clause 25.1, no Bidders shall contact the Employer on any matter relating to his Bid opening to the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Employer, it should do so in writing.

25.3. Any effort by the Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decision may result in the rejection of the Bidders' bid.

26. ExaminationofBidsandDeterminationofResponsiveness

26.1 During the detail evaluation of "Technical Bid", the Employer will determine whether each Bid (a) meets the eligibility criteria defined in Clause 3 and 4; (b) has been properly signed; (c) is accompanied by the required securities and; (d) is substantially responsive to the requirements of the Bidding document. During the detailed evaluation of the "Financial Bid", the responsiveness of the bids will be further determined with respect to the remaining bid conditions, i.e., priced bill of quantities, technical specifications, and drawings.

26.2 A substantially responsive "Financial Bid" is one which confirms all the terms, conditions and specifications of bidding documents, without material deviation or reservation. A material deviation or reservation is one (a) which affects in any substantial way the scope, quality, or performance of the Works; (b) which limits in any substantial way, inconsistent with the Bidding documents, the Employer's rights or the Bidder's obligations under the Contract; or (c) whose rectification would affect unfairly the competitive position of other Bidders presenting substantially responsive Bids.

26.3 If a "Financial Bid" is not substantially responsive, it will be rejected by the Employer, and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

27. Deleted

28. Deleted

29. Evaluation and Comparison of Financial Bids

~~29.1.~~ The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Sub-Clause 26.2.

~~29.2.~~ Deleted.

~~29.3.~~ The Employer reserves the right to accept or reject any variation or deviation. Variations and deviations and other factors, which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the Employer, shall not be taken into account in Bid evaluation.

~~29.4.~~ The estimated effect of the price adjustment conditions under Clause 47 of the Conditions of Contract, during the period of implementation of the Contract, will not be taken into account in Bid evaluation.

~~29.5.~~ If the Bid of the successful Bidder is seriously unbalanced in relation to the Engineer's estimate of the cost of work to be performed under the contract the Employer may require the Bidder to produce detailed consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Employer may require that the amount of the performance security set forth in Clause 34 be increased at the expense of the successful /bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

~~29.6.~~ A bid which contains several items in the bill of Quantities which are unrealistically priced low and which cannot be substantiated satisfactorily by the bidder may be rejected as non-responsive. (Applicable for item rate tender only)

30. Deleted

F. AWARD OF CONTRACT

31. Award Criteria

~~31.1.~~ Subject to Clause 32, the Employer will award the contract to the Bidder whose Bid has been determined.

- (i) to be substantially responsive to the Bidding documents and who has offered the lowest evaluated Bid Price; and
- (ii) to be within the available bid capacity adjusted to account for his bid price which is the lowest evaluation in any of the packages opened earlier than the one consideration.

In no case, the contract shall be awarded to any bidder whose available bid capacity is less than the evaluated bid price, even if the said bid is the lowest evaluated bid. The contract will in such cases be awarded to the next lowest bidder at this evaluation bid price.

32. Employer's Right to Accept any Bid and to Reject any or all Bids

~~32.1.~~ Notwithstanding Clause 31, the Employer reserves the right to accept or reject any Bid, and to cancel the Bidding process and reject all Bids, at any time prior to the award of contract, without thereby incurring any liability to the affected bidder or Bidder or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

33. Notification of Award and Signing of Agreement

~~33.1.~~ The Bidder whose Bid has been accepted will be notified of the award by the Employer prior to expiration of the Bid validity period by cable, telex or facsimile confirmed by registered letter. This letter (hereinafter and in the condition of contract called the "Letter of Acceptance") will state the sum that the Employer will pay the Contractor in consideration of the execution, completion, and maintenance of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Contract called the "Contract Price").

33.2 The notification of award will constitute the formation of the contract, subject only to the furnishing of a performance security in accordance with the provisions of Clause.

33.3 The Agreement will incorporate all agreements between the Employer and the successful Bidder. It will be signed by the Employer and to the successful Bidder, within 28 days following the notification of award along with the Letter of Acceptance. Within 21 days of receipt, the successful Bidder will sign the Agreement and deliver it to the Employer.

33.4 Upon the furnishing by the successful Bidder of the Performance Security, the Employer will promptly notify the other Bidder that their Bid has been unsuccessful.

34 Security Deposit

(Total 5.0% of contract value, This will be deposited as under) Initial S.D. @ 2.50% of contract value 2.50% of contract value (Not less than EMD) in cash or in the form of pay order/DD/FDR/Bank Guarantee (From the Nationalized Bank

Encashable at BHAVNAGAR Only)

To be deducted from current bill at: value 10.00% to build up remaining Of SD value	2.50% of contract
Total deposit at 5.00% of contract value	5.00% of contract

B. Performance Guarantee

Performance Guarantee @ 5.00% of actual work amount in form of F.D.R. of Nationalized or Scheduled bank / N.S.C. / Narmada bond pledged in favour of Commissioner, Municipal Corporation, Bhavnagar. (To be submitted on completion of work & before final payment) Performance guarantee will be released after defect liability period is over.

34. Performance Security

~~34.1. (A) Within 10 (Ten) days of receipt of Letter of Acceptance, the successful Bidder shall furnish to the Employer an irrevocable and unconditional guarantee from _____~~

~~a Bank in the form set forth in Section 8 (the "Performance Security") for an amount equal to 5% (five percent) of its Contract Price. In case of bids mentioned below, the successful Bidder, along with the Performance Security, shall also furnish to the Authority an irrevocable and unconditional guarantee from a Bank in the same form given at Section 8 towards an Additional Performance Security (The "Additional Performance Security") for an amount calculated as under:~~

- ~~(a) If the Contract Price offered by the Selected Bidder is lower than 10% but up to 20% of the Estimated Project Cost, then the Additional Performance Security shall be calculated @ 20% of the difference in the (i) _____ Estimated Project Cost (as mentioned in Bid Document) - Minus 10% of the Estimated Project Cost and (ii) Contract Price offered by the Selected Bidder.~~
- ~~(b) If the Contract Price offered by the Selected Bidder is lower than 20% of the Estimated Project Cost, then the Additional Performance Security shall be calculated @ 30% of the difference in the (i) Estimated Project Cost (as mentioned in Bid Document) - Minus 10% of the Estimated Project Cost and (ii) Contract Price offered by the selected Bidder.~~
- ~~(c) This Additional Performance Security shall be treated as part of the Performance Security.~~

~~(B) The Performance Security shall be valid beyond 60 (sixty) days of the Defects Liability Period and the Additional Performance Security shall be valid beyond 28 (twenty-eight) days of Project Completion Date.~~

~~34.2. If the performance security is provided by the successful Bidder in the form of a Bank Guarantee, it shall be issued either (a) at the Bidder's option, by a Nationalized / Scheduled Indian bank or (b) by a foreign bank located in India and acceptable to the Employer. As per GoG Finance Department's Circular No. FD/MSM/e-file/4/2023/0057/D.M.O. Date 21/04/2023 or as per their latest amendment.~~

~~34.3. Failure of the successful Bidder to comply with the requirement of Sub-Clause 34.1 shall constitute sufficient grounds for cancellation of the award and forfeiture of the Bid Security.~~

~~35~~ **~~Advance Payment and Security~~**

~~35.1~~ The Employer will provide an Advance payment on the Contract Price as stipulated in the Conditions of Contract, subject to maximum amount, as stated in the Contract Data.

36. Deleted

37. Corrupt or Fraudulent Practices

37.1 The Employer will reject a proposal if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in completing for the contract in question and will declare the firm ineligible, either indefinitely or for a stated period of time, to be awarded a contract with National Highways Authority of India/ State PWD and any other agencies, if it at any time determines that the firm has engaged in corrupt or fraudulent practices in completing for the contractor, or in execution.

37.2 Furthermore, Bidders shall be aware of the provision stated in Sub- Clause 59.2 of the Conditions of Contract.

APPENDIX TO ITB

Clause
Reference With
respect
to Section -I

1.	The Name of the Employer is Commissioner Shree, Bhavnagar Municipal Corporation.	[Cl.1.1]
2.	The last five/Seven years. OR (AS PER NIT)	
	2023-2024	
	2022-2023	
	2021-2022	
	2020-2021	
	2019-2020 2018-2019 2017-2018	
3.	This Annual Financial Turnover Amount is Rs.	[Cl.4.5.3(a)]
4.	Value of Work is Rs.46,10,573.00 (without GST)	
5.	Deleted	
6.	Deleted	
7.	N.A.	
8.	Liquid assets and/or availability of credit facilities (i.e. 25% of contract value/ estimated cost) is Rs.11.52Lacs.	[Cl.4.5.6]
9.	Price level of the financial year 2024-25	[Cl.4.5.2]
10.	The pre-bid meeting will take place at.....	[Cl.10.2]
11.	The technical Bid will be opened at the office of the..... on dt. As per NIT	
12.	Address of the Employer: 2 nd Floor, Office of the Executive Engineer, Building Department, Sir Mangal Singhji road, Municipal Corporation Bhavnagar, Main office building, Bhavnagar 364001	
13.	Deleted	
14.	The bid should be submitted latest by As stated on online NIT	[Cl.20.1 & 20.2]
15.	The bid will be opened on dt. As per NIT As stated on online NIT	[Cl.23.1]
16.	The Bank Draft in favour of 'Commissioner Shree, Bhavnagar Municipal Corporation.	
17.	Deleted	
18.	Escalation factors (for the cost of works executed and financial figure to a common base value) for works completed	[Cl.4.5.2]

<u>Year</u>	<u>Financial Year</u>	<u>Multiplying factor</u>
Base year of inviting tender	2024-2025	1.00
-1	2023-2024	1.10

-2	2022-2023	1.21
-3	2021-2022	1.33
-4	2020-2021	1.46
-5	2019-2020	1.61

#LISTOFKEYPLANT& EQUIPMENT TOBEDEPLOYEDONCONTRACTWORK

[ReferenceCL.4.5.5]

The contractors shall also give a list of machineries in his possession and which theyproposetouseonthework.

Sr. No.	Plant orMachine ry	Nos.	Location	Age ofMachine ry(maximum 15years)	Make	Capacity	Approximate Value	Remark
1	2(a)	2(b)	2(c)	3	4	5	6	7
1	TipperTrucks							
2	Concrete mixerwithintegralway batchfacility							
3	NeedleVibrator							
4	SurfaceVibrator							
5	DieselGenerator							
6	ConcreteConveying System andTrolley							
7	Excavator							
8	Steel/Wooden shuttering(Scaffolding,props)							
9	Concretebreaker							
10	Surveying Equipment (TotalStation&Other)							
11	Weldingmachine							
12	BarBendingand Cuttingmachines							
13	Goodsliftfor							
14	Watertanker							

List of Key Personnel to be deployed on Contract

Work(Reference Cl.4.5.4)

#Employment of a qualified site Engineer by the Contractor.

The Contractor shall employ full-time technically qualified staff during the execution of this work as under:-

1. Two graduate Civil Engineers and three diploma Civil Engineers when cost of the work to be executed is more than Rs.50 lakhs.
2. One graduate & two Diploma, Civil Engineers when the cost of the work to be executed is more than Rs.15 lakhs but less than Rs.50 lakhs.
3. Minimum one Diploma Civil Engineer when the cost of work is less than Rs.15 lakhs but more than Rs.5 lakhs.
4. Minimum two Diploma Civil Engineers for the work when the cost of work to be executed is less than Rs. 5 lakhs. The Engineer so employed for the Government work must have sufficient experience to handle the work independently. Such an Engineer shall have to stay at the site of work and he shall not be entrusted with other duty except this work.

Within 15 days of issue of work-order the Contractor will have to furnish to the Deputy Executive Engineer-in-charge of the work the Name, Qualifications, copy of marksheet, Colour Photograph and the appointment order issued such engineers engaged for this contract work. If 15 days after issue of work order such designated Site Engineers do not resume or do not remain present on site of work, the recovery at the rate of Rs.15,000-00 per month per Engineer will be made from the bills/deposit/dues of the contractor. Such recovery shall be non-refundable.

SECTION-2
QUALIFICATIONINFORMATION

QUALIFICATION INFORMATION

The information to be filled in by the Bidder in the following pages will be used for the purpose of post qualification as provided for in Clause 4 of the Instruction to Bidders. This information will not be incorporated in the Contract.

1. For Individual Bidders

1.1 Constitution or legal status of Bidder (Attach Copy)

Place of registration _____

Principal place of business _____

Power of attorney of signatory of Bid

(Attach)

1.2 Total value of Civil engineering constructions Work performed in the last five/seven years (in Rs. Lakhs)

Year	Work done value (in Rs. Lakhs)	Supporting documents certified by CA
2019-20		
2020-21		
2021-22		
2022-23		
2023-24		

1.3.1 Work performed as prime contractor, work performed in the past as a nominated sub-contractor will also be considered the sub-contract involved execution of all main items of work described in the bid documents, provided further that all other qualification criteria are satisfied (in the same name) on works of a similar nature over the last five years** and in current year before the submission of the bid.

Project Name	Name of the Employer	Description of work	Contract No.	Value of contract (Rs. Crore)	Date of issue of work order	Stipulated period of completion	Actual date of completion*	Remarks explaining reasons for delay & work Completed

* Attach certificate(s) from the Engineer(s) in-charge

** Immediately preceding the financial year in which bids are received.

Preferably standard 3-A certificate issued by various government authority/ if work is private it should be by employer and private work should be supported by TDS work order, final bill payment, work order and as instructed in ITB.

#1.3.2 Quantities of work executed as prime contractor, work performed, in the past as anominated sub-contractor, will also be considered provided the sub-contract involved execution of all main items of work described in the bid document, provided, further that all other qualification criteria are called (in the same name and style) in the last five years** and in current year before the submission of the bid.

Year	Name of the work	Name of the Employer	Quantity of work performed (Cum/MT)				Remarks* (indicate contract Ref)
			Cement Concrete (Including RCC & PCC)	Masonry	Earth Works	Bituminous Work	
2023-2024							
2022-2023							
2021-2022							
2020-2021							
2019-2020							

1.4 Information on Bid Capacity (works for which bids have been submitted and works which are yet to be completed) as on the date of this bid.

(A) Existing commitments and on-going works:

Name of Building/Hospital works	Place & State	Contract No.	Name & Address of Employer	Value of Contract (Rs. Cr)	Stipulated Period of Completion	Value of Works* remaining to be completed (Rs. Cr)	Anticipated completion	Remarks
1	2	3	4	5	6	7	8	9

*Attach certificate(s) from the Engineer(s) in-charge

**Immediately preceding the financial year in which bids are received.

1.5 Availability of key items of Contractor's Equipment for carrying out the works (Ref. Clause 4.5.5). The Bidders should list all the information requested below.

Sr. No.	Plant or Machinery	Nos.	Location	Age of Machinery (maximum 15 years)	Make	Capacity	Approximate Value	Remark
1	2(a)	2(b)	2(c)	3	4	5	6	7

- 1.8 Financial reports for the last five years: balance sheets, profit and loss statements, auditors' reports (in case of companies/corporations), etc. List them below and attach copies.
- 1.9 Evidence of access to financial resources to meet the qualification requirements: cash in hand, lines of credit, etc. List them below and attach copied documents.
- 1.10 Name, address, and telephone, mobile number and Email ID of the Bidders bankers whom you provide references if contacted by the Employer.
- 1.11 Information on Litigation history in which the Bidder is involved.

Other Party (ies)	Employer	Cause of Dispute	Amount Involved	Remarks showing Present Status

1.12. Statement of compliance under the requirements of Sub Clause 3.2 of the instruction to Bidders. (Name of Consultant engaged for project preparations*)

1.13 Proposed work method and schedule. The Bidders should attach descriptions, drawings and charts as necessary to comply with the requirements of the Bidding documents. (Refer ITB Clause 4.1)

- 1 Key Plan
- 2 Sectional Elevation
- 3 Campus Layout
- 4 Water Supply & Sewage Points
- 5 Other

1.14 Programme

2. Deleted

3. Additional Requirements

3.1 Bidders should provide any additional information required to fulfill the requirements of Clause 4 of the Instruction to the Bidders, if applicable.

- (i) Affidavit
- (ii) Undertaking

* Fill the name of consultant

**SAMPLE FORMAT FOR EVIDENCE OF ACCESS TO
OR AVAILABILITY OF CREDIT FACILITIES**

(CLAUSE 4.5.6 OF

ITB) BANK CE

R TIFICATE

This is to certify that M/s. _____ is a reputed company
with a good financial standing.

If the contract for the work, namely _____ is awarded to the
above firm, we shall be able to provide overdraft/credit facilities to the extent of
Rs. _____ to meet their working capital requirements for executing the
above during the contract period. Estimated Cost

(Signature) Name

of Bank

Senior Bank Manager

Address of the Bank

APPENDIX-A
(FormNo.3A)(Selfattested)

ReferredtoinRulesNo.1.3.1

DETAILSOFSIMILARWORKCOMPLETED

1. NameofContractor :
2. Name ofWork:
3. EstimatedcostofWorkputtotender:
4. RevisedEstimatedCost :
5. TenderAmount :
6. Date ofStartingtheWork :
7. Dateofcompletionofthework(As percontractagreement):
8. ActualdateoftheCompletionofwork:
9. AmountofActualcompletionofthetotalproject:
A) ElectricalWorkcost:
10. State whether the details as above given by the contractor are correct if not state as to what is thecorrectinformation:
11. State whether the contractor has executed the work in progress. Satisfactory as per specification ifnotgivethecorrectpositionofthework. :
12. Periodrate&amountofcompensationiflevied. :
13. Periodofextensiongrantedifany :
14. Reasonfor delayinggrantedifany :
15. Anyother remarks :

Particularsofworkcompleted:

Date :

-AuthorizedSignature-

ANNEXURE-C

Format: Joint Venture

Referred to in Rules No. 4.6

- (1) The Joint Venture Agreement made and entered into at _____ day of (year) by _____ and between _____.
- a. Firm A (Name with address of the registered office)
 - b. Firm B (Name with address of the registered office)
- (2) **Definitions:** In this deed the following words and expressions shall have the meanings set out below.
- a. "The Authority" shall mean Project _____ Implementation _____ Unit, Gandhinagar.
 - b. "The Works" shall mean _____ (Name of work) which is more particularly _____ described in the pre-qualification and tender documents issued thereof by the Authority.
 - c. The Tender "shall" mean the tender to be submitted by Joint Venture to the Authority for the work/works.
 - d. "The Contract" shall mean the contract entered to be entered into between the Joint Venture and the Authority for the works.
- (3) **Joint Venture (JV)**
The Parties hereto declare that they have agreed to form a Joint Venture for the purpose of submitting the pre-qualification Application/tender document initially and then tender and if successful for the execution of the works as an integrated Joint Venture. The parties are not under this agreement entering into any permanent partnership of Joint _____ Venture _____ to tender _____ or _____ undertake any contract other than the subject works. Nothing herein contained shall be considered to constitute the parties of partner to constitute either Party the agent of the other.
- (4) **Witnesses:** Whereas Project Implementation Unit, Gandhinagar / Authority has invited tenders from intending bidders and the Authority has permitted a group of firms (not exceeding three) forming a Joint Venture to be eligible to be a bidder. And whereas _____ party of the first part, _____ party of the second part and _____ party of the third part are desirous to enter into a Joint Venture in the nature of partnership engaged in the joint undertaking for the specific purpose of execution of the work of constructing _____ and whereas Parties of the First, Second and Third part reached understanding to submit pre-qualification/tender, if pre-qualified, and to execute the contract if awarded;

This agreement witnesses as follows:

- (a) The parties do not enter into an agreement of any permanent partnership of Joint Venture to tender or undertake any Contract other than the specified above;
- (b) That the operation of this Joint Venture firm concerns and is confined to the work of _____ of Authority;
- (c) The name of the Joint Venture firm for convenience and continuity shall be
- (d) The Address of Joint Venture for communications shall be as under:

.....
.....
.....
.....
.....
(e) The Joint Venture shall jointly submit pre-qualification application on the above name according to all terms and conditions stated in the relevant instructions contained in the bid documents.

(f) That this Joint Venture shall regulate the relations between the parties thereto and shall include without being limited to them the following conditions:

(1) _____ firm shall be the lead company in charge of the joint venture for all intents and purpose.

(2) In case the said work is awarded to the Joint Venture, the partners of the Joint Venture _____ will nominate a person with duly _____ notarized power of Attorney on stamp paper, who will represent the Joint Venture with the authority to incur liabilities, receive instructions and payments, sign and execute the contract for and on behalf of the Joint Venture,

(i) All the (Maximum two) parties agree to make financial participation and to place at disposal of Joint Venture the benefits of its individual experience, technical knowledge skill and shall in all respect bear its share as regards planning and execution of the work and responsibilities including the provision of information, advice and other assistance required in the Joint Venture and participations shall be in proportion of, Firm-A.....% and Firm-B.....%

(ii) All rights, interests, liabilities, obligations work experience and risks (and all net profits or net losses) arising out of the contract shall be borne by the parties in proportion to their shares. Each of the parties shall furnish its proportionate share in any bonds, guarantees, sureties required for the works as well as its proportionate share in connection with the works. The share and participation of the two/three partners in working capital and other financial requirements shall be in ratio as mentioned above.

(5) Internal responsibilities and liabilities

(a) The division of individual scope of work may be worked out mutually by the parties but the party shall be jointly and severally liable to the Authority for the whole work.

(b) The parties specifically undertake to carry out their separate works in full compliance with the contract with the Authority. Each party shall be responsible jointly and severally for consequences if any arising out of defective or delayed execution of works which falls within the individual 'sparty's area of responsibility and/or it has been caused due to acts and/or omission of the concerned party.

(c) The parties jointly and severally agree to replace modify or repair any defect in their respective portions of works in accordance with the terms and condition of the Contract with the Authority.

(d) The parties jointly and severally shall indemnify and hold harmless to each other against any claim made by the Authority or any other third party for injury,

damage, loss or expenses is attributed to the breach/non-performance of his responsibilities by the indemnifying party in accordance with the agreements and/or Contract with the Authority.

(e) None of parties have joined in any other Joint Venture for the said works.

(6) Responsibilities and liabilities of Joint Venture towards the Authority

(a) Parties hereto shall be jointly and severally liable and responsible for the acts, deeds and things done or omitted to be done in respect of the execution of the Contract and for any financial liability arising therefrom.

(a) Parties hereto shall be jointly and severally responsible to the Authority for the execution of the works in accordance with the Contract Conditions;

(c) Parties hereto shall be jointly and severally indemnifying to the Authority against any claim made against the Authority or any other third party for any injury, damage or loss which may be attributed to the breach of the obligations under the Contract pursuant to the Contract.

(7) Site management

(a) The execution of the work on the site will be managed by a Project Manager appointed _____ by the Joint Venture and who will report to the _____ (JV). The Project Manager shall be authorized to represent the Joint Venture on site in respect of matters arising under the Contract.

(b) The _____ (Name of the JV) shall be jointly and severally liable to the Authority for the execution of the Contract commitment in respect of the works in accordance with Contract Conditions.

(8) Termination of the Agreement

This agreement shall be terminated in the following circumstances.

(a) The Authority awards the contract for the work to the other Bidder. (b) The Authority cancels the work to award the contract.

(c) On completion of the defect liability period as stipulated in the Contract Agreement of the works and all the liabilities thereof are liquidated.

(9) No partner has right to assign any benefits, obligation of liability under the agreement to any third party without prior written consent of the other partner as well as Authority.

(10) Financial matter

(a) Bank Account in the name of the Joint Venture will be opened with any scheduled or nationalized Bank to be operated by an individual signatory as decided mutually by the Joint Venture partners.

(b) All the partners shall be responsible to maintain or cause to maintain proper Books of accounts, balance sheet and profit and loss account as to the state of affairs of the firm as at the end of the financial year and as to the profit and loss made or incurred by the firm for the year ended on that date, respectively shall be prepared and the same shall be subject to audit by a Chartered Accountant.

(c) None of the party shall be entitled to make any borrowing on behalf of the Joint Venture without express prior written consent of the other party.

~~(d) — Bank guarantee for the application/execution of the work shall be provided jointly~~

from a bank acceptable to the Authority.

- (11) **Negotiation:** Any negotiation of agreement between the parties hereto and the Authority subsequent to the submission of the tender and prior to award, shall take place only with consent of each of the parties who shall be represented at the such negotiation by one or more representative(s) duly empowered to make such negotiation or agreement.
- (12) **Legal jurisdiction:** All questions relating to validity interpretation of this agreement shall be governed by the law of India and shall be subject to jurisdiction of High Court at Ahmedabad.
- (13) **Settlement of disputes:** Any dispute in interpretation of any condition mentioned herein shall be referred to an arbitrator/tribunal by mutual consent of the partners and such proceedings shall be governed by Gujarat Public Works contract dispute tribunal act of 1992 and as amended from time to time. The award of arbitrator shall be final and binding on the party hereto. Neither the obligation of each party hereto the performance of contract nor the execution of work shall stop during the course of arbitration proceeding or as a result thereof.
- (14) **Insurance**
- (a) The Joint Venture through the parties individually shall take such insurance in connection with the work in accordance with the tender condition acceptable to the Authority.
- (b) The cost of the insurance premium paid by the Joint Venture shall be borne and paid by the parties in proportion to their respective shares of work. Other insurance taken individually by the parties shall be fully borne by the respective parties.
- (15) No changes shall be made to this agreement without prior written consent of the Authority and other party. However the Authority directs the parties to make changes in the agreement so as to fulfil tender condition the parties discuss with Authority and mutually agree such changes required to be made in the agreement.
- (16) **Default and withdrawal from the Joint Venture:** in case that either party fails to observe the provision stipulated in this agreement withdrawal from the Joint Venture, Loss and/or expenses incurred by other party due to such default and/or withdrawal shall be fully compensated by the party who has defaulted.
- (17) All matter relating to or arising due to this agreement shall be treated as confidential and shall not be disclosed to any other party.

In witness whereof the parties have caused their duly authorized representatives to sign below.

Signed for and on behalf of Firm - A

Date

Seal &

Sign Witne

ss

Signed for and on behalf of Firm - B

Date

Seal &

Sign Witne

86

AFFIDAVIT

1. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.

2. The undersigned also hereby certifies that neither our firm M/s. _____
_____ have not abandoned any work of Government of Gujarat/Government of India/any Board or Corporation under Government of Gujarat/Government of India nor any contract awarded to us for such work has been rescinded, during last five years prior to the date of this bid.

3. The undersigned hereby authorize(s) and request (s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding any (our) competence and general reputation.

4. The undersigned understands and agrees that further qualifying information may be requested, and agrees to furnish any such information at the request of the Department/Project implementing agency.

(Signed by an Authorized Officer of the Firm)

Title of Officer

Name of Firm

Date

UNDERTAKING

I, the undersigned do hereby undertake that our firm M/s
..... would invest a minimum cash
upto 25% of the value of the work during implementation of the contract.

(Signed by an Authorized officer of the firm)

Title of officer

Name of firm

DATE

SECTION-3
CONDITIONS OF CONTRACT

ConditionsofContract

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CONDITIONS OF CONTRACT

A. GENERAL

1. Definitions

- 1.1 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meaning.

Bill of Quantities means the priced and completed Bill of Quantities forming part of the Bid

Compensation Events are those defined in Clause 44 hereunder

The **Completion Date** is the date of completion of the Works as certified by the Engineer in accordance with Sub Clause 55.1

The Contract is the contract between the Employer and Contractor to execute, complete and maintain the Works **till the completion of Defects Liability Period**. It consists of the documents listed in Clause 2.3 below.

The **Contract Data** defines the documents and other information which comprise the Contract.

The **Contractor** is a person or corporate body whose Bid to carry out the Work has been accepted by the Employer.

The **Contractor's Bid** is the completed Bidding document submitted by the Contractor to the Employer and includes Technical and Financial Bids.

The **Contract Price** is the price stated in the Letter of Acceptance and thereafter as adjusted in accordance with the provisions of the Contract.

Days are calendar days; **months** are calendar months.

The **Defects Liability Period** is the period named in the Contract Data and calculated from the Completion Date.

The Employer-BMC

On behalf of the Bhavnagar Municipal Corporation, The Executive Engineer, Building Department, Municipal Corporation, Bhavnagar is in charge of the works and one of the persons for contract signing authority.

The Engineer is the person named in the Contract Data (or any other competent person appointed and notified to the contractor to act in replacement of the Engineer) who is responsible for supervising the Contractor, administering the Contract, certifying payments due to the Contractor, issuing and valuing Variations to the Contract, and valuing the Compensation Events under the control of **Executive Engineer**.

Equipment is Contractor's machinery and vehicles brought temporarily to the site to construct the Works.

The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.

The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the Contract Data. The Intended Completion Date may be revised only by the Engineer by issuing an extension of time.

Materials are all supplies, including consumables, used by the contractor for incorporation in the works.

Plant is any integral part of the work which is to have mechanical, electrical, electronic or chemical or biological functions.

The **Site** is the area defined as such in the Contract Data.

Site Investigation Reports are those which were included in the Bidding documents and are factual interpretive reports about the surface and subsurface conditions at the site.

Specifications means the Specifications of the works included in the Contract and any modification or addition made or approved by the Engineer.

The **Start Date** is given in the Contract Data or Indicating in Work Order. It is the date when the Contractor shall commence execution of the works. It does not necessarily coincide with any of the Site Possession Dates.

A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract which includes work on the Site.

Temporary Works are works designed, constructed, installed, and removed by the Contractor which are needed for construction or installation of the Works.

A **Variation** is an instruction given by the Engineer, which varies the

Works. The **Works** are what the Contract requires the Contractor to construct, install, and turn over to the Employer, as defined in the Contract Data.

2. Interpretation

21 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter and the other way around. Heading have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Engineer will provide instructions clarifying queries about Conditions of Contract.

22 If sectional completion is specified in the Contract Data, references in the Conditions of Contract to the Works, the Completion date, and Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion date for the whole works)

23 The documents forming the Contract shall be interpreted in the following order of priority

- (1) Agreement
- (2) Letter of Acceptance, notice to proceed with works

(3) Contractor's Bid

- (4) ContractData
- (5) ConditionsofContractincludingConditionsofContract
- (6) Specifications
- (7) Drawings
- (8) Bills of quantities and
- (9) Any other document listed in the Contract Data as forming part of the Contract.

3. Language and Law

- 31 The language of the Contract and the law governing the Contract are stated in the Contract Data.

4. Engineers Decisions

- 41 Except where otherwise specifically stated, the Engineer will decide contractual matters between the Employer and the Contractor in the role representing the Employer.

5. Delegation

- 51 The Engineer may delegate any of his duties and responsibilities to other people after notifying the Contractor and may cancel any delegation after notifying the Contractor.

6. Communications

- 61 Communications between parties which are referred to in the conditions are effective only when in writing. A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

7. Sub-Contracting

- 71 ~~The Contractor may subcontract any portion of work, up to a limit specified in contract data, with the approval of the engineer but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor's obligations. Subcontracting of supply or specific items of work is not allowed.~~

- 72 The sub-contractor must be registered in appropriate class and category for the part of work to be subcontracted.

8. Other Contractors

- 81 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities and the Employer between the dates given in the Schedule of other Contractor. The Contractors shall as refer to in the Contract Data, also provide facilities and services for them as described in the Schedule. The employer may modify the schedule of other contractors and shall notify the contractor of any such modifications.

9. Personnel

91 The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the Contract Data to carry out the functions stated in the Schedule or other personnel approved by the Engineer. The Engineer will approve any proposed replacement of key personnel only if their qualifications, abilities, and relevant experience are substantially equal to or better than those of the personnel listed in the Schedule.

92 If the engineer asks the Contractor to remove a person who is a member of the Contractor Staff or his work force stating the reasons the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

10. Employer's and Contractors Risks

101 The Employer carries the risk which these Contract states are Employer's risks, and the Contractor carries the risks which these Contracts states are Contractor's risk.

11. Employer's Risks

111 The employer is responsible for the excepted risks which are (a) insofar as they directly affect the execution of the Works, the risks of war, hostilities, invasion, act of foreign enemies, rebellion, revolution, insurrection or military or usurped power, civil war, riot commotion or disorder (unless restricted to the Contractor's employees), and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive.

12. Contractor's Risks

121 All risks of loss of or damages to physical property and of personal injury and death which arise during and in consequence of the performance of the Contract other than the excepted risks are the responsibility of the Contractor.

13. Insurance

131 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start date to the end of the Defects Liability Period, in the amounts and deductibles stated in the Contract data for the following events which are due to the Contractor's risks:

(a) Loss of or damage to the works, Plant and materials,

(b) Loss of or damage to Equipment

(c) Loss of or damages of property (except the Works, Plant, Materials and Equipment) in connection with the Contract; and

(d) Personal injury or death.

132 Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Start Date. All such insurances shall provide for compensation to be payable in the types and proportions of currency required to rectify the loss or damage incurred.

133 If the Contractor does not provide any of the policies and certificates required, the Employer may affect the insurance which the Contractor should have provided and recover the premium the Employer has paid from payment so otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.

134 Alterations to the terms of an insurance shall not be made without the approval of the Engineer.

135 Both parties shall comply with any conditions of the insurance policies.

14. Site Investigation Report

141 The Contractor in preparing the Bid shall rely on any site investigation reports referred to in the Contract Data, supplemented by any information available to the Bidder.

15. Queries about the Contract data

151 The engineer will clarify queries on the Contract Data

16. Contractor to Construct the Works

161 The Contractor shall construct and install the works in accordance with the specification and Drawings.

17. The Works to be completed by the Intended Completion Date

171 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the programme submitted by the Contractor, as updated with the approval of the Engineer, and complete them by the Intended Completion date

18. Approval by the Engineer

181 The Contractor shall submit Specifications and Drawings showing the proposed Temporary works to the Engineer, who is to approve them if they comply with the Specifications and drawings.

182 The Contractor shall be responsible for design of temporary works.

183 The Engineer's approval shall not alter the contractor's responsibility for design of the Temporary works.

184 The Contractor shall obtain approval of third parties to the design of the Temporary works where required.

185 All Drawings prepared by the Contractors for the execution of the temporary or permanent work are subject to prior approval by the Engineer before their use.

19. Safety

191 The Contractor shall be responsible for the safety of all activities on the Site.

20. Discoveries

201 Anything of historical or other interest or of significant value unexpectedly discovered on the site is the property of the Employer. The contractor is to notify the engineer of such discoveries and carry out the Engineer's instructions for dealing with them.

21. Possession of the Site

211 The Employer shall give possession of all parts of the site to the Contractor. If possession of a part is not given by the date stated in the Contract Data the Employer is deemed to have delayed the start of the relevant activities and this will be a Compensation Event.

212 If within 25% of the time limit of the project, 80% of possession of the site is not handed over to the Contractor, then contractor/ Employer may foreclose the contract. Contractor/ Employer has to foreclose the work within a period decided by Employer. After lapse of 25%-time limit and after 30 days foreclosing option will be closed.

22. Access to the Site

221 The Contractor shall allow the Engineer and any person authorized by the Engineer access to the Site, to any place where work in connection with the Contract is being carried out or is intended to be carried out and to any place where materials or plants are being manufactured/ fabricated/ assembled for the works.

23. Instructions

231 The Contractor shall carry out all instructions of the Engineer pertaining to works which comply with the applicable laws where the site is located.

232 The Contractor shall permit the Employer to inspect the Contractor's accounts and records relating to the performance of the Contractor and to have them audited by auditors appointed by the Employer, if so required by the Employer.

24. Disputes

241 If the Contractor is of the view that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to **#Commissioner, BMC** Higher Authority within 30 days of the notification of the Engineer's decision. If the issue is not resolved, any party can refer the matter for conciliation within 30 days from the decision given by the **#Commissioner, BMC** Higher Authority

242 24.2

(a) For any of the parties is not satisfied with the decision of the **#Commissioner, BMC**, both the parties have to refer to the OSD or DMC or Municipal **Commissioner, BMC** for the conciliation process.

(b) ~~For the work more than Rs.250 Cr., if any of the parties is not satisfied with the decision of the #Chief Engineer, both the parties have to~~ refer to the **#Secretary, Roads & Building Department, Government of Gujarat** for the conciliation process.

If the dispute is not resolved through the conciliation process, he may refer the dispute to Competent Authority of BMC.

If the dispute is not resolved by the Employer, he may refer to Gujarat Public Works Contract Dispute Arbitration Tribunal. If the Contractor fails to refer a claim / dispute to the Higher Authority within 14 days of the notification of the Engineer's decision, the Contractor shall not be entitled to any additional payment/claim if he doesn't follow the above sequence in stipulated time and he should not stop the work.

25. Procedure for Disputes

25.1 The arbitration shall be conducted in accordance with the arbitration procedure stated in the Special Conditions of Contract.

26. Deleted

B. TIME CONTROL

27. Programme

- 27.1 Within the time stated in the Contract Data the Contractor shall submit to the Engineer for approval a Programme showing the general methods, arrangements orders, and timing for all the activities in the works along with monthly cash flow forecast.
- 27.2 An update of the Programme shall be a programme showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work including any changes to the sequence of the activities.
- 27.3 The Contractor shall submit to the Engineer, for approval an updated programme at intervals no longer than the period stated in the Contract data. If the Contractor does not submit an updated programme within this period, the Engineer may withhold the amount stated in the Contract data from the next payment after the date on which the overdue programme has been submitted.
- 27.4 The Engineer's approval of the programme shall not alter the Contractor's obligations. The Contractor may revise the programme and submit it to the Engineer again at any time. A revised programme is to show the effect of Variations and Compensation events.

28. Extension of the Intended Completion Date

- 28.1 The Engineer shall extend the Intended Completion Date if a compensation Event occurs or a Variation is issued which makes it impossible for completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work and which would cause the Contractor to incur additional cost.
- 28.2 The Engineer shall decide whether and by how much to extend the Intended Completion Date within 35 days of the Contractor asking the Engineer for a decision upon the effect of a compensation event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.
- 28.3 The Engineer shall within 14 days of receiving full justification from the contractor for extension of Intended Completion Date refer to the Employer his decision. The employer shall in not more than 21 days communicate to the engineer the acceptance or otherwise of the Engineer's decision. If the employer fails to give his acceptance, the Engineer shall not grant the extension and the contractor may refer the matter under Clause 24.1

29. Deleted

30. Delays Ordered by the Engineer

301 The Engineer may instruct the Contractor to delay the start or progress of any activity within the works.

31. Management Meetings

311 Either the Engineer or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

312 The Engineer shall record the business of management meetings and is to provide copies of his record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken is to be decided by the Engineer either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

32. Early Warning

321 The Contractor is to warn the Engineer at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract price or delay the execution of works. The Engineer may require the contractor to provide an estimate of the expected effect of the future event or circumstance on the contract price and completion date. The estimate is to be provided by the Contractor as soon as reasonably possible.

322 The Contractor shall cooperate with the Engineer in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Engineer.

C.QUALITYCONTROL

#33. Identifying Defects/Defect liability period

33.1 : Defect liability period: The contractor shall be responsible to make good and remedy at his own expense any defect which may develop or may be noticed before the period mentioned hereunder from the certified date of completion. The Engineer in charge shall give the contractor a notice in writing about the defects and the contractor shall make good the same within 15 days of receipt of the notice. In the case of failure on the part of the contractor, the Engineer-in-charge may rectify or remove or re-execute the work at the risk & cost of the contractor. The Engineer-in-charge shall be entitled to appropriate the whole or any part of the amount of security deposit towards the expenses, if any, incurred by him in rectification, removal or re-execution. The Defects Liability period shall be as under....

- (a) ~~For all works costing up to Rs. 50,000 (amount put to tender), the period shall be 3 Months from the certified date of completion.~~
- (b) ~~For all works costing more than Rs. 50,000 and up to Rs. 1 crore (amount put to tender), the period shall be 12 (Twelve) months from the certified date of completion or one monsoon, whichever is later.~~
- (c) ~~For major projects costing more than Rs. 1 crore, the period shall be 36 Months from the certified date of completion which should include three monsoons.~~
- (d) ~~For original building works the defect liability period will be 4 years or elapse of 4 monsoon period following date of possession of building taken over by user agency following the certified date of completion, whichever is later.~~
For the purpose of deciding the monsoon period, the 30th September shall be treated as the last date.

33.2 **Free maintenance guarantee period for works of building and allied system construction.**

(a) Deleted

(b) Deleted

(c) Building and allied system of MGPS, MOT, CSSD, Lift, Electrification, ELV, Water Supply System, Drainage System, HVAC contractor shall maintain in operational condition by repairing, replacing, renovating of any component of building or allied system above as per mention period Cl.33(D) also contractor shall deploy the qualified manpower for the operation of the system as per requirement

However, this amount shall be released against fixed deposit or bank guarantee pledged in the name of Executive Engineer after completion certificate of work is issued.

(1) Deleted

(2) Deleted

(3) Deleted

(4) Deleted

further that such interruption and diversion shall be undertaken by the Contractor only with the prior written approval of the Executive Engineer which approval shall not be unreasonably withheld. For the avoidance of doubt, it is agreed that the Contractor shall at all times be responsible for ensuring safe operation of the road.

33.3 The Engineer shall check the Contractor's work and notify the Contractor of any defects that are found. Such checking shall not affect the Contractor's responsibilities. The Engineer may instruct the Contractor to search for a defect and to uncover and test any work that the Engineer considers may have a defect.

34. Tests

34.1 If the engineer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no defect the test shall be a Compensation Event.

34.2 # **1% of the amount of work done should be deducted from R.A. Bill** of the contractor for testing the quality of material workmanship, irrespective of actual charges. We may allow testing certificates of GER or Government approved Lab by R&B Department/ BMC

34.3 ~~Agency has to establish testing laboratory on site for the various test to be carried out in the work for this purpose agency shall construct a pukka laboratory building with all facility on site at locations specified by the engineer in charge. Penalty as per R&B Circular no. _____ Dt. _____.~~

35. Correction of defects

35.1 The engineer shall give notice to the Contractor of any defects before the end of the defects Liability Period, which begins at Completion and is defined in the contract data. The Defects Liability Period shall be extended for as long as defects remain to be corrected.

35.2 Every time notice of a defect is given, the Contractor shall correct the notified defect within the length of time specified by the Engineer's notice.

36. Uncorrected Defects

36.1 If the Contractor has not corrected a defect within the time specified in the Engineer's notice, the Engineer will assess the cost of having the defect corrected, and the Contractor will pay this amount.

D. COST CONTROL

37. Bill of Quantities

37.1 The bill of Quantities shall contain items for the constructions, installation, testing and commissioning work to be done by the Contractor.

37.2 The bill of Quantities is used to calculate the Contract price. The Contractor is paid for the quantity of the work done at the rate in the Bill of Quantities for each item.

38. Change in the Quantities

38.1 The Engineer shall have power to make any alterations in or addition to the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and

the contractor shall be bound to carry out the work in accordance with any instruction in this connection which may be given to him in writing signed by the Engineer and such alteration shall not invalidate the contract and any additional work which the contractor may be directed to do in the manner above specified as part of the work shall be carried out by the contractor on the same conditions in all respects on which he agreed to do the main work and at the same rate as are specified in the tender for the main work.

Except that when the quantity of any item exceeds the quantity as in the tender by more than 130%, the contractor will be paid for the quantity in excess of 130%, at the rate entered in the SOR of the year during which the excess in quantity is first executed.

39. Variations

39.1 All Variations shall be included in updated programmes produced by the Contractor.

40. Payments for Variations

40.1 If the additional or altered work includes any class of work for which no rate is specified in this contract, then such class of work shall be carried out as under.

(i) At the rate derived from the item within the contract which is comparable to the one involving additional or altered class of work; where there are more than one comparable items, the item of the contract which is nearest in comparison with regard to class or classes of the work involved shall be selected and the decision of the **Executive Engineer** as to the nearest comparable item shall be final and binding on the contractor.

(ii) If the rate cannot be derived in accordance with (i) above, such class of work shall be carried out at the rate entered in the Schedule of Rates of the division

for the year in which the tender was received, increased or decreased by the percentage by which the tender amount is more or less as compared to the amount arrived at the rates in the "Schedule of Rates" of the Division in the year in which the tender was received. If the Schedule of rates of the Division does not contain all the items, the percentage increase or decrease of the tender shall be calculated considering such items which were included in the "Scheduled Rates" of the division for the year and for materials consumed on such item the rate to be charged would be the basic rate taken into account for fixing the rate in S.O.R. referred to above.

- (iii) If it is not possible to arrive at the rate from (i) and (ii) above, such class of work shall be carried out at the rate decided by the competent authorities on the basis of detailed rate analysis after hearing the contractor before a Committee of two **Executive Engineer** stationed at the same place or the nearest place.

402 If the additional or altered work, for which no rate is entered in the "Schedule of Rates" of the Division is ordered to be carried out before the rate is agreed upon, then the contractor shall within seven days of the date of receipt by him of the order to carry out the work, inform the Engineer-in-charge of the rate, which it is his intention to charge for such class of work and if the Engineer in charge does not agree to this rate, he shall by notice in writing be at liberty to cancel his order to carry out such class of work and arrange to carry it out in such manner as he may consider it advisable, provided always that if the contractor shall commence work or incur any expenditure in regard thereof before the rate shall have been determined as lastly hereinbefore mentioned, then in such cases he shall only be entitled to be paid in respect of the work carried out or expenditure incurred by him prior to the date of the determination of the rate as aforesaid according to such rate or rates as shall be fixed by the Engineer-in-charge. In the event of the dispute, the decision of the **Municipal Commissioner (BMC)** shall be final.

Where, however, the work is to be executed according to the designs, drawings and specifications recommended by the contractor and accepted by the competent authority, the alternation above referred to shall be within the scope of such designs, drawings and specifications appended to the tenders.

The time limit for the completion of the work shall be extended in the proportion that the increase in the cost occasioned by alterations bears to the cost of the original work and the certificate of the Engineer-in-charge as to such proportion shall be final and conclusive.

41. Cash Flow Forecasts

41.1 When the programme is updated, the contractor is to provide the engineer with an updated cash flow forecast.

42. Payment certificates.

421 The Contractor shall submit to the Engineer monthly statements of the estimated value of the work completed less the cumulative amount certified previously.

422 ~~The Engineer shall check the Contractor's monthly statement within 14 days and certify the amount to be paid to the Contractor after taking in to account any credit or debit for the month in question in respect of materials for the works in the relevant amounts and under conditions set forth in sub-clause 32.3 of the Contract Data (secured Advance).~~

423 The value of work executed shall be determined by the Engineer.

424 The value of work executed shall comprise the value of the quantities of the items in the Bill of Quantities completed.

425 The value of work executed shall include the evaluation of variations and compensation events.

426 The Engineer may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information

43. Payments

431 Payments shall be adjusted for deductions for advance payments, retention, other recoveries in terms of the contract and taxes at source, as applicable under the law. The Employer shall pay the Contractor the amounts certified by the Engineer within 28 days of the date of each certificate.

432 ~~Payment of GST (prevailing rates) on the amount payable under the contract to the Contractor will be made by the Employer.~~

~~Hence, it is the responsibility of the contractor to pay the GST to the concerned Authority of Government. We should decide policy for estimate base on R&BSO rather than 2023-24 and other RA items and electrical items.~~

433 Items of the works for which no rate or price has been entered in will not be paid by the Employer and shall be deemed covered by other rates and prices in the Contract.

44. Compensation events

441 The following are compensation Events unless they are caused by the Contractor:

(a)

The Employer does not give access to a part of the Site by the site Possession date stated in Contract Data to the Contractor

442 In case of compensation event occurs and it prevents the work being completed beyond the Intended Completion Date then Authority will approve Extension of Time with eligible contractual price escalation.

45. Tax

451 The rates quoted by the Contractor must be inclusive of all taxes prevailing on due date of bid submission except GST. However, any subsequent changes in the tax structure by Government after due date of bid submission will be compensated (+/-) on availability or submission of factual documentation. Contractor will have to intimate Engineer regarding changes occurred in the tax structure after bid submission. If the contractor fails to provide such information and if any financial obligation may arise due to change in tax structure, same will be recovered from the contractor.

452 GST will be paid separately on the bills. Hence, it is the responsibility of the contractor to pay the GST to the concerned Authority. **Ref.43.2**

46. Currencies.

461 All payments shall be made in Indian Rupees.

47. Price Adjustment

471 ~~Contract price shall be adjusted for increase or decrease in rates and price of labour, materials, fuels and lubricants in accordance with the following principles and procedures and as per formula given in the contract data:~~

~~(a) The price adjustment shall apply for the work done from the start date given in the contract data up to end of the initial intended completion date or extensions granted by the Engineer and shall not apply to the work carried out beyond the stipulated time for reasons attributable to the contractor.~~

~~(b) The price adjustment shall be determined during each month from the formula given in the contract data.~~

~~(c) Following expressions and meanings during to the work done during each month~~

~~R = Total value of work done during the month. It would include the amount of secured advance granted, if any, during the month less the amount of secured advance recovered, if any, during the month. It will exclude value for work executed under variations for which price adjustment will be worked separately based on the terms mutually agreed.~~

472 ~~To the extent that full compensation for any rise or fall in costs to the contractor is not covered by the provisions of this or other clause in the contract, the unit rates and prices included in the contract shall be deemed to include amounts to cover the contingency of such other rise or fall in costs.~~

48. Retention

481 The Employer shall retain from each payment due to Contractor the proportion stated in the Contract Data until Completion of the whole of the Works.

- 482 On Completion of the whole of the Works half the total amount retained is repaid to the Contractor and half when the Defects Liability Period has passed and the Engineer has certified that all Defects notified by the Engineer to the Contractor before the end of this period have been corrected.
- 483 On completion of the whole works, the contractor may substitute retention money with an "on demand" Bank guarantee.

In case, Contractor requests for refund of the Retention Money deducted by the Employer under the provision of this clause, Employer shall consider the said request of the Contractor provided that the refund hereunder shall be made in tranches of not less than 1% (One Percent) of the Contract Price and Contractor furnishes an irrevocable and unconditional Bank guarantee for an equal amount substantially in the format of Bank Guarantee for Performance Guarantee enclosed with SBD and valid up to 60 days beyond the scheduled / extended Defects Liability Period. On completion of the whole works, the contractor has however an option to submit a fresh irrevocable and unconditional Bank Guarantee for an amount equal to 5% of the total value of work executed substantially in the format of Bank Guarantee for Performance Guarantee enclosed with SBD and valid up to 60 days beyond the Defect Liability Period and yet refund the Retention Money Bank Guarantees submitted for refund of Retention Money.

49. Liquidated Damages

- 491 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the Contract Data for each day that the Completion Date is later than the Intended Completion Date (for the whole works or the milestone as stated in the contract data). The total amount of liquidated damages shall not exceed the amount defined in the Contract Data. The Employer may deduct liquidated damages from payment due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.
- 492 If the Intended Completion Date is extended after liquidated damages have been paid, the Engineer shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall not be entitled for any interest on the over payment calculated from the date of payment to the date of repayment.
- 493 If the contractor fails to comply with the time for completion as stipulated in the tender, then the contractor shall pay to the employer the relevant sum stated in the Contract Data as Liquidated damages for such default and not as penalty for every day or part of day which shall elapse between relevant time for completion and the date stated in the taking over certificate of the whole of the works on the relevant section, subject to the limit stated in the contract data.

The employer may, without prejudice to any other method of recovery deduct the amount of such damages from any monies due or to become due

to the contractor. The payment or deduction of such damages shall not relieve

the contractor from his obligation to complete the works on from any other of his obligations and liabilities under the contract.

49.4 If, before the Time for Completion of the whole of the Works or, if applicable any Section, a Taking Over Certificate has been issued for any part of the Works or of a Section, the liquidated damages for delay in completion of the remainder of the Works or of that Section shall, for any period of delay after the date stated in such Taking-Over-Certificate, and in the absence of alternative provisions in the Contract, be reduced in the proportion which the value of the part so certified bears to the value of the whole of the Works or Section, as applicable. The provisions of this Sub-clause shall only apply to the rate of liquidated damages and shall not affect the limit thereof.

50 — Bonus

50.1 If the contractor achieves completion of the whole of the works prior to the intended Completion Date prescribed in Contract Data the Employer shall pay to the contractor a sum stated in Contract Data as bonus for every completed month but subjected to maximum amount as stated in Contract Data; which shall elapse between the date of completion of all items of works as stipulated in the contract, including variations ordered by the Engineer and the time prescribed in Clause 17.

50.2 Bonus shall be paid only to works amounting to above INR 5 crore with time limit of the works is equal or more than 6 months. The bonus would be paid as under

% of Time Saved	% of Initial Contract Price entitled for Bonuses
50%	5%
40%	4%
30%	3%
20%	2%
10%	1%
Less than 10%	0%

51. — Advance Payment.

51.1 The Employer shall make advance payment (not to be paid less than two installments except in special circumstances for which there is reason to be recorded in writing) to the Contractor of the amounts stated in the Contract Data by the date stated in the Contract Data, against provision by the Contractor of an Unconditional Bank Guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to be at

least 110% of the advance payment. The guarantees shall remain effective until the

~~advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. The Mobilization advance would be deemed as interest bearing advance at an interest rate of 10% to be compounded, quarterly.~~

51.2 ~~The Contractor shall use the advance payment only to pay for Equipment, plant and Mobilization expenses required specifically for execution of the Works. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the engineer.~~

51.3 ~~The advance payment shall be repaid by deduction of a proportionate amount from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, variations, price adjustments, Compensation Events, or Liquidated damages.~~

51.4 ~~Deleted~~

~~52. Securities~~

52.1 The performance Security (including additional security for unbalanced bids) shall be provided to the Employer no later than the dates specified in the Letter of Acceptance and shall be issued in an amount and form and by a bank or surety acceptable to the Employer, and denominated in Indian Rupees. The performance Security shall be valid until a date 60 days from the date of expiry of Defects Liability Period and the additional security for unbalanced bids shall be valid until a date 28 days from the date of issue of the certificate of completion.

~~53. Deleted~~

~~54. Cost of Repairs.~~

54.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start date and the end of Defects Correction periods shall be remedied by the Contractor at the Contractor's cost if the loss or damage arises from the Contractor's acts or omissions.

E. FINISHING THE CONTRACT

55. Completion

55.1 The Contractor shall request the Engineer to issue a Certificate of Completion of the works and the Engineer will do so upon deciding that the work is completed.

56. Taking Over

56.1 The Employer shall take over the Site and the Works within seven days of the Engineer issuing a certificate of Completion.

57. Final Account

57.1 The Contractor shall supply to the Engineer a detailed final account of the total amount that the Contractor considers payable as full and final settlement of all claims under the Contract for items before the end of the Defect Liability Period. The Engineer shall issue a Defect Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor's account if it is correct and complete. If it is not, the Engineer shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted, the Engineer shall decide on the amount payable to the Contractor and issue a payment certificate, within 56 days of receiving the Contractor's revised account.

57.2 If reversal in characteristic of tender (L1 becoming L2) on account of excesses and savings in final account is observed, the Engineer/Employer shall be at liberty to restrict the final payment of BOQ items to the lowest amount evaluated of the bids considering the final quantities and the rates quoted including therebates if any. Payment of variation items shall however be made at the rates approved by the Employer, within 90 days from the physical completion of work. (Applicable for item rates tender only)

Operating and Maintenance Manuals

57.3 If "as built" drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the Contract data.

57.4 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the Contract data, or they do not receive the Engineer's approval, the Engineer shall withhold the amount stated in the Contract Data from payments due to the Contractor.

58. Termination

58.1 The Employer or the Contractor may terminate the Contract if the other

partycausesa fundamentalbreachoftheContract.

58.2 Fundamental breaches of Contract include, but shall not be limited to the following:

1. The contractor stops work for 28 days when no stoppage of work is shown on the current programme and the stoppage has not been authorized by the Engineer
2. The Engineer instructs the Contractor to delay the progress of the Works and the instructions is not withdrawn within 28 days;
3. The Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation
4. A payment certified by the Engineer is not paid by the Employer to the Contractor within 56 days of the date of the Engineer's certificate
5. The Engineer gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Engineer;
6. The Contractor does not maintain a security which is required;
7. The Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages can be paid as defined in the Contract data; and
8. If the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

For the purpose of this paragraph: "corrupt practice" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution. "Fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the borrower, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition.

58.3 When either party to the Contract gives notice of a breach of contract to the Engineer for a cause other than those listed under Sub Clause 59.2 above, the Engineers shall decide whether the breach is fundamental or not.

58.4 Notwithstanding the above, the employer may terminate the Contract for convenience.

59. Payment upon Termination

59.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Engineer shall issue a Certificate for the value of the work done less advance payments received up to the date of the issue of the

certificate, less other recoveries due in terms of the contract, less taxes due to be deducted at source as per applicable law and less the percentage to apply to the work not completed as indicated in the Contract data. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor the difference shall be a debt payable to the Employer.

- 59.2 If the Contract is terminated at the Employer's convenience or because of a fundamental breach of Contract by the Employer, the Engineer shall issue a certificate for the value of the work done, the cost of balance material brought by the contractor and available at site, the reasonable cost of removal of equipment, repatriation of the Contractor's personnel employed solely on the works, and the Contractor's cost of protecting and securing the Works and less advance payment received up to the date of the certificate, less other recoveries due in terms of the contract and less taxes due to be deducted at source as per applicable law.

~~60.~~ Property

- 60.1 All materials on the Site, Plant Equipments, Temporary Works and Works are deemed to be property of the Employer, if the Contract is terminated because of a Contractor's default.

~~61.~~ Release from Performance

- 61.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor the Engineer shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterward to which commitment was made.

F. SPECIAL CONDITIONS OF CONTRACT

62. LABOUR

The Contractor shall, unless otherwise provided in the Contract, make his own arrangements for the engagement of all staff and labour, local or other, and for their payment of housing, feeding and transport.

The Contractor shall, if required by the Engineer, deliver to the Engineer a return in detail, in such form and at such intervals as the Engineer may prescribe, showing the staff and the numbers of the several classes of labour from time to time employed by the Contractor on the site and such other information as the Engineer may require.

63. COMPLIANCE WITH LABOUR REGULATIONS

During continuance of the contract, the Contractor and his sub-contractor shall abide at all times by all existing labour enactments and rules made thereunder, regulations, notification and bye laws of the State or central Government or local authority and any other labour law (including rules), regulations, bye laws that may be passed or notifications that may be issued under any labour law in future either by the State or the Central Government or the local authority. Salient features of some of the major labour laws that are applicable to the construction industry are given below. The Contractor shall keep the Employer indemnified in case any action is taken against the Employer by the competent authority on account of contravention of any of the provisions of any Act or rules made thereunder, regulations or notifications including amendments. If the Employer is caused to pay or reimburse, such amounts as may be necessary to cause or observe, or for observance of the provisions stipulated in the notifications/byelaws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor, the Engineer/employer shall have the right to deduct any money due to the Contractor including his amount of performance security. The Employer/Engineer shall also have the right to recover from the Contractor any sum required or estimated to be required for making good the loss or damages suffered by the Employer.

The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Employer at any point of time.

SALIENT FEATURES OF SOME MAJOR LABOUR AND OTHER LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTION WORK

- A) **Workmen Compensation Act 1923**:- The Act provides for compensation in case of injury by accident arising out of and during the course of employment.
- B) **Payment of Gratuity Act. 1972**:- Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years service or more on death, the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.
- C) **Employees P.F. and Miscellaneous Provision Act 1952**:- The Act Provides for monthly contributions by the employer plus workers @ 10% or 8.33% The benefits payable under the Act are:
1. Pension or family pension on retirement or death, as the case may be.
 2. Deposit linked insurance on the death in harness of the worker.
 3. Payment of P.F. accumulation on retirement/death etc.
- D) **Maternity Benefit Act 1951**:- The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.
- E) **Contract Labour (Regulation & Abolition) Act 1970**: The Act provides for certain welfare measures to be provided by the Contractor to contract labour and in case the Contractor fails to provide, the same are required to be provided, by the Principal Employer by Law. The principal Employer is required to take Certificate of Registration and the Contractor is required to take license from the designated Officer. The Act is applicable to the establishments or Contractor of Principal Employer, if they employ 20 or more contract labour.
- F) **Minimum Wages Act 1948** :- The Employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act, if the employment is a scheduled employment. Construction of Building, Roads, Runways are scheduled employment.
- G) **Payments of wages Act 1936**:- It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.
- H) **Equal remunerations Act 1979**:- The Act provides for payment of equal wages for work of equal nature to Male and Female workers and for not making discrimination against female employees in the matter of transfer, training and promotion etc.
- I) **Payments of Bonus Act 1965**:- The Act is applicable to all establishments employing 20 or more employees. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20 % of wages to employees drawing Rs. 3500/- per month or less. The bonus to be paid to employees getting Rs. 2500/- per month or above Rs. 3500/- per month shall

beworkedoutbytakingwagesasRs.2500/-permonthonly.TheActdoesnot

apply to certain establishments. The newly set-up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of this Act.

- J) **Industrial Disputes Act 1947**:- The Act lays down the machinery and procedure for resolutions of Industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.
- K) **Industrial employment (standing Orders) Act 1946** :- It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the State and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the Employer on matters provided in the Act and get the same certified by the designated Authority.
- L) **Trade Unions Act 1926**:- The Act lays the procedure for registration of trade unions of workmen and employers. The Trade Unions registered under the Act have given certain immunities from civil and criminal liabilities.
- M) **Child Labour (Prohibition & Regulation Act 1986**:- The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of Child labour is prohibited in Building and Construction Industry.
- N) **Inter - State Migrant workmen's (Regulation of Employment & Conditions of service) Act 1979**:- The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.
- O) **The Building and Other Construction workers (Regulation of employment and Conditions of Service) Act 1996 and the Cess Act of 1996**:- All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay cess at the rate not exceeding 1% of the cost of construction as may be modified by the government. The Employer of the establishment is required to provide safety measures at the Building or construction work and other welfare measures, such as canteens, First Aid facilities, Ambulance, Housing accommodations for workers near the workplace etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officers appointed by the Government.

P) **Factories Act 1948 :-**The Act lays down the procedure for approval of plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual leave and rendering information regarding accidents or dangerous occurrences to designated authorities. It is applicable to premises employing 10 persons or more with aid of power or 20 or more persons without the aid of power engaged in the manufacturing process.

Q) **Royalty charges-**The contractor shall pay the royalty to the competent authority as per rule. The royalty charges paid shall be borne by the contractor and shall not be reimbursed by the Employer.

R) **Following Pollution control Acts and amendments made there off from time to time shall be applicable.**

1. Water(Preservation and control of Pollution) Act, 1974
2. Air(Prevention and Control of Pollution Act) 1981
3. Environmental(Protection) Act 1986

The contractor must commit to adopting Environmental management plan for best energy use, waste management, the reduction of pollution as in EMS (Environmental Management system) ISO-14001-2015

64. ARBITRATION(GCC Clause 24)

The procedure for arbitration will be as follows:-

64.1 If the Contractor is of the view that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to **#Executive Engineer** (Higher Authority) within 14 days of the notification of the Engineer's decision. If the issue is not resolved, any party can refer the matter for conciliation within 15 days from the decision given by the **#Executive Engineer**.

64.2 If the Contractor is of the view that a decision taken by the Engineer was either outside the authority given to the Engineer by the Contract or that the decision was wrongly taken, the decision shall be referred to **#Executive Engineer** Higher Authority within 30 days of the notification of the Engineer's decision. If the issue is not resolved, any party can refer the matter for conciliation within 30 days from the decision given by the **#Executive Engineer** Higher Authority

64.3

(a) For any of the parties is not satisfied with the decision of the **#Executive Engineer**, both the parties have to refer to the OSD or DMC or Municipal Commissioner **Chief Engineer concern** for the conciliation process.

(b) ~~For the work more than Rs.250 Cr., if any of the parties is not satisfied with the decision of the #Chief Engineer, both the parties have to refer to the #Secretary, Roads & Building Department, Government of Gujarat for the~~

econciliation process.

If the dispute is not resolved through the conciliation process, he may refer the dispute to Competent Authority of BMC.

If the dispute is not resolved by the Employer, he may refer to Gujarat Public Works Contract Dispute Arbitration Tribunal. If the Contractor fails to refer a claim / dispute to the Higher Authority within 14 days of the notification of the Engineer's decision, the Contractor shall not be entitled to any additional payment/claim if he doesn't follow the above sequence in stipulated time and he should not stop the work.

SECTION-4
CONTRACTDATA

#CONTRACTDATA

Clause Reference
With respect to section
3

Item marked "N/A" do not apply to this Contract.

1. The Employer is
Name: Commissioner, Bhavnagar Municipal Corporation
Address: Bhavnagar Municipal Corporation, Bhavnagar
Name of authorized Representative..... [CL.1.1]
2. The Engineer is Executive Engineer.
Name of Authorized Representative:.....
3. The Defects Liability Period is **3 years** from the date of completion. [CL.1.1&33]
4. The Start Date shall be **1st** days for the date of issue of the Notice to proceed with the work. [CL.1.1]
5. The Intended Completion Date for the whole of the work is **9 Months** after start of work with the following milestones: [CL.1.1,17&2]
Milestone dates: [CL.2.2&49.1]
Physical work to be completed Period from the start date
6. The Site is located at **Nilambag**, Bhavnagar city [CL.1.1]
7. The name and identification number of the Contract is:..... [CL.1.1]
8. The works consist of Building Work with items as per B.O.Q. [CL.1.1]
The works shall, inter alia, include the following, as Specified or as directed:

~~(A) Road Works Deleted~~

~~Site clearance; setting out and layout; widening of existing carriageway and strengthening including camber corrections; construction of new road/Parallel service road; bituminous pavements remodeling/construction of junctions, intersection, bus bays, lay-bays; supplying and placing of drainage Channels, flumes, guard posts and guard other related items; construction/extension of cross drainage works, bridge, approaches and other related stones; protective works for roads/bridge; all aspects of quality assurance of various components of the works; rectification of The defects in the completed works during the Defects Liability Period; submission of "As-built" drawings and any other related documents; and other item of work as may be required to be carried out for completing the work in accordance with the drawings and the provisions of the contract and to ensure safety.~~

(B) Bridge Works Deleted

Site clearance; setting out, provision of foundations, piers, abutments and bearing; prestressed/reinforced cement concrete superstructure; wearing coat, handrailings, expansion joints, approach slabs, drainage spouts/downtake pipes, arrangements for fixing light posts, water mains, utilities etc; provision of suitably designed protective works; providing wing/return walls; provision of road markings, road signs etc.; all aspects of quality assurance; clearing the site and handing over the works on completion; rectification of the defects during the Defects Liability Period and submission of "As-built" drawings and other related documents; and other items of work as may be required to be carried out for completing the works in accordance with the drawings and the provisions of the contract and to insure safety

(C) Building Works

[CL.1.1]

(D) Other Items

Any Other Items as required to fulfill all contractual obligations as per the Bid documents.

10. The following documents also form part of the Contract:
_____ As per clause 2-3 _____ [CL.2.3(9)]
11. The law which applies to the Contract is the law of Union of India [CL.3.1]
12. The language of the Contract documents is English [CL.3.1]
13. Limit of subcontracting 25% of the Initial Contract Price (Not Applicable) [CL.7.1]
14. The Schedule of Other Contractors [CL.8]
15. The Schedule of Key Personnel As per Annex - II to Section I [CL.9]
16. The minimum insurance cover should be done by the contractor for physical property, injury and death is Rs. 5 lakhs per occurrence with the number of occurrences limited to four. After each occurrence, the contractor will pay an additional premium necessary to make insurance valid for four occurrences always. [CL.13]
17. Site Investigation report [CL.14]
18. The Site Possession dates shall be actual date of Possession given to the contractor. [CL.21]
19. The period for submission of programme with BAR CHART for approval of the engineers shall be 10 days from the issue of Letter of Acceptance. [CL.27.1]
20. The period between program updates will be 60 days. [CL.27.3]
21. The amount to be withheld for late submission of each updated programme shall be Rs 0.10 lakhs per day. [CL.27.3]

22. The following events shall also be Compensation
Events Substantially adverse ground conditions encountered during the
course of execution of work not provided for in the bidding document.
- (i) Removal of underground utilities detected subsequently
 - (ii) Significant changes in classification of soil
requiring additional mobilization by the contractor, e.g. ordinary soil or rock excavation,
 - (iii) Removal of unsuitable material like marsh, debris dumps,
etc. not caused by the contractor.

[CL.44]

- (iv) Artesian conditions
- (v) Seepage, erosion, landslide
- (vi) River training requiring protection of permanent work
- (vii) Presence of historical, archeological or religious structures, monuments interfering with the works
- (viii) Restriction of access to ground imposed by civil, judicial, or military authority

23. The currency of the Contract is Indian Rupees [CL.46]

24. **The formula(e) for adjustment of prices are as under: NOT APPLICABLE** [CL.47]

- If any of the commodities like Cement, Steel or Bitumen are not found applicable in a work, the weight component of that commodities (i.e. 'Cement' (Pc), 'Steel' (Ps) or 'Bitumen' (Pb) as indicated in SBD for the purpose of Price Adjustment) shall be clubbed with the weight component of 'Other Material' (Pm), such that the gross % weight of the components shall remain as 100%.

R = value of work as defined in Clause 47.1 of Conditions of Contract

Adjustment for labour component

- (i) Price adjustment for increase or decrease in the cost due to labour shall be paid in accordance with the following formula:

$$V_L = 0.85 \times (P_1/100) \times R \times (L_i - L_0) / L_0$$

V_L = Increase or decrease in the cost of work during the month under consideration due to changes in rates for local labour

L_0 = The consumer price index for industrial workers for the State on 28 days preceding the scheduled date of opening of technical Bids as published by Labour Bureau, Ministry of Labour, Government of India

L_i = The consumer price index for industrial workers for the State for the month under consideration as published by the Labour Bureau, Ministry of Labour, Government of India.

P_1 = Percentage of labor component of the work.

Adjustment for cement component.

- (ii) Prices adjustment for increase or decrease in the cost of cement procured by the contractor

$$V_c = 0.85 \times (P_c/100) \times R \times (C_i - C_0) / C_0$$

V_c = Increase or decrease in the cost of work during the month under consideration due to changes in rates for cement.

C_0 = The all India wholesale price index for Ordinary Portland Cement on 28 days preceding the scheduled date of opening of technical bids as published by the Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.

C_i = The all India average wholesale price index for Ordinary Portland Cement for the month under consideration as published by **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_c = Percentage of cement component of the work

Adjustment for steel component

(iii) Price adjustment for increase or decrease in the cost of steel procured by the contractor shall be paid in accordance with the following formula

$$V_s = 0.85 \times (P_s / 100) \times R \times (S_i - S_0) / S_0$$

V_s = Increase or decrease in the cost of work during the month under consideration due to changes in the rates for steel

S_0 = The all India wholesale price index for steel (**Mild Steel-Long Products Rebars**) on 28 days preceding the date of opening of Bids as published by the **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

S_i = The all India average wholesale price index for steel (**Mild Steel-Long Products Rebars**) for the month under consideration as published by **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_s = Percentage of steel component of the work

Note : For the application of this clause, the index of **Mild Steel-Long products Rebar** has been chosen to represent the steel group.

Adjustment of bitumen component

(iv) Price adjustment for increase in the cost of bitumen shall be paid in accordance with the following formula

$$V_b = 0.85 \times (P_b / 100) \times R \times (B_i - B_0) / B_0$$

V_b = Increase or decrease in the cost of work during the month under consideration due to changes in rates for bitumen.

B_0 = The official retail price of bitumen at the IOC depot at the nearest centre on the day 28 days prior to the scheduled date of opening of technical bid.

B_i = The official retail price of bitumen of IOC depot at the nearest centre or the 15th day of the month under consideration.

P_b = Percentage of bitumen component of the work

Adjustment of POL (fuel and lubricant) component

(v) Price adjustment for increase or decrease in cost of POL (fuel and lubricant) shall be paid in accordance with the following formula

$$V_f = 0.85 \times (P_f / 100) \times R \times (F_i - F_0) / F_0$$

V_f = Increase or decrease in the cost of work during the month under consideration due to changes in rates for fuel and lubricants.

F_0 = The official retail price of High Speed Diesel (HSD) at the existing consumer pumps of IOC at the nearest centre on the day 28 prior to the date of opening of Bids.

F_i = The official retail price of HSD at the existing consumer pumps of IOC at the nearest centre for the 15th day of the month of the under consideration.

P_f = Percentage of fuel and lubricants component of the work

Note: For the application of this clause, the price of High Speed diesel Oil has been chosen to represent the fuel and lubricants group.

Adjustment for Construction Machinery

(vi) Price adjustment for increase or decrease in the cost of plant and Machinery spare procured by the Contractors shall be paid in accordance with the following formula

$$V_p = 0.85 \times (P_p / 100) \times R \times (P_i - P_0) / P_0$$

V_p = Increase or decrease in the cost of work during the month under consideration due to changes in rates for plant and machinery spares

P_0 = The all India wholesale price index for **manufacturer of machinery for mining, quarrying and Construction** for the month under consideration as published **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_i = The all India average wholesale price index for **manufacturer of machinery for mining, quarrying and Construction** for the month under consideration as published **Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.**

P_p = Percentage of plant and machinery spares component of the work.

Note: For the application of this clause, index of Heavy Machinery and parts has been chosen to represent the Plant and Machinery Spares group

Adjustment of other materials Component

(vii) ~~Price adjustment for increase or decrease in cost of local materials other than cement, steel, bitumen and POL procured by the contractor shall be paid in accordance with the following formula~~

$$V_m = 0.85 \times (P_m / 100) \times R \times (M_i - M_0) / M_0$$

~~V_m = Increase or decrease in the cost of work during the month under consideration due to change in rates for local materials other than cement, steel, bitumen and POL.~~

~~M₀ = The All India wholesale price index (all commodities) on 28 days preceding the scheduled date of opening of technical Bids, as published by the Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.~~

~~M_i = The All India wholesale price index (all commodities) for the month under reconsideration as published by the Office of the Economic Adviser, Department for Promotion of Industry and Internal Trade, Ministry of Commerce & Industry.~~

~~P_m = Percentage of local material components (other than cement, steel, bitumen and POL) of the work.~~

~~The following percentage will govern the price adjustment for the entire contract:~~

**Other
s**

Labour			
P ₁ % Cement			
P _c % Steel	P _s		
	_____ %		
Bitumen	P _b %		
POL	P _f _____ %		
Plant & Machinery Spares	P _p _____ %		
Other Materials			
P _m _____ %		100	100
Total		100 %	%
		%	

Note 1) Delete

2) for new construction of SDH/DH/Medical Colleges and Other building works % shall be applicable as mentioning tender documents.

~~25. The proportion of payments retained (retention money) shall be 6% (CL-48) from each RA bill subject to a maximum of 5% of final contract price.~~

~~26. Amount of Liquidated damages for {CL.49} delay in completion of works For Whole of work (1/2000)th of the Initial contract price, rounded off to the nearest Thousand, per day. For sectional Completion (wherever specified in item 6 of Contract data) (1/2000)th of initial contract price for #5 km Section, rounded off to the nearest thousand per day.~~

- ~~27. Maximum limit of liquidated damages for delay in completion work 10 percent of the Initial Contract Price rounded off to the nearest thousand (CL.49)~~
28. Amount of Bonus for early completion of work shall be given as per CL.50 of Section 3
29. Maximum limit of bonus for early completion of work 5 percent of the Contract Price (CL.50)
30. The amount of the advance payment are: (CL.51&52)

Nature of Advances

Amount (Rs.) Conditions to be fulfilled

- | | | |
|-----|--|--|
| i | Mobilization
10% of the contract unconditional Price | On submission of Bank Guarantee. (to be drawn before the end of 20% of the contract period). The contractor may furnish four bank guarantees of 2.5 % of each valid for the full period. |
| ii | Equipment
90% for new and 50% of depreciated value for old equipment. Total amount will be subject to a maximum of 5% of the Contract Price | After equipment is brought to site (provided the Engineer is satisfied that the equipment is required for performance of the contract) and on submission of unconditional Bank Guarantee for amount of advance |
| iii | Secured Advance for Non-persishable material Brought to site | Deleted |

(The advance payment will be paid to the Contractor no later than 28 days after fulfillment of the above conditions).

31. **Repayment of advance payment for mobilization and equipment (CL.51.3)**

The advance loan shall be repaid with percentage deduction from the interim payments certified by the Engineer under the Contract. Deductions shall commence in the next Interim Payment Certificate following that in which the

~~total of all such payments to the Contractor has reached not less than 20 percent of the Contract Price or 6 (six) months from the date of payment of first installment of advance, whichever period concludes earlier, and shall be made at the rate of 20 percent (collectively for both Mobilization Advance and Equipment Advance) of the amounts of all Interim Payment Certificate until such time as the loan has been repaid, always provided that the loan shall be completely repaid prior to the expiry of the original time for completion pursuant to Clause 17 and 28.~~

32. Deleted
33. The securities shall be for the following minimum amounts equivalent {CL.52} As a percentage of the Contract Price:
Performance Security for 5 percent of contract price plus Rs. (to be decided after evaluation of the bid) as additional security in terms of ITB Clause 29.5

The standard form of Performance security acceptable to the Employer shall be an unconditional Bank Guarantee of the type as presented in Section 8 of the Bidding Documents.

34. ~~The Schedule of Operating and maintenance Manuals.....N/A.~~ {CL.58}
35. The date by which "as-built" drawings (in scale as directed) in 2 sets {CL.58} are required within 28 days of the issue of certificate of completion of the whole or section of the work, as the case may be.
36. The amount to be withheld for failing to supply "as built" drawings {CL.58} by the Date required is Rs. Lakhs.
37. The following events shall also be fundamental breach of contract: {CL.59.2} "The Contractor has contravened Sub-clause 7.1 and Clause 9 of GCC"
38. ~~The percentage to apply the value of the work not completed representing {CL.60} the Employer's additional cost for completing the Work shall be 20 percent.~~

SECTION-5
TECHNICALSPECIFICATION

SeparateSheetAttached

SECTION-6
FORMOFBID

FORM OF BID

Description of the Works:

BID

To :

Address :

- 1. We offer to execute the Works described above and remedy any defects therein in conformity with the conditions of Contract, specification, drawings, Bill of Quantities and Addenda for the sum(s) of

(-----)

- 2. We undertake, if our Bid is accepted, to commence the Works as soon as is reasonably possible after the receipt of the Engineer's notice to commence, and to complete the whole of the Works in the Contract within the time stated in the document.
- 3. We agree to abide by this Bid for the period of 120 Days from the date fixed for receiving the same, and it shall remain binding upon it and may be accepted at any time before the expiration of that period.
- 4. Unless and until a formal Agreement is prepared and executed this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.
- 5. We understand that you are not bound to accept the lowest or any tender you may receive.

Dated this ----- day of ----- 20

Signature ----- in the capacity of -----

----- duly authorized to sign bids for and on behalf of -----

(in block capitals or typed)

Address

Witness

Address

Occupation

SECTION-7
BILLOFQUANTITIES

SeparateSheetAttached

BILLOFQUANTITIES

Preamble

1. The bill of Quantities shall be read in conjunction with the Instructions to Bidder, Conditions of Contract, Technical Specifications and Drawings.
2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work ordered and carried out, as measured by the Contractor and verified by the Engineer and valued at the rates and prices tendered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix within the terms of the Contract.
3. The rates and prices tendered in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract, include all constructional plant, layout, supervision, materials, erection, maintenance, insurance, profit, taxes and duties, together with all general risks, liabilities and obligations set out or implied in the Contract.
4. The rates and prices shall be quoted entirely in Indian Currency.
5. A rate or price shall be entered against each item in the Bill Quantities, whether quantities are stated or not. The cost of Items against which Contractor has failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities (in case of Item rate contract).
6. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, and where no Items are provided the cost shall be deemed to be distributed among the rates and prices entered for the related items of Work.
7. General direction and descriptions of work and materials are not necessarily repeated or summarized in the Bill of Quantities. Reference to the relevant sections of the contract documentation shall be made before entering rates or prices against each item in the Bill of Quantities.
8. The method of completed work of payments shall be in accordance with the specification for Road and Bridge works. For building works specifications for building are to be followed.
9. Errors will be corrected by the Employer for any arithmetic errors pursuant to **Clause 29** of the Instructions to Bidder.
10. Rock is defined as all materials which, in the opinion of the Engineer, require blasting, or the use of metal wedges and sledge hammers, or the use of compressed air drilling for its removal, and which cannot be extracted by ripping with a tractor of at least 150 kw with a single rear mounted heavy duty ripper.

BILLOFQUANTITIES

(A) PercentageRateTenderSeparatesheetattached

I/Weam/arewillingtocarryouttheworkat%above/belowpercent(Should be written in figures and words) of the estimated rate mentioned above. Amount of my /ourtenderworks outasunder.

Estimatedamountputtotender

Estimatedamountputtotender

Deduct.....%below

Add.....%Above

Net

Net

Inwords

Inwords

(B) ForItemRateTender(ForaboveINR50Cr.):SORYear20----- 20 (NotApplicable)

Item No	Description of Item (with brief specification and reference to book of specifications)	Quantity	Unit	Rate		Amount
				Infigures	InWords	

(A) Total Tendered Amount

(B) Rebate on above tendered amount (if any) % (in figure)
(in words)

(C) Net Tendered Amount (A-B) (in figure)
(in words)

1	The Contractor shall exhibit a board with detailed specification and details of work as directed by the Engineer-In-Charge for which no extra payments shall be made.
2	The labour cess will be deducted as per prevailing rules i.e. 1% of the work done.
3	All taxes and levies as per prevailing norms of Government will be born by the contractor, excluding GST. GST will be paid extra as per prevailing norms for bills.

SECTION-8
SECURITIESANDOTHERFORMS

BID SECURITY (BANK GUARANTEE)

WHEREAS, ----- (name of Bidder) (hereinafter called the "The Bidder") has submitted his bid Dated -----

(Date) for the construction of (Name of Contractor hereinafter called "the Bid")

KNOW ALL PEOPLE by these presents that We -----
(name of Bank) of ----- (name of country) having our
registered office at ----- (hereinafter called
"the bank") are bound unto _____ (name of Employer)
(hereinafter called "The Employer") in the sum of ----- *
for which payment well and truly to be made to the said Employer the Bank itself,
his successors and assigns by these presents.

SEALED with the Common Seal of the said Bank this ----- day of ----- 20

THE CONDITIONS of these obligations are:

(1) If after Bid opening the Bidder withdraws his bid during the period of Bid validity specified in the Form of Bid;

Or

(2) If the Bidder has been notified of the acceptance of his bid by the Employer during the period of Bid Validity:

- A. Fails or refuses to execute the Form of Agreement in accordance with the Instructions to Bidders, if required; or
- B. Fails or refuses to furnish the Performance Security, in accordance with the Instructions to Bidders; or
- C. does not accept the correction of the Bid Price pursuant to Clause 27 (Correction of Errors)

We undertake to pay to the Employer up to the above amount upon receipt of his first written demand, without the employer having to substantiate his demand, provided that in his demand the Employer will not state the amount claimed by him is due to him owing to the occurrence of one or any of the three conditions, specifying the occurred conditions or conditions.

This Guarantee will remain in force up to and including the date----- **
days after the deadline for submission of Bids as such the deadline is stated in
the Instructions to Bidders or as it may be extended by the Employer, notice of
which extension(s) to the Bank is hereby waived. Any demand in respect of this guarantee
should reach the Bank not later than the above date

DATE-----

SIGNATURE-----

WITNESS-----

SEAL-----

(Signature, name and address)

* The Bidder should insert the amount of the guarantee in words and figures denominated in Indian Rupees. This figure should be the same as shown in Clause 16.1 (Bid Security) of the Instructions to Bidders.

** **45 days** after the **end of the validity period** of the Bid. Dates should be inserted by the Employer before the Bidding documents are issued.

PERFORMANCE SECURITY

TO,
Commissioner, Bhavnagar Municipal Corporation (Name of Employer)
....., Bhavnagar. (Address of Employer)

WHEREAS -----(name and address of contractor) (hereafter called "the Contractor") has undertaken, in pursuance of Contracts No. ----- dates ----- to execute -----
----- (name of Contract and brief description of Works) (hereinafter called "The Contract")

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sums specified therein as security for compliance with his obligation in accordance with the Contract.

AND WHEREAS we have agreed to give the Contractor such a bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you on behalf of the Contractor, up to a total of -----
(amount of guarantee)* ----- (in words), such sum being payable in types and proportions of currencies in which the Contract prices is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limit of -----
(amount of guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sums specified therein.

We hereby waive the necessity of your demanding the said debt from the contractor before presenting it with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract to of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such charge, addition or modifications.

This guarantee shall be valid until 60 days from the date of expiring of the Defect Liabilities period.

Signature and Seal of the guarantor -----

Name of Bank -----

Address -----

Date -----

*An amount shall be inserted by the Guarantor, representing the percentage of the Contract prices specified in the Contract denominated in Indian Rupees.

ADDITIONAL PERFORMANCE SECURITY

[Clause 34.1.(A)]

TO,
Commissioner, Bhavnagar Municipal Corporation (Name of Employer)
....., Bhavnagar. (Address of Employer)

WHEREAS (Name and address of contractor) (hereafter called "The Contractor") has undertaken, in pursuance of Contracts No. dates to execute (Name of Contract and brief description of Works) (hereinafter called "The Contract")

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sums specified therein as security for compliance with his obligation in accordance with the Contract.

AND WHEREAS we have agreed to give the Contractor such a bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you on behalf of the Contractor, up to a total of (amount of guarantee) (in words), such sum being payable in types and proportions of currencies in which the Contract prices is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limit of (amount of guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sums specified therein.

We hereby waive the necessity of your demanding the said debt from the contractor before presenting it with the demand

We further agree that no change or addition to or other modification of the terms of the Contract to of the Works to be performed thereunder or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such charge, addition or modifications.

This guarantee shall be valid until **90 days** from the project completion date.

Signature and Seal of the guarantor

Name of Bank

Address

Date

BANK GUARANTEE FOR ADVANCE PAYMENT

TO,

Commissioner, Bhavnagar Municipal Corporation (Name of Employer)
....., Bhavnagar. (Address of Employer)

----- (Name of Contractor)

Gentlemen:

In accordance with the provisions of the Conditions of Contract, sub-clause 51.1 ("Advance Payment") of the above-mentioned Contract, ----- (name and address of Contractor) (hereinafter called "the Contractor") shall deposit with (name of Employer) a bank guarantee his proper and faithful performance under the said Clause of the Contract in an amount of ----- (amount of Guarantee)* ----- in words).

We, the ----- (bank of financial institution), as instructed by the Contractor, agree unconditionally and irrevocably to guarantee as primary obligator and not as Surety merely, the payment to -----

----- (name of Employer) on his first demand without whatsoever right of obligation on our part and without his first claim to the Contractor, in the amount not exceeding --- (in (amount of guarantee)* words)

We further agree that no change or addition to or other modifications of the terms of the Contractor or Work to be performed thereunder or of any of the Contract documents which may be made between ----- (name of Employer) and the Contractor, shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modifications.

This guarantee shall remain valid and in full effect from the date of the advance payment under the Contract until ----- (name of employer) receives full repayment of the same amount from the contractor.

YOUR STRULY

Signature and Seal _____
Name of Bank/Financial Institution _____
Address _____
Date _____

* An amount shall be inserted by that Bank or Financial Institution representing the amount of the Advance Payment, and denominated in Indian Rupees.

Letter of Acceptance

(Letterhead paper of the Employer)

To, _____ (date)

(Name and address of the Contractor)

Dear Sirs,

This is to notify you that your Bid dated _____ for execution of the _____ (Name of the contract and identification number, as given in the Instructions to Bidders) for the Contract Price of Rupees _____ (_____) (amount in words and figures) as corrected and modified in accordance with the Instructions to Bidders* is hereby accepted by your agency.

You are requested to furnish performance security, in the form detailed in para 34.1 of ITB for an amount equivalent to Rs. within **10 days** of the receipt of this letter of acceptance, having Validity up to beyond **90 days** from the date of expiry of defects Liability period i.e. upto _____

_____ and the Additional Performance Security for an amount equivalent to Rs.

_____ shall be valid beyond 90 (Ninety) days of Project Completion Date i.e. upto _____

_____ and sign the contract, failing which action as stated in Para 34.3 of ITB will be taken.

Yours Faithfully

Authorized Signature Name
and title of _____
Signatory Name of Employer

* Delete "Corrected and" or and modified if only one of these actions applies. Delete

as corrected and modified in accordance with the Instructions to Bidders, if corrections or modifications have not been affected.

Issue of Notice to proceed with the work

(Letterhead of the Employer)

----- (date)

To,

(Name and address of the Contractor)

Dear Sirs,

Pursuant to your furnishing the requisite security in ITB Clause 34.1
and signing of the Contract for the construction of _____

_____ at a bid Price of Rs.
_____.

You are hereby instructed to proceed with the execution of the said works
in accordance with the contract documents.

Yours faithfully

(Signature, name and title of signatory
authorized to sign on behalf of Employer)

AGREEMENT FORM

This agreement, made on the _____ day of _____ between
_____ (name and address of Employer) (Hereinafter called
"the Employer) and _____ (name and
address of contractor) hereinafter called "the
Contractor" of the other part.

Whereas the Employer is desirous that the Contractor execute

Name and identification number of contract (hereinafter called "the works") and the employer has accepted the Bid by the Contractor for the execution and completion of such works and the remedying of any defects therein, at a cost of Rs.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS

1. In this Agreement, words and expression shall have the same meanings as are respectively assigned to them in the conditions of contract hereinafter referred to and they shall be deemed to form and be read construed as part of this Agreement.
2. In Consideration of the payment to be made by the Employer to the contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the works and remedy any defects therein in conformity in all aspects with the provisions of the contracts.
3. The employer hereby covenants to pay the Contractor in consideration of the execution and completion of the works and the remedying the defects wherein contract price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the contract.
4. The Following documents shall be deemed to form and be ready and construed as part of this Agreement viz
 - i) letter of Acceptance
 - ii) Notice to proceed with the works:
 - iii) Contractor's Bid

- iv) Conditions of contract: General and Special
- v) Contract Data
- vi) Additional conditions
- vii) Drawings
- viii) Bill of Quantities and
- ix) Any other documents listed in the Contract data as forming part of the Contract.

In witness whereof the parties there to have caused this Agreement to be executed the day and year first before written

The Common seal of _____

Was hereunto affixed in the presence of:

Signed, sealed and Delivered by the said _____

In the presence of

Binding signature of Employer _____

Binding Signature of Contractor _____

UNDERTAKING
(For Investment)

I, the undersigned do hereby undertake that our firm M/s
..... would invest a minimum cash
upto 25% of the value of the work during implementation of the contract.

(Signed by an Authorized officer of the firm)

Title of officer

Name of firm

DATE

UNDERTAKING
(For Validity)

I, the undersigned do hereby undertake that our firm M/s.....
.....agree to abide by this bid for a period days
for date fixed for receiving the same and it shall be binding on us and may be accepted
at any time before the expiration of that period.

(Signed by an Authorized officer of the firm)

Title of officer

Name of firm

DATE

SECTION-9
DRAWINGS

Asperattachedfilesinthistender

SECTION-10

DOCUMENTS TO BE FURNISHED BY BIDDER

Following documents shall be submitted in electronic format only through online by scanning and the (i) Bid Document Fee/ Tender Fee (ii) Bid Security / EMD should be sent in original to the Tender opening authority through RPAD, so as to reach the Executive Engineer within stipulated date in the tender.

- (xv) Bid Document Fee/Tender Fee **(From Bidder's A/C Only)**
- (xvi) Bid Security / EMD ~~or Valid EMD Exemption Certificate of Appropriate Class of Registration of Approved Contractors~~
- (xvii) Registration Certificate: **"E-1" Class & Above** with State/Central Govt./Municipal Corporations/P.S.U.
- (xviii) ~~Registration Certificate of Special Category – Building and Category I / II / III~~
- (xix) GST Number & PAN Number
- (xx) Solvency Certificate (for current calendar year)
- (xxi) A solvency certificate of an Amount of 20% (Twenty Percent) of estimated cost put to tender will have to be produced along with tender. It shall be of Scheduled Bank or Nationalized Bank or Bank Approved for Government business. Solvency Certificates shall have validity **of same calendar year** as that of date in which tender is issued.
- (xxii) Work Experience, FORM 3(A), should be given by officer not having position below the Executive Engineer.
- (xxiii) EPF Registration Number & ESIC Registration Number
- (xxiv) Other Documents, as required...

AFFIDAVIT
Affidavit / Confirmation Regarding
Non Banned – Non Debarred – Non Black Listed – No Litigation & Other Details
(On Non-Judicial Stamp Paper Of Rs 300/- Duly Attested By First Class Magistrate/ Notary Public)

I/we, _____ age _____ year residing at _____ in capacity of _____ M/s _____ hereby solemnly affirm that

1. All general instructions, general terms and conditions, as well as special terms & conditions laid down on all the pages of the tender form, have been read carefully and understood properly by me which are completely acceptable to me and I agree to abide by the same.
2. I/We have submitted following certificates /document for T.E as required as per general terms& conditions as well as special terms & conditions of the tender.

Sr. No	Name of the Document
1	
2	
Onwards	

3. All the certificates /permissions /Document / Permits /Affidavits are valid and current as on date and have not been withdrawn/ cancelled by the issuing authority.
4. It is clearly and distinctly understood by me that the tender is liable to be rejected if on scrutiny at any time, any of the required certificates / permissions /Document/ permits/ affidavits is /are found to be invalid/wrong /incorrect/ misleading /fabricated/expired or having any defect.
5. I/We further undertake to produce on demand the original certificate/permission/Document/permits for verification at any stage during the processing of the tender as well as at any time asked to produce.
6. I/We also understand that failure to produce the Documents in “prescribed Performa” (wherever applicable) as well as failure to give requisite information in the prescribed Performa may result in to rejection of the tender.
7. My /our firm has not been banned/ debarred/ black listed at least for three years (excluding the current financial year) by any government department / state government/ government of India / Board / corporation/ municipal corporation / metro city / government financial institution within India in context to purchase procedure or work through tender.
8. I/We conform that I/We have meticulously filled in, checked and verified the enclosed Documents/certificates/ permission/permits/ affidavits /information etc. from every aspect and the same are enclosed on order(i.e. in chronology) in which they are supposed to be enclosed. Page numbers are given each submitted Document. Important information in each Document is “highlighted” with the help of “marker pen” as required.
9. The above certificates/documents are enclosed separately and not on the Performa printed from tender document.
10. I /We say and submit that the permanent account Number (PAN) given by the income tax Department is _____ Which is issued on the name of _____ [Kindly mention here either name of the proprietor (in case of proprietor Firm) or name of the tendering firm, Whichever is applicable].
11. I / We understand that giving Wrong information on oath amounts to forgery and perjury, and I/We am/are aware of the consequences thereof, in case any information provided by us are found to be false or incorrect, you have right to reject our bid at any stage including forfeiture of our EMD/PBG/cancel the award of contract, in this event, this office reserves the right to take legal action on me/us.
12. I/We have physically signed & stamped all the above Documents along with copy of tender Documents (page no. ___ to ___).
13. I/We hereby confirm that all our quoted items meet or exceed the requirement and are absolutely compliment with specification mentioned in the bid Document .
14. My /our company has not filed any writ petition, court matter and there is no court matter filed by state government and its Board corporation, is pending against our company.
15. I/We hereby commit that we have paid all outstanding amounts of dues/taxes/ cess /charges/fees with interest and penalty.
16. In case of breach of any tender terms and conditions or deviation from bid specification other than already specified as mentioned above, the decision of tender committee for disqualification will be accepted by us.

Whatever stated above is true and correct to the best of my knowledge and belief.

Date:

stamp & sign of the Tenderer

Place:

(signature and seal of the notary)

(Upload Scan Copy And To Be Submitted Physically in Original)

NAME OF WORK: REDEVELOPMENT OF TRAFFIC ISLAND CIRCLE AT NILAMBAG, BHAVNAGAR**NAME OF DOCUMENT: SCHEDULE-B**

Item No.	Item Description	Quantity	Unit	Rate (In Rs.)	Total Amount (In Rs.)
1	Demolition including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift. (i) R.C.C. work	21.00	Cmt	1030.81	21,647.01
2	Demolition of Brick work and stone masonry including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift.(ii) In Cement Mortar.	4.00	Cmt	536.09	2,144.36
3	Dismantling tiled of stone floors laid in mortar including stacking of serviceable materilas and disposal of unserviceable materials with all lead and lift.	199.00	Smt	46.78	9,309.22
4	Dismantling steel work including distempering and stacking the materials with all lead and lift.	2430.00	Kg	3.67	8,918.10
5	Clearing and grubbing road land including uprooting rank vegetation grass bushes, shrubs, sapling and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unserviceable materials (C) By mechanical means in area of light jungle	296.00	Smt	2.84	840.64
6	Excavation for foundation in any kind of soil incl. sand, soft or hard marum, soft rock not requiring Blasting incl. dewatering if required at cost and risk of agency incl. shoring, struting, making the bottom level and sides in plumb incl. watering, raming and consolidating the bottom etc. incl. removing the surplus stuff and black cotton soil if any within all lead and lift using the selected stuff for back filling to foundation, in side trencehs and plinth in layers of 20 cms. th. with watering, consolidating etc. comp. as directed. - up to 1.50mt.	166.00	Cmt	196.49	32,617.34

7	Excavation for foundation in any kind of soil incl. sand, soft or hard marum, soft rock not requiring Blasting incl. dewatering if required at cost and risk of agency incl. shoring, struting, making the bottom level and sides in plumb incl. watering, raming and consolidating the bottom etc. incl. removing the surplus stuff and black cotton soil if any within all lead and lift using the selected stuff for back filling to foundation, in side trencehs and plinth in layers of 20 cms. th. with watering, consolidating etc. comp. as directed. - from 1.50 to 3.00mt.	35.00	Cmt	212.52	7,438.20
8	Filling available excavated earth (excluding rock) in trenches. plinth, sides of foundations etc. in layers not exceeding 20 cm. in depth consolidating each dispoisted layer by ramming and watering.	161.00	Cmt	130.40	20,994.40
9	Filling in foundation and plinth with murrum or selected soil in layers of 20cm. thickness including watering, ramming and consolidating etc. complete.	77.00	Cmt	289.07	22,258.39
10	Providing and laying cement concrete 1:3:6 (1-Cement : 3- coarse sand : 6- hand broken stone aggregates 40 mm nominal size) and curing complete excluding cost of formwork in (A) Foundation and Plinth	44.00	Cmt	3005.76	1,32,253.44
11	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (A) Foundation and bottom of slab (linear or curvilinear shape)	42.00	Cmt	4597.52	1,93,095.84
12	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (C) Coping and Beams (linear or curvilinear shape) upto floor two level.	9.00	Cmt	5867.23	52,805.07
13	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (B) Walls (linear or curvilinear shape) from top of foundation level upto floor two level	19.00	Cmt	8633.91	1,64,044.29

14	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (D) Columns upto floor two level	9.00	Cmt	9966.46	89,698.14
15	Providing TMT Bar FE 500D reinforcement for R.C.C. work including bending, binding and placing in position complete upto floor two level	9740.00	Kg	76.22	7,42,382.80
16	Uncoursed Rubble Masonry with hard stone of approved quality in foundations and plinth in Cement Mortar 1:5 (1-cement : 5-coarse sand including levelling up etc. complete	34.00	Cmt	2542.31	86,438.54
17	Brick work using common burnt clay building bricks having crushing strength not less than 35 kg./Sq.Cm. in superstructure above plinth level upto floor two level in Cement Mortar 1:5 (1- Cement : 5 -fine sand) (B) Conventional	29.00	Cmt	4320.09	1,25,282.61
18	20mm thick mala / sand faced cement plaster on walls upto height 10 metres above ground level consisting of 12mm thick backing coat of C.M. 1:3 (1-cement : 3-sand) and 8mm thick finishing coat of C.M. 1:1 (1-cement : 1-sand) etc. complete.	190.00	Smt	326.11	61,960.90

19	<p>Providing, fabricating, assembling, hoisting/ erecting and fixing in position at all heights/ all shapes & sizes with all leads & lifts using MS Rolled Steel Sections, Hollow sections, MS Plates/ sheet, Flats, Bright Bars, Anchor bar, deep threaded MS bolts, threaded J bolts, insert plate, support plate etc as per drawing and all confirming to latest relevant IS codes for steel structures like staircases, railings, handrail, platforms, brackets, monkey ladder or similar etc. including straightening, cutting, bending, bolting and welding the members, scaffolding/ staging etc. complete and comprising of :</p> <p>i) Profile Cutting of components to required length/ width and shape/ profile;</p> <p>ii) Smooth grinding/ machining of edges/ faces/ all welding joints;</p> <p>iii) Necessary welding (electric arc welding) in required weld length and size;</p> <p>iv) Machine drilling of holes for joining/ anchoring</p> <p>Standard measurements will be paid for as actual cut length used at site. The rate shall include dry sanding, degreasing (wet cleaning) & preparation of rust free surface manually or mechanically, metal putty to make the surface even and smooth, 2 coat zinc chromate yellow oxide primer and 2 coat of enamel paint of approved make, shade and finish over all the surfaces of the steel sections.</p> <p>Note: The contractor shall be submit shop/ fabrication drawings based on construction drawings for approval from the Architect and Engineer in charge. The fabrication work shall start only after approval of the fabrication drawings submitted by contractor. Fabrication shall be in a perfect architectural workmanship manner and as provided in section V</p>	3893.00	Kg	64.33	2,50,436.69
20	<p>Finishing wall with weather proof exterior emulsion paint on wall surface (two coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remains of loose powdered materials. etc complete</p>	190.00	Smt	114.54	21,762.60

21	Providing and fixing Rajula stone work of thickness 100 mm for wall lining (veneer work) in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement mortar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-in-Charge.	42.00	Smt	3597.29	1,51,086.18
22	Providing and fixing Rajula stone cornice work of 6" high and 2" thick with moulding work for column & wall base pedestal and top in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement mortar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-in-Charge.	37.00	Rmt	7685.70	2,84,370.90
23	Providing and laying Polished Rajula slat stone work on wall top / flooring in required colour, design and patterns, in linear as well as curvilinear portions all complete as per the architectural drawings with 20 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.	30.00	Smt	2604.16	78,124.80
24	Providing and fixing Rajula slat stone work (polished and machine cut) of thickness 20 mm for wall lining (veneer work) in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement mortar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-in-Charge.	93.00	Smt	4392.63	4,08,514.59

25	<p>Providing and laying Polished Granite stone slab of all colour and texture for flooring, thred and riser in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.</p>	42.00	Smt	4526.12	1,90,097.04
26	<p>Providing, making, cutting, polishing, transporting and fixing in position good quality Krushna Kumnar Sinh sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge. Note :- Sculpture size will be 6' x 10' as per proposed intent</p>	1.00	No.	209070.00	2,09,070.00
27	<p>Providing, making, cutting, polishing, transporting and fixing in position good quality Bhavnagar State Logo sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge. Note :- Sculpture size will be 6' x 10' as per proposed intent</p>	1.00	No.	174225.00	1,74,225.00

28	<p>Providing, making, cutting, polishing, transporting and fixing in position good quality Krushna Kumnar Sinh & Sardar Patel sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge.</p> <p>Note :- Sculpture size will be 6' x 10' as per proposed intent drawing in specification.</p>	1.00	No.	209070.00	2,09,070.00
29	Rolling and consolidation of soling including filling in depression which occur during the process, with power roler 8 tonne to 12 tonne.	116.00	Smt	22.37	2,594.92
30	Supplying and spreading of graded stone aggregate of following sizes for rolling and W.B.M. including filling the interstices to required camber and gradient (2) Hand broken stone aggregate 40 mm to 63 mm size.	18.00	Cmt	541.93	9,754.74
31	Painting lines, deashes, arrows, letters etc. on roads, Air fields and like in two coats with road marking paint, brushing including cleaning the surface of all dirt, dust and other foreign matter. (i) Over 10cm in width	8.00	Smt	123.13	985.04
32	Supplying and fixing cat eye (Stim Sonite) made out from Acrilo beaultile sterine injuction high compressed molding with reflector made of MMC (prismatic type of size 12cm x 6cm x 2.5cm) provided with bituminous adhesive 100g. with each unit for fixing. (High Intensity grade)	89.00	No.	375.72	33,439.08
33	Providing and fixing Rajula Cobble Stone of 100 x 100 x 60 mm thick as per approved design Confirming to IS including 65 mm Sand layer for levelling and filling the joint with sand in proper line and level as per guidlines of IRC : SP 63-2018 etc. Complete.	116.00	Smt	2488.74	2,88,693.84

34	Providing and casting in situ controlled cement concrete M-200 for Kerb/ kerb blocks including formwork curing and finishing, complete	14.00	Cmt	4766.56	66,731.84
35	Providing cement vata (10cm. x 10 cm. size) quarter round in cement mortar 1:1 including neat cement finishing, watering etc. complete.	77.00	Rmt	23.69	1,824.13
36	Anti termite treatment of lawn / plant area through premise 30.50% I P. one liter premise diluted in 499 liters water and applying solution @ 1.00 litre solution per sqm lawn or bed area. (two application) i/c cost of chemical)and as per direction of officer-in-charge	296.00	Sqm	7.63	2,258.48
37	Point wiring for Light / Bell with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires up to 10 mtr length , in below type of pipe erected with 6A Modular type switch / bell push & accessories and earth continuity of following type, erected on PVC / Metallic/Wooden box, single mounting base frame covered with textured/metallic/white front plate modules erected on / in wall / ceiling as per pipe erected, with necessary Lamp holder/ceiling rose / H.D.Connector as directed. (a) with medium class Rigid PVC pipe and accessories erected flushed on wall/ceiling complete Cat. III	14.00	Pt.	493.89	6,914.46
38	Supplying & erecting Galvanized M.S pipe post "B" class 88.9 mm O.D 4 mtr. Long duly painted with two coats of aluminium paint complete with metallic base plate of 300 mm x 300 mm x 4mm thick for using as a compound light pole with approx. weight 32 Kg.	8.00	Ea.	3805.68	30,445.44
39	Supplying and erecting Cerco Out Door Pole Lights With Fittings as per material palette and approved by Architect including materil, labour, transportation, tools etc. complete as directed by Engineer in Charge.	8.00	Ea.	41349.40	3,30,795.20
40	Supplying and erecting Cerco Out Door Wall Lights as per material palette and approved by Architect including materil, labour, transportation, tools etc. complete as directed by Engineer in Charge.	14.00	Ea.	2903.75	40,652.50

41	Providing 1:2:4 cement concrete foundation & 70 % PCC from bottom including excavation for the pole of size 45 x 45 x 100 cm. Deep in below ground level with plinth of 45 cm x 45 cm (or 45 cm dia x 45 cm) high upper ground level with necessary curing and finishing in approved manner. (for 4 & 6 mtr pole)	8.00	Ea.	953.44	7,627.52
42	Supplying & erecting approved make SMC press moulded composite FRP. loop-in, loop-out approx. 2mm thick box complete with Bakelite connector strip 5way(3P+N+E),DIN rail for mounting mob & hinged doors as per requirement having locking arrangements with mounting clamp with nuts, bolts & washers suitable for erection on pole with cable clamps& earth bolt of following size of box. (E) 200mm x 140mm x 125mm [door]	8.00	Ea.	617.11	4,936.88
43	Providing and erecting Pipe type earthing having 150 cms.long and 2.5 cms. dia. galvanised iron pipe with coupling and buch buried in specially prepared earth pit complete with necessary 8 SWG earth wire.	8.00	Ea.	434.30	3,474.40
44	For using salt and charcoal / coke as required for pipe type earthing.	8.00	Ea.	202.00	1,616.00
45	Supplying and erecting Flexible PVC insulated multi strand multi core 1.1 kv grade ISI marked copper wires of following size to be erected as directed. (e) 1.50 Sq.mm 3 core round PVC sheathed	35.00	Mtr.	51.51	1,802.85
46	Providing and erecting Sheet Steel powder coated MCB distribution board - flush / surface mounted fitted with busbar, neutral link, earth bar and DIN rail, Conforms to IS 8623-1 & 3, IEC 61439-1 & 3 without MCB to house appropriate nos. of MCBs.(The DBs should be used of same company of MCB to be used) suitable for (A) single phase incoming and horizontal single phase outgoing (b) sheet steel double door (IP-43) (ii)6 way	1.00	Ea.	1044.34	1,044.34

47	providing and erecting Approved make RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 10 KA and suitable for operation on single phase 240 V,50Hz. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. for following Max. rating erected as directed (i) 25 Amps.DP Cat. III	1.00	Ea.	2323.00	2,323.00
48	providing and erecting Miniature circuit breaker single pole 6A to 25A suitable to operate on 240 V A.C. system and having breaking capacity 10 KA to be erected in existing box. confirming to IS 8828/1996 with ISI Mark Cat III	12.00	Ea.	131.30	1,575.60
49	Hanging bed switch / Bell push 5A erected on existing flexible wire.	8.00	Ea.	18.18	145.44

50	<p>Supplying & erecting earth pit of minimum bore dia.150mm size approved make Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free hot dipped G.I.Pipes having Outer pipe dia of 50mm having 80-200 Micron galvanising, Inner pipe dia of 25 mm having 200-250 Micron galvanising, connection terminal dia of 12mm with constant ohmic value surrounded by highly conductive compound with high charge dissipation suitable for following type of applications with chamber and heavy duty cover. (A)(approved make OEM has to submit test certificate including value of earth resistance of installation duly stamped and signed by agency and officer Incharge has to ensure the value of earthing resistane mentioned in test Certificate) & having back filling compound of (B) Inner chemical (CCM Compound)- Resistivity:- 0.2 ohm / meter testing as per IEC 62561-2017, Voltage drop:- < 1 volt at no load & dry form, Sulphar content:- <2%(C) Back fill Compound :- Earthing compound should be capable to retain moisture for long time Necessary test report must be submitted by Agency.</p> <p>(b)For Electrical installation up to 11 KV in normal soil.</p> <p>Length of Pipe : 2.00 mtrs</p> <p>Back filling Compound :1 no. Bag of 25 Kg.</p>	1.00	Ea.	6795.28	6,795.28
51	<p>Providing & laying approved make Double walled corrugated pipes (DWC) of polyethylene(conforming to IS 14930 II)with necessary connecting accessories of same material at required depth in existing trench for laying of cable. below ground / road surface for enclosing cable</p> <p>(A)50 mm outer dia</p>	60.00	Mtr.	72.72	4,363.20
52	<p>Supplying and erecting Flexible PVC insulated multi strand multi core 1.1 kv grade ISI marked copper wires of following size to be erected as directed.</p> <p>(h) 2.50 Sq.mm 3 core round PVC sheathed</p>	50.00	Mtr.	85.85	4,292.50

53	Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with outgoing tails, insulating tape etc for following size of cables. (A) 2 to 4 core 2.5 / 4 Sq. mm	18.00	Ea.	37.37	672.66
54	Solder less crimping type Copper lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. (A) 1 5/2 5 to 6 Sq mm	72.00	Ea.	9.09	654.48
55	Making trench in soft soil of suitable width of 90 cm deep for laying cable or locating the fault all over the run and back filling the same and making the surface as normal ground.	60.00	Mtr.	54.54	3,272.40
				Total Rs. :-	46,10,573.31

NAME OF WORK: REDEVELOPMENT OF TRAFFIC ISLAND CIRCLE AT NILAMBAG, BHAVNAGAR**NAME OF DOCUMENT: CEMENT CONSUMPTION**

Item No.	Item Description	Quantity	Unit	Cement Consumption (Kg/Cmt)	Total Cement (Kg)
10	Providing and laying cement concrete 1:3:6 (1-Cement : 3- coarse sand : 6- hand broken stone aggregates 40 mm nominal size) and curing complete excluding cost of formwork in (A) Foundation and Plinth	44.00	Cmt	220.00	9,680.00
11	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (A) Foundation and bottom of slab (linear or curvilinear shape)	42.00	Cmt	380.00	15,960.00
12	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (C) Coping and Beams (linear or curvilinear shape) upto floor two level.	7.00	Cmt	380.00	2,660.00
13	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (B) Walls (linear or curvilinear shape) from top of foundation level upto floor two level	19.00	Cmt	380.00	7,220.00
14	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (D) Columns upto floor two level	9.00	Cmt	380.00	3,420.00
16	Uncoursed Rubble Masonry with hard stone of approved quality in foundations and plinth in Cement Mortar 1:5 (1-cement : 5-coarse sand including levelling up etc. complete	34.00	Cmt	102.30	3,478.20
17	Brick work using common burnt clay building bricks having crushing strength not less than 35 kg./Sq.Cm. in superstructure above plinth level upto floor two level in Cement Mortar 1:5 (1- Cement : 5 -fine sand) (B) Conventional	29.00	Cmt	74.40	2,157.60

18	20mm thick mala / sand faced cement plaster on walls upto height 10 metres above ground level consisting of 12mm thick backing coat of C.M. 1:3 (1-cement : 3-sand) and 8mm thick finishing coat of C.M. 1:1 (1-cement : 1-sand) etc. complete.	190.00	Smt	16.83	3,197.70
21	Providing and fixing Rajula stone work of thickness 100 mm for wall lining (veneer work) in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement mortar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-in-Charge.	42.00	Smt	12.52	525.84
22	Providing and fixing Rajula stone cornice work of 6" high and 2" thick with moulding work for column & wall base pedestal and top in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement mortar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-in-Charge.	37.00	Rmt	6.00	222.00
23	Providing and laying Polished Rajula slat stone work on wall top / flooring in required colour, design and patterns, in linear as well as curvilinear portions all complete as per the architectural drawings with 20 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.	30.00	Smt	8.51	255.30
24	Providing and fixing Rajula slat stone work (polished and machine cut) of thickness 20 mm for wall lining (veneer work) in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement mortar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-in-Charge.	93.00	Smt	12.52	1,164.36

25	<p>Providing and laying Polished Granite stone slab of all colour and texture for flooring, thred and riser in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.</p>	42.00	Smt	11.61	487.62
26	<p>Providing, making, cutting, polishing, transporting and fixing in position good quality Krushna Kumnar Sinh sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge. Note :- Sculpture size will be 6' x 10' as per proposed intent</p>	1.00	No.	10.00	10.00
27	<p>Providing, making, cutting, polishing, transporting and fixing in position good quality Bhavnagar State Logo sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge. Note :- Sculpture size will be 6' x 10' as per proposed intent</p>	1.00	No.	15.00	15.00

28	Providing, making, cutting, polishing, transporting and fixing in position good quality Krushna Kumnar Sinh & Sardar Patel sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge. Note :- Sculpture size will be 6' x 10' as per proposed intent drawing in specification.	1.00	No.	10.00	10.00
34	Providing and casting in situ controlled cement concrete M-200 for Kerb/ kerb blocks including formwork curing and finishing, complete	14.00	Cmt	360.00	5,040.00
35	Providing cement vata (10cm. x 10 cm. size) quarter round in cement mortar 1:1 including neat cement finishing, watering etc. complete.	77.00	Rmt	2.55	196.35
37 To 55	Electrical Work	1.00	Job	20.00	20.00
				Total Cement in Kg. :-	55,719.97
				Total Cement in Bag :-	1,115.00

NAME OF WORK: REDEVELOPMENT OF TRAFFIC ISLAND CIRCLE AT NILAMBAG, BHAVNAGAR

NAME OF DOCUMENT: STEEL CONSUMPTION

Item No.	Item Description	Quantity	Unit	Total Cement (Kg)
15	Providing TMT Bar FE 500D reinforcement for R.C.C. work including bending, binding and placing in position complete upto floor two level	9740.00	Kg	9,740.00
Total Steel in Kg. :-				9,740.00
Total Steel in MT. :-				9.74

NAME OF WORK: REDEVELOPMENT OF TRAFFIC ISLAND CIRCLE AT NILAMBAG, BHAVNAGAR**NAME OF DOCUMENT: SPECIFICATION INDEX**

Item No.	Item Description	Applicable Specification Reference
1	Demolition including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift. (i) R.C.C. work	As per Building work specification booklet Item No. 20.3 & Page No. 147.
2	Demolition of Brick work and stone masonry including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift.(ii) In Cement Mortar.	As per Building work specification booklet Item No. 20.11(iii) & Page No. 148.
3	Dismantling tiled of stone floors laid in mortar including stacking of serviceable materilas and disposal of unserviceable materials with all lead and lift.	As per Building work specification booklet Item No. 20.23 & Page No. 148.
4	Dismantling steel work including distempering and stacking the materials with all lead and lift.	As per Building work specification booklet Item No. 20.43 & Page No. 150.
5	Clearing and grubbing road land including uprooting rank vegetation grass bushes, shrubs, sapling and trees girth up to 300 mm removal of stumps of trees cut earlier and disposal of unserviceable materials (C) By mechanical means in area of light jungle	As per Road and bridges work specification booklet attached herewith.
6	Excavation for foundation in any kind of soil incl. sand, soft or hard marum, soft rock not requiring Blasting incl. dewatering if required at cost and risk of agency incl. shoring, struting, making the bottom level and sides in plumb incl. watering, raming and consolidating the bottom etc. incl. removing the surplus stuff and black cotton soil if any within all lead and lift using the selected stuff for back filling to foundation, in side trencehs and plinth in layers of 20 cms. th. with watering, consolidating etc. comp. as directed. - up to	As per Building work specification booklet Item No. 4.0.0. (A) + 4.0.0. (B) + 4.0.0. (C) + 4.0.0. (D) & Page No. 29.

7	Excavation for foundation in any kind of soil incl. sand, soft or hard marum, soft rock not requiring Blasting incl. dewatering if required at cost and risk of agency incl. shoring, struting, making the bottom level and sides in plumb incl. watering, raming and consolidating the bottom etc. incl. removing the surplus stuff and black cotton soil if any within all lead and lift using the selected stuff for back filling to foundation, in side trencehs and plinth in layers of 20 cms. th. with watering, consolidating etc. comp. as directed. - from	As per Building work specification booklet Item No. 4.0.0.1. (A) + 4.0.0.1. (B) + 4.0.0.1. (C) + 4.0.0.1. (D) & Page No. 32.
8	Filling available excavated earth (excluding rock) in trenches. plinth, sides of foundations etc. in layers not exceeding 20 cm. in depth consolidating each disposed layer by ramming and watering.	As per Building work specification booklet Item No. 4.12 & Page No. 35.
9	Filling in foundation and plinth with murrum or selected soil in layers of 20cm. thickness including watering, ramming and consolidating etc. complete.	As per Building work specification booklet Item No. 4.0.0.4 & Page No. 35.
10	Providing and laying cement concrete 1:3:6 (1-Cement : 3- coarse sand : 6- hand broken stone aggregates 40 mm nominal size) and curing complete excluding cost of formwork in (A) Foundation and Plinth	As per Building work specification booklet Item No. 5.3.2. (A) & Page No. 38.
11	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (A) Foundation and bottom of slab (linear or curvilinear shape)	As per Building work specification booklet Item No. 5.8.3 + 9.1 (A) & Page No. 47 + 63.
12	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (C) Coping and Beams (linear or curvilinear shape) upto floor two level.	As per Building work specification booklet Item No. 5.8.3 + 9.1 (H) (I) & Page No. 47 + 65.

13	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (B) Walls (linear or curvilinear shape) from top of foundation level upto floor two level	As per Building work specification booklet Item No. 5.8.3 + 9.1 (C) & Page No. 47 + 65.
14	Providing and laying controlled cement concrete M.250 and curing complete including cost of formwork but excluding the cost of reinforcement for reinforced concrete work in (D) Columns upto floor two level	As per Building work specification booklet Item No. 5.8.3 + 9.1 (G) (I) & Page No. 47 + 65.
15	Providing TMT Bar FE 500D reinforcement for R.C.C. work including bending, binding and placing in position complete upto floor two level	As per Building work specification booklet Item No. 5.4.11 & Page No. 45.
16	Uncoursed Rubble Masonry with hard stone of approved quality in foundations and plinth in Cement Mortar 1:5 (1-cement : 5-coarse sand including levelling up etc. complete	As per Building work specification booklet Item No. 7.6. (II) & Page No. 58.
17	Brick work using common burnt clay building bricks having crushing strength not less than 35 kg./Sq.Cm. in superstructure above plinth level upto floor two level in Cement Mortar 1:5 (1- Cement : 5 -fine sand) (B) Conventional	As per Building work specification booklet Item No. 6.12. (B) + 6.19 (B) & Page No. 51 + 53.
18	20mm thick mala / sand faced cement plaster on walls upto height 10 metres above ground level consisting of 12mm thick backing coat of C.M. 1:3 (1-cement : 3-sand) and 8mm thick finishing coat of C.M. 1:1 (1-cement : 1-sand) etc. complete	As per Building work specification booklet Item No. 17.95 & Page No. 122.

19	<p>Providing, fabricating, assembling, hoisting/ erecting and fixing in position at all heights/ all shapes & sizes with all leads & lifts using MS Rolled Steel Sections, Hollow sections, MS Plates/ sheet, Flats, Bright Bars, Anchor bar, deep threaded MS bolts, threaded J bolts, insert plate, support plate etc as per drawing and all confirming to latest relevant IS codes for steel structures like staircases, railings, handrail, platforms, brackets, monkey ladder or similar etc. including straightening, cutting, bending, bolting and welding the members, scaffolding/ staging etc. complete and comprising of :</p> <p>i) Profile Cutting of components to required length/ width and shape/ profile;</p> <p>ii) Smooth grinding/ machining of edges/ faces/ all welding joints;</p> <p>iii) Necessary welding (electric arc welding) in required weld length and size;</p> <p>iv) Machine drilling of holes for joining/ anchoring</p> <p>Standard measurements will be paid for as actual cut length used at site. The rate shall include dry sanding, degreasing (wet cleaning) & preparation of rust free surface manually or mechanically, metal putty to make the surface even and smooth, 2 coat zinc chromate yellow oxide primer and 2 coat of enamel paint of</p>	As per Building work specification booklet Item No. 11.2. (A) + 19.7 & Page No. 78 + 138.
20	<p>Finishing wall with weather proof exterior emulsion paint on wall surface (two coats) to give an required shape even shade after thoroughly brushing the surface to remove all dirt, and remains of loose powdered materials etc complete</p>	As per Building work specification booklet Item No. 18.57 & Page No. 136.

21	Providing and fixing Rajula stone work of thickness 100 mm for wall lining (vener work) in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement morar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-	As per Building work specification booklet Item No. 14.44. & Page No. 99 but except for Rajula stone work of thickness 100 mm for wall lining.
22	Providing and fixing Rajula stone cornice work of 6" high and 2" thick with moulding work for column & wall base pedestal and top in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement morar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-in-Charge.	As per Building work specification booklet Item No. 14.44. & Page No. 99 but except for Rajula stone cornice work of 6" high and 2" thick with moulding work.
23	Providing and laying Polished Rajula slat stone work on wall top / flooring in required colour, design and patterns, in linear as well as curvilinear portions all complete as per the architectural drawings with 20 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.	As per Building work specification booklet Item No. 14.43. (A) & Page No. 98 but except for Polished Rajula slat stone work on wall top / flooring.

24	<p>Providing and fixing Rajula slat stone work (polished and machine cut) of thickness 20 mm for wall lining (veneer work) in linear as well as curvilinear portions, backing filled with a grout of average 12 mm thick in cement morar 1:3 (1 cement : 3 coarse sand), including pointing with white cement mortar 1:2 (1 white cement : 2 stone dust) with an admixture of pigment to match the stone shade etc. all complete as specified and as directed by the Engineer-in-Charge.</p>	<p>As per Building work specification booklet Item No. 14.44. & Page No. 99 but except for Rajula slat stone work (polished or machine cut) of thickness 20 mm for wall lining.</p>
25	<p>Providing and laying Polished Granite stone slab of all colour and texture for flooring, thred and riser in required design and patterns, in linear as well as curvilinear portions of the building all complete as per the architectural drawings with 18 mm thick stone slab over 20 mm (average) thick base of cement mortar 1:4 (1 cement : 4 coarse sand) laid and jointed with cement slurry and pointing with white cement slurry admixed with pigment of matching shade including rubbing, curing and polishing etc. all complete as specified and as directed by the Engineer-in-Charge.</p>	<p>As per Building work specification booklet Item No. 14.32. & 14.36. (A) & Page No. 97 but except for Granite stone slab flooring, thred and riser in any pattern.</p>
26	<p>Providing, making, cutting, polishing, transporting and fixing in position good quality Krushna Kumnar Sinh sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge. Note :- Sculpture size will be 6' x 10' as per proposed</p>	<p>As per separate sheet attached herewith.</p>

27	<p>Providing, making, cutting, polishing, transporting and fixing in position good quality Bhavnagar State Logo sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge.</p> <p>Note :- Sculpture size will be 6' x 10' as per proposed</p>	As per separate sheet attached herewith.
28	<p>Providing, making, cutting, polishing, transporting and fixing in position good quality Krushna Kumnar Sinh & Sardar Patel sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge.</p> <p>Note :- Sculpture size will be 6' x 10' as per proposed intent drawing in specification.</p>	As per separate sheet attached herewith.
29	<p>Rolling and consolidation of soling including filling in depression which occur during the process, with power roler 8 tonne to 12 tonne.</p>	As per Building work specification booklet Item No. 26.76.
30	<p>Supplying and spreading of graded stone aggregate of following sizes for rolling and W.B.M. including filling the interstices to required camber and gradient (2) Hand broken stone aggregate 40 mm to 63 mm size.</p>	As per Building work specification booklet Item No. 26.5 + 26.2.

31	Painting lines, dashes, arrows, letters etc. on roads, Air fields and like in two coats with road marking paint, brushing including cleaning the surface of all dirt, dust and other foreign matter. (i) Over 10cm in width	As per Building work specification booklet Item No. 19.126 & Page No. 146.
32	Supplying and fixing cat eye (Stim Sonite) made out from Acrilo beutile sterine injuction high compressed molding with reflector made of MMC (prismatic type of size 12cm x 6cm x 2.5cm) provided with bituminous adhesive 100g. with each unit for fixing. (High Intensity grade)	As per Road and bridges work specification booklet attached herewith.
33	Providing and fixing Rajula Cobble Stone of 100 x 100 x 60 mm thick as per approved design Confirming to IS including 65 mm Sand layer for levelling and filling the joint with sand in proper line and level as per guidelines of IRC : SP 63-2018 etc. Complete.	As per separate sheet attached herewith.
34	Providing and casting in situ controlled cement concrete M-200 for Kerb/ kerb blocks including formwork curing and finishing. complete	As per separate sheet attached herewith.
35	Providing cement vata (10cm. x 10 cm. size) quarter round in cement mortar 1:1 including neat cement finishing, watering etc. complete.	As per Building work specification booklet Item No. 17.0.0.1 & Page No. 124.
36	Anti termite treatment of lawn / plant area through premise 30.50% I P. one liter premise diluted in 499 liters water and applying solution @ 1.00 litre solution per sqm lawn or bed area. (two application) i/c cost of chemical)and as per direction of officer-in-charge.	As per Horticulture & landsape work specification booklet attached herewith.

37	<p>Point wiring for Light / Bell with 2-1.5 sq.mm & earth wire of 1.5 sq.mm (Green) both are of ISI marked 1.1 KV grade FRLS PVC insulated multi strand copper wires up to 10 mtr length , in below type of pipe erected with 6A Modular type switch / bell push & accessories and earth continuity of following type, erected on PVC / Metallic/Wooden box, single mounting base frame covered with textured/metallic/white front plate modules erected on / in wall / ceiling as per pipe erected, with necessary Lamp holder/ceiling rose / H.D.Connector as directed.</p> <p>(a) with medium class Rigid PVC pipe and accessories erected flushed on wall/ceiling complete Cat. III</p>	As per Electrical work specification booklet attached herewith.
38	<p>Supplying & erecting Galvanized M.S pipe post "B" class 88.9 mm O.D 4 mtr. Long duly painted with two coats of aluminium paint complete with metallic base plate of 300 mm x 300 mm x 4mm thick for using as a compound light pole with approx. weight 32 Kg.</p>	As per Electrical work specification booklet attached herewith.
39	<p>Supplying and erecting Cerco Out Door Pole Lights With Fittings as per material palette and approved by Architect including materil, labour, transportation, tools etc. complete as directed by Engineer in Charge.</p>	As per Electrical work specification booklet attached herewith.
40	<p>Supplying and erecting Cerco Out Door Wall Lights as per material palette and approved by Architect including materil, labour, transportation, tools etc. complete as directed by Engineer in Charge.</p>	As per Electrical work specification booklet attached herewith.

41	<p>Providing 1:2:4 cement concrete foundation & 70 % PCC from bottom including excavation for the pole of size 45 x 45 x 100 cm. Deep in below ground level with plinth of 45 cm x 45 cm (or 45 cm dia x 45 cm) high upper ground level with necessary curing and finishing in approved manner. (for 4 & 6 mtr pole)</p>	As per Electrical work specification booklet attached herewith.
42	<p>Supplying & erecting approved make SMC press moulded composite FRP. loop-in, loop-out approx. 2mm thick box complete with Bakelite connector strip 5way(3P+N+E),DIN rail for mounting mob & hinged doors as per requirement having locking arrangements with mounting clamp with nuts, bolts & washers suitable for erection on pole with cable clamps& earth bolt of following size of box. (E) 200 x 140 x 125 (H x W x D)</p>	As per Electrical work specification booklet attached herewith.
43	<p>Providing and erecting Pipe type earthing having 150 cms.long and 2.5 cms. dia. galvanised iron pipe with coupling and buch buried in specially prepared earth pit complete with necessary 8 SWG earth wire.</p>	As per Electrical work specification booklet attached herewith.
44	<p>For using salt and charcoal / coke as required for pipe type earthing.</p>	As per Electrical work specification booklet attached herewith.
45	<p>Supplying and erecting Flexible PVC insulated multi strand multi core 1.1 kv grade ISI marked copper wires of following size to be erected as directed. (e) 1.50 Sq.mm 3 core round PVC sheathed</p>	As per Electrical work specification booklet attached herewith.

46	<p>Providing and erecting Sheet Steel powder coated MCB distribution board - flush / surface mounted fitted with busbar, neutral link, earth bar and DIN rail, Conforms to IS 8623-1 & 3, IEC 61439-1 & 3 without MCB to house appropriate nos. of MCBs.(The DBs should be used of same company of MCB to be used) suitable for</p> <p>(A) single phase incoming and horizontal single phase outgoing</p> <p>(b) sheet steel double door (IP-43)</p> <p>(ii)6 way</p>	As per Electrical work specification booklet attached herewith.
47	<p>providing and erecting Approved make RCCBs conforming to IS: 12640 and having sensitivity of 30 mA and Short Circuit withstand capacity of 10 KA and suitable for operation on single phase 240 V,50Hz. having characteristic of quick action & tripping with all advance feature & do not incorporate any electronic component. for following Max. rating erected as directed</p> <p>(i) 25 Amps.DP</p>	As per Electrical work specification booklet attached herewith.
48	<p>providing and erecting Miniature circuit breaker single pole 6A to 25A suitable to operate on 240 V A.C. system and having breaking capacity 10 KA to be erected in existing box. conforming to IS 8828/1996 with ISI Mark Cat.III</p>	As per Electrical work specification booklet attached herewith.
49	<p>Hanging bed switch / Bell push 5A erected on existing flexible wire.</p>	As per Electrical work specification booklet attached herewith.

50	<p>Supplying & erecting earth pit of minimum bore dia.150mm size approved make Earthing Electrode consisting Pipe-in-Pipe Technology as per IS 3043-1987 made of corrosion free hot dipped G.I.Pipes having Outer pipe dia of 50mm having 80-200 Micron galvanising, Inner pipe dia of 25 mm having 200-250 Micron galvanising, connection terminal dia of 12mm with constant ohmic value surrounded by highly conductive compound with high charge dissipation suitable for following type of applications with chamber and heavy duty cover. (A)(approved make OEM has to submit test certificate including value of earth resistance of installation duly stamped and signed by agency and officer Incharge has to ensure the value of earthing resistane mentioned in test Certificate) & having back filling compound of (B) Inner chemical (CCM Compound)- Resistivity:- 0.2 ohm / meter testing as per IEC 62561-2017, Voltage drop:- < 1 volt at no load & dry form, Sulphar content:- <2%(C) Back fill Compound :- Earthing compound should be capable to retain moisture for long time Necessary test report must be submitted by Agency.</p> <p>(b)For Electrical installation up to 11 KV in normal soil.</p> <p>Length of Pipe : 2.00 mtrs</p> <p>Back filling Compound :1 no. Bag of 25 Kg</p>	As per Electrical work specification booklet attached herewith.
51	<p>Providing & laying approved make Double walled corrugated pipes (DWC) of polyethylene(conforming to IS 14930 II)with necessary connecting accessories of same material at required depth in existing trench for laying of cable. below ground / road surface for enclosing cable</p> <p>(A)50 mm outer dia</p>	As per Electrical work specification booklet attached herewith.
52	<p>Supplying and erecting Flexible PVC insulated multi strand multi core 1.1 kv grade ISI marked copper wires of following size to be erected as directed.</p> <p>(h) 2.50 Sq.mm 3 core round PVC sheathed</p>	As per Electrical work specification booklet attached herewith.

53	Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with out going tails, insulating tape etc for following size of cables. (A) 2 to 4 core 25 / 4 Sq. mm	As per Electrical work specification booklet attached herewith.
54	Solder less crimping type Copper lugs conforming to IS suitable for cable of following size evenly crimped with high pressure tool & connected to switchgear terminals with brass/cadmium plated nut bolts in an approved manner. (A) 1.5/2.5 to 6 Sq. mm	As per Electrical work specification booklet attached herewith.
55	Making trench in soft soil of suitable width of 90 cm deep for laying cable or locating the fault all over the run and back filling the same and making the surface as normal ground.	As per Electrical work specification booklet attached herewith.

**NAME OF WORK: REDEVELOPMENT OF TRAFFIC ISLAND CIRCLE AT
NILAMBAG, BHAVNAGAR**

NAME OF DOCUMENT: DETAIL SPECIFICATION

Item No. 26 Providing, making, cutting, polishing, transporting and fixing in position good quality Krishna Kumnar Sinh sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge.

Note :- Sculpture size will be 6' x 10' as per proposed intent drawing in specification.

and

Item No. 27 Providing, making, cutting, polishing, transporting and fixing in position good quality Bhavnagar State Logo sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge.

Note :- Sculpture size will be 6' x 10' as per proposed intent drawing in specification.

and

Item No. 28 Providing, making, cutting, polishing, transporting and fixing in position good quality Krishna Kumnar Sinh & Sardar Patel sculpture made out from Siporex Panel Work of any shade, any finish, any shape. Sculpture shall be free from cracks, lines, stains, white spots of efflorescence and even in shade for each elements. The work shall be carried out as per drawings and got approval by Architect. The sculpture to be fixed in line, level and plumb in all respect with the use of required tools, cement mortar, adhesive, joining material and cement slurry with matching pigment as approved by the Engineer-in-charge.

Note :- Sculpture size will be 6' x 10' as per proposed intent drawing in specification.

Material:

Siporex Panel Work, Letters, Cement Mortar, Adhesive, Pigment.

Labour and Tools:

Loading, unloading, transportation, store yard, fixing, scaffolding, tools, machineries, Cleaning.

Intent:



Mode of Measurement:

The rate shall be for a unit of one Nos. No extra payment made for this item.

Item No. 33 Providing and fixing Rajula Cobble Stone of 100 x 100 x 60 mm thick as per approved design Confirming to IS including 65 mm Sand layer for levelling and filling the joint with sand in proper line and level as per guidelines of IRC : SP 63-2018 etc. Complete.

Material:

Rajula Cobble Stone

Rajula Cobble Stone of Specified class designations shall be used. These shall conform to the specifications described in item.

Sand

The sand layer for levelling and filling the joint.

Laying

The Rajula Cobble Stone shall be laid on the edge, diagonal herring bone bond, or other pattern as specified or directed by the Engineer-in-Charge.

On completion of a portion of flooring, the vertical joints shall be fully filled from the top with sand. During laying, the surface of the flooring shall be frequently checked with a straight edge of length at least 2 m, so as to obtain a true plain surface with the required slope.

Measurements

Length and breadth of the flooring shall be measured correct to a cm and area shall be calculated in square metres correct to two places of decimal. No deduction shall be made for extra paid for voids not exceeding 0.20 sqm. Deduction for ends of dissimilar materials or other articles embedded shall not be made for areas not exceeding 0.10 sqm.

The rate shall include the cost of all materials and labour involved in all the operations described above, including application of sand on base or top.

Item No. 34 Providing and casting in situ controlled cement concrete M-200 for Kerb/ kerb blocks including formwork curing and finishing, complete

Material:

Cement, Sand, Kapachi, Water.

Laying:

Trenches shall first be made along the edge of the wearing course of the road to receive the kerb stones of cement concrete of specified grade. The bed of the trenches shall be compacted manually with steel rammers to a firm and even surface and then the stones shall be set in cement mortar of specified proportion.

The kerb stones with top 20 cm. wide shall be laid with their length running parallel to the road edge, true in line and gradient at a distance of 30 cm. from the road edge to allow for the channel and shall project about 12.5 cm. above the latter. The channel stones with top 30 cm. wide shall be laid in position in chamber with finished road surface and with sufficient slope towards the road gully chamber. The joints of kerb and channel stones shall be staggered and shall be not more than 10 mm. Wherever specified all joints shall be filled with mortar 1:3 (1 cement : 3 coarse sand) and pointed with mortar 1:2 (1 cement: 2 fine sand) which shall be cured for 7 days.

The necessary drainage openings of specified sizes shall be made through the kerb as per drawings or as directed by the Engineer-in-Charge for connecting to storm water drains.

Measurements

It shall be measured in cubic meters with Length of the finished work (for specified width and height of stone) shall be measured in running metre along the edge of the road correct to a cm.

The rate shall include the cost of all the materials and labour involved in all the operations described above

ELECTRICAL LOAD CALCULATION & SPECIFICATIONS

SR NO.	CONNECTED ITEM	ITEM LOAD	NOS.	TOTAL LOAD	PHASE
1	POST TOP LIGHT	30 W	8	240 W	SINGLE
2	WALL LIGHT	20 W	6	120 W	SINGLE
3	WALL LIGHT (COLUMN)	20 W	8	160 W	SINGLE
	TOTAL LOAD -			520 W	

ELECTRICAL ITEMS SPECIFICATIONS

SR NO.	ELECTRICAL ITEM	APPROVED BRAND
1	P.V.C Pipes	precision, vraj, nihar
2	M.C.B, R.C.C.B, D.B	Schneider, Legrand, Hager
3	WIRES & CABLES	R.R, K.E.I, polyclab
4	Motor starter	siemens, or as per selection

NOTE* - ALL ELECTRICAL ITEMS AS PER ATTACHED SPECIFICATION BOOKLET OR AS PER DIRECTION & SELECTION BY AUTHORITY

**MUNICIPAL CORPORATION
BHAVNAGAR**

VENDOR LIST

(A) LIST OF APPROVED VENDORS FOR CIVIL WORKS

Sr. No.	ITEMS	Approved Brands / Quality
1	CEMENT PPC 53 Grade & SULPHATE RESISTANT CEMENT,S.R.C.	Ambuja, Hathi, Ultra Tech, Sanghi, Siddhi, Hi-bond
2	BRICKS	MBM, Arjun, PBM, 555, Kisan, ABM, TRD, Paresh, Dhara, B.R.C., Kiran, BMB, Kirit, Sonal
3	Steel TMT, CRS	TISCO, SAIL, VIZAG, Kamdhenu, NATIONAL, Electrotherm, JSW, Welspun steel, Pollad Steel, DIAMOUND TMT, M. G. Steel, Friends Steel, Crown next TMT, Briskon TMT
4	VITRIFIED TILES	Asian, Kajaria, Jonson, Varmora, Simpolo, OASIS
5	CERAMIC TILES	Asian, Kajaria, Johnson, Varmora, Simpolo, OASIS
6	GLAZED TILES	Asian, Kajaria, Johnson, Varmora, Simpolo
7	ACRYLIC PAINT	ICI, Asian, Nerolac, Burger
8	OIL BOUND DISTEMPER	ICI, Asian, Nerolac, Burger
9	EXTERIOR WEATHER PROOF EMULSION PAINT	ICI, Asian, Nerolac, Burger
10	Oil Paint	ICI, Asian, Nerolac, Burger
11	SANITARY WARE	Cera, Hindware, Parryware
12	CAST IRON PIPES AND FITTINGS.	NECO, Swayarhoo, Bengal, Oriental Castings, Electro steel Castings
13	P.V.C. PIPES AND FITTING (UPVC/CPVC)	Finolex, Supreme, Jain, Kisan, Astral, Dutron, Prince
14	CHROMIUM PLATED WATER SUPPLY FITTINGS	Jaquar, Ess Ess, Plumber ,ESSCO, Crown, Metro, Prince
15	GALVANIZED PIPE	Tata, Essco, Jaquar, Ess Ess, Plumber
16	GALVANIZED FITTINGS	'R' Brand, 'RV' Brand, Kranti
17	C.I. MANHOLE COVER	Manish, Sil, NECO
18	PLUMBING FIXTURES	Jaguar, Plumber, Essco
19	PVC WATER TANK (100% VIRGIN PVC)	Sintex, Aqua
20	ALUMINIUM SHEETS AND ACCESSORIES	Nalco, Jindal, Hindalco, Banko

Sr. No.	ITEMS	Approved Brands / Quality
21	ALUMINIUM EXTRUDED DOOR/ WINDOW SECTION	Jindal, Hindalco, Banko, Ajin India, Aldowin, Alumilite
22	ALUMINIUM HARDWARE	Rajdoot, Belu, Diamond, Glider, Ajin India, Aldowin, Alumilite
23	WATER PROOFING MATERIALS	Zycosil, Dr. Fixit, Kerakoll, Pidilite, Roff
24	DOOR CLOSER	Efficient Gadget, Everite, Hardwin, Aldowin, Ozone
25	DOOR FITTINGS	Godrej, Efficient Gadgets (E.G.) Dunex, Doorset, Suzu, Coral
26	HINGES	Suzu, Yama, E.P.P.W.
27	SCREW AND BOLTS	Nettle Folds, GKW, Stud
28	BOLTS & FASTENERS	Hilti, Fisher
29	LIFT	Top, Express, Omega, OTIS, Schander, TRIO, Aegis Elevator, Mitsubishi, Aditya, Siemens slider
30	ROOFING MATERIAL – Galvalume sheets	TATA, Essar, Jindal
31	Slag Cement	SANGHI CEMENT Sanghipuram
32	CPVC PIPES FOR AUTOMATIC SPRINKLER FIRE EXTINGUISHING SYSTEM	ASTRAL POLY TECHNIK LIMITED પાર્કિંગ એરિયા, બેઈઝમેન્ટ એરિયા જેવા વિસ્તારો સિવાય માત્ર કન્સીલ્ડ પાઈપીંગ માટે આ કંપનીના CPVC pipe નો ઉપયોગ fire sprinkler piping માટે કરવાની મંજૂરી આપવામાં આવે છે.
33	AAC Blocks	NXTBLOC
34	Jointing Mortar	NXTFIX Block
35	Ready Mix Plaster	NXTPLAST
36	Block joining Masonry Mortar	Unifix
37	Tile adhesive	Unifix
38	RCC bench	Sardar Pre cast
39	Rubber mould garden curbin	Sardar Pre cast

Sr. No.	ITEMS	Approved Brands / Quality
40	Rubber mould Paver block	Sardar Pre cast
41	Fencing Pole	Sardar Pre cast
42	RCC Masonry block	Sardar Pre cast
43	Pre cast wall	Sardar Pre cast

(B) LIST OF APPROVED VENDORS FOR MECHANICAL & ELECTRICAL WORKS

Sr. No.	Description	Name of Manufacturer
1	HSCF Pump	Crompton Greaves Ltd
		Kirloskar Brothers Limited (KBL)
		JASCO
		Mather & Platt Pumps Ltd.
		Jyoti Ltd.
2	Electric Motor	Lubi Industries LLP
		Bharat Bijlee Ltd.
		Jyoti Ltd.
		JSL Industries Ltd.
		Jeumont Electrical India Pvt. Ltd.
LHP		
3	Electrical Panel	Crompton Greaves Ltd
		Bhagyashree Power Control
		Dynamic Control System
		Elembica Services
		JSL Industries Ltd.
Nutral Power Tech		
4	Kinetic Air Valve	Kirloskar Brothers Limited (KBL)
		FOURESS Engineering (India) Limited.
		Durga Valves Pvt.Ltd
		Orbinox
		ಶ್ರೀ ಕ್ರಿಸ್ತಿಯಾ ಲಿಮಿಟೆಡ್
5	Expansion Bellows	Precise Engineers
6	Dewatering (Drain) Pump(Submersible/Horizontal)	KSB Pumps
		Kirloskar Brothers Limited (KBL)
		JASCO
		Crompton Greaves Ltd
		La Gajjar Machinery Pvt Ltd.
		Pullen Pumps Industries Pvt. Ltd.
MBH		
7	Sluice Valves and Sluice Gate	Kirloskar Brothers Limited (KBL)
		DURGA Valves Pvt.Ltd
		L & T Valves
		Jupiter
		SACHDEVA
8	UPVC Pipe	Supreme Industries Ltd.,Mumbai
		Dutron Polymers Ltd
		Parixit Industries Ltd., A'bad
		Jain Irrigation Systems Ltd., Jalgaon
9	HDPE Pipe	Parixit Industries Ltd., A'bad
		Jain Irrigation Systems Ltd., Jalgaon
		Dutron Polymers Ltd
		Jindal
Essar Steel		
10	C.I. Pipe	Electro Steel, Kejriwal, Oriental Castings, BIC, Jindal, Lanco Industries Ltd.,Chennai, Kesins
13	EOT Crane	Grip Engineering Pvt. Ltd., JAPS Project, Brady & Morris Engineering Co. Ltd., Techno Industries

Sr. No.	Description	Name of Manufacturer
14	Cable & Wires	KEI Industries Ltd.
		Polycab Wires Pvt. Ltd.
		Aerolex Cables Pvt. Ltd.
		Allwin Industries
		Finolex Cables
		L&T Cables
		ULTRA CAB (India) Limited
15	Transformer	Atlanta Electricals Pvt. Ltd.
		Powerlite Electricals
		Voltamp Transformers Ltd.
		SKP Transformers
		Arya Electronics
16	Components for MCC :	
	Switch	L&T, Siemens
	HRC Fuse	L&T, Siemens
	Timer	L&T, Siemens
	Relay	L&T, Siemens
	Push Button Stations	L&T, Siemens
	Indicating Lamp	L&T, Siemens
	Cable Jointing Kit	CCI, M. Seal
	MCB/DB's	MDS, Siemens, Indokupp
17	Capacitors	L&T, Crompton, Khatau Note: Capacitors shall be oil fill type
18	KWH Meter	Simco, Jaipur, GEC
19	Light Fittings: (Indoor & Outdoor Luminaries)	Philips, Crompton, Bajaj, NESSA Illumination
20	Exhaust Fans	Crompton, Bajaj,
21	Ceiling Fans	Crompton, Bajaj, Havells
22	Air Blowers	Everest Ltd.
		Swan Pneumatics (P) Ltd
23	Alum Dosing Pumps	Asia LMI
		VK Pumps
		Swelore
24	Pressure Gauges	General Instruments
		Bells Control
		H. Guru Marketing
25	Level Gauge / Indicator	R K Dutt
		Levecon
		S. B. Electromec
26	Clarifier Equipment	Enviro Control Associates
		Voltas Ltd
		Hindustan Dorr-Oliver
		Geomiller/Triveni
27	Chlorination System	Industrial Device (I) Pvt. Ltd
		Metito
		Chloroequip
		Pennwalt
28	Gear Box	Greaves
		Radicon
		Elecon
		Shanti

Sr. No.	Description	Name of Manufacturer
29	Level Switches	Level-Tech
		Revathi Electronics
		Levec
30	Refrigerator	LG, Samsung, Kelvinator
31	PVC Pipes for Fluid	Finolex, Jain Irrigation
32	PVC Conduits for Electricals	Precision, Shakti
33	Butterfly Valve	KIRLOSKAR Brothers Limited(KBL), DURGA valves Pvt Ltd, L & T valves, R&D MULTIPLE, Jupiter, श्री कृष्णा इंजिनियर्स IVC, IVI, Audco, R & D multiple, Jupiter, Cair, Orbit Engineers
34	Check Valve (Dual Plate check Valve)	KIRLOSKAR Brothers Limited(KBL), DURGA valves Pvt Ltd, Orbinox, R&D MULTIPLE, Orbit Engineers
35	Metallic Expansion Bellow	Beloflex(B.D. Engineers), Stanfab Engineering Pvt. Ltd., D. Wren Engineering Pvt. Ltd., Sur Industries,
36	Centrifugal / Centrifugal Non Clog Pumps	Beacon Weir, KSB, Mather & Platt (Wilo), Worthington, WPIL, Xylem pumps , Grundfos Pumps Pvt. Ltd., MBH, JASCO
37	Submersible non Clog Pumps / Submersible Centrifugal Pumps	Kirlosker, KSB, ABS, ITT- Flyght, Xylem pumps, Grundfos Pumps Pvt. Ltd. , MBH, JASCO, AQUA, Jyoti, PULLEN PUMPS, Alpha, Het Pump
38	Screw Pump	Roto, Netzsch, Tushaco, Seepex
39	Metering / Dosing Pumps	Swelore, V.K. Pumps, Shapotools
40	Non Return Valves (Single / multi door) / Dual Plate Check Valves	Kirlosker, IVC, IVI, R & D multiple, Durga, Jupiter, Cair, Orbit Engineers
41	Knife Gate valves	Jash, Fouess, Vass (Dezurick), Vag, Orbinox, Orbit Engineers
42	Sluice gates / open Chanel Gates	Jash Engineering, IVC, R & D Multiple, Jupiter
43	Mechanical Fine Screens – Step (Mat) Type / Drum Type	Jash, Huber, Johnson, Savi, Italy, Apollo Screens
44	Mechanical Course bar Screen	Jash, Huber, Johnson, HDO, Triveni, Savi, Italy
45	Manual Bar Screen	Jash, Japs, HDO, Triveni, Auric
46	Grit mechanism	EIMCO – KCP, Hindustan Dorr – Oliver, Jash-Shivpad, Triveni, Voltas
47	Diffused Aeration System	EDI, OTT, Rehau
48	Air Blower	Kay, Swam, Everest, Usha Compressors, Gardner Denver
49	Agitator / mixer	Remi, Schurtek, Fibre & Fibre, Milton Roy
50	Gear Boxes	Greaves, Elecon, CPEC, PEPL, Bonfiglioli
51	Centrifuge	Humboldt, Alpha Laval, Hiller

Sr. No.	Description	Name of Manufacturer
52	HDPE Pipes	Astral, Dutron, Duraline, Narmada, RIL (PIL), Penwalt, Anjney, jain irrigation, Sangir
53	Air Compressor	Ingersoll – Rand, khosla, Kirlosker, CPE, Alpha
54	Bearing For All Equipments	SKF, FAG, Tata
55	Fasteners	Precision, Durakhanawala, Echjay, Tata, Sundaram
56	Mechanical Seals	Eagle Seals (Sealol), Durametallic, Burgman
57	Electric Actuator	Auma ,Rotork, Emerson, Pentair
58	(1) CATEGORY III Indoor LED fittings, LED Panel light, LED down light, outdoor LED ligh (street light, LED flood light, LED Post top lantern, LED bollard) (2) Solar LED Light	NESSA ILLUMINATION TECHNOLOGIES PVT.LTD., Litsun, Nextray
59	STREET LIGHT POLES	AMBICA POLES (for octogonal poles,swage poles,street loght poles, high mast poles,decorative poles, conical poles, JETCOTECH Engineering LLP
60	Resilient Seated Slice Valve	Cair
61	Air Vale	Cair, Orbit Engineers
62	Flow Control valve	Cair
63	Altitude Control valve	Cair, Orbit Engineers
64	Pressure reducing valve	Orbit Engineers
65	Pressure relief valve	Orbit Engineers
66	Ball valve	Orbit Engineers
67	Mast pole	JETCOTECH Engineering LLP
68	Earthing material	JETCOTECH Engineering LLP
69	Hot dip galvanizing	JETCOTECH Engineering LLP
70	LED Highbay	Litsun

(C) LIST OF APPROVED VENDOR FOR INSTRUMENTATION SYSTEM

SR NO	DESCRIPTION	Name Of Manufacturer
1	Electromagnetic Flow Meter	E+H, Siemens, Abb, Fuji, Yokogawa, Krohne-Marshall, AAROHI Embedded System Pvt Ltd., Emerson, SBEM
2	Pressure Gauges	Wika, H.Guru, General Instruments Consortium Manometer (India) P. Ltd. , Baumer, Waaree
3	Pressure Switch	Danfoss , Indfoss , Switzer
4	Process Analyzers (pH, DO, Free / Residual Chlorine , BOD / COD)	E+H , Emerson , Hach , Chemitech , Polymetron, Wtw (Forbes Marshall),Yokogawa
5	Ultrasonic transmitter level / diff. level / flow	E+H, Siemens – Milltronics, Krohne, Vega
6	Hydraulic level transmitter	E+H,Siemens, ABB, Forbes- Marshall, Emerson, SBEM
7	Displacer/Float Switches	Levcon, Nivo, Toshbro, Pune Techtrol , SBEM
8	PP Float / Buoyancy switch	Pepprl + Fuchs, Baumer, Waaree, E+H , Pune Techtrol , SBEM
9	Float & Board Type Level Gauge	Levcon, Nivo, Toshbro, Pune Techtrol, SBEM
10	Electromagnetic Flow Meter	E+H, Siemens, ABB, Fuji, Yokogawa, Krohne-Marshall
11	Field Transmitter (P, DP,F, L , T)	ABB, Fuji, Yokogawa, Honeywell, Emerson
12	Pressure Gauges	Wika, H.Guru, General Instruments Consortium Manometer (India) P. Ltd., Baumer, Waaree
13	Panel Mounted Process Indicator & Flow Integrator	Masibus, Nishko, Nivam, Selectron, Radix, Yokogawa, ABB
14	Pressure Switch	Danfoss, Indfoss, Switzer
15	Programmable Logic Controllers	Rockwell (Allen Bradeley), Siemens, Schneider, Fuji, ABB, GE Fanuc
16	Control Panel Enclosure	Rittal, Enklotek, Bartakke, BCH, Eldon
17	Alarm Annunciator	Aplab Ltd., Minilec , IIC
18	Solenoid valves	Asco, Rotex, Schrader
19	Tube Fitting	Excel Hydropneumatic, Multimetal, Placka

20	Instrument Valves , Manifolds	Aptek, Anmol (Superlok), Excel Hydropneumatic, General
21	Fitting	Instrument Consortium , Multimetal, Technomatic, Placka
22	Pneum , Brass Fitting	Swagelok, Multimetal Industries, SMC, Festo
23	Control Panel Accessories / Components	
a.	Miniature Relay	Wago, Omron,Phoenix, Rockwell
b.	Indication Pilot Lamps (LED Type)	Teknic, Schneider, Siemens
c.	Push Button / Selector Switch (with NO/NC Elements)	Teknic, Schneider, Siemens
d.	DC Power Supplies (DIN Rail mounted)	Phoenix, Omron, Schneider, Rockwell
e.	Terminals	Elmex, Phoenix, Wago, Connectwell
f.	Panel Wires	Finolex , Havell's , R R Kabel
g.	Panel Illumination	Philips , Crompton , GE
24	Instrument Cables (Power , Signal , Control)	Associated Cables, Associated Flexible and Wires P.Ltd., Brooks Cables, Thermo Cables, Udey Pyro
25	Cable Glands	Ex- protecta, Braco, Sudhir, Comet, Connectwell
26	Junction Box	Ex- protecta, CEAG, Sudhir, Baliga, FCG
27	Cable Tray	M.M.Engineering, Globe, Jacinth, Equi. Reputed, JETCOTECH Engineering LLP
28	Computer System	HP-Compaq, Dell, IBM, Sony, Samsung
29	UPS	Hirel-Hitachi, Emerson, APC
30	<ol style="list-style-type: none"> 1. PLC (Programmable Logic Controller) 2. SCADA (Supervisory Control and Data acquisition) 3. VFD (Variable Frequency Drive Up to 500 KW) 4. ACB (Air Circuit Breaker up to 	MITSUBISHI ELECTRIC INDIA PRIVATE LIMITED, Emerald House, EL-3, J Block, M.I.D.C., Bhosari, Pune 411026

	<p>6000A)</p> <ol style="list-style-type: none">5. MCCB (Moulded Case Circuit Breaker up to – 1600 A)6. MCB (Miniature Circuit Breaker up to – 63 A)7. ELCB (Earth Leakage Moulded Case Circuit Breaker up to 1600 A)8. Contractor up to – 800 A & OLR (Over load Relay) up to 630 A9. Multi Functional Meters10. MPCB (Motor Protection Circuit Breaker up to 32 A)	
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**(D) LIST OF APPROVED VENDORS FOR MATERIALS RELATED TO WATER
SUPPLY AND SEWERAGE NETWORK**

SR. NO.	ITEMS	NAME OF AGENCIES
1	A C Pressure pipe MAZZA process	Lotus, Kirti
2	A C Pressure pipe MEGHNANI process	Lotus, Kirti, Hindustan
3	Sluice Valve	Durga, kartar, Kirloskar, Jupiter, SACHDEVA (C.I. & D.I.), શ્રી કિર્તી ઇન્જિનીયર્સ, Cair, Orbit Engineers
4	DI Pipe	Electrotherm (I) Ltd.,Ahmedabad, Lanco Industries Ltd.,Chennai, Electrsteel, Jindal Saw Ltd.,Ahmedabad, Kesins, Welspun
5	R.C.C. PIPE (COLLAR JOINT & SOCKET SPIGOT JOINT) CLASS NP3 & NP4, & R.C.C. COLLARS	VIPUL SPUN PIPES (SIHOR & LATHIDAD,BOTAD), KATARIYA & CO. (DHASSA), OMKARESHVAR PIPES (NAVAGAAM), OMKAR PIPES (LATHIDAD, BOTAD), MARUTI PIPES (BAGODARA ,AHMEDABAD), KALATHIYA PIPES(BAGODARA ,AHMEDABAD), R. S. PIPES (BODELI), UMA HUME PIPES (KALOL, GANDHINAGAR), SIDHDHIVINAYAK (KARDEJ ,BHAVNAGAR)
6	R.C.C. MACHINEOLE FRAME & COVER, INLET FRAME COVER 10T.(600*450 MM.) , 20T.,35T., & 50T.	SONI CEMENT PRODUCT , VIPUL SPUN PIPES, KATARIYA & CO., OMKARESHVAR PIPES, OMKAR PIPES, MARUTI PIPES, KALATHIYA PIPES , R. S. PIPES, UMA HUME PIPES, SIDHDHIVINAYAK , S.K. Corporation, Laxmi Price Industries, S.J.Corporation, Sardar pre cast
7	Stone ware PipeManufacturer having BIS Certificate for ISI marking	Krishna Pipe, j.K. Pipe, Taya ceramic, Burn & co., perfect Potteries, Navroji Vakil, Kashmira
8	D.I. & C.I. FITTINGS	RG BRAND, ESSEM Engineering Industries, Bikaners Engineers works
9	CID Joints	ESSEM Engineering Industries
10	Valves & Graded Castings	ESSEM Engineering Industries
11	Pipe Fittings	ESSEM Engineering Industries, Bikaners Engineers works
12	CI/DI/MS graded castings	Bikaners Engineers works
13	Scaper machine hole	Sardar Pre cast

***GENERAL TECHNICAL
SPECIFICATIONS
FOR
BUILDING WORKS***

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GENERAL TECHNICAL SPECIFICATIONS FOR BUILDING WORKS

GENERAL:

1. In the specifications "as directed" / "approved" shall be taken to mean "as directed" / "approved by the Engineer-in-Charge".
2. Wherever a reference to any Indian Standard appears in the specifications, it shall be taken to mean as a reference to the latest edition of the same in force on the date of agreement.
3. In "Mode of Measurement" in the specifications wherever a dispute arises in the absence of specific mention of a particular point of aspect the provisions on these particular points, or aspects in the relevant Indian Standards shall be referred to
4. All measurements and computations, unless otherwise specified, shall be carried out nearest to the following limits:

(i)	Length, width and depth (height)	0.01	meter
(ii)	Areas	0.01	Sq.Mt.
(iii)	Cubic Contents	0.01	Cu.Mt.

In recording dimensions of work the sequence of length, width and height (depth) or thickness shall be followed.
5. The distance which constitutes lead shall be determined along the shortest practical route and note necessarily the route actually taken The decision of the Engineer-in-charge in this regard shall be taken as final.
6. Where no lead is specific, it shall mean "all leads"
7. Lift shall be measured from plinth level.
8. Up to "floor two level" means actual height of floor (Maxi 4 M) up to 3 Mt. above plinth level.
9. Definite particulars covered in the items of work, though not mentioned or elucidated in its specifications shall be deemed to be included therein.
10. Reference to specifications of materials as made in the detailed specification of the items of works is in the form of a designation containing them under the specification of the material and prefix 'M' e.g. 'M-5',
11. Approval to the samples of various materials given by the Engineer-in-charge shall not absolve the contractor from the responsibility of replacing defective material brought on site or materials used in the work found defective at a later date. The contractor shall have no claim to any payment or compensation whatsoever on account of any such materials being rejected by the Engineer-in-charge.
12. The contract rate of the item of work shall be for the work completed in all aspects.
13. No collection of materials shall be made before it is got approved from the Engineer-in-charge.
14. Collection of approved materials shall be done at site of work in a systematic manner. Materials shall be stored in such a manner as to prevent damage, deterioration or intrusion of foreign matter and to ensure the preservation of their quality and fitness for the work
15. Materials, if and when rejected by the Engineer-in-charge, shall be immediately removed from the site of work.
16. No materials shall be stored prior to, during and after execution of a structure in such a way as to cause or lead to damage or overloading of the various components of the structure.
17. All works shall be carried out in a workmanlike manner as per the best techniques for the particular item.
18. All tools, templates, machinery and equipment for correct execution of the work as well as for checking lines, levels, alignment of the works during execution shall be kept in sufficient numbers and in good working condition on the site of the work.
19. The mode, procedure and manner of execution shall be such that it does not cause damage or over-loading of the various components of the structure during execution or after completion of the structure.
20. Special modes of construction not adopted in general Engineering practice if proposed to be adopted by the Contractor, shall be considered only if the contractor provides satisfactory evidence that such special mode

Of construction is safe, sound and helps in speedy construction and Completion of work to the required strength and quality. Acceptance of the same by the Engineer-in-Charge shall not, however absolve the contractor of the responsibility of any adverse effects and consequences of adopting the same in the course of execution of completion of the work.

21. All installations pertaining to water supply and fixtures there of as well as drainage lines and sanitary fittings shall be deemed to be completed only after giving satisfactory tests by the contractor.
22. The contractor shall be responsible for observing the rules and regulations imposed under the "Minor Minerals Act", and such of the laws and rules prescribed by Government from to time.
23. All necessary safety measures and precautions (including those laid down in the various relevant Indian Standards) shall be taken to ensure to ensure the safety of men. Materials and machinery on the works as also of the work itself.
24. The testing charges of all materials shall be borne by the Contractor.
25. Approval to any of the executed items for the work does not in any relieve the contractor of his responsibility for the correctness, soundness and strength of the structure as per the drawings and specifications

GENERAL**STANDARD TECHNICAL SPECIFICATIONS**

Sr. No. of the item in the Schedule 'B' of tender	Sr. No. of applicable Specification	Sr. No. of the item in the Schedule 'B' of tender	Sr. No. of applicable Specification	Sr. No. of the item in the Schedule 'B' of tender	Sr. No. of applicable specification
1		25		49	
2		26		50	
3		27		51	
4		28		52	
5		29		53	
6		30		54	
7		31		55	
8		32		56	
9		33		57	
10		34		58	
11		35		59	
12		36		60	
13		37		61	
14		38		62	
15		39		63	
16		40		64	
17		41		65	
18		42		66	
19		43		67	
20		44		68	
21		45		69	
22		46		70	
23		47		71	
24		48		72	

Sr. No. of the item in the Schedule 'B' of tender	Sr. No. of applicable Specification	Sr. No. of the item in the Schedule 'B' of tender	Sr. No. of applicable Specification	Sr. No. of the item in the Schedule 'B' of tender	Sr. No. of applicable specification
73		99		125	
74		100		126	
75		101		127	
76		102		128	
77		103		129	
78		104		130	
79		105		131	
80		106		132	
81		107		133	
82		108		134	
83		109		135	
84		110		136	
85		111		137	
86		112		138	
87		113		139	
88		114		140	
89		115		141	
90		116		142	
91		117		143	
92		118		144	
93		119		145	
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95		121		147	
96		122		148	
97		123		149	
98		124		150	

SPECIFICATIONS OF MATERIALS

M-1. Water

1.1. Water shall not be salty brackish and shall be clean, reasonably clear and free objectionable quantities of silt and traces of oil and injurious alkalis, salts, organic matter and other deleterious material which will either weaken the mortar of concrete or cause efflorescence or attack the steel in R.C.C. Container for transport, storage and handling of water shall be clean. Water shall conform to the standard specified in I.S. 456-1978.

1.2. If required by the Engineer-in-Charge it shall be tested by comparison with distilled water Comparison shall be made by means of standard cement tests for soundness time of setting and mortar strength as specified in I.S. 269-1976. Any indication of unsoundness change in time of setting by 30 minutes or more or decrease of more than 10 per cent in strength, of mortar prepared with water sample when compared with the results obtained with mortar prepared with distilled water shall be sufficient cause for rejection of water under test.

1.3. Water for curing mortar, concrete or masonry should not be too acidic or too alkaline .

It shall be free of elements which significantly affect the hydration reaction or otherwise interfere with the hardening of mortar or concrete during curing or those which produce objectionable stains or other unsightly deposits on concrete or mortar surfaces

1.4. Hard and bitter water shall not be used for curing

1.5. Potable water will generally found suitable for curing mortar or concrete.

M-2. Lime

2.1. Lime shall be hydraulic lime as per I.S. 712-1973 Necessary tests shall be carried out as per I.S. 6932 (Parts I to X) 1973

2.2. The following field tests for limes are to be earned out:

(1) A very rough idea can be formed about the type of lime by its visual examination i.e. fat lime bears pure white colour, lime in form of porous lumps of dirty white colour indicates quick lime, and solid lumps are the un burnt lime stone.

(2) Acid tests for determining the carbonate content in lime Excessive amount of impurities and rough determination of class of lime.

2.3. Storage shall comply with J.S. 712-1973 The slaked lime, if stored, shall be kept in a weather proof and damp-proof shed with impervious floor and sides to protect it against rain, moisture, weather and extraneous materials mixing with it. All lime that has been damaged" in any way shall be rejected and all rejected materials shall be removed from site of work.

2.4. Field testing shall be done according to I.S 1624-1974 to show the acceptability of materials.

M-3. Cement

3.1. Cement snail be ordinary Portland slag cement as per I.S.269-1976 or Portland slag cement as per I.S. 455-1976

M-4. White Cement

4.1. The white cement shall conform to I S. 8042-E-1978.,

M-5. Coloured Cement

5.1. Coloured cement shall be with white of grey Portland cement as specified in the item of the work.

5.2. The pigments used for coloured cement shall be of approved quality and shall not exceed 10% of cement used in the mix. The mixture of pigment add cement shall be properly ground to have a uniform colour and shade. The pigments shall have such properties to provide for durability underexposure to sunlight and weather.

5.3. The pigment shall have the property such that it is neither affected by the cement nor detrimental to it

M-6 Sand

6.1. Sand shall be natural sand, clean, well graded hard strong, durable and gritty particles free from injurious amounts of dust, clay kankar nodules, soft or flaky particles shale, alkali salts organic matter, loam, mica or other deleterious substances and shall be got approved from the Engineer-in-Charge. The sand shall not contain more contain more than 8 percent of silt as determined by field test, if necessary the sand shall

be washed to make it clean.

6.2. Coarse Sand : The fineness modulus of coarse sand shall not be less than 2.5 and shall not exceed 3.0. The sieve analysis of coarse sand shall be as under.

I.S. Designation	Sieve passing sieve	Percentage by weight Designation	I.S. Sieve Percentage by weight passing Sieve
4.75 mm	100	600 micron	30 - 100
2.36 mm	90 to 100	300 micron	50 - 70
1.18 mm	70 to 100	150 micron	0 - 50

6.3. Fine Sand :

The fineness modulus shall not exceed 1.0 The sieve analysis of fine sand shall be as under.

I.S. Designation	Percentage by weight Sieve passing	I.S. Designation	Percentage by weight Sieve passing
4.75 mm	100	600 micron	40 - 85
2.36 mm	100	300 micron	5 - 50
1.18 mm	75 to 100	150 micron	0 - 10

M-7. Stone Dust

7.1. This shall be obtained from crushing hard black trap or equivalent. It shall not contain more than 8% of silt as determined by field test will measuring cylinder. The method of determining silt contents by field test is given as under :

7.2. A sample of stone dust to be tested shall be placed without drying in 200 mm. measuring cylinder. The quantity of the sample shall be such that it fills the cylinder up to 100 mm. mark. The clean water shall be added up to 150 mm. mark. The mixture shall be stirred vigorously and the content allowed to settle for 3 hours.

7.3. The height of silt, visible as settled layer above the stone dust shall be expressed as percentage of the height of the stone dust below. The stone dust containing more than 8% silt shall be washed so as to bring the content within the allowable limit.

7.4. The fineness modulus of stone dust shall not be less than 1.80

M-8. Stone Grit

8.1. Grit shall consist of crushed or broken stone and be hard, strong, dense, durable, clean of proper gradation and free from skin or coating likely to prevent proper adhesion of mortar. Grit shall generally be cubical in shape and as far as possible flakey elongated pieces shall be avoided. It shall generally comply with the provisions of I.S. 383-1970. Unless special stone of particular quarries is mentioned grit shall be obtained from the best black trap or equivalent hard stone as approved by the Engineer-in-charge. The grit shall have no deleterious with cement.

8.2. The grit shall conform to the following gradation as per sieve analysis :

I.S. sieve designation	Percentage by weight	I.S. Sieve designation	Percentage by weight
12,50 mm	100 %	4.75 mm	0-20%
1000 mm	85 - 100%	2.36 mm	0-25%

8.3. The crushing strength of grit will be such as to allow the concrete in which it used to build-up the specified strength of concrete

8.4. The necessary tests for grit shall be carried out as per the requirements of I.S.2386- (parts-I to VIII) 1963, as per instructions of the Engineer-in-charge. The necessity of test will be decided by the Engineer-in-charge.

M-9. Cinder

9.1. Cinder is will burnt furnace residue which has been fused or sintered into lumps of varying sizes

9.2. Cinder aggregates shall be well burnt furnace residue obtained from furnace using coal fuel only It shall be sound clean and free from clay dirt, ash or other deleterious matter

9.3. The average grading for cinder aggregates shall be as mentioned below .

I.S. Designation	Percentage by weight Sieve passing	I.S. Designation	Percentage by weight Sieve passing
20 mm	100	4.75 mm	70
10 mm	86	2.36 mm	52

M-10. Lime Mortar

10.1. Lime : Lime shall conform to specification M-2, Water : Water shall conform to specification M-1 and Sand: Sand shall conform to specification M-6

10.2. Proportion of Mix:

10.2.1. mortar shall consist of such proportions of slaked lime and sand as may be specified in item The slaked lime and sand shall be measured by volume

10.3. Preparation of mortar;

10.3.1. Lime mortar shall be prepared by wet process as per I S 1625-1971 .Power driven mill shall be used for preparation of lime mortar. The slaked lime shall be placed in the mill in an even layer and ground for 180 revolutions with a sufficient water. Water shall be added as required during grinding (care being taken not to add more water) that will bring the mixed material to a consistency of stiff paste. Thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

10.4. Storage:

10.4.1. Mortar shall always be kept damp, protected from sun and rain till used up, covering it by tarpaulin or open sheds.

10.5. Use:

10.5.1. All mortar shall be used as soon as possible after grinding. It should be used on the day on which it prepared, But in no case mortar made earlier than 36 hours shall be permitted for use.

M-11. Cement Mortar

11.1. Water shall conform to specification M-1, Cement : Cement shall conform to specifications M-3 and Sand : Sand shall conform to M-6

11.2. Proportion of Mix

11.2.1. Cement and sand shall be mixed to specified proportion, sand being measured by measuring boxes, the proportion of cement will be by volume on the basis of 50 Kg/Bag of cement being equal to 0.0342 Cu.m. The mortar may be hand mixed or machine mixed as directed.

11.3. Proportion of Mortar :

11.3.1. In hand mixed mortar, cement and sand in the specified proportions shall be thoroughly mixed dry on a clean impervious platform by turning over at least 3 times or more till a homogeneous mixture of uniform colour is obtained. Mixing platform shall be so arranged that no deleterious extraneous material shall get mixed with mortar or mortar shall flow out. While mixing, the water shall be gradually added and thoroughly mixed to form a stiff plastic mass of uniform colour so that each particle of sand shall be completely covered with a film of wet cement. The water cement ratio shall be adopted as directed

11.3.2. The mortar so prepared shall be used within 30 minutes of adding water. Only such quantity of mortar shall be prepared as can be used within 30 minutes

M-12. Stone Coarse Aggregate For Nominal Mix Concrete

12.1. coarse aggregate shall be of machine crushed stone of black trap or equivalent and be hard strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar

12.2. The aggregate shall generally be cubical in shape Unless special stones of particular quarries are mentioned aggregates shall be machine crushed from the best black trap or equivalent hard stone as approved Aggregate shall have no deleterious reaction with cement. The size of the coarse aggregate for plain cement and ordinary reinforced cement concrete shall generally be as per the table given below.

However, in case of reinforced cement concrete the maximum limit may be restricted to 6 mm. less than the minimum lateral clear distance between bars or 6- mm. less than the cover whichever is smaller.

I.S. Sieve Designation	Percentage passing for single Sized aggregates of Nominal size			I.S. Sieve Designation	Percentage passing for single Sized aggregates of Nominal size		
	40 mm	20 mm	16 mm		40 mm	20 mm	16 mm
80 mm	-	-	-	12.5 mm	-	-	-
63 mm	100	-	-	10 mm	05	0.20	0.30
40 mm	85-100	100	-	4.75 mm	-	0.5	0.5
20 mm	0.20	85-100	100	2.35 mm	-	-	-
16 mm	85-100						

Note : This percentage may be varied some what by the Engineer-in-charge when considered necessary for obtaining better density and strength of concrete.

12.3. The grading test shall be taken in the beginning and at the change of source of materials. The necessary tests, indicated in I.S. 383-1970 and 456-197f shall have to be carried out to ensure the acceptability. The aggregates shall be stored separately and handled in such a manner as to prevent the intermixing of different aggregates. If she aggregates are covered with dust, they shall be washed with water to make them clean. .

M-13. Black Trap or Equivalent Hard Stone Coarse

13.1. Aggregate For Design Mix Concrete . Coarse aggregate shall be of machine crushed stone of black trap or equivalent hard stone and be hard, strong, dense, durable, clean and free from skin and coating likely to prevent proper adhesion of mortar.

13.2. The aggregates shall generally be cubical in shape. Unless special stones of particular quarries are mentioned, aggregates shall be machine crushed, from the best, black trap or equivalent hard stones as approved, Aggregate shall have no deleterious with cement

13.3. The necessary tests indicated in I S. 383-1970 and I.S.456-1978 shall have to be carried out to ensure the acceptability of the material.

13.4. If aggregate is covered with dust it shall be washed with water to make it clean.

M-14. Brick Bats Aggregate

14.1. Brick bat aggregate shall be broken from well burnt or slightly over burnt and dense bricks. It shall be homogeneous in texture, roughly cubical in shape, clean and free from dirt of any other foreign material. The brick bats shall be of 40 mm - 50 mm. size unless otherwise specified in the item The under burnt or over burnt brick bats shall not be allowed.

14.2. The brick bats shall be measured by suitable boxes or as directed.

M-15. Bricks

15.1. The bricks shall be hand or machine molded and made from suitable soils and kiln burnt. They shall be free from cracks and flaws and nodules of free lime they shall have smooth rectangular faces with sharp corners and shall be of uniform colour.

The bricks shall be- moulded with a frog of 100 mm. x 40 mm. and 10 mm. to 20 mm. deep on one of its flat sides. The bricks shall not break when thrown on the ground from a height of 600 mm.

15.2. The size of modular bricks shall be 190 mm.x 90 mm.x 90 mm.

15.3. The size of the conventional bricks shall be as under :

(9" x 4.3/8" x 2,3/4") 225 x 110 x 75 mm.

15.4. Only bricks of one standard size shall be used on one work. The following tolerances shall be permitted in the conventional size adopted in a particular work.

Length \pm 1/8" (3.0 mm.) Width \pm 1/16" (1.50 mm.) Height \pm 1/16" (1.50 mm.)

15.5. The crushing strength of the bricks shall not be less than 35 Kg/Sq. Cm. The average water absorption shall not be more the 20 percent by weight Necessary tests for crushing strength and water

absorption etc. shall be carried out as per I.S. 3495 (Part-I to IV) - 1976

M-16. Stone

16.1. The stone shall be of the specified variety such as Granite/Trap Stone/ Quartzite or any other type of good hard stones. The stones shall be only from the approved quarry and shall be hard sound, durable and free from defects like cavities, cracks, sand holes, flaws injurious veins, patches of loose or soft materials etc., and weathered portions and other structural defects Or imperfections tending to affect their soundness and strength. The stone with round surface shall not be used. The percentage of water absorption shall not be more than 5% of dry weight. When tested in accordance with I.S. 1124-1974. The minimum crushing strength of stone shall be 200 Kg/Sq. Cm. unless otherwise, specified

16.2. The samples of the stone to be used shall be got approved before the work is started

16.3. The Khanki facing stone shall be dressed by chisel as specified in the item for khanki facing in required shape and size. The face of the stone shall be-so dressed that the bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on face to be plastered it shall not project by more than 19 mm. nor shall it have depressions more than 10 mm. from the average wall surface

M-17. Laterite Stone

17.1. Laterite stone shall be obtained from the approved quarry it shall be compacted in texture sound, durable and free from soft patch. It shall have minimum crushing strength of 100 Kg/Sq. Cm. in its dry condition. It shall not absorb water more than 20% of its own weight, when immersed for 24 hours in water. After quarrying, the stone shall be allowed to weather for some time before using in work.

17.2. The stone shall be dressed into regular rectangular blocks so that all faces are free from waviness and unevenness, and the edges true and square

17.3. Those types of stone in which white clay occurs should not be used

17.4. Special corner stones shall be provided where so directed.

M-18. Mild Steel Bars

18.1. Mild steel bars reinforcement for R.C C. work shall conform to I.S. 432 (Part -II) 1966 and shall be of tested quality. It shall also comply with relevant part of I.S. 456-1978.

18.2. All the reinforcement shall be clean and free from dirt, paint, grease, mill scale or loose or thick rust at the time of placing

18.3. For the purpose of payment, the bar shall be measured correct up to 10 mm. length and weight payable worked out at the rate specified below :

1.	6 mm	0.22 Kg/Rmt.	8.	20 mm.	2.47 Kg/Rmt
2.	8 mm.	0.39 Kg/Rmt.	9	22 mm.	2.98 Kg/Rmt.
3.	10 mm.	0.62 Kg/Rmt.	10.	25 mm.	3.85 Kg/Rmt.
4.	12 mm.	0.89 Kg/Rmt.	11.	28 mm.	4.83 Kg/Rmt.
5.	14 mm	1.21 Kg/Rmt.	12.	32 mm.	6.31 Kg/Rmt.
6.	16 mm	1.58 Kg/Rmt	13.	36 mm.	7.99 Kg/Rmt. *
7.	18 mm.	2.00 Kg/Rmt.	14.	40 mm.	9.86 Kg/Rmt.

M-19. High Yield Strength Steel Deformed Bars

19.1. High yield strength steel deformed bars shall be either cold twisted other rolled and shall conform to I.S. 1786-1966 and I.S. 1139-1966 respectively.

19.2. Other provisions and requirements shall conform to specification No. M-18 for Mild Steel Bars.

M-20. High Tensile Steel Wires

20.1. The high tensile wires for use in pre stressed concrete work shall conform to I.S.2090-1962.

20.2. The tensile strength of the high tensile steel bars shall be as specified in the item. In absence of the given strength the minimum strength shall be taken as per Para 6-1 of the I.S. 1785-1962. Testing shall be done as per I.S. requirements.

20.3. The high tensile steel shall be free from loose mill scale, rust, oil, grease, or any other harmful matter. Cleaning of steel bars may be carried out by immersion in solvent solution, wire brushing or passing through

a pressure box containing Carborundum.

20.4. The high tensile wire shall be obtained from manufacturers. in coils having diameter not less than 350 times the diameter of wire itself so that wire springs back straight on being uncoiled .

M-21. Mild Steel Binding Wire

21.1. The mild steel wire shall be of 1.63 mm. or 1.22 mm. (16 to 18 gauge) diameter and shall conform to I.S. 280-1972.

21.2. The use of black wire will be permitted for binding reinforcement bars. It shall be free from rust oil paint, grease loose mill scale or any other undesirable coating which may prevent adhesion of cement mortar

M-22. Structural Steel

22.1. All structural Steel shall conform to I S. 226-1985: The steel shall be free from the defects mentioned in I.S 226-1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. River bars shall conform to I.S. 1148-1973.

22.2. When the steel is supplied by the Contractor test certificate of the manufacturers shall be obtained according to I.S. 226-1975 and other relevant Indian Standards.

M-23. Galvanised Iron Sheets

23.1. The galvanised iron sheets shall be plain or corrugated sheets of gauges as specified in item The G.I. Sheets shall conform to I.S.277-1977. The sheets shall be undamaged in carnage and handling either by rubbing off of zinc coating or otherwise. They shall have clean and bright surface and shall be free from dents, bends, holes, rust or white powdery deposit.

23.2. The length and width of G.I. sheets shall be as directed as per site condition.

M-23.A :G.I. Valleys gutter, ridges

23.A.1. The G.I. ridges and hips shall be of plain galvanised sheets Class - 3 of the thickness as specified in item. These shall be 600 mm. in width and properly bent up to shape without damage to the sheets in process of bending.

23.A.2. Valleys gutters and flashings shall also be of galvanised sheet of thickness as specified in item Valleys Shall be 900 mm. wide overall and flashing shall be 380 mm. wide overall They shall be bent to the required shape without damage to the sheet in the process of bending.

M-24. Asbestos Cement Sheets

24.1. Asbestos cement sheets plain, corrugated of semi-corrugated shall conform to I.S.459-1970 The thickness of the sheets shall be as specified in the item. The sheets shall be free from all defects such as cracks, holes, deformities chipped edges or otherwise damaged.

24.2. Ridges & Hips :

24.2.1. Ridges and hips shall be of same thickness as that of A.C. sheets. The types, of ridges shall be suitable for the type of sheets and location.

24.2.2. Other accessories to be used in roof such as flashing pieces eaves filler pieces, valley gutters, north light, and ventilator curves, barge boards etc, shall be of standard manufacture and shall be suitable for the type of sheets and location.

M-25. Mangalore Pattern Roof Tiles

25.1. The mangalore pattern tiles shall conform to I S 654-1972 for Class AA or Class A type as specified in item. Samples of the tiles to be provided shall be got approved from the Engineer-in-charge. Necessary tests shall be carried out as directed.

M-26. Shuttering

26.1. The shuttering shall be either of wooden planking of 30 mm. minimum thickness with or without steel lining or of steel plates stiffened by steel angles The shuttering shall be supported on battens and beams and props of vertical bullies properly cross braced together so as to make the centering rigid. In places of bullies props, brick pillar of adequate section built in mud mortar may be used

26.2. The form work shall be sufficiently strong and shall have camber so that it assumes correct shape after deposition of the concrete and shall be able to resist forces caused by vibration of live load of men working over it and other incidental loads associated with it. The shuttering shall have smooth and even

surface and its joints shall permit leakage of cement grout

26.3. If at any stage of work during or after placing concrete in the structure, the form work sags or bulges out beyond the required shape of the structure, the concrete shall be removed and work redone with fresh concrete and adequately rigid form work. The complete form work shall be got inspected by and got approved from the Engineer-in-charge, before the reinforcement bars are placed in position.

26.4. The props shall consist of bullies having 100 mm minimum diameter measured at mid length and 80 mm. at thin end shall be placed as per design requirement. These shall rest squarely on wooden sole plates 40 mm. thick and minimum bearing area of 0-10 sq m laid on sufficiently hard base.

26.5. Double wedges shall further be provided between the sole plate and the wooden props so as to facilitate tightening and easing of shuttering without jerking the concrete.

26.6. The timber used in shuttering shall not be so dry as to absorb water from concrete and swell or bulge nor so green or wet as to shrink after erection. The timber shall be properly sawn and planed on the sides and the surface coming in contact with concrete. Wooden form work with metal sheet lining or steel plates stiffened by steel angles shall be permitted.

26.7. As far as practicable, clamps shall be used to hold the forms together and use of nails and spikes avoided.

26.8. The surface of timber shuttering that would come in contact with concrete shall be well wetted and coated with soap solution before the concreting is done. Alternatively coat of raw linseed oil or oil of approved manufacture may be applied in place of soap solution. In case of steel shuttering either soap solution or raw linseed oil shall be applied after thoroughly cleaning the surface. Under no circumstances black or burnt oil shall be permitted.

26.9. The shuttering for beams and slabs shall have camber of 4 mm per meter (1 in 250) or as directed by the Engineer-in-charge so as to offset the subsequent deflection. For cantilevers, the camber at free end shall be 1/50 of the projected length or as directed by the Engineer-in-charge.

M- 27. Expansion Joints - Permoulded filler

27.1. The item provides for expansion joints in R.C.C. frame structures for internal joints, as well as exposed joints, with the use of premoulded bituminous joint filler.

27.2. Premoulded bituminous joints filler i.e. performed strip of expansion joints filler shall not get deformed, or broken by twisting bending or other handling when exposed to atmospheric condition. Pieces of joints filler that have been damaged shall be rejected.

27.3. Thickness of the per-moulded joints filler shall be 25 mm. unless otherwise specified.

27.4. Premoulded bituminous joints filler shall conform to I S 1838-1961

M-28. Expansion joints-Copper strips & hold .fasts

28.1. The item provide for expansion joints in R.C.C. frame structure for internal joints, as well as exposed joints, with the use of premoulded bituminous joints filler.

28.2. Copper sheet shall be of 1.25 mm. width and or 1 25 mm. width and the " U " shape in the middle. Copper strip shall have holdfast of 3 m.m diameter copper rod fixed to the plate soldered on strip at intervals of about 30 cm or as shown in the drawing or as directed. The width of each flange (horizontal side) of the copper plate Jo be embedded in the concrete work shall be 25 mm depth of "U" to be provided in the expansion joint, in the copper plate shall be of 25 mm.

M-29. Teak wood

29.1. The teak wood shall be of good quality as required for the item to be executed. When the kind of wood is not specifically mentioned, good Indian teak wood as approved shall be used.

29.2. Teak wood shall generally be free from large, loose dead or cluster knots, flaws, shakes, warps, twists, bends or any other defects. It shall generally be uniform in substance and of straight fibers as far as possible. It shall be free from rot decay, harmful fungi and other defects of harmful nature which will affect the strength, durability or its usefulness for the purpose for which it is required. The colour shall be uniform as far as possible. Any effort like painting using any adhesive materials made to hide the defects shall render the pieces liable to rejection by the Engineer-in-charge.

29.3. All scantlings, planks etc., shall be sawn in straight lines and planes in the direction of grains and of uniform thickness.

29.4. The tolerances-in the dimensions shall be allowed at the rate of 1.5 mm. per face to be planed.

29.5. First class teak wood

29.5.1. First class teak wood shall have no individual hard and-sound knots, more than 6 sq. cm. in size and the aggregate area of such knots shall not be more than 1% of area of piece, The timber shall be closed grained.

29.6. Second Class Teak Wood:

29.6.1. No individual hard and sound knots shall be more than 15 sq. cms. in size and aggregates area of such knots shall be not exceed 2% of the area of piece.

M-29. A Non-teak wood:

The non-teak wood shall be chemically treated, seasoned as per I.S. Specifications and of good quality. The type of wood shall be got approved before collecting the same on site Fabrication of wooden members shall be started only after approval.

For this purpose wood of Bio, Kalai, Sires. Saded, Behda, Jamun, Sisoo will be used for door where as only Kalai. Sires, Halda. Kalam etc. will be permitted for shutters after proper seasoning and chemical treatment.

The non-teak wood shall be free from large loose dead of cluster knots, flows, shakes, warps, bends or any other defects, It shall be uniform in substance and of straight fibers as far as possible It shall be free fro rots, decay, harmful fungi and other defects of nature which will effect the strength, durability or its usefulness for the purpose for which it is required. The colour of wood shall be uniform as far as possible. The scantlings planks etc. shall be saw in straight lines and planes in the direction of grain and of uniform thickness. The department will use the Agency to produce certificate from Forest Department in event of dispute and the decision of the Department shall be final and binding to the contractor. The tolerance in the dimension shall be allowed at 1.5 mm. per face to be planed.

M-30. Wooden flush door shutters (solid core)

30.1. The solid core type flush door shutters shall be of decorative or non-decorative type as specified in the drawing. The size and thickness of the shutter shall be as specified in drawings or as directed. The timber species for core shall be used as per I.S.2202 (part -I) 1980. The timber shall be free from decay and insect attack Knots and knot holes less than half the width of cross-section of the members in which they occur may be permitted. Pitch pockets, pitch streaks and harmless pin holes shall be permissible except in the exposed edges of the core members. The commercial plywood, cross-bands shall conform to I.S. 303-1275

30.2. The face-panel of the shutters shall be formed by gluing by the hot press process on both faces of the core with either plywood or cross-bands and face veneers. The¹ hopping, rebating. opening of glazing, venation etc., shall be provided if specified in the drawing.

30.3. All edges of the door shutters shall be square. The shutters shall be free from twist or warp in its plane. Both faces of the shutters shall be sand papered to smooth even texture.

30.4. The shutters shall be tested for-

(1) End immersion test: The test shall be carried out as per I.S.2202 (part-1) 1980 There shall be no delamination at the end of the test.

(2) Knife Test : The face panel when tested in accordance with I.S 1659-1979 shall pass the test.

(3) Glue adhesion test : The flush door shall be tested for glue adhesive test in accordance with I S 2202 (part -I) 1980. The shutters shall be considered to have passed the test, if no delamination occurs in the glue lines in the plywood and if no single determination more than 80 mm in length and more than 3 mm in depth has occurred in the assembly glue lines between the plywood face and the style and rail. Delamination at the corner shall be measured continuously around the corner Delamination at the knots, knot hole and other permissible wood defectects shall not be considered in assessing the sample.

30.5. The tolerance in size of scud core type flush door shall-be as under :

In Nominal thickness ± 1.2 mm. In Nominal height ± 3 m

30.6. The thickness of the shutter shall be uniform throughout with a permissible variation of not more than 0.8 mm when measured at any points.

M-31. Aluminum doors, windows, ventilators

31.1. Aluminum alloy used in the manufacture of extruded window sections shall conform to I.S. designation HEA-WP of I.S. 733-1975 and also to I.S. Designation WVG-WP of I.S. 1285-1975 The section shall be as specified in the drawing and design. The fabrication shall be done as directed

31.2. The hinges shall be cast or extruded aluminum hinges of same type as in window but of larger size.

31.3. The hinges shall normally be of 50 mm. projecting type. Non-projecting type of hinges may also be used if directed. The handles of door shall be of specified design A suitable lock for the door Operable either from outside or inside shall be provided. In double shutter door, the first closing shutter shall have concealed aluminum alloy bolt at top and bottom.

M-32. Rolling Shutters

32.1. The rolling shutters shall conform to I.S.6248-1979 Rolling shutters shall be supplied of specified type with accessories. The size of the rolling shutters shall be specified in the drawings. The shutters shall be specified in the drawings. The shutters shall be constructed with interlocking lath sections formed from cold rolled steel strips not less than 0.9 mm. thick and 80 mm. wide for shutters up to 3.5 m .width not less than 1.25 mm. thick and 80 mm wide for shutters 3.5 m. in width and above unless otherwise specified.

32.2. Guide channels shall be of mild steel deep channel section and of rolled pressed or built up (fabricated) joint less construction The thickness of sheet used shall not be less than 3 15 mm.

32.3. Hood covers shall be made of M S. Sheets not less than 0.90 mm. thick. For shutters having width 3.5 Meter and above, the thickness of M.S. sheet for the hood cover shall be not less than 1 25 mm.

32.4. The spring shall be of best quality and shall be manufactured from tested high tensile spring steel wire of strip of adequate strength to balance the shutters in all position. The spring pipe shaft etc . shall be supported on strong M S of malleable C I. brackets. The brackets shall be fixed on or under the lintel as specified with-raw! plugs and screws bolts etc.

32.5. The rolling shutters shall be of self rolling up to 8 Sq. m. clear area without ball bearing and up to 12 Sq.m. clear area with ball bearing. If the rolling shutters are of larger, then gear operated type shutters shall be used.

32.6. The locking arrangement shall be provided at the bottom of shutter at both ends The shutters shall be opened from outside.

32.7. The Shutters shall be completed with door suspension shafts, looking arrangements, pulling hooks, handles and other accessories.

M-33. Collapsible Steel Gate

33.1. The collapsible steel gate shall be in one or two leaves and size as per approved drawings or as specified. The gate shall be fabricated from best quality mild steel channels, flats etc. Either steel pulleys or ball-bearings shall be provided in every double channel Unless otherwise specified the particulars of collapsible gate shall be as under.

(a) Pickets : These shall be of 20 mm. M.S. channels of heavy sections unless otherwise shown on drawings. The distance centre to centre of pickets shall be 12 cms .with an opening or 10 Cms

(b) Pivoted M.S. flats shall be 20 mm x6 mm

(c) Top and bottom guides shall be from tee of flat iron of approved size.

(d) The fittings like stoppers fixing, locking cleats, brass handles and cast iron rollers shall be of approved design and size

M-34. Welded Steel Wire Fabric

34.1 Welded steel wire fabric for general purpose shall be manufactured form cold drawn steel wire "as drawn" or galvenised steel conforming to I.S. 226-1975 with longitudinal and transverse wire securely connected at every intersection by a process of electrical resistance welding and conforming to I.S.4948-1974. it shall be fabricated and finished in workmanlike manner and shall be free from injurious defects and shall be rust proof The type of mesh shall be oblong or square as directed The mesh sizes and sizes if wire for square 3b well as oblong welded steel wire fabric shall be as directed The steel wire fabric in panels shall be in one whole piece in each panel as far as stock sizes permit.

M-35 Expanded Metal Sheets

35.1. The expanded metal sheets shall he free from flaws joints broken strands laminations and other harmful surface defects. Expanded metal steel sheet shall confirm to IS-412-1975. except that blank sheets need not be with guaranteed mechanical properties The size of the diamond mesh of expanded metal and dimensions of strands (width and thickness) shall be as specified. The tolerance on nominal weight of expanded metal sheets shall be of ± 10 percent.

35.2. Expanded metal in panels shall be in one whole piece in each panel as far as stock sizes permit. The expanded metal sheets shall be coated with suitable protective coating to prevent corrosion.

M-36. Mild Steel Wire (Wire Gauze Jali)

36.1. Mild steel wire may be galvanized as indicated. All finished steel wire shall be well cleanly drawn to the

dimensions and size of wire as specified in item. The wire shall be sound free from splits surface flaws, rough jagged and imperfect edges and other harmful surface defects and shall conform to I.S. 280-1978.

M-37. Plywood

37.1. The plywood for general purpose shall conform I.S. 303-17-1975.

Plywood is made by cementing together than boards or starts of wood into panels. There are always an odd number of layers, 3,5,7,9, ply etc. The piles are placed so that grain of each layer is at right angles to the grain in the adjacent level.

37.2. The chief advantages of plywood a single board of the same thickness is the more uniform strength of the plywood, along the length and width of the plywood and greater resistance to cracking and splitting with charge in moisture content.

37.3. Usually synthetic resins are used to gluing, phenolic resins are usually cured in a hot press which compresses and simultaneously heats the plies between hot plates which maintain a temperature of 90 degree C to 140 degree C and a pressure of 11 to 14 Kg/ Sq. Cm on the wood. The time of heating may be anything from 2 to 60 minutes depending upon thickness

37.4. When water glue are used the wood absorbs so much water that the finished plywood must be dried carefully. When synthetic resins are used as adhesive the finished plywood must be exposed to an atmosphere of controlled humidity until the proper amount of moisture has been absorbed.

37.5. According to I.S. 303-1975 the plywood for general purpose shall be of the grades namely BWR, WWR and CWR depending up to the adhesives used for bonding the veneers and it will be further classified into six types namely AA, AB, AC, BB, BC and CC based on the quality of the two faces each face being of three kinds namely A, Band C After pressing, the finished plywood should be reconditioned to a moisture content not less than 8 percent and not more than 16 percent.

37.6. Thickness of plywood Boards.

TABLE

Board	Thickness	Board	Thickness	Board	Thickness	Board	Thickness
3 ply.	3 mm.	5 ply.	5 mm.	7 ply.	9 mm.	9 ply.	16 mm
	4 mm.		6 mm.		13 mm.		19 mm.
	5 mm.		7 mm.		16 mm.	11 ply.	19 mm.
	6 mm.		8 mm.	9 ply.	13 mm.		25 mm.

M-38. Glass

38.1. All glass shall be of the brief quality, free from specks, bubbles, smokes veins, air holes blisters and other defects. The kind of glass to be used shall be as mentioned in the item or specification or in the special provision or as shown in detailed drawings. Thickness of glass panes shall be uniform. The specifications for different kinds of glass shall be as under.

38.2. Sheet Glass

38.2.1. In absence of any specified thickness or weight in the item or detailed specifications of the item of work, sheet glass shall be weighing 7.5 Kg/Sq. m for panes up to 600 mm x 600 mm.

38.2.2. For panes larger than 600 mm x 600 mm and up to 800 mm x 800 mm the glass weighing not less than 8.75 Kg/Sq m shall be used For bigger panes up to 900 mm x 900 mm. glass weighing not less

than 8.75 Kg/Sq. m shall be used. For bigger panes up to 900 mm x 900 mm. glass weighting not less than 11.25 Kg/Sq. m. shall be used

38.2.3. Sheet glass shall be patent flattened glass of best quality and for glazing and framing purposes shall conform to I.S. 1761-1960. Sheet glass of the specified colours shall be used, if so shown, on detailed drawings or so specified For important buildings and for panes with any dimension over 900 mm plate glass of specified thickness shall be used

38.3. Plate Glass:

38.3.1. When plate glass is specified it shall be "polished patent plate glass" of best quality It shall have both the surface ground flat and parallel and polished to obtain clear undisturbed vision and reflection The plate glass shall be of the thickness mentioned in the item or as shown in the detailed drawing or as specified. In absence of any specified thickness, the thickness of plate glass to be supplied shall be 6 mm. and a tolerance of 0.20 mm shall be admissible

38.4. Obscured Glass:

38.4.1. This type of glass transmits light so that vision is partially or almost completely obscured. Glass shall be plain rolled, figured, ribbed or fluted, or frosted glass as may be specified as required. The thickness and type of glass shall be as per details on drawings or as specified or as directed

38.5. Wired Glass:

38.5.1. Glass shall be with wire netting embedded in a sheet of planet glass. Electrically welded 13 mm Georgian square mesh shall be used Thickness of glass shall not be less than 6 mm Wired glass shall be of type and thickness as specified

M-39. Acrylic Sheets

39.1. Acrylic sheets shall be of thickness as specified in the item and of an specified shape and size as the case may be panels may be flat or curved It should be light in weight it shall be colourless or coloured or opaque as specified in the item. Colourless sheet shall be as transparent as the finest optical glass. Its light transmission rate shall be about 95% Transparency shall not be affected for the sheets of larger thickens, it shall be extremely resistant to sunlight weather and low temperatures.

It shall not sow any significant yellowing or change in physical properties or loss of light transmission over a longer period of use. The sheet shall be impact resistant also Sheets should be of such quality that they can be cut, bent jointed as desired Solution for the joints shall be used as per the requirement of manufacturer.

M-40. Particle board

40.1. The particle boards used for face panels shall of best quality free from any defects. "I he particle boards shall be made with phenolmaldehyde adhesive The particle boards shall conform I S 3087-1905" Specification for wood particle board for general purpose" The size and the thickness shall be as indicated.

M-41. Expanded polystyrene or framed styroper slabs

41.1. The expanded polystyrene ceiling boards and tiles shall be of approved make and shall be of sizes, thickness, finish and colour as indicated. It shall be of high density and suitable for use as insulating material. The insulating material shall be like slabs of Thermocole etc.

M-42. Resin bonded fiber glass.

42.1. The resin bonded fiber glass tiles or roils shall be of approved make and shall be of sizes. thickness, and finish as indicated.

42.2. For test of Mineral wool thermal insulation [Blanket I S 3144-1965 shall be followed

42.3. Insulation wool blanks shall be with the following coverings on one or both sides as indicated

- (1) Bituminous Hessian Kraft paper suitable for use in position where moisture has to be excluded.
- (2) Hessian cloth or Kraft paper for keeping out dust
- (3) G.I wire netting, suitable for surfaces to be plaster over

M-43. Fixtures and fastenings

43.1. General:

43.1.1. The fixtures and fastenings, that is butt hinges tee and strap hinges sliding door bolts, tower bolts, door latch, bath-room latch, handles door stoppers, casement window fasteners, casement

stays and ventilators catch shall be made of the metal as specified in the item or its specification.

43.1.2. They shall be of iron, brass, aluminum chromium plated iron, chromium plated brass, copper oxidised iron, copper oxidised brass or anodised aluminum as specified

43.1.3. The fixtures shall be heavy medium or light type. The fixtures and fastenings shall be smooth finished and shall be such as will ensue ease of operations.

43.1.4. The samples of fixtures and fastenings shall be got approved as regards, quality and shape before providing them in position

43.1.5. Brass and anodised aluminium fixtures and fastenings shall be bright finished

43.2. Holdfasts:

43.2.1. Holdfasts shall be made from mild steel flat 30 cm length and one of the holdfasts shall be bent at right angle and two nos of 6 mm. diameter holes, shall be made in it for fixing it to the frame with screws. At the other end, the holdfast shall be forked and bent at right angles in opposite directions

43.3. Butt hinges:

43.3.1. Railway standard heavy type butt hinges shall be used when so specified

43.3.2. Tee and strap hinges shall be manufactured from M S Sheet

43.4. Siding door bolts (Aldrops):

43.4.1. The aldrops as specified in the item shall be used and shall be got approved.

43.5. Tower bolts (Barrel Type):

43.5.1. Tower bolts as specified in the item shall be used and shall be got approved

43.6. Door Latch:

43.6.1. The size of door latch shall be taken as the length of latch.

43.7. Bathroom Latch:

43.7.1. Bathroom latch shall be similar to tower bolt.

43.8. Handle:

The size of the handles shall be determined by the inside grip length of the handles. Handles shall have a base plate of length 50 mm. more than the size" of the handle.

43.9. Door Catch:

43.9.1. Door stoppers shall be either floor door stopper type or door catch type Floor stopper shall be of overall size as specified and shall have a rubber cushion.

43.10. Door Stoppers:

43.10.1. Door catch shall be fixed at a height to about 900 mm from the floor level such that one part of the catch is fitted on the inside of the shutter and the other part is fixed in the wall with necessary wooden plug arrangements for appropriate fixity The catch shall be fixed 20 mm inside the face of the door for easy operation of catch.

43.11. Wooden Door Stop with hinges:

43.11.1. Wooden door stop of size 100 mm x GO mm x 40 mm shall be fixed on the door frame with a hinges of 75 mm. size and at a height of 900 mm. from the floor level The wooden door stop shall be provided with 3 coats of approved oil paint

43.12. Casement Window Fastener:

43.12.1. Casement window fastener for single leaf window shutter shall be left or right handed as directed

43.13. Casement stays (Straight Red Stay):

43.13.1. The stays shall be made from a channel section having three holes at appropriate position so that the window can be opened either fully or partially as directed. Size of the stay shall be 250 mm to 300 mm. as directed.

43.14. Ventilator Catch:

43.14.1. The pattern and shape of the catch shall be as approved

43.15. Pivot:

43.15.1. The base and socket plate shall be made from minimum 3 mm. thick plate; and projected pivot shall not be less than 12 mm 'diameter and 12 mm. length and shall be firmly riveted to the base plate in

case of iron pivot and in single piece plate in the case of brass pivot.

M-44. Paints:

44.1. (A) Oil paints :

44.1.1. Oil paints shall be of the specified colour and as approved. The ready mixed paints shall only be used. However, if ready mixed paint of specified shade or tint is not available white ready mixed paint with approved stainer will be allowed. In such a case the contractor shall ensure that the shade of the paint so allowed shall be uniform.

44.1.2. All the paints shall meet with the following general requirements

(i) Paint shall not show excessive setting in a freshly opened full can and shall easily be ready spread with a paddle to a smooth homogeneous state. The paint shall show no curdling, levering, caking or colour separation and shall be free from lumps and skins

(ii) The paint as received shall brush easily, possess good leveling properties and show no running or sagging tendencies

(iii) The paint shall not skin within 48 hours in a three quarters filled closed container

(iv) The paint shall dry to a smooth uniform finish free from roughness, grit unevenness and other imperfections

44.1.3. Ready mixed paint shall be used exactly as received from the manufacturers and generally according to their instructions and without any admixtures whatsoever

44.2. (B) Enamel paints:

44.2.1. The enamel paint shall satisfy in general requirements in specification of oil paints, Enamel paint shall conform to I.S. 2933-1975.

M-45. French Polish

45.1. The French polish of required tint and shade shall be prepared with the below mentioned ingredients and other necessary materials:

(i) Denatured spirit of approved quality (ii) Chandras (iii) Pigment.

45.2. The French polish so prepared shall conform to I S : 348-1 9C8.

M-46. Marble chips for marble mosaic terrazzo

46.1. The marble chips shall be of approved quality and shades. It shall be hard, sound, dense and homogeneous in texture with crystalline and coarse grains. It shall be uniform in colour and free from stains, cracks, decay and weathering.

46.2. The size of various colours of marble chips ranging from the smallest up to 20 mm shall be used where the thickness of top wearing layer is 6 mm. The marble chips of approved quality and colours only as per grading as decided by the Engineer-in-charge shall be used for marble mosaic tiles or works

46.3. The marble chips shall be machine crushed. They shall be free from foreign matter, dust etc. Except as above, the chips shall conform to I S 2114-1962

M-47. Flooring Tiles

47.1. (A) Plain Cement tiles;

47.1.1. The plain cement tiles shall be of general purpose type. These are the tiles in the manufacture of which no pigments are used. Cement used in the manufacture of tiles shall be as per Indian Standards.

47.1.2. The tiles shall be manufactured from a mixture of cement and natural aggregates by pressure process. During manufacture the tiles shall be subjected to pressure of not less than 140 Kg/Sq. Cm. The proportion of cement to aggregate in the backing of the tiles shall be not less than 1.3 by weight. The wearing face, through the tiles are of plain cement, shall be provided with stone chips of 1 to 2 mm. size. The proportions of cement to aggregate in the wearing layer of the tiles shall be three parts of cement to one part chips by weight. The minimum thickness of wearing layer shall be 3 mm. The colour and texture of wearing layer shall be uniform throughout its face and thickness. On removal from mould, the tiles shall be kept in moist condition continuously at least for seven days and subsequently, if necessary, for such long period as would ensure their conformity to requirements of I.S.1237-1980 regarding strength resistance to wear and water absorption.

47.1.3 The wearing face of the tiles shall be plane, free from projections, depressions and cracks and shall be reasonably parallel to the back face of the tile. All angles shall be right angle and all edges shall be sharp and true.

47.1.4. The size of tiles generally be square shapes 24.85 Cm x24.85 Cm. or 25 Cm x 25 Cm The thickness of tiles shall be 20 mm.

47.1.5. Tolerance of length and breadth shall be plus of minus one millimeter Tolerance on thickness shall be plus 5mm.

47.1.6. The tiles shall satisfy the tests as regards transverse strength, resistance to wear and water absorption as per I.S 1237-1980.

47.2. (B) Plain Coloured Tiles:

47.2.1. The tiles shall have the same specification as for plain cement tiles as per (A) above expect that they shall have a plain wearing surface wherein pigments are used. They shall conform it I.S. 1237-1980.

47.2.2. The pigments used for colouring cement shall not exceed 10 percent by weight of cement used in the mix. The pigments, synthetic or otherwise, used for colouring tiles shall have permanent colour and shall not contain materials detrimental to concrete

47.2.3 The colour of the tiles shall be specified in the item or as directed

47.3. (C) Marble mosaic tiles:

47.3.1. These tiles have same specification as per plain cement tiles except the requirements as stated below

47.3.2. The marble mosaic tiles shall conform to I.S 1237-1980. The wearing face of the tiles shall be mechanically ground and filled. The wearing face of tiles shall be free from projections depressions and cracks and shall be reasonably parallel to the back face of the tiles. All angles shall be right angles and all edges shall be sharp and true.

47.3.3. Chips used in the tiles be from smallest up to 20 mm. size. The minimum thickness of wearing layer of tiles shall be 6 mm. For pattern of chips to be had on the wearing face, a few samples with or without their full size photographs as directed shall be approved by the Engineer-in-charge, for approval.

47.3.4. Any particular samples if found suitable shall be approved by the Engineer-in-charge, or he may ask for a few more samples to be presented The samples shall have to be made by the contractor till a suitable sample is finally approved for use in the work. The Contractor shall ensure that the tiles supplied for, the work shall be in conformity with the approved sample only, in terms of its dimensions, thickness of backing layer and wearing surface, materials, ingredients, colour, shade, chips, distribution etc. required.

47.3.5. The tiles shall be prepared from cement conforming to Indian Standards or coloured port land cement generally depending upon the colour of tiles to be used or as directed.

47.4. (D) Chequered Tiles :

47.4.1. Chequered tiles shall be plain cement tiles or marble mosaic tiles. The former shall have the same specification as per (A) above and the latter as per marble mosaic tiles as per (C) except as mentioned below

47.4.2. The tiles shall be of nominal size of 250 mm. x 250 mm. or as specified. The centre to centre distance of chequer shall not be less than 25 mm. and not more than 50 mm. The overall thickness of the tile shall be 22 mm

47.4.3. The grooves in the chequers shall be uniform and straight. The depth of the grooves shall not be less than 3 mm. The chequered tiles shall be plain coloured or mosaic as specified The thickness of the upper layer measured from the top of the chequers shall not be less than 6 mm. The tiles shall be given the first grinding with machine before delivery to site

47.4.4. Tiles shall conform or relevant I.S 1237-1980. 47.5.

(E) Chequered Tiles For Stair Cases :

47.5.1. The requirements of these tiles shall be the same as chequered tiles as per (D) above except in following respects :

(1) The length of a tile including nosing shall be 300 mm (2) The minimum thickness shall be 28 mm (3) The nosing shall have also the same wearing layer as at the top. (4) The nosing edge shall be rounded (5) The front portion of the tile for a minimum length of 75 mm. from and including the nosing shall have grooves running parallel to nosing and at centers not exceeding 25 mm Beyond that the tiles shall have normal chequer pattern.

M-48. Rough Kotah Storm

48.1. The Kotah stones shall be hard even, sound, and regular in shape and generally uniform in colour. The colour of the stone shall generally be green Brown coloured shall not be allowed for use They shall be without any soft veins, cranks of flaws.

48.2. The size of the stones to be used for flooring shall be of size 600 mm x 600 mm and/or size 600 mm. x 450 mm as directed However smaller sizes will be allowed to be used to the extent of maintaining required pattern. Thickness shall be as specified

48.3. The edges of minus 30 mm on accounts of chisel dressing of edges shall be permitted for length as well as breadth. Tolerance in thickness shall be ± 3 mm

48.4. The edges of stones shall be truly chiseled and table rubbed with coarse sand before paving. All angles and edges of the stones of shall be true, square and free from chipping and surface shall De true and plain

48.5. When machine cut edges are specified, the exposed and the edges at joints shall be machine cut The thickness of the exposed machine cut edges shall be uniform

M-49. Polished Kotah Stoics

49.1. Polished kotah stone shall have the same specification as per rough kotah stone except as mentioned below

49.2. The stones shall have machine polished surface. When brought on site, the stones-shall be single polished or double polished depending upon its use. The stones for paving shall generally be single polished The stones to be used for dedo, skirting, sink, veneering, sills steps etc. where machine polishing after the stones are fixed in situ is not possible shall be double polished

M-50. Dholpur Stone Slab

50.1. Dholpur stone slab shall be of best quality as approve by the Engineer-m-charge The stone slab shall be without my veins, cracks, and flaws The stone slab shall be even sound and durable regular in snaps and of uniform colour

50.2. The size of the stone shall be as specified in the item or detailed drawing or as approved by the Engineer-in-charge The thickness of the stone shall be as specified in the item of work with the permissible tolerance of plus or minus 2 mm. The provision in respect of .polishing as for polished kotah stone shall apply to polished Dholpur stone also. All angles and edges of the face of the stone slab shall be fine chiseled or polished as specified in the item of work and all the four edges shall be machine cut All angles and edges of the stone slab shall be true and plane

50.3. The sample of stone shall be got approved by the Engineer-in-charge for a particular work It shall be ensured' that the stones to be used in a particular work shall not differ much in shade or tint from the approved sample

M-51. Marble Slab

51.1. Marble slab shall be white or of other and of best quality as approved by the Engineer-in-charge

51.2. Slabs shall be hard, close, uniform and homogeneous in texture. They shall have even crystalline gram and free from defects and cracks. The surface shall be machine polished to an even and perfect plane surface and edges machine cut true and square. The rear f ice shall be rough to provide key for the mortar

51.3. Marble slabs with natural veins, if selected shall have to be laid as per the pattern given by the Engineer-in-charge. Size of the slab shall be minimum 460 mm x450 mm and preferably 600 mm 'x 600 mm. However, smaller sizes will be allowed to be used of the extent of maintaining required pattern.

51.4. The slab shall not be thinner than the specified thickness at its thinnest part. A few specimen of finished slab to be used shall be deposited by the Contractor in the office for reference

51.5. Except as above the marble slabs shall conform to I.S. 1130-1969

M-52. Granite Stone slab

52.1. Granite shad be of approved colour and quality. The stone shall be hard, even sound and regular in shape and generally uniform in colour. It shall be without any soft veins, cracks of flaws

52.2. The thickness of the stone shall be specified in items

52.3. AH exposed faces shall be double polished to tender truly smooth and even reflecting surface. The

exposed edges and corners shall be rounded off as directed The exposed edges shall be machine cut and shall have uniform thickness.

M-53. P.V.C. Flooring

53.1. P.V.C. sheets for P.V.C., floor covering shall be of homogenous flexible type conforming to I S 3462-1966. The P.V.C. covering shall neither develop any toxic effect while put to use nor shall give off any disagreeable odour.

53.2. Thickness of flexible type covering tiles shall be as specified in the description of the item

53.3. The flexible type shall be backed with Hessian or other woven fabric The following tolerances shall be applicable on the nominal dimensions of the rolls or tiles :

(a) Thickness ± 015 mm.

(b) Length or Width

(1)	300 mm. Square tiles	± 0.20 mm.	(3)	900 mm Square tiles	± 0.60 mm.
(2)	600 mm. Square tiles	± 0.40 mm.	(4)	Sheets and roll	± 0.10 percent.

53.4. Adhesive:

53.4.1. The adhesive for PVC flooring shall be of the type and make recommended by the manufactures of PVC sheets/tiles.

M-54. Facing Tiles

54.1. The facing tiles (burnt clay facing bricks) shall be free from cracks, and nodules of free lime. They shall be thoroughly burnt and shall have plane rectangular faces with parallel sides and sharp straight right angled faces. The texture of the finished surface that will be exposed when in place shall conform to an approved sample consisting not less than for stretcher bricks each representing the texture desired. The facing tiles shall have a pleasing appearance, sufficient resistance to penetration by ram and greater durability than common bricks. The tiles shall conform to I.S. 2691-1972.

54.2. The standard size of facing brick tiles shall be 19 x 9 x 4 cms. The facing brick tiles shall be provided with frog which shall conform to I.S. 11077-1976.

54.3. The permissible tolerance in dimensions specified above shall be as follows:

Size	Tolerance for	
	1st Class Brick	2nd Class Brick
19 cm.	± 6 mm.	± 10 mm.
9 cm.	± 3 mm.	± 7 mm.
4 cm.	± 1.5 mm.	± 3 mm.

The tolerance for distortion or warpage of face or edges of individual brick from a plane surface and from a straight line respectively shall be as follows:

Facing dimensions	Permissible tolerance
Max. below 19 cms.	Max. 2.5 mm.
-do- above 19 cms.	Max. 3.0 mm.

54.5. The average compressive strength obtained as a sample of five tiles when tested in accordance with the procedure laid as per I S 1077-1976 shall be not less than 175 Kg/Sq Cm. The average compressive strength of any individual bricks shall be not less than 160 Kg / Sq.Cm.

54.6. The average water absorption for five bricks tiles shall not exceed 12 percent of average weight of brick before testing. The absorption for each individual bricks shall not exceed 25 percent.

54.7. The brick tiles when tested in accordance with I.S. 1077-1976, the rate of efflorescence shall not be more than "Slightly effloresced"

M-55. White glazed tiles

55.1. The tiles shall be of best quality as approved by the Engineer-in-charge. They shall be flat and true to shape They shall be free from cracks, crazing sports chipper) edges and corners. The glazing shall be of uniform shade.

55.2. The tiles shall be nominal size of 150 mm x 150 mm unless otherwise, specified. The maximum

variation the stated sizes other than the thickness of tile shall be plus or minus 1.5 mm. The thickness of tile shall be 6 mm. Except as above the tiles shall conform to I.S. 1977-19/0

M-56. Galvanised iron pipes and fittings

56.1. Galvanised iron pipes shall be of the medium type and of required diameter and shall comply with I.S. 1239-1979. The specified diameter of the pipes shall refer to the inside diameter of the bore. Clamps, screw and all galvanised iron fittings shall be of the standard 'R' or equivalent make

M-57. Bib cock and stop cock

57.1. A bib cock is a draw off tap with a horizontal inlet and free outlet A stop cock is a valve with suitable means of connection for insertion in a pipe line for controlling or stopping the flow

57.2. They shall be of screw down type and of brass chromium plated and of diameter as specified in the description of the item. They shall conform to I.S. 781-1977 and they shall be of best Indian make. They shall be polished bright.

57.3. The minimum finished weight of bib cock and stop cock shall be as given below

Diameter	Bib cock	Stop cock	Diameter	Bib cock	Stop cock
8 mm	0.25 kg.	0.25 kg.	15 mm	0.40 kg.	0.40 kg.
10 mm	0.30 kg.	0.35 kg.	20 mm	0.75 kg.	0.75 kg.

M-58. Gun metal wheel valve

58.1. The gun metal wheel valve shall be of approved quality. These shall be of gun metal fitted with wheel and shall be of gate valve opening full way and of the size specified. These shall conform to I.S. 778-1971.

M-59. White glazed porcelain wash basin

59.1. Wash basin shall be of white porcelain first quality best Indian make and it shall conform to I.S. 2556 (Part -IV) -1972 and I.S. 771-1979. The size of the wash basin shall be as specified in item. Wash basin shall be of one piece construction with continued over flow arrangements All internal angles shall be designed so as to facilitate cleaning. Wash basin shall have single tap hole as specified. Each basin shall have a circular waste hole which is either riveted or beveled internally with 65 mm. diameter at top and 10 mm. depth to suit the waste fitting. The necessary stud slot to receive the bracket on the under side of the basin shall be provided Basin shall have an internal soap holder which shall fully drain into the bowl.

59.2. White glazed pedestal of the quality and colour as that the basin shall be provided where specified in the item. It shall be completely recessed at the back for reception of supply and wash pipe. It shall be capable of supporting the basin rigidly and adequately and shall be so designed as to make the height from the floor to top of the rim of basin 750 mm. to 800 mm. as directed.

M-60. European type water closet/with low flushing

60.1. The European type water closet shall be white glazed porcelain first quality and shall be of wash down type conforming to I.S. 2556-1973 and I.S. 771-1979

60.2. 'S' trap shall be provided as required with water seal not than 50 mm. The solid plastic seat and cover shall be of best Indian make conforming to I.S 2548-1980. They shall be made of moulded synthetic materials which shall be tough and hard with high resistance to solvents and shall be free from blisters and surface defects and shall have chromium plated brass hinges and rubber buffer of suitable size.

M-61. Orrissa type water closet

61.1. The Specification of Orrissa type white glazed water closet of first quality shall conform to I.S. 2256 (Part-III) -1981 and relevant specification of Indian type water closet except that pan will be with the integral squatting pan of size 580 mm x 400 mm with raised footrest.

M-62. Indian type water closet

62.1. The Indian type white glazed water closet of first quality shall be of size as specified in the item and conforming to I.S. 771-1979 and I.S. 2556 – (Part-II) 1981. Each pan shall have integral flushing. It shall

also have an inlet at back or front for connecting flush pipes as directed. The inside of the bottom of the pan shall have sufficient slope from the front towards the outlet and surface shall be uniform and smooth. Pan shall be provided with 100 mm. diameter 'P' or 'S' trap with approximately 50 mm. Water seal and 50 mm. diameter vent horn.

M-62. A. Foot Rests

62.A.1. A pair of whit glazed earthen ware rectangular foot to minimum size 250 mm.x 130 mm. x 20 mm shall be provided with the water closet.

M-63. Glazed Earthen Ware Sink

63.1. The glazed earthen-ware sink shall be of specified size, colour and quality. The sink shall conform, to I.S. 771 part – II – 1979. The brackets for sinks shall conform to I.S 775-1970

63.2. The pipes shall conform to I.S. 1239-part-I 1973 and I.S. 404-1962. for steel and lead pipes respectively. 32 mm. brass waste coupling of standard pattern with brass chain and rubble plug shall be provided with sink.

M-64. Glazed earthen-ware Lipped type flat back urinal/corner type urinal

64.1. The lipped type urinal shall be fiat back or corner type as specified in the item and shall conform to I.S 771-1979. It shall be of best Indian make and size as specified and approved by the Engineer-in-charge. The flat back of corner type urinal must be of 1st quality free from any defects, cracks etc.

M-65. Low level Enamel flushing tank

65.1. The low level enamel flushing tank shall be of 15 liters capacity. It shall conform of I S 774-1971. The flushing cistern shall be of best quality and free from any defects. The flushing tank shall have outlet 32 mm. diameter. The outlet shall be connected with W.C. pan by lead pipe or P.V.C. pipe as specified. The flushing tank shall be provided with inlet and outlet for fixing G.I. inlet pipes and over-flow pipes. The flushing cistern shall be provided with chromium plated handle for flushing The flushing tank shall be provided with bracket of cast iron so that it can be fixed on wall at specified height. The brackets shall conform to I.S. 775-1970.

M-66. Cast iron flushing cistern.

66.1. The cast iron flushing cistern shall be of 15 liters capacity. It shall conform to I.S. 774-1971. The flushing cistern shall be of best quality free from any defects. The flushing cistern shall have outlet of 32 mm diameter. The lead pipe shall conform to I.S 404 (Part-I) - 1962; For fixing G.I. inlet pipes and overflow pipe 20 mm. dia. inlet and outlet shall be provided The flushing cistern shall be provided with galvanised iron chain and pull of sufficient length and shall be got approved from the Engineer-in-charge. The cast iron flushing cistern shall be painted with one coat of anticorrosive paint and two coats of paints The flushing cistern shall be fixed on two C I brackets The C I brackets shall conform to I S 775-1970.

M-67. Flush cock.

67.1. Half turn flush cock (Heavy weight) shall be of gun metal chromium plated of diameter as specified in the description of the item. The flush cock shall conform to relevant Indian Standard.

M-68. Cast iron pipes and fittings.

68.1. All soil water, vent and anti syphonage pipes and fitting shall conform to I S.1729-1964. The pipes shall have spigot and socket ends with head on spigot end. The pipes and fitting shall be true to shape smooth, cylindrical, their inner and outer surfaces being as nearly as practicable concentric. They shall be sound and nicely cast and shall be free from cracks, laps, pinholes or there imperfection and shall be neatly dressed and carefully fettled.

68.2. The end of pipes and fittings shall be reasonable square to their axis.

68.3. The sand of cast iron pipes shall be of the diameter as specified in the description and shall be in lengths of 1.5 M., 1.8 M. including socket ends of the pipe unless shorter lengths are either specified or required at junctions etc. The pipes and fittings shall be supplied without ears unless specified or directed otherwise.

68.4. Tolerances :

68.4.1. The Standard weights and thickness of pipes shall be as shown in the following table
A tolerance up to minus 10 per cent may however be -allowed against these standard weights

Sr. No.	Nominal dia. of bore	Thickness	Overall		
			1.5 m. long	1.8 m long	2.m long
1.	75 mm.	5.0 mm.	12.38 Kg.	16.52 Kg.	18.37 Kg.
2	100. mm.	5.0 mm.	18.14 Kg.	21.67 Kg.	24.15 Kg.

68.4.2. A tolerance up to minus 15 percent in thickness and 20 mm. length will be allowed For fittings tolerance in lengths shall be plus 25 mm. and minus 10 mm.

68.4.3. The thickness of fittings and their socket and spigot dimensions shall conform to the thickness and dimensions specified for the corresponding sizes of straight pipes. The tolerance in weights and thickness shall be the same as for straight pipes.

M-69. Nahni Trap

69.1. Nahni trap shall be of cast iron and shall be sound and free from porosity or other defects which affect serviceability The thickness of the base metal shall not be less than 6.5 mm The surface shall be smooth and free .form craze, chips and other flaws or any other kind of defects which affect serviceability The size of nahni trap shall be specified and shall be of self cleaning design.

69.2. The Nahni trap shall be of-quality approved by the Engineer-in-charge and shall generally conform to the relevant Indian Standards.

69.3. The Nahni trap provide shall be with deep seal, minimum 50 mm. except at places where trap with deep seal cannot be accommodated. The cover shall be cast iron perforated cover shall be provided on the trap of appropriate size.

M-70. Gully Trap

70.1. Gully trap shall conform to I.S. 651-1980. If shall be some, free .from defects such as fire-cracks or hair cracks. The glaze of the traps shall be free from crazing. They shall give a sharp clear note when struck with light hammer. There shall be no broken blisters.

70.2. The size of the gully trap shall be as specified in the item.

70.3. Each gully trap shall have one C.I. grating of square size corresponding to the dimensions, of inlet of gully trap. It will also have a water tight C.I. cover with frame inside dimensions 300 mm. x 300 mm. the cover with frame inside dimensions 300 mm. x 300 mm. the cover and weighing not less than 4.53 Kg. and the frame not less than 2.72 Kg. The grating cover and frame shall be of sound and good casting and shall have truly square machined seating faces.

M 71. Glazed Stone Ware pipe And Fittings

71.1. The pipes and fittings shall be of best quality as approved, by the Engineer-m-charge. The pipe shall be of best quality manufactured from stone- ware of fire clay, salt glazed thoroughly burnt through the whole thickness, of a close, even texture, free from air blows, fire blisters, cracks and other imperfections, which affect the serviceability. The inner and outer surfaces shall be smooth and perfectly glazed. The pipe shall be capable to withstand pressures or 1.5 M lead without showing sign of leakage. The thickness of the wall shall not be less than 1/12th of the internal dia. The depth of socket shall not be less than 38 mm. The socket shall be sufficiently large to allow a joint of 6 mm. around the pipe.

71.2. The pipes shall generally conform to relevant I S 651-1980.

M-72. Wall Peg Rail

72.1. The aluminum wall peg rail shall have three aluminum pegs approved quality and size. It shall be fixed on teakwood plank of size 450 mm x 75 mm x 20 mm. The teakwood shall be French polished or oil painted as specified.

M-73. G.I. Water Spot

73.1. The G.I. pipes of 40 mm dia shall be of medium quality and specials shall be of 'R' brand or equivalent brand of best approved quality

73.2. The pipe shall have length as required for the thickness of wall in which it is fixed and at outside end tee bend cut at half the length shall be provided and at other end coupling shall be provided to have better fixing. The water spout shall be provided as per detailed drawing or as directed

M-74. Asbestos Cement pipe (A.C. pipe)

74.1. The asbestos cement pipe of diameter as specified in the description of the item shall conform to I.S. 1626-1980. Special like bends, shoes, cowls, etc. shall conform to relevant Indian Standards The intent of pipe shall have is smooth finish, regular surface and regular internal diameter. The tolerance in all dimensions shall be as I.S. 1626-part-I-1980.

M-75. Crydon Ball valve

75.1. Ball valve of screwed type including polythene float and necessary level etc shall be of the size as mentioned in the description of item and shall conform to I.S 1703-1977

M-76. Bitumen Felt For Water proofing And Damp Proofing

76.1. Bitumen felt shall be on the fiber bases and shall be of type 2, self finished felt grade-2 and shall conform to I.S. 1322-1970

M-77. Selected Earth

77.1. The selected earth shall be that obtained from excavated material or shall have to be brought from outside as indicated in the items If item does not indicate anything the selected earth shall have to be brought from outside.

77.2. The selected earth shall be good yellow soil and shall be got approved from the Engineer-in-charge. In no case black cotton soil or similar expansive and shrinkable soil shall be used. It shall be clean and free from all rubbish and perishable materials, stones or brick bats. The clods shall be broken to a size of 50 mm or less. Contractor shall make his own arrangement at his own cost for land for borrowing selected earth. The stacking of material shall be done as directed by the Engineer-in-charge in such a way not to interfere with any construction all activities and in proper stacks.

77.3. When excavated material is to be used only selected stuff got approved from the Engineer-in-charge shall be used. It shall be stacked separately and shall, comply with all the requirements of selected earth mentioned above

M-78. Barbed Wire

78.1. The barbed wire shall be of galvanised steel and it shall generally conform to I.S. 278-1978. The barbed wire shall be of types-I whose nominal diameter for line wire shall be 2.5 mm. and point wire 2.24 mm. The nominal distance between two barbs shall be 75 mm unless otherwise specified in the item. The barbed wire shall be formed by twisting together two fine wires. One containing the barbs. The size of the line and point wires and barb spacing shall be as specified above. The permissible deviation from the nominal diameter of the line wire and point wire shall not exceed ± 0.08 mm

78.2. The barbs shall carry four points and shall be formed by twisting two point wires, each two turns tightly round one line wire making altogether four complete turns. The barbs shall have a length of not less than 13 mm and not more than 18 mm. The point shall be sharp and cut at an angle not greater than 35 degree of the axis of the wire forming the barbs.

78.3. The line and point wires shall be circular in section, free from scale and other defects and shall be uniformly galvanized. The line wire shall be in continuous length and shall not contain any welds other than those in the rod before it is drawn. The distance between two successive splices shall not be less than 15 meters.

78.4. The lengths per 100 Kg. of barbed wire I.S. type I shall be as under:

Nominal 1000 meter Minimum 934 meter Maximum 1066 Meter.

SECTION -4
Excavation

4.0.0. (A) Excavation for foundation up to 1.5 M. depth including sorting out and stacking of useful materials and disposing of the excavated stuff up to 50 meter lead in loose or soft soil.

1.0. General

1.1. Any soil which generally yields to the application of pickaxes and shovels, phawaras rakes or any such ordinary excavating implement or organic soil, gravel silt, sand turf loam, clay, peat etc., fall under this category

2.0. Clearing the site

2.1. The site on which the structure is to be built shall be cleared, and all obstructions loose stone, materials and rubbish of all kind bush wood and trees shall be removed as directed. The materials so obtained shall be property of the Government and shall be conveyed and stacked as directed within 50 m lead. The roots of the trees coming in the sides shall be cut and coated with a hot asphalt

2.2. The rate of side clearance is deemed to be included in the rate of earth work for which no extra will be paid.

3.0. Setting out

After clearing the site the centre lines will be given, by the Engineer-in-charge. The contractor shall assume full responsibility for alignment, elevation and dimension of each and all parts of the work. Contractor shall supply labours materials, etc. required for setting out the reference marks and bench marks and shall maintain them as long as required and directed.

4.0. Excavation

The excavation in foundation shall be carried out in true line and level and shall have the width and depth as shown in the drawings or as directed. The contractor shall do the necessary shoring and shutting or providing necessary slopes to a safe angle, at his own cost. The payment for such precautionary measures shall be paid separately if not specified. The bottom of the excavated area shall be leveled both longitudinally and transversely as directed by removing and watering as required. No earth filling will be allowed for bringing it to level. If by mistake or any excavation is made deeper or wider than, that shown on the plan or directed. The extra depth or width shall be made up with concrete of same proportion as specified for the foundation concrete at the cost of the contractor. The excavation up to 1.5 m depth shall be measured under this item.

5.0. Disposal of the excavated stuff

5.1. The excavated stuff of the selected type shall be used in filling the trenches and plinth or leveling the ground in layers including ramming and watering etc.

5.2. The balance of the excavated quantity shall be removed by the contractor from the site of work to a place as directed with lead up to 50 M. and all lift.

6.0. Mode of measurements & payment

6.1. The measurement of excavation in trenches for foundation shall be made according to the sections of trenches shown on the drawing or as per sections given by the Engineer-in-charge. No payment shall be made for surplus excavation made in excess of above requirements or due to stopping and sloping back as found necessary on account of conditions of soil and requirements of safety.

6.2. The rate shall be for a unit of one cubic meter

4.0.0. (B): Excavation for foundation up to 1.5 M. depth including sorting out and stacking of useful materials and disposing of the excavated stuff up to 50 meter lead in dense or hard soil.

1.0. Dense or Hard Soil

Any soil which generally require close application of picks or jumpers or scarifiers to loosen it stiff clay, gravel and stone etc. fall under this category.

2.0. Workmanship

The relevant specifications of item No. 4.0.0.(A) shall be followed except that the excavation work shall be carried out in dense or hard soil,

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 4.0.0. (A) shall be followed

3.2. The rate shall be for unit of one cubic meter.

4.0.0.(C): Excavation for foundation up to 1.5 M. depth including sorting out and stacking of useful

materials and disposing of the excavated stuff up to 50 meter lead in hard murrum.

1.0. Hard murrum.

The hard murrum shall be clean of good binding quality and of approved quality obtained from approved quarries of disintegrated rocks which contain some materials and natural mixture of clay of clastic origin. The size of hard murrum shall not be more than 20 mm.

2.0. Workmanship

The relevant specification of item No. 4.0.0.(A) shall be followed except that the excavation work shall be carried in hard murrum.

3.0. Mode of measurements & Payments

3.1. The relevant specifications of item No. 4.0.0. (A) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

4.0.0.(D): Excavation for foundation up to 1.50 M. depth including sorting out and stacking of useful materials and disposing of the excavated stuff up to 50 meter lead-soft rock not requiring blasting.

1.0. Workmanship

1.1. The relevant specifications of item No. 4.0.0.(A) shall be followed except that the excavation shall be earned out for foundation upon 1.5 M lift in soft rock not requiring blasting

1.2. The excavation in soft or disintegrated rock shall be carried out by crow bars, pickaxes or pneumatic drills or any other suitable means

1.3. If contractor desires to resort to blasting, he can do so with permission of the Engineer-in-charge but nothing extra shall be paid to him.

1.4. The materials available from soft excavation shall be properly stacked within 50 M. lead and 1.5 m. lift and shall be the property of department.

1.5. The classification of strata of the foundation soil shall be done by the Engineer-in-charge and shall be acceptable to the contractor

1.6. However this shall include the type of rock and boulder which may be quarried or split with crow bars. Laterite and conglomerate also come under this category.

2.0. Mode of measurements & Payment

2.1. The relevant specifications of item No. 4.0.0 (A) shall be followed.

2.2. The rate shall be for a unit of one cubic metre.

4.0.0.(E): Excavation for foundation up to 1.5 M. depth including sorting out and stacking of useful material and disposing of the excavated stuff up to 50 meter lead in hard rocks.

1.0. Workmanship

1.1. The relevant specification of item No. 4.0.0.(A) shall be followed except that the excavation for foundation work shall be carried out in hard rock.

1.2. Excavation shall be done by blasting to the dimensions shown in the drawings or as directed. The blasting shall be carried out only with written permission of the Engineer-in-charge. All the laws, regulations etc., pertaining to the precautions, acquisition, transport, landing and use of explosive shall be rigidly followed. The Magazine for the storage of the explosive shall be built to the design and specifications of explosive authority and located at the approved site. No unauthorised persons shall be admitted into the magazine and when not in use it shall be kept securely locked. No matches or inflammable materials shall be allowed in Magazine. The Magazine shall have an effective lightning conductor. The rules of explosive 1940 revised from time to time shall be followed strictly for obtaining, starting, handling, undertaking blasting work.

1.3. The contractor shall be responsible for damage to property, workmen public due to any accident due to use of explosives and operations

1.4. Precautions

1.4.1. The blasting operation shall remain in charge of competent and experienced supervisor and workmen who are thoroughly acquainted with the detail of handling explosive and blasting operations. The blasting shall be carried out during fixed hours of the day, preferably during the mid-day lunch hours or at the close of the work as ordered in writing by the Engineer-in-charge. The hours of blasting shall be notified in advance to the people in the vicinity. All the charges shall be prepared by the man in charge only.

1.4.2. Red danger flags shall be displayed prominently in all directions during the blasting operations.

1.4.3. People except those who actually light the fuse shall be prohibited from entering into this area. The flags shall be stationed at 200 m. from the firing-site in all directions and all persons including workmen shall be excluded from the flagged area at least 1.0 minutes before the firing warning whistle being sounded for this purpose

1.4.4. During excavation in rock by blasting, the lowest 15 cm. of strata shall be blasted with light charge so

as not to shatter or weaken the underlying rock on which the foundation will be actually laid. If excavation in rock is done to large widths and length than those shown on the drawings or as directed, no payment shall be made for such over break. If excavation is done to depths greater than shown on the drawings or directed, excess depth shall be made up with foundation grade concrete as directed at the contractor's cost.

1.4.5. The charged hole shall be drilled to the required depth and in suitable places when blasting is done with powder, the fuse cut to the required length shall be inserted in the holes and the powder dropped in. The powder shall be gently tamped with copper rod with rounded ends. The explosive powder shall then be covered with trapping materials which shall be tamped lightly out firmly. When blasting is done with dynamite and other high explosive, dynamite cartridges shall be prepared by inserting the square cut ends of fuse into the detonator, and finished with dippers at the open ends. The detonator should be gently pushed into the detonator and finished with dippers at the opened ends. The detonator should be gently pushed explosive. Bore holes shall be of such size that the cartridges can be easily passed down. The holes shall be cleared of all debris and explosive inserted. The space for about 20 cms, above the charge shall then be gently filled with dry clay pressed home and rest of tamping is with firmed any convenient materials gently packed with a wooden cover.

1.4.6. At a time not more than 10 such charge shall be prepared and fired. The man in charge shall blow a whistle in a recognised manner for cautioning the people. All the people shall then be required to move to number of explosions. He shall satisfy himself that all the charges have been exploded before allowing the workmen to go to the work site.

1.4.7. The contractor shall be fully responsible to strictly follow the prevailing rules and procedures regarding blasting procedures.

1.5. Misfire

1.5.1. In case of a misfire the following procedure shall be observed :

1.5.2. Sufficient time shall be allowed to account for the delayed blast. The man in charge shall inspect all the charges and determine the missed charge.

1.5.3. If it is the blasting powder charge it shall be completely flooded with water. A new hole shall be drilled at, about 45 cm. from the old and fired. This should blast the old charge. Should it not blast the old charge, the procedure shall be repeated till the old charge is blasted.

1.5.4. In case of charge of gelatins, dynamite etc, the man in charge shall gently remove the tamping and the primer with detonator and primer shall then be used to blast the charge. Alternatively the hole may be cleared of one foot of tamping and the direction then ascertained by placing a stick in the hole. Another hole may then be drilled 15 cm away and parallel to it. The man in charge shall report to the office all cases of misfire and cause of the same and what steps were taken in connection therewith.

1.5.6. If a misfire has been found to be due to defective or dynamite, the whole quantity in the box from which defective article was taken must be sent to authority as directed for inspection to ascertain whether all the remaining materials in the box are also defective or not.

1.6. Accidents:

1.6.1. The contractor shall be solely responsible for any accident during the entire procedure of handling explosive and blasting and shall pay necessary compensation to persons affected or damage to lands or property etc, due to the blasting, without extra claims on the department.

1.7. Account:

1.7.1. A careful and day to day account of explosives shall be maintained by the contractor in an approved manner and shall be open to inspection of the Engineer-in charge. Surprise visits may also be paid by the Engineer-in-charge to the storage and in case of any unaccountable shortage or unsatisfactory accounting, the contractor shall be liable to be penalised by forfeiture of part or whole of his Security Deposit or by cancellation of tender in which case he shall not be entitled for any compensation .-

1.8. Disposal of Excavated Materials:

1.8.1 No materials excavated from foundation trenches of whatever kind they may be, are to be placed even temporarily nearer than 1.5 m. or distance prescribed by the Engineer from the outer edge of excavation. All materials excavated shall remain the property of Government. Rate for excavation includes sorting out of useful materials and stacking them separately as directed within the specific lead. Materials suitable and useful for backfilling or other use shall be stacked in convenient places but not in such a way as to obstruct free movement of men, animals and vehicles or encroach upon the area required for constructional purpose. The site shall be left clean of all debris on completion.

1.8.2. Disposal of excavated materials is subject to the following :

Unsuitable materials obtained from clearing site and excavation shall be disposed off within a lead of 50 meters as directed. Useful materials obtained from clearing site and excavation shall be stacked within a lead of 50 M beyond the building areas is directed. Materials suitable for back-filling shall be stacked at convenient places within a lead of 50 M. from the structure for reuse. Useful stones from rock excavation shall be stacked neatly. within a lead of 50 M. and will be allowed to be used by the contractor on payment at rates laid down in the contract or if not so laid down, at scheduled rates of the Division or at a mutually agreed rates if there are no such rates in the schedule of rates.

1.8.3. If surplus materials are required to be conveyed beyond 50 M, conveyance will be paid for under a separate item

2.0. Mode of measurements & Payment

2.1. The work shall be measured for the work limited to the dimensions shown on drawings or directed Excavation to dimension in excess of the above will not be measured or paid for and if so ordered by the Engineer the contractor shall have to fill up the excess depth with cement concrete specified for foundation without extra payment.

2.2. Driving of sounding bars, drill holes to explore the nature of substratum up to a total length of meter distributed in 2 or 3 places in each foundation if necessary, will be considered incidental work and will not be paid for separately.

2.3. Removal of slips and blows in the foundation trenches will not be measured or paid for.

2.4. if it is necessary in the opinion of the Engineer-in-charge to carry foundation below the levels shown on the plans, the excavations for the 1.5 M of addition depth will be included in the quantity for the particular classification and will be paid for as extra at rate to be decided under the general conditions of contract unless, the contractor is willing to accept payment as tendered rates.

2.5. The rate shall be for a unit of one cubic meter

4.0.0.1.(A): Excavation for foundation for depth from 1.5 M. to 3.0 M. including sorting out and stacking of useful materials and disposing of the excavated stuff up to 50 M. lead-loose or soft soil.

1.0. Workmanship

1.1. The relevant specifications of item No. 4 0.0. (A) shall be followed except that the excavation work shall be carried out to loose or soft soil with lift 1.5 M. to 3.0 M.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 4.0 0.(A) shall be followed.

2.2. The excavation work of from 1.5 M. to 3.0 M. shall be measured under this item

2.3. The rate shall be for a unit of one cubic meter

4.0.0.1.(B): Excavation for foundation for depth from 1.5 M. to 3.0 M. including sorting out and stacking of useful materials and disposing of excavated stuff up to 50 M. lead in Dense or Hard soil.

1.0. Workmanship

The relevant specifications of item No. 4.0 0.(B) shall be followed except that the excavation work shall be carried out with 1.5 M. to 3.0 M. lift in dense or hard soil.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No.4.0.0.(A) shall be followed.

2.2. The excavation work from 1.5 to 3.0M shall be measured under this item

2.3. The rate shall be for a unit of one cubic meter.

4.0.0.1.(C): Excavation for foundation for depth from 1.5 M. to 3.0 M. including sorting out and stacking of useful materials and disposing of excavated stuff up to 50 M. lead in Hard murrum.

1.0. Workmanship

1.1. the relevant specifications of item No. 4.0.0. (A) shall be followed except that the excavation work shall be carried out from 1.5 M. to 3.0 M lift in hard murrum.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 4.0.0. (A) shall be followed.

2.2. The excavation work from 1.5 M to 3.0 M shall be measured under

2.3. The rate shall be for unit of one cubic meter

4.0.0,1.(D): Excavation for foundation for depth 1.5 M. to 3.0 M. including sorting out and stacking

of useful materials and disposing of excavated stuff up to 50 M. lead in soft rock not required blasting.

1.0. Workmanship

The relevant specifications item No. 4.0.0.(D) shall be followed except that the excavation work shall be earned out from 1.5 M. to 3.0 M. lift in soft rock not required blasting.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No 4.0.0.(A) shall be followed.

2.2. The excavation work from 1.5 M, to 3.0 M lift shall be measured under this item.

2.3. The rate shall be for a unit of one cubic meter

4.0.0.1.(E): Excavation for foundation for depth 1.5 M. to 3.0 M. including sorting out and stacking of useful materials and disposing of excavated stuff up to 50 M. lead in hard rock

1.0. Workmanship

1.1. The relevant specifications of item No. 4.0.0.(E) shall be followed except that the excavation work shall be carried out from 1.5 M. to 3.0 M. lift in hard rock.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 4.0.0. (A) shall be followed.

2.2. The excavation-work from 1.5 M, to 3.0 lift shall be measured under this item

2.3. The rate shall be for a unit of cubic meter

4.0.0.2. (A): Excavation for foundation for depth from 3.0 M. to 5.0 M. including sorting out and stacking of useful materials and disposing of the excavated stuff Upton 50 M. lead in loose or soft soil.

1.0. Workmanship

1.1. The relevant specifications of item No. 4.0.0.(A) shall be followed except that the excavation work shall be carried out from 3.0 M. to 5.0. M. lift in loose or soft soil.

2.0. Mode of Measurement & Payment

2.1. Relevant specifications of item No. 4.0.0.(A) shall be followed.

2.2. The excavation work from 3.0 M. to 5.0 M. lift shall be measured under this item.

2.3. The rate shall be for a unit of one cubic meter.

4.0.0.2.(B): Excavation for foundation for depth from 3.0 M. to 5.0 M. including sorting our and stacking of useful materials and disposing of the excavated stuff up to 50 M. lead in Dense or Hard soil.

1.0. Workmanship

1.1. The relevant specifications of item No. 4 0.0.(B) shall be followed except that the excavation work shall be carried out from 3.0.m. to 5.0.m. lift in Dense or Hard soil.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 4.0.0.(A) shall be followed:

2.2. The excavation work from 3.0. M. to 5,0 M. lift shall be measured under this item.

2.3. The rate shall be for a unit of one cubic metre.

4.0.0.2.(C): Excavation for foundation for depth from 3.0 M. to 5.0 M. including sorting out and stacking of useful material and disposing of the excavated stuff up to 50 M. lead in Hard murrum.

1.0. Workmanship

1.1. The relevant specifications items No. 4 0.0. (C) shall be followed except that the excavation work shall be carried out from 3.0 m to 5 0 M in Hard murrum.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 4.0.0.(A) be followed.

2.2. The excavation work from 3.0 M. to 5.0. lift shall be measured under this item.

2.3. The rate shall be for a unit of one cubic metre.

4.0.0.2.(D) Excavation for foundation for depth from 3.0 M. to 5.0 M. including sorting out and stacking of useful materials and disposing of the excavated stuff up to 50 M. in soft rock not required blasting.

1.0. Workmanship

1.1. The relevant specification-of item NO 4 0.0.(D) shall be followed except that the excavation work shall be carried out from 3.0. M to 5.0. M soft rock not requiring blasting

2.0. Mode of Measurement & Payment

- 2.1. The relevant specification of item No. 4.0 O.(A) shall be followed.
- 2.2. The excavation work from 30 M. to 50 M. lift shall be measured under this item.
- 2.3. The rate shall be for a unit of one cubic meter
- 4.0.0.2.(E): Excavation for foundation depth from 3.0 M. to 5.0 M. including sorting out and stacking of useful material land .disposing of the excavated stuff up to 50 M. lead in Hard rock.**
- 1.0. Workmanship**
- 1.1. The relevant specifications of item No 4.0.0.(E) shall be followed except that the excavation work shall be earned out from 3.0. M. to 5.0 M in hard rock
- 2.0. Mode of Measurement & Payment**
- 2.1. The relevant specification of item No. 4.0.0.(A) shall be followed.
- 2.2. The excavation work from 3.0. M to 5.0 M. lift shall be measured under this item.
- 2.3. The rate shall be for a unit of one cubic meter.
- 4.0.0.3.(A): Extra for additional depth more than 5.0 M. for excavation for foundation including sorting out and stacking of useful material disposing of the excavated stuff up to 50 M. lead in loose or soft soil.**
- 1.0. Workmanship**
- 1.1. The relevant specification of item. No 4 0.0 (A) shall be followed except that the excavation work shall be earned out from more than 50 M. lift in loose or soft soil
- 2.0. Mode of Measurement & Payment**
- 2.1. The relevant specifications of item No. 4.0.0.(A) shall be followed
- 2.2. The rate shall be paid extra over and above the rate of item No. 4 0 0.2.(A) for carrying' out excavation work for additional depth from 5.0 M. and above.
- 2.3. The rate shall be for a unit of cubic per meter
- 4.0.0.3.(B): Extra for additional depth more than 5.0 M. for excavation for foundation including sorting and stacking of useful materials disposing of excavated stuff up to 50 M. lead in Dense or Hard soil.**
- 1.0 Workmanship**
- 1.1. The relevant specifications of item No. 4.0.0.(B) shall be followed except that the excavation work shall be carried out from more than 5.0. M. lift in dense or hard soil.
- 2.0. Mode of Measurement & Payment**
- 2.1. The relevant specifications of item No. 4 0.0 (A) shall be followed.
- 2.2. The rate shall be paid extra over and above the rate of item No 4 0.0 2.(B) for carrying out excavation work for additional depth from 5 0 M. and above.
- 2.3. The rate shall be for a unit of one cubic meter.
- 4.0.0.3.(C): Extra for additional depth more than 5.0 M. for excavation for foundation including sorting out and stacking of useful materials disposing of excavated stuff up to 50 M. lead in Hard murrum.**
- 1.0. Workmanship**
- 1.1. The relevant specification of item No. 4.0.0 (C) shall be followed except that the excavation work shall be carried out from more than 50 M. lift in hard murrum.
- 2.0. Mode of Measurements & Payment**
- 2.1. The relevant specification of item No. 4.0.0.(A) shall be followed.
- 2.2. The rate shall be paid extra over and above the rate item No 4.0.0 2.{C}for carrying out excavation work for additional depth from 50 M. and above.
- 2.3. The rate shall be for a unit of one cubic meter.
- 4.0.0.3.(D): Extra for additional depth more than 5.0 M. for excavation for foundation including sorting out and stacking of useful materials disposing of excavated stuff up to 50 M. lead in soft rock not requiring blasting.**
- 1.0. Workmanship**
- 1.1. The relevant specifications of Item No. 4.0.0.(D) shall be followed except that the excavation work shall be carried out from more than 5.0 M. lift in soft rock not requiring blasting.
- 2.0. Mode of Measurement & Payment**
- 2.1. The relevant specifications of item No. 4.0.0.(A) shall be followed.

2.2. The rate shall be paid extra over and above the rate of item No. 4.0.0.2.(D) for carrying out excavation work for additional depth from 5.0.(M) and above.

2.3. The rates shall be for a unit of one cubic meter per meter

4.0.0.3.(E): **Extra for additional depth more than 5.0 M. for excavation for foundation including sorting out and stacking of useful material disposing of excavated stuff up to 50 M. lead in hard rock.**

1.0. Workmanship

1.1. The relevant specification of item No 4.0.0(E) shall be followed except that the excavation work shall be carried out from more than 50 m. lift in hard rock

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No.4.0 O.(A) shall be followed.

2.2. The rates shall be paid extra over and above the rate of item No. 4.0.0 2.(E) for carrying out excavation work for additional depth from 5.0. M. and above.

2.3. The rate shall be unit of one cubic meter per meter

4.1.2. **Filling available excavated earth (excluding rock) in trenches, plinth sides of foundations, etc., in layers not exceeding 20 CM. depth, consolidating each deposited layer by ramming and watering.**

1.0. Workmanship

1.1. The earth to be used for filling shall be free from salts, organic or other foreign matter. All clods of earth shall be broken.

1.2. As soon as the work in foundation has been completed and measured the site of foundation shall be cleared of all debris, brick bats: mortar dropping etc., and filled with earth in layers not exceeding 20 cms. Each layer shall be adequately watered, rammed and consolidated before the succeeding layer is laid The earth shall be rammed with iron rammers where feasible and with the but ends of crow-bars, where rammer cannot be used.

1.3. The plinth shall be similarly filled with earth in layers not exceeding 20 cms. adequately watered and consolidated by ramming with iron or wooden rammers. When filling reaches finished level the surface shall be flooded with water for at least 24 hours and allowed to dry and then rammed and consolidated.

1.4. The finished level of filling shall be kept to shape intended to be given to floor.

1.5. In case off large heavy duty flooring like factory flooring, the consolidation may be done by power rollers, where so specified. The extent of consolidation required, shall also be as specified.

1.6. The excavated stuff of the selected type shall be allowed to be used in filling the trenches and plinth. Under no circumstances black cotton soil be used for filling the plinth.

2.0. Mode of Measurements & Payment

2.1. The payment shall be made for filling in plinth and trenches. No deduction shall be made for shrinkage or voids, if consolidated as instructed above.

2.2. The rate shall be for a unit of one cubic meter.

4.2.4. **Filling in plinth with sand under floors including watering, ramming consolidating and dressing etc. complete.**

1.0. Materials

1.1. Sand shall conform to M 6

2.0. Workmanship

The relevant specifications of item No. 4.12 shall be followed except that sand shall be filled in under floors, including watering, ramming, consolidating and dressing etc , complete.

3.0. Mode of Measurements & Payment

3.1. The relevant specifications of item No. 4.12 shall be followed.

3.2. The rate includes cost of collecting, carting sand with all lead and labour for filling the same in plinth under floors.

3.3. The rate shall be for a unit of one cubic meter.

4.0.0.4. **Filling in foundation arid plinth with murrum or selected soil in layers of 20 cm. thickness including watering, ramming and consolidating etc., complete.**

1.0. Materials

1.1. Murrum shall be clean, of good binding quality and of approved quality obtained from approved pots/ quarries of disintegrated rocks which contain silicon material and natural mixture of clay of clarions origin. The size of murrum shall not be more than 20 mm

2.0. Workmanship

2.1. The relevant specifications of item No. 4.12 shall be followed except that the murrum or selected soil shall be filled in foundations and plinth in 20 cms layer including consolidating, ramming, watering, dressing etc. complete

3.0. Mode of Measurements & Payment

3.1. The relevant specifications of item No. 4.12 shall be followed-

3.2. The rate includes cost of collecting and carting murrum / or selected earth of approved quality with all lead and labour required for filling in trenches and plinth.

3.3. Rate shall be for a unit of one cubic meter.

4.0.0.5. Filling in foundation and plinth with brick-bats / chhara in layers of 20 cms. thickness including watering, ramming and consolidating etc. complete.**1.0. Materials**

Brick bats shall conform to M.14

2.0. Workmanship

The relevant specification of item No. 4.12 shall be followed except that brick bats of-burnt bricks shall be filled in foundation and plinth in 20 cms layer including watering, ramming, consolidating etc.,*complete.

3.0. Mode of Measurements & Payment

3.1. The relevant specification item No. 4 12 shall be followed.

3.2. The rate includes cost of collecting and carting brick bats/chhara with all lead and labour required filling in trenches and plinth.

3.3. The rate shall be for a unit of one cubic meter

4.27. Boring holes 3.5 M. deep in ordinary soil (for cast in situ piles) and getting out the soil disposal of the surplus excavated soil as directed within a lead of 50 M. for following diameter for piles, (i) 200 mm. (ii) 250 mm, (iii) 300 mm.**1.0. Workmanship**

1.0. The ground shall be roughly leveled and after making the position of piles, the holes shall be bored with a spiral angle to the 3.5 M. depth and specified diameter using boring guide.

2.0. The bore holes shall be truly vertical and uniform bore through out of specified diameter, After boring to the required depth, the bore shall be cleared off the loose soil and disposal of surplus excavated stuff as directed within a lead of 50 M. . 2.0? Mode of Measurement & Payment

2.1. The rate for boring holes shall include :

(a) roughly leveling the ground in positions where piles are to be provided (b) Making the position of piles by pegs and boring guide and also for shifting of boring guide. (c) Bailing out water, if any met with during boring, (d) Disposal or surplus excavated soil within a lead of 50 M and'(e) All tools, plants, equipments and labour required for satisfactory completion or. work.

2.2. The rate shall be for a unit of one Number.

4.28. Extra for under ramming inside the bore holes for under rammed piles of following nominal diameter :(i) 200 mm. (ii) 250, (iii) 300 mm.**1.0. Workmanship**

The relevant specifications of item No. 4.27 shall be followed except that after boring to the required depth, the bore shall be enlarged at the bottom by an under rammer 2 to 2 1/2 times the diameter of the bore as directed It shall be ensured that the bore for the pile shall be enlarged to the correct diameter.

2.0. Mode of Measurement & Payment

2.1. The relevant specification of item No. 4.27 for under reaming the piles.

2.2. The rate shall be paid extra over and above the rate of item No. 4.27 for under ramming the piles.

2.3. The rate shall be for a unit of one number.

SECTION 5**Plain & RCC Work****5.1.6. Providing and laying in foundation and plinth/under floors lime concrete with hard broken aggregate 40 mm. nominal size and 40% mortar comprising of 1 Lime putty : 2 fine sand and curing complete excluding cost of form work.****1.0. Materials**

Water shall conform to M-1. Sand shall conform to M-6 Lime shall conform to M-2. Graded aggregate 40 mm. nominal size shall conform to M-12

2.1. General

2.1.1. Before starting the concrete the bed of the foundation trenches shall be cleared of all loose materials and watered and rammed as directed.

2.2. Proportion of Mix

2.2.1. The proportion of lime, sand and aggregate shall be specified in the item of the work and shall be measured by volume.

2.2.2. The lime mortar shall consist of proportion of 1 lime putty : 2 sand by volume. The lime mortar shall be prepared by wet process. Power driven mill shall be used for preparation of lime mortar. The slaked lime shall be placed in the mill in even layer and ground for 180 revolutions with sufficient water. The water shall be added as required during grinding and care shall be taken not to add more water so that it will bring the mixed materials to a consistency of stiff paste, thoroughly wetted sand shall then be added evenly and the mixture ground for another 180 revolutions.

2.2.3. Lime mortar shall be kept, protected from sun and rain till used-up, covering it by tarpaulin or open sheds.

2.2.4. All the lime mortar shall be used as soon as possible after grinding. It should be used on the day on which it is prepared but in no case mortar- made earlier than 36 hours shall be permitted for use.

2.3. Mixing:

2.3.1. The concrete shall be mixed in mechanical mixer. Mixing shall be continued until there is uniform distribution of the materials and the mass is uniform in colour and consistency but in no case mixing shall be done for less than 2 to 3 minutes.

2.4. Laying & Compacting:

2.4.1. The concrete shall always be used while quite fresh It shall be laid (not thrown) in layers not exceeding 150 mm. in thickness and shall be well and quickly rammed with wooden or iron rammers, till the required compaction is achieved. The concrete laid shall not be of too fluid consistency. After it has been mixed no more water shall be added, but the surface during and after compaction shall be kept damp. In laying consecutive layers, the layer cast shall be well watered and made rough before the upper layer is laid. The concrete shall be kept continuously wet for period of 7 days from the date of placing of until it- is built over whichever is more.

2.5. Mode of Measurement & Payment :

2.5.1. The concrete work shall be measured in length, breadth and depth as specified on drawing or as directed, correct up to nearest centimeter and cubical content shall be worked out nearest up to two places of decimals.

2.5.2. The rate shall be for unit of one cubic meter.

5.1.8. Providing and laying in foundation and plinth/under floors lime concrete with graded bricks aggregate 40 mm. nominal size and 40% mortar comprising of 1 lime putty : 2 fine sand and curing complete, excluding cost of form work.**1.0. Materials**

1.1. Water shall conform to M-1. Lime mortar shall conform to M-10. Brick bats aggregate 40 mm. nominal sizes shall conform to M-14.

2.0. Workmanship

2.1. The relevant specification of item No. 5.1.6. shall be followed except that brick aggregate shall be used instead of graded stone aggregate.

3.0. Mode of Measurements & Payment

3.1. The concrete work shall be measured in length, breadth and depth as specified in drawing or as directed. Correct up to nearest centimeter and cubical content shall be worked out up to two places of decimals.

3.2. The rate shall be for a unit of cubic meter.

5.3.2.(A) Providing and laying cement concrete 1.3.6. (1 cement : 3 coarse sand : 6 graded stone aggregate 40 mm. nominal size) and curing complete excluding the cost of form work in foundations and plinth.

1.0. Materials

1.1. Water shall conform to M-1. Cement shall conform to M-3 Sand shall conform to M-6. Stones aggregate 40 mm. nominal size shall conform to M-12.

2.0. Workmanship

2.1. General

2.1.1. Before stating concrete the bed of foundation trenches shall be cleared of all loose materials, leveled, watered and rammed as directed

2.2. Proportion of Mix:

2.2.1. The proportion of cement, sand and coarse aggregate shall be one part of cement. 3 parts of sand and 6 parts of stone aggregates and shall be measured by volume.

2.3. Mixing:

2.3.1. The concrete shall be mixed in a mechanical mixer at the site of work. Hand mixing may however be allowed for smaller quantity of work if approved by the Engineer-in-charge. When hand mixing is permitted by the Engineer-in-charge in case "of break-down of machineries and in the interest of the work, it shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency, However in such case 10% more cement than otherwise period 1 1/2 to 2 minutes. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose.

2.4. Transporting & Placing the Concrete:

2.4.1. The concrete shall be handed from the place, of mixing to the final position in not more than 15 minutes by the method as directed and shall be placed into its final-position, compacted and finished within 30 minutes of mixing with water i.e. before the setting commences.

2.4.2. The concrete shall be laid in layers of 15 cms. to 20 cms.

2.5.1. The concrete shall be rammed with heavy iron rammers and rapidly to get the required compaction and to allow all the interstices to be filled with mortar.

2.6. Curing:

2.6.1. After the final set, the concrete-shall be kept continuously wet if required by pounding for a period of not less than 7 days form the date of placement.

2.7. Mode of Measurement & Payment:

2.7.1. The concrete shall be measured for its length, breadth and depth, limiting dimensions to those specified on plan or as directed.

2.7.2. The rate shall be for a unit of one cubic meter.

5.3.3.(A) Providing and laying cement concrete 1:4:8 (1 cement: 4 coarse sand : 8 graded stone aggregate 40 mm. nominal size) and curing complete, excluding cost of form work in foundations and plinth.

1.0. Materials

1.1. Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6 stone aggregate 40 mm. nominal size shall conform to M-12.

2.0. Workmanship

2.1. Relevant Specifications of item No. 5.3.? shall be followed except that cement concrete shall be mixed in the preparation of 1:4:8 instead of 1:3.6 by volume.

3.0. Mode of measurement and payment

3.1. The concrete shall be measured for its length, breadth and depth, limiting dimensions to those specified on plans or as directed

3.2. The rate shall be for a unit of one cubic meter

5.3.14.(A) Providing and laying cement concrete 1.3.6 (1 cement : 3 coarse sand : 6 crushed stone aggregate 20 mm. nominal size) and curing complete including cost of form work in wall caps/coping.

1.0. Material & Workmanship

1.1. The relevant specification of item No. 5.3.2. (A) shall be followed except that the work shall be carried our for coping and wall caps, except the stone aggregate 20 mm. nominal size shall be used. The concrete work of wall caps/coping.

2.0. Mode of measurements and payment

2.1. The relevant specification of item No. 5.3.2. (A) shall be followed except that the rate includes cost of necessary form work.

- 2.2. The rate shall be for a unit of one cubic meter.
- 5.3.3. **Providing and laying brick bats cement 1:4:8 (1 cement : 4 coarse sand : 8 graded bricks bats), and curing complete excluding the cost of form work in foundation and plinth.**
- 1.0. **Materials**
- 1.1. Water shall conform to M-1 Cement shall conform to M-3. Sand shall conform to M-6 Brick bat shall conform to M-14
- 2.0. **Workmanship**
- 2.1. The specification of this item shall be followed as per item No 5.3.14 (A) except that the proportion of brick bat cement concrete shall be 1 4:8 i e 1 part of cements 4 part of coarse sand and 8 parts of graded brick bat by volume, using graded brick bat as coarse aggregate instead of stone aggregates
- 3.0. **Mode of Measurements & Payment**
- 3.1. The concrete work shall be measured in length, breadth and depth as specified on drawing limiting dimensions to those specified on drawings or as directed.
- 3.2. The rate shall be for a unit of one cubic meter.
- 5.3.4.(A) **Providing and laying cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded stone aggregate 40 mm. nominal size) and curing complete, excluding the cost of form work, for foundation and plinth.**
- 1.0. **Materials**
- 1.1. Water shall conform to M-1. Cement shall conform to M-3 Sand shall conform to M-6 Stone aggregate 40 mm nominal size shall conform to M-12.
- 2.0. **Workmanship**
- 2.1. The relevant specification of item No. 5.3.2. (A) shall be followed for the work except that the work is to be carried out in cement concrete 1:5:10
- 3.0. **Mode of Measurement & Payment**
- 3.1. The concrete shall be measured for its length, breadth and depth, limiting dimensions to those specified on plans or as directed.
- 3.2. The rate shall be for a unit of one cubic meter.
- 5.3.8.(A) **Providing and laying cement concrete 1:5:10 (1 cement : 5 coarse sand : 10 graded brick bats 10 mm. nominal size) and curing complete excluding, cost of form work in foundation and plinth.**
- 1.0. **Materials**
- 1.1. Water shall conform to M-1 Sand shall conform to M-6 Cement shall conform to M-3. Brick bats shall conform to M-14.
- 2.0. **Workmanship**
- 2.1. The relevant specification of item No 5.3.4 shall followed except that brick bats aggregate shall be used instead of stone aggregate.
- 3.0. **Mode of Measurement & Payment**
- 3.1. The relevant specification of item No 5.3.4 shall be followed
- 3.2. The rate shall be for a unit of one cubic meter
- 5.3.2.(B) **Providing and laying brick bat cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 graded-brick bats) and curing complete excluding cost of form work in foundation and plinth.**
- 1.0. The specification of item No 5 3.2 (A) shall be followed except that the brick bats shall be used as coarse aggregate instead of stone aggregates.
- 2.0. **Mode of Measurement & Payment**
- 2.1. The relevant specification of item No 5.3.5 (A) shall be followed for mode of measurements and payment except that it excludes the cost of form work.
- 2.2. The rate shall be for a unit or one cubic meter.
- 5.4.18. **Providing throating or plaster drip and molding to R.C.C. Chhajas.**
- 1.0. **Materials**
- Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6 Cement mortar shall conform to M-11
- 2.0. **Workmanship**
- 2.1. The work shall be carried out as directed. The proportion of mix for finishing shall be in C.M. 1:2 by volume. Curing shall be done for not less than 7 days. The work shall be carried out in best workman like manner. The throating or plaster drip and mounding shall be one centimeter in thickness.

5.7.5. Extra for providing and mixing Water Proofing material in cement concrete in mix proportions recommended by the manufacturers.

2.0. Workmanship

2.1. The proportions of materials for the cement concrete shall be mentioned with the specifications of that item. The quantity of water proofing materials to be added and the method of addition shall be as specified by manufacturers.

2.2. Mixing:

2.2.1. The mixing of the water proofing materials in cement, water or concrete shall be done according to the specifications of the manufacture.

3.0. Mode of Measurements and Payment

3.1. The payment is extra over and above the rate of concrete for mixing water proofing proper.

3.2. The rate shall be for a unit of one lithe or kg. per quintal of cement in which water proofing material is added.

5.7.1. Providing and laying damp proof course 25 mm. thick cement concrete 1:2:4 (1 cement : coarse sand :4 stone aggregate 10 mm. nominal size) and curing complete.

1.0. The specifications of item No. 5.3.13. (A) of ordinary concrete with or without reinforcement shall be followed except that the size of the stone aggregate shall be 10 mm nominal size and the concrete work shall be carried out in 25 mm. thick damp proof course

2.0. Mode of measurements & payment

2.1. The rate includes cost of all materials and labour required to complete the item

2.2. The rate shall be for a unit one sq. meter.

5.3.13. Providing and laying cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) and curing complete excluding cost of form work in (A) foundation and plinth, (B) Independent piers, columns and pillars up to floor two level.

1.0. Materials

Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Grit shall conform to M-8. Graded stone aggregate 20 mm nominal size shall conform to M-12.

2.0. General

2.1. The concrete mix is not required to be designed by preliminary testes. The proportion of the concrete mix shall be 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) by volume concrete work shall have exposed concrete surface or as specified in the item

2.2. The designation ordinary M-100, M-150m M-200, M-250 specified as per I.S. correspond approximately to 1:3:6, 1.2:4, 1:1:1/2:3 and 1:1:2 nominal mix of ordinary concrete by volume respectively

2.3. The ingredients required for ordinary concrete containing one beg of cement of 50 kg. by weight (0.0342 Cu M.) for different proportions of mix shall be as under:

Grade of concrete	Total quantity of dry aggregate by volume per 50 kgs. of cement to be taken as the sum of individual volume of fine and coarse aggregates, maximum	Proportion of fine aggregate to coarse aggregate	Quantity of water per 50 Kecs. of cement maximum
1	2	3	4
M-100 (1:3:6)	300 Liters	Generally 1:2 for line aggregate to coarse aggregate by volume 160 but subject to an upper limit of 1:1.1/2 and lower limit	34 Liters
M-150 (1:2:4)	220 Liters		32 Liters
M-200 (1:1.1/2:3)	100 Liters		30 Liters
M-250 (1:1:2)			1:3 27 Liters

2.4. The water cement ratios shall not be more than specified in the above table. The cement content of the mix specified in the table shall be increased if the quantity of water in mix has to be met eased to overcome the difficulties of placements and compaction so that the water-cement ratio specified in the table is not exceeded.

2.5. Workability of the concrete shall be controlled by maintaining a water -cement-ratio that is found to give a concrete mix which is just sufficient wet to be placed and compacted without difficulty with the means available.

2.6. The maximum size of course aggregate shall be as large as possible within the limits specified but in no case greater than one forth of the minimum thickness of the member provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and to fill the corners of the form.

2.7. For reinforced concrete work; coarse aggregates having a nominal size of 20 mm. are generally considered satisfactory.

2.8. For heavily reinforced concrete members as in the case of ribs of main beams, the nominal maximum size of coarse aggregate should usually be restricted to 5 mm. less than the minimum clear distance between the main bar or 5 mm. less than the minimum cover to the reinforcement whichever is smaller.

2.9. Where the reinforcement is widely spaced as in solid slabs, limitations of size of the aggregate may not be so important, and the nominal maximum size may some times be as great as or greater than the minimum cover.

2.10. Admixture maybe used in concrete only with approval of Engineer-in-charge based upon the evidence that with the passage of time neither the compressive strength of concrete is reduced nor are other requisite qualities of concrete and steel impaired by the use of such admixtures.

3.0. Workmanship

3.1. Proportioning : Proportioning shall be done by volume, except which shall be measured in terms of bags of 50 kg. weight, the volume of one such bag being taken as 0.0342 cu. meter Boxes of suitable size shall be used for measuring sand aggregate. The size of boxes (internal) shall be 35 x 25 cms. and 40 cms deep while measuring the aggregate and sand the boxes shall be filled without shaking ramming or hammering. The proportioning of sand shall be on the basis of its dry volume and in case of damp saner, allowances for bulk age shall be made.

3.2. Mixing :

3.2.1. For all work, concrete shall be mixed in a mechanical mixed which along with other accessories shall be kept in first class working condition and so maintained throughout the construction Measured quantity of aggregate, sand and cement required for each batch shall be poured into the claim of the mechanical mixer while it is continuously running. After half a minute of dry mixing measured quantity of water required for each batch of concrete mix shall be added gradually and mixing continued for another one and a half minute Mixing shall be continued till materials are uniformly distributed and uniform colour of the entire mass is obtained and each individual particle of the coarse aggregate shows complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after-oil ingredients have been put into the mixer.

3.2.2. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons, it shall be done on the smooth watertight platform large enough to allow efficient tuning over the ingredients of concrete before and after adding water Mixing platform shall be so arranged that no foreign material gets mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be spread in n layer of uniform thickness on the mixing platform. Dry coarse and fine aggregate and cement shall then be mixed thoroughly by turning over to get a mixture to uniform colour. Specified quantity water shall then be added gradually through a rose can and the mass turned over till a mix of required consistency is obtained. In hand mixing quantity of cement shall be increased by 10 percent above that specified

3.2.3. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before putting in a new batch. Unless otherwise agreed to by the Engineer in-charge the first batch of concrete from the mixture shall contain only two thirds of normal quantity of coarse aggregate Mixing plant shall be thoroughly cleaned before changing from one type of cement to another

3.3. Consistency:

3.3.1. The degree of consistency which shall depend upon the nature of the work and methods of vibration of concrete, shall be determined by regular slump tests in accordance with I.S. 1199-193. The slump of 10 mm. to 25 mm shall be adopted when vibrators are used and 80 mm. when vibrators are not used.

3.4. Inspection:

3.4.1. Contractor shall give the Engineer-in-charge due notice before placing any concrete in the forms to permit him to inspect and accept the false work and forms as to their strength, alignment and general fitness but such inspection shall not relieve the contractor of his responsibility for the safety of men machinery materials and for results obtained immediately before concreting all forms shall be thoroughly cleaned.

3.4.2. Centering design and its erection shall be got approved from the engineer-in-charge. One carpenter with helper shall invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited for reinforcement laid in position. For access to different parts suitable mobile platforms shall be provided so that steel reinforcement in position is not disturbed. For ensuring proper cover, mortar blocks of suitable size shall be cast and tied to the reinforcement. Timber kapachi or metal pieces shall not be used for this purpose.

3.5. Transporting and laying:

3.5.1. The method of transporting and placing concrete shall be as approved. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All form work shall be cleaned and made free from standing water dust, snow or ice immediately before placing of concrete. No concrete

shall be placed in any part of the structure until the approval of the engineer-in-charge has been obtained.

3.5.2. Concreting shall proceed continuously over the area between construction joints. Fresh concrete proper contraction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer. Except where otherwise agreed to by the engineer-in-charge, concrete shall be deposited in horizontal layers to a compacted depth of not more than 0.45 meter when internal vibrators are used and not exceeding 0.30 meter in all other cases.

3.5.3. Unless otherwise agreed to by the Engineer-in-charge concrete shall be dropped in to place from a height exceeding 2 meters. When trucking or chutes are used they shall be kept close and used in such a way as to avoid segregation. When concreting has to be resumed on a surface which has hardened, it shall be roughened, swept clean, thoroughly wetted and covered with a 13 mm. thick layer of mortar composed of cement and sand in the same ratio as in the concrete mix itself. This 13 mm. layer of mortar shall be freshly mixed and placed immediately before placing of new concrete. Where concrete has not fully hardened, all lateness shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of any particles of coarse aggregate. The surface shall then be thoroughly wetted, all free water removed and then coated with neat cement grout. The first layer of concrete to be placed on this surface shall not exceed 150 mm. in thickness and shall be well rammed against old work, particular attention being given to corners and close spots.

3.5.4. All concrete shall be compacted to produce a dense homogeneous mass with the assistance of vibrators, unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water, where vibrators cannot be used. Sufficient vibrators in serviceable condition shall be kept at site so that spare equipment is always available in the even of breakdowns. Concrete shall be judged to be compacted when the mortar fills the spaces between the coarse aggregate and begins to cream up to form an even surface. Compaction shall be completed before the initial setting starts i.e. within 30 minutes of addition of water to dry mixture. During compaction, it shall be observed that needle vibrators are not applied on reinforcement which is likely to destroy the bond between concrete and reinforcement.

3.6. Curing:

Immediately after compaction, concrete weather including rain, running water, shocks, vibration, traffic, rapid temperature changes, frost and drying out process. It shall be covered with wet sacking has Sian or other similar absorbent material approved, soon after the initial set, and shall be kept continuously wet for a period of not less than 14 days from the date of placement. Masonry work over foundation concrete may be started after 48 hours of its laying but curing of concrete shall be continued for a minimum period of 14 days.

3.7. Sampling and testing of concrete:

3.7.1. Samples from fresh concrete shall be taken as per I.S. 1199-1959 and cubes shall be made, cured and tested at 7 days and 28 days as per requirements in accordance with I.S. 526-1959. A random sampling procedure shall be adopted to ensure that each concrete batch shall have a reasonable chance of being tested i.e. the sampling should be spread over the entire period of concreting and cover all mixing units. The minimum frequency of sampling of concrete of each grade shall be in accordance with following:

Quantity of concrete in the work.	No of samples	Quantity of concrete in the works	No of samples
1-5 cmt.	1	16-30 cmt.	3
6.15 cmt.	2	31-50 cmt.	4
51 and above	4+ one additional for each additional 50 mm. or part thereof.		

Note : At least one sample shall be taken from each shift, Ten test specimens shall be made from each sample, five for testing at 7 days and the remaining five at 28 days. The samples of concrete shall be taken on each day of concreting as per above frequency. The number of specimens may be suitably increased as deemed necessary by the Engineer-in-charge when procedure of tests given above reveals a poor quality of concrete and in other special cases.

3.7.2. The average of the group of cubes cast for each day shall not be less than the specified cube strength of 150 K/g Cm² at 28 days. 20% of the cubes cast for each day may have value less than the specified strength provided the lowest value is not less than 85% of the specified strength. If the concrete made in accordance with the proportions given for a particular grade does not yield the specified strength, such concrete shall be classified as belonging to the appropriate lower grade. Concrete made in accordance with the Proportions given for a particular grade shall not, however be placed in a higher grade on the ground that the test strength are higher than the minimum specified.

3.8. Stripping:

3.8.1. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike the form work. While fixing the time of removal of form work, due consideration shall be given to local conditions,

character of the structure, the weather and other conditions that influence the setting of concrete and of the materials used in the mix. In normal circumstances (generally where temperatures are above 20.C) and where ordinary concrete is used, forms may be struck after expire or periods specified in item No.9.1 (A) for respective item of form work.

3.8.2. All form work shall be removed without causing any shock or vibration as would damage the concrete. Before the soft and struts are removed, the concrete surface shall be gradually exposed, where necessary in order to ascertain that concrete has sufficiently hardened. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually. Where internal metal tiles are permitted, they or their removable parts shall be extracted without causing any damage to the concrete and remaining holes filled with mortar. No permanently embedded metal part shall have less than 25 mm. cover to the finished concrete surface. Where it is intended to re-use the form work, it shall be cleaned and made good to the satisfaction of the Engineer-in-charge. After removal of form work and shutting, the Executive Engineer shall inspect the work and satisfy by random checks that concrete produced is of good quality.

3.8.3. Immediately after the removal of forms, all exposed bolts etc. passing through the cement concrete member and used for stuttering or any other purpose shall be cut inside the cement concrete member to a depth of at least 25 m. below the surface of the concrete and the resulting holes be filled by cement mortar, all fins, caused by form joints, all cavities produced by the removal of form tiles and all other holes and depressions, honeycomb spots, broken edges or comers and other defects, shall be thoroughly cleaned", saturated with water and carefully pointed an rendered true with mortar of cement and fine aggregate mixed in proportions used in the grade of concrete that is being furnished and of as dry consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure through filling in all voids. Surface which are pointed shall be kept moist for a period of 24 hours. If rock pockets/honeycombs in the opinion of the Engineer-in-charge are of such an extent or character as to effect the strength of the structure materially or to endanger the life of the steel reinforcement, he may declare the concrete defective and require the removal and replacement of the portions of structure affected.

4.0. Mode of Measurement & Payment

4.1. The consolidated cubical contents of concrete work as specified in item shall be measured. No deduction shall be made for

(a) Ends of dissimilar materials such as joints, beams, posts, girders, falters, purling trusses, corbels and steps etc., up to 500 Sq, Cm. in section.

4.2. The rate includes cost of all materials labour, tools and plant required for mixing, placing in position, vibrating and compacting, finishing, as directed, curing and all other incidental expenses for producing centre of specified strength. The rate excludes the cost of form work.

4.3. The rate shall be for a unit of one cubic meter.

5.4.1. Providing and laying cement concrete 1:2:4 (1 cement : 2 coarse sand :4 graded stone aggregate 20 mm. nominal size) and curing complete excluding cost of form work and reinforcement for reinforced work in : (A) Foundations, footing base of columns and mass concrete. (C) Slabs, landings, shelves, balconies, lintels, beams, girders and cantilever up to floor two level. (D) Columns, pillars, pots, and struts up to floor up to floor two level (E) Staircase up to floor two level (K) Vertical and horizontal fins up to floor two level.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 5.3.13 shall be followed except that the work shall be carried out for reinforced concrete work for work as specified in item 1.2. In addition, the following stipulations shall be followed for:

(a) The bars shall be kept in position by the following methods :

(i) In case of beam and slab construction, sufficient number of precast cover blocks in cement mortar 1:2 (1 cement : 2 coarse sand) about 4 cms. x 4 cms. section and of thickness equal to the specified cover shall be placed between the bars and shattering as to secure and maintain the requisite cover of concrete over the reinforcement. In case of cantilevered or doubly reinforce beams or slabs, the main reinforcing bars shall be held in position by introducing chain spacers or supports bars at 1.0 to 1.2 meter centers.

(ii) In case of columns and walls, the vertical bars shall be kept in position be means of timber temphthes with slots accurately out in them, the tamphthes shall be removed after concreting has been done below it. The bars may be also be suitably tied by means of annealed steel wires to the shuttering to maintain their position during concreting.

1.2. AH bars projecting form pillars, columns, beams, slabs etc, to which other bars and concrete are to be attached of bounded to later on, shall be protected with a coat of thin neat cement grout, if the bars are not likely to be incorporated with succeeding mass of concrete within the following 10 days. This coat of thin neat cement shall be removed before concreting.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 5.3.13 shall be followed.

- 2.2. The volume Occupied by reinforcement shall not be deducted from R.C.C. work.
- 2.3. The rate shall be for a unit of one cubic meter.
- 5.4.4. **Providing and laying cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) for reinforced concrete chhajjas not exceeding 10cms. thickness up to floor two level including finishing the exposed surface with cement mortar 1:3 (1 cement : 3 fine sand) to give a smooth and even surface, centering and form work and curing complete excluding cost of reinforcement.**
- 1.0. Materials & Workmanship**
- 1.1. The cement mortar shall conform to m-11.
- 1.2. The relevant specification of item No. 5.3.13 and 5.4.1 shall be followed except that the work shall be carried out for reinforced concrete chhajjas not exceeding 10 cms. in thickness.
- 1.3. The specifications for form work and centering shall be as per item No. 9.1.
- 1.4. The finishing work in cement mortar 1:3 (1 cement : 3 fine sand) shall be carried out as per specifications of item No. 17.49 (I), Before the plastering is done, the surface of the concrete shall be raked for proper bond.
- 2.0. Mode of measurements & payment**
- 2.1. The relevant specification of item No. 5.3.13 and 5.4.1 shall be followed except that the work of chhajjas up to 10 cms. shall be earned out including centering form work and finishing the surface with cement mortar 1:3 (1 cement : 3 fine sand).
- 2.2. The rate shall be for a unit of one cubic meter,
- 5.4.10. **Providing an Mild Steel reinforcement for R.C.C. work including bending binding and placing in position etc. complete up to floor two level.**
- 1.0. Materials**
- 1.1. Mild Steel bars shall conform to M-18. Mild steel binding wires shall conform to M-21.
- 2.0. Workmanship**
- 2.1. The work shall consist of furnishing and-placing reinforcement to the shape and dimensions shown as on the drawings or as directed
- 2.2. Steel shall be clean and free from rust and loose mill scale at the lime of fixing in position and subsequent concreting.
- 2.3. Reinforcing steel shall conform accurate to the dimensions given in the bar bending schedules shown on relevant drawings. Bars shall be bent cold to specified shape and dimensions or as directed, using a proper bar bender, operated by hand or power to attain proper radius of bends. Bars shall not be bent or straightened in a manner that will injure the material. Bars bent during transport-or handling shall be straightened before being used on the work. They shall not be heated to facilitate bending Unless otherwise specified a "U" type hook at the end of each bar shall invariably be provided to main reinforcement. The radius of the bend shall not be less than twice the diameter of the round bar and the length of the straight part of the bar beyond the end of the curve shall be at least four times the diameter of the round bar. In case of bars which are not round and in case of deformed bars, the diameter shall be taken as the diameter of circle having an equivalent effective area. The hooks shall be suitably encased to prevent any splitting of the concrete.
- 2.4. All the reinforcement bars shall lie accurately placed in exact position shown on the drawings, and shall be securely held in position during placing of concrete by annealed binding wire not less than 1 mm in size, and by using stay blocks or metal chair spacers, metal hangers supporting wires or other approved devices at sufficiently close intervals, Bars shall not be allowed to sag between supports nor displaced during concreting or any other operations of the work. All devices used for positioning shall be of non-corrodible material. Wooden and metal supports shall not extend to the surface of concrete, except where shown on drawings. Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing shall not be allowed Pieces of broken stone or brick and wooden blocks shall not be used Layers of bars shall be separated by spacer bars, precast mortar blocks or other approved devices Reinforcement after being placed in position shall be maintained in a clean condition until completely embedded in concrete. Special care shall be exercised to prevent any displacement of reinforcement in concrete already placed. To prevent reinforcement from corrosion, concrete cover shall be provided as indicated on drawings. All the bars protruding from concrete and to which other bars are to be lapped and which are likely to be exposed for a period exceeding 10 days shall be protected by a thick coat of neat cement grout.
- 2.5. Bars crossing each other where required shall be secured by binding wire (annealed) of size not less than 1 mm. in such a manner that they do not slip over each other at the time of fixing and concreting.
- 2.6. As far possible, bars of full length shall be used. In case this is not possible. Over lapping of bars shall be done as directed When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm. Where not feasible, overlapping bars shall be bound with annealed wires not less than 1 mm. thick

twisted tight. The overlaps shall be staggered for different bars and located at points, along the span where neither shear nor bending moment is maximum.

2.7. Whenever indicated on the drawings or desired by the Engineer-in-charge, bars shall be jointed by couplings which shall have a cross-section sufficient to transmit the full stresses of bars. The ends of the bars that are joined by coupling shall be upset for sufficient length so that the effective cross section at the base of threads is not less than the normal cross-section of the bar. Threads shall be standard threads Steel for coupling shall conform to I.S. 226.

2.8. When permitted or specified on the drawings, joints of reinforcement bars shall bull-welded so as to transmit their full stresses. Welded joints shall preferably be located at points when steel will not be subject to more than 75 percent of the maximum permissible stresses and welds so staggered that at any one section not more than 20 percent of the rods are welded. Only electric arc welding using a process which excludes air from the molten metal and conforms to any or all other special provisions for the work shall be accepted. Suitable means shall be provided for holding bars securely in position during welding. It shall be ensured that no voids are left in welding and when welding is done in two or three stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, stains, paint and other foreign matter before welding. Only competent welders shall be employed on the work. The M.S. electrodes used for welding shall conform to I.S. 814. Welded pieces of reinforcement shall be tested. Specimen shall be taken from the actual site and their number and frequency of test shall be as directed.

3.0. Mode of Measurements & Payment

3.1. For the purpose of calculating consumption, wastage shall not be permitted beyond 5 percent. Excess consumption over 5% will be charged at penal rate.

3.2. Reinforcement shall be measured in length including overlaps, separately for different diameters as actually used in the work. Where welding or coupling is resorted to in place lap joints, such joints shall be measured for payment as equivalent length of overlap as per design requirement. From the length so measured, the weight of reinforcement shall be calculated in tones on the same basis of as per M-18 even though steel is supplied to the contractor by the department on actual weight. Length shall include hooks at the ends. Wastage and annealed steel wire for binding shall not be measured and the cost of these items shall be deemed to be included in the rate for reinforcement.

3.3. The rate for reinforcement includes cost of steel binding wires, its carting from Department store to work site, cutting, bending, placing, binding and fixing in position as shown on the drawings and as directed. It shall also include all devices for keeping reinforcement in approved position, cost of joining as per approved method and all wastage and spacer bars.

3.4. The rate shall be for a unit of One Kg.

5.4.11. High yield deform bars steel reinforcement for R.C.C. work including bending, binding and placing in position complete up to floor two level.

1.0. Materials

1.1. Cold twisted steel bars (high yield strength deformed bars) shall conform to M.19 Mild steel binding wires shall conform to M-21.

2.0. Workmanship

2.1. The specifications of item No. 5.4.10 shall be followed except that the cold twisted steel bars shall be used with or without hooks at the ends. Deformed bars without hooks shall, however, comply with relevant anchorage requirements.

3.0. Mode of Measurement & Payment

3.1. The relevant specifications of item No. 5.4.10 shall be followed.

3.2. The rate shall be for a unit of One kg.

5.4.13. Extra for additional lift of concrete for all R.C.C. work above floor two level excluding cost of reinforcement.

1.0. Materials & Workmanship

The relevant specifications for item No. 5.4.1 shall be followed for the work except that the R.C.C. work shall be done for ground floor i.e. above plinth level to first floor level.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 5.4.1 shall be followed except that rate shall be for extra lift above plinth to floor two level over and above the rate of concrete at floor two level.

2.2. The rate shall be for a unit of one cubic meter per floor.

5.4.13.(A) Extra for additional lift of reinforcement steel for all R.C.C. work above floor two level.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 5.4.10 as may be applicable, shall be followed except that the work shall be carried out above floor two level for each floor.

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 5.4.10 or 5.4.11 as may be applicable shall be followed except

that the work shall be carried out above floor tow level.

2.2. The rate shall be for a unit of one kg. per floor.

5.6.2. **Providing up to floor two level precast cement concrete or grill 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6 mm: nominal size) reinforced with 1.6 mm. dia mild steel size wire including roughening, cleaning fixing and finishing in cement mortar 1:3 and curing complete.**

(A) 50 mm. thick (B) 40. mm. thick (C) 25. mm. thick (E) 100 mm. thick.

1.0. Materials

1.1. Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Mortar shall conform to M-11. Aggregates shall conform to M-12. Mild steel wire shall conform to M-21. Shattering shall conform to M-26.

2.0. Workmanship

It shall be cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 6 mm. nominal size), reinforced with 1.6. mm. dia mild steel wire unless otherwise specified. The thickness of the jali shall be as specified in the item. The jali shall be set in position true to line and level before the jambs sills and soffits to the opening are plastered. It shall then be properly cemented with cement mortar 1:3 (1 cement : 3 sand) and rechecked for levels. Finally the jambs, sills and soffits shall be plastered gripping the jali uniformly on all sides.

3.0. Mode of measurement of payment

3.1. The item shall be measured in square meter.

3.2. The rate shall be for a unit of one square meter,

5.8.1. **Providing and laying controlled concrete M-150 and curing complete excluding the cost of form work and reinforcement for reinforced concrete work in:**

(A) Foundation, footings, base of columns, and mass concrete, (B) Walls from top of foundation/level up to floor two level. (C) Slabs, pillars, posts and struts, up to floor two level (E) Staircase up to floor two level. (F) Vertical and horizontal fins up to floor two level.

1.0. Materials

1.1. Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Grit shall conform to M-8 Course aggregate shall conform M-12.

2.0. General

2.1. The relevant specification of item No. 5.4.1. of ordinary concrete shall be followed except that the concrete mix shall be designed form preliminary tests. The proportioning of cement and aggregates shall be done by weight and necessary precautions shall be taken in the production to ensure that the required work cube strength is attained and maintained. The controlled concrete shall be in grades of M-100, M-150, M-200, M-250, M-300, M-350 & M-400 with prefix controlled added to it. The letter M refers to mix and the numbers specify 28 days works cube compressive strength of 150 mm. cubes of the mix expressed in Kg./Cmnt.

2.2. The proportion of cement, sand and coarse aggregate shall be determined of weight. The weight batch machine shall be used for maintaining proper control over the proportion of aggregates as per mix design. The strength requirements of different grades of concrete shall be as under:

Grade Concrete	Compressive strength of 15 cms. cubes in Kg./Cmt. at 28 days, conducted in accordance with I.S. 516-1959. Preliminary test Min.	Work test Min.
M-1 50	200	150
M-200	260	200
M-250	320	250
M-300	380	300
M-350	440	350
M-400	500	400

In all cases, the 28 days compressive strength specified in above be the criteria for acceptance or rejection of the concrete. Where the strength of a concrete mix as indicated by tests, lies in between the strength of any two grades specified in the above table, such concrete shall be classified in for purpose as concrete belonging to the lower of the grades between which its strength lies.

3.0. Workmanship

3.1. The proportions for ingredients chosen shall be such that concrete has adequate workability for conditions prevailing on the work question and can be property compacted with means available except where ft can be shown to the satisfaction of the Engineer-in-charge, that supply of properly graded aggregate of uniform quality can be maintained till the completion of work, grading of aggregate shall be controlled by obtaining the coarse aggregates in different sizes and bending them in the right proportions as required. Aggregates of different sizes shall be

stocked in separate stock piles. The required quantity of material shall be stock piled several hours, preferably a day before use. The grading of coarse and fine aggregate shall be checked as frequently as possible, the frequency for a given job being determined by Engineer-in-charge to ensure that the suppliers are maintaining the uniform grading as approved for samples used in the preliminary tests..

3.2. In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the maker's weight per bag, a reasonable number of bags shall be weighted separately to check the net weight. Where cement is weighted from bulk stocks at site and not by bags, it shall be weighed separately from the aggregate. Water, shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in clean, and serviceable condition. Their accuracy shall be periodically checked.

3.3. It is most important to keep the specified water cement ratio constant and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined by the Engineer-in-charge according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. For the determination of moisture content in the aggregates. I.S. 2386 (Part-III) shall be referred to. Suitable adjustments shall also be made in the weights of aggregates due to variation in their moisture content. Minimum quantity of cement to be used in controlled concrete shall not be less than 220 kg./M³ in plain concrete and not less than 250 kg/M³ in reinforced concrete.

4.0. Mode of measurement & payment

4.1. The relevant specifications of item No.5.4.1 shall be followed, except that the controlled concrete R.C.C. work as specified in item shall be measured under this item. The rate excludes cost of form work.

5.8.2. Providing and laying controlled cement concrete M-200 and curing complete, excluding the cost of form work and reinforcement for reinforced concrete work in :

(A) Foundations, footings base of columns, and mass concrete. (B) walls from top of foundation up to floor two level (C) Slabs, landings, shelves, balconies lintels, beams, girders and cantilever up to floor two level, (D) Columns, pillars, posts and struts upto floor two level (E) Stair cases up to floor two level (K) Vertical and horizontal fins upto floor two level.

1.0. Materials & Workmanship

The relevant specifications of item No. 5.8.1 shall be followed except that the grading of concrete shall be controlled concrete M-200 grades for works 35 specified in item.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No, 5.8.1. shall be followed.

2.2. The rate shall be for one cubic meter.

5.8.3. Providing and laying controlled cement concrete M-250 and curing complete excluding the cost of reinforcement of reinforced concrete work in:

(A) Foundations, footings, bases of columns, and the like and mass concrete (B) Walls from, top of foundation level up to floor two level (C) Slabs, landing, shelves, balconies, beams, girders and cantilever up to floor two level (D) Columns, pillars, struts up to floor two level.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 5.8.1. shall be followed except the grading of concrete shall be controlled concrete M-250 grades for the works as specified in the item.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 5.8.1. shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

5.00.1. Providing and laying ordinary concrete 1:2:4 (1 cement : 2 coarse sand :4 graded stone aggregates 20 mm. nominal size) and finishing smooth with curing etc., complete including the cost of form work but excluding the cost of reinforcement for R.C.C. work in: (I) Slabs up to 8 cms. thickness (II) Slabs having more than 8 cms. and up to (III) Slabs having more than 10 cms. and up to 13 cms. thickness (IV) Slabs having more than 13 cms. and up to 15 cms. thickness.

1.0. Materials & Workmanship

1.1. The relevant specifications for item No. 5.4.1. shall be followed for concrete work and relevant specifications of item No. 9.1. shall be followed for form work and centering. The concrete surface shall be smooth finished with cement mortar 1:3 (1 cement: 3 fine sand) as per item No. 17.59 (I) The thickness shall be as specified in the item.

2.0. Mode of measurement & payment

2.1. The relevant specification for item No. 5.4.1 shall be followed except that item shall include the item providing from work and centering work as directed.

2.2. The rate shall be for a unit of one cubic meter.

5.00.2. Providing and laying controlled cement M-150 and finishing smooth with curing etc. complete including the cost of form work but excluding the cost of reinforcement for R.C.C. work in :
(I) slabs up to 8 cms. thickness (II) Slabs more than 8 cms. 10 cms. (III) Slabs more the 10 cms. and up to 13 cms. (IV) Slabs more than 13 cms. and up to 15 cms.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 5.8.1. shall be followed for concrete work and item No. 9.1. shall be followed for form work and centering. The concrete surface shall be smooth finished with cement mortar 1:3 (1 cement : 3 fine sand) as per No. 17.59 (I) The thickness shall be as specified in the item.

2.0. Mode of Measurement & Payment

2.1. The relevant of item No. 5.8.1. shall be followed except that the item shall include the cost and from work and centering.

2.2. The rate shall be for a unit of one cubic meter.

5.00.3. Providing and laying ordinary cement concrete 1:2:4 (1 cement: 2 coarse sand : 4 graded stone aggregates 20 mm. nominal size) exposed work with curing etc. complete. including the cost of work but excluding the cost of reinforcement for R.C.C. work in : (I) Slabs up to 8 cms. thickness (II) Slabs having more than 8 cms.-and up to 10 cms. thickness (HI) Slabs having more than 10 cms. and up to 13 cms. thickness. (IV) Slabs having more than 13 cms. and up to 15 cms. thickness.

1.0. Materials & Workmanship

1.1. There relevant specifications of item No. 5.4.1. shall be followed for concrete work and that of form work and centering work shall be followed as per item No. 9.1. and 9.7. the thickness of the slab shall be as specified in the item.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 5.4.1. shall be followed except that form work and centering work shall be included in the item.

2.2. The rate shall be for a unit of one cubic meter.

5.00.4. Providing any laying controlled cement concrete M-150 exposed work with curing ere., complete including the cost of form work but excluding the cost of reinforcement for R.C.C. work in : (I) Slabs up to 8 cms. thickness (II) Slabs having more than 8 cms. and up to 10 cms. thickness (III) Slabs having more than 10 cms. and up to 13 cms. thickness. (IV) Slabs having more than 13cms. and up to 15 cms. thickness.

1.0. Materials & Workmanship

1.1. The relevant specification of item No 5.4.1. shall be followed for controlled concrete and the relevant specifications of item No. 9.7. and 9.1. shall be followed for exposed concrete form work and centering work. The thickness of the stab shall he as specified in the item.

2.0. Mode of Measurement & Payment

2.1. The relevant specifications of item No. 5.8.1. shall be followed except that the form work and centering work shall be included in the item.

2.2. The rate shall be for a unit of one cubic meter.

5.00.5. Providing and laying ordinary cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 grades stone aggregate 20 mm. nominal size) for R.C.C. lintel including finishing smooth with curing etc. complete including the cost of form work but excluding the cost of reinforcement.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 581. shall be followed for concrete work, relevant specifications of item No. 17.59.(I) for finishing work and relevant specifications of item No. 9.1. shall be followed form work and centering work The concrete work shall be followed for the form work and centering work for exposed concrete work.

2.0. Mode of measurement & payment

2.1. The relevant specification of item No. 5.3.1. shah be followed except that the item includes the cost form work for exposed concrete work

- 2.2. The rate shall be for a unit of one cubic meter.
- 5.00.6. **Providing and laying cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) and finishing smooth with curing etc., complete, including the cost of form work but excluding reinforcement for R.C.C. work in : (A) Beams : (I) Having cross sectional areas 0.05 to 0.08 Sq. meter. (II) Having cross sectional area more than 0.08 Sq. up to 0.12 Sq. mt (III) Having cross sectional area more than 0.12 Sq. Mt. and up to 0.18 Sq. Mt (B) Column; (I) Having cross sectional area 0.05. to 0.08 Sq. mt. (III) Having cross sectional area more than 0.12 Sq.Mt. and up to 0.18 Sq.mt.**
- 1.0. Materials & Workmanship**
- 1.1. The relevant specifications of item No. 5.4.1. shall be followed for concrete work and item No. 9.1. shall be followed for form work and centering work. The finishing shall be done in cement mortar 1:3 (1 cement: 3 fine sand) as per item No. 17.59(1). The cross sectional area of beam shall be specified in item.
- 2.0. Mode of measurement & payment**
- 2.1. The relevant specification of item No. 5.4.1. shall be followed but the form work and centering work shall be included in the item.
- 2.2. The rate shall be for a unit of one cubic meter.
- 5.00.7. **Providing and laying controlled cement concrete M-150 exposed work with curing etc. complete, including the cost of form work but excluding the cost of reinforcement for R.C.C. work in : (A) Beams : (I) Having cross sectional area 0.05 to 0.08 Sq. mt. (II) Having cross sectional area more than 0.08 Sq. mt. up to 0.12 Sq.mt (III) Having cross sectional area more than 0.12 Sq. mt. and up to 0.18 Sq.mt.: (B) Columns; (I) Having cross sectional area of 0.05 to 0.08 Sq.mt (II) Having cross sectional area more than 0.08 sq.mt. and up to 0.12 sq.mt. (III) Having cross sectional area more than 0.12 Sq.Mt and up to 0.18 Sq.mt.**
- 1.0. Materials & Workmanship**
- 1.1. The relevant specifications of item No. 5.8.1. shall be followed for controlled concrete work as specified in item for M-150 and relevant specifications of item 9.1 shall be followed for the form work centering work for exposed cement work.
- 2.0. Mode of measurement & payment**
- 2.1. The relevant specifications of item No. 5.8.1 shall be followed except that the form work and centering work shall be included in the item.
- 2.2. The rate shall be for a unit of one cubic meter.
- 5.00.8. **Providing and laying controlled cement concrete M-200 exposed work with curing etc. complete, including the cost of form work but excluding the cost of reinforcement for R.C.C. work in (A) Beams : (I) Having cross section area 0.05 to 0.08 Sq. mt (II) Having cross sectional area 0.08 Sq.mt and up to 0.12 Sq. mt. (III) Having cross sectional area 0.12 Sq. and up to 0.18 Sq. Mt. (B) Columns : (I) Having cross sectional area 0.05 to 0.08 Sq.Mt. (II) Having cross sectional area more than 0.08 Sq.Mt and up to 0.12 Sq.Mt. (III) Having cross sectional area more than 0.12 Sq. mt. and up to 0.18 Sq.Mt.**
- 1.0. Materials & Workmanship**
- 1.1. The relevant specifications of item No. 5.8.1. shall be followed for controlled concrete work for work as specified in item for M-200 and relevant specifications of item 9.7 and 9.1 shall be followed for the form work and centering work for exposed cement work.
- 2.0. Mode of measurements & payment**
- 2.1. The relevant specification of item No. 5.8.1. shall be followed except that the item includes the cost of form work and centering work for exposed work.
- 2.2. The rate shall be for a unit one cubic meter.
- 5.00.9. **Providing and laying controlled cement concrete M-250 exposed work with curing etc. complete including the cost of from work but excluding the cost of reinforcement for R.C.C. work in : (A) Beams : (I) Having cross sectional area 0.05 to 0.08 Sq.mt.(II) Having cross sectional areas more than 0.08 Sq.mt. and up to 0.12 Sq. mt (III) Having cross sectional area more than 0.12 Sq.mt. and up to 0.18 Sq. Mt. (5) Columns :(I) Having cross sectional area 0.05 to 0.08. Sq.Mt (II) Having cross sectional area more than 0.08 Sq. mt. and up to 0.12 Sq. mt. (III) Having cross sectional area more than 0.12 Sq.mt. and up to 0.18 Sq.mt.**
- 1.0. Materials & Workmanship**
- 1.1. The relevant specifications of item No. 5.8.1. shall be followed for controlled concrete work for the work as specified in the item for M-250 and the relevant R.C.C. lintels shall be carried out.
- 2.0. Mode of measurement & payment**
- 2.1. The relevant specifications of item No. 5.4.1 shall be followed except that the cost of form work finishing and centering shall be included in the item.
- 2.2. The rate shall be for a unit of one cubic meter.

SECTION – 6

Masonry Work

6.12 (A) Brick work using common burnt clay building bricks having crushing strength not less than 35 Kg/Sq. Cm. in foundations and plinth in cement mortar 1:5 (1 cement :5 fine sand) modular bricks.

1.0. Materials

Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Brick shall conform to M-15. Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. Proportion:

2.1.1. The proportion of the cement mortar shall be 1:5 (1 cement: 5 fine sand) by volume.

2.2. Wetting of bricks:

2.2.1. The bricks required for masonry shall be thoroughly wetted with clean water for about two hours before use or as directed. The cessation of bubbles, when the bricks are wetted with water is as indication of through wetting of bricks.

2.3. Laying:

2.3.1. Bricks shall be laid in English bond unless directed otherwise. Half or cut bricks shall not be used except when necessary to complete to bond; closures in such case shall be cut to required size and used near the ends of walls.

2.3.2. A layer of mortar shall be spread on full width for suitable length of the lower course. Each brick shall first be properly bedded and set home by gently tapping with handle of trowel or wooden mallet. Its inside face shall be flushed with mortar before the next brick is laid and pressed against it. On completion of course, the vertical joints shall be fully filled from the top with mortar.

2.3.3. The walls shall be taken up truly in plumb. All courses shall be laid truly horizontal and all vertical joint shall be truly vertical. Vertical joints in alternate course shall generally be directly one over the other. The thickness of brick course shall be kept uniform.

2.3.4. The brick shall be laid with frog up wards. A set of tools comprising of wooden straight edges, man son's spirit level, square half meter rub, and pins, string and plumb shall be kept on the site of work for frequent checking during the progress of work.

2.3.5. Both the faces of walls of thickness greater than 23 cms. shall be kept in proper place. All the connected brick work shall be kept not more than one meter over the rest of the work. Where this is not possible, the work shall be raked back according to bond (and not left toothed) at an angle not steeper than 45 degrees.

2.3.6. All futures, pipes, outlets of water, hold fasts of doors and windows etc. which are required to be built in wall shall be embedded in cement mortar

2.4. Joints:

2.4.1. Bricks shall be so laid that all joints are quite flush with mortar. Thickness of joints shall not exposed 12 mm. The face joints shall be raked out as directed by raking tools daily during the progress of work, when the mortar is still green so as to provide key for plaster or pointing to done.

2.4.2. The face of brick shall be cleaned the very day on which the work is laid and all mortar dropping removed.

2.5. Curing:

2.5.1. Green work shall be protected from rain suitably. Masonry work shall be kept moist on all the faces for a period of seven days. The top of masonry work shall be kept well wetted at the close of the day.

2.6. Preparation of foundation bed:

2.6.1. If the foundation is to be laid directly on the excavated bed, the shall be leveled, cleared of all loose materials, cleaned and wetted before stating masonry, If masonry is to be laid on concrete footing, the top of concrete shall be cleaned and moistened. The contractor shall obtain the engineer's approval for the foundation bed before foundation masonry is started. When pucca flooring is to be provided flush with the top to plinth, the inside plinth offset shall be kept lower than the outside plinth top by the thickness of the flooring.

3.0. Mode measurements & payment

3.1. The measurements of this item shall be taken for the brick masonry fully completed in foundation up to plinth. The limiting dimensions not exceeding those shown on the plinths or as directed shall be final. Battered tapered and curved portions shall be measured net.

3.2. No deduction shall be made from the quantity of brick work, for any extra payment made for embedding in masonry or making holes in respect of following items:

- (1) Ends of joists, beams, posts, girders, purlins, trusses, corbel, steps etc. where cross sectional area does not exceed 500 Sq.Cm.
- (2) Openings not exceeding 1000 Sq.Cm.
- (3) Wall plates and bed plates, bearing of slabs, chajjas and the like whose thickness does not exceed 10 Cms. and the bearing does not extend to the full thickness of wall.
- (4) Drainage holes, and recesses for cement concrete blocks to embed hold fasts for doors, windows etc.
- (5) Iron fixtures, pipes up to 300 mm. dia hold fasts, and doors and windows built into masonry and pipes etc. for concealed wiring.
- (6) Forming chases of section not exceeding 350 -Sq. Cm. in masonry.

3.3. Apertures for fire places shall not be deducted nor shall be paid for separately.

3.4. The rate shall be for a unit of one cubic meter.

6.12. (B) Brick work using common burnt clay building bricks having crushing strength not less than 35 Kg/Sq. Cm. in foundations and plinth in cement mortar 1:5 (1 cement : 5 fine sand) conventional bricks.

1.0. Materials

Cement mortar of proportion 1:5 shall conform to M-11. Conventional bricks shall conform to M-15.

2.0. Workmanship

The relevant specification of item No. 6.12 (A) shall be followed except that the bricks to be used shall be modular bricks and the proportion of cement mortar is 1:6.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 6.12(A) shall be followed.

3.2. The rate shall be a unit of one cubic meter.

6.13.(A) Bricks work using common burnt clay building bricks having crushing strength not less than 35 Kg/Sq. Cm in foundation and plinth in cement mortar 1:6 (1 cement : 6 find sand) with conventional bricks.

1.0. Materials

Water shall conform to M-1. Cement mortar shall conform to M-11. Bricks shall conform to M-15.

2.0. Workmanship

2.1. The relevant specification of item No. 6.12 (A) shall be followed except that the bricks to be used shall be conventional bricks and proportion of cement mortar shall in C.M. 1:6.

3.0. Mode of measurements & payment

3.1. The relevant specification of item No. 6.12(A) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

6.0.0.1(A) Brick work using common burnt clay building bricks having crushing strength not less than 35 Kg/Sq. Cm. in foundation and plinth in cement mortar 1:8 (1 cement :8 find sand), with Modular bricks.

1.0. Materials

Water shall conform to M-1. Brick shall conform to M-15. Cement mortar shall be conform to M-11.

2.0. Workmanship

2.1. The relevant specification of item No. 6.12(A) shall be followed except that the proportion of cement mortar shall be cement mortar 1:8 and bricks used shall be conventional bricks.

3.0. Mode of measurements & payment

3.1. The relevant specification of item No. 6.12(A) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

6.00.1.(B) Brick work using common burnt clay building bricks having crushing strength not less than 35 Kg/Sq. Cm. in foundation and plinth in cement mortar 1:8 (1 cement : 8 fine sand), with conventional bricks.

1.0. Materials

Water shall conform to M-1. Brick shall conform to M-15, cement mortar shall be conform to M-11.

2.0. Workmanship

2.1. There relevant specifications of item No. 6.12(A) shall be followed except that the proportion of cement mortar shall be cement mortar 1:8.

3.0. Mode of measurement & payment

3.1. The relevant specifications of item No. 6.12(A) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

6.0.0.1.(A) Brick work using common burnt clay building bricks having crushing strength not less than 35 Kg./Sq. Cm. in foundation and plinth in time mortar 1:1.5 (1 Lime putty : 1.5 find sand) modular bricks.

1.0. Materials

Lime mortar of proportion (1:1.5) shall conform to M-10. Bricks shall conform to M-15.

2.0. Workmanship

2.1. The relevant specification of item No. 6.12(A) shall be followed except that the proportion of cement mortar shall be cement mortar 1:8 and bricks used shall be conventional bricks.

3.0. Mode of measurements & payment

3.1. The relevant specification of item No. 6.12(A) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

6.001.(B) Brick work using common burnt clay building having crushing strength not less than 35 Kg/Sq. Cm. in foundation and plinth in cement mortar 1:8 (1 cement: 8 fine sand), with conventional bricks.

1.0. Materials

Water shall conform to M-1. Brick shall conform to M-15, Cement mortar shall be conform to M-11.

2.0. Workmanship

2.1. The relevant specifications of item No. 6.12. (A) shall be followed except that the proportion of cement mortar shall be cement mortar 1:8.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 6.12. (A) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

6.0.0.2.(A) Brick work using common burnt clay building bricks having crushing strength not less than 35 Kg./Sq. Cm. in foundation and plinth in lime mortar 1:1.5 (1 Lime putty: 1.5 find sand) modular bricks.

1.0. Materials

Lime mortar of proportion (1:1.5) shall conform to M-10. Bricks shall conform to M-15.

2.0. Workmanship

The relevant specification of item No. 6.12. (A) shall be followed except the masonry work shall be carried out in lime mortar 1:1.5 (1 lime putty 1.5 fine sand) in foundation and plinth.

3.0. Mode of measurements & payment

3.1. The relevant specification of item No. 6.12. (A) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

6.0.0.2.(B) Brick work using common burnt clay building bricks having crushing strength not less than 35 Kg/Sq. Cm. in foundation and plinth in lime mortar 1:1.5 (1 Lime putty : 1.5 find sand) conventional bricks.

1.0. Materials & Workmanship

The relevant specification of item No. 6.12(A) and 60.02(A) shall be followed except that the masonry work shall be carried out by using conventional bricks in lime mortar 1:1.5 (1 Lime putty: 1.5 fine sand) in foundation and plinth.

2.0. Mode of measurements & payment

2.1. The relevant specification of item No. 6.12(A) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

6.0.0.3.(A) Brick work using common burnt clay building brick having crushing strength not less than 35 Kg. Sq. Cm. in foundation and plinth in lime mortar 1:2 (1 lime putty :2 find sand) modular bricks.

1.0. Materials & workmanship

The relevant specification of item No. 6.12(A) and 6.0.0.(A) shall be followed except that the masonry work shall be carried out in lime mortar 1:2 (1 Lime putty : fine sand) in foundation and plinth,

2.0. Mode of measurements & payment

2.1. The relevant specification of item No. 6.12 (A) shall be followed.

2.2. The rate shall be for a one cubic meter.

6.0.0.3(3) Brick work using burnt clay building bricks having crushing strength not less than 35 Kg/Sq. Cm. in foundation and plinth in lime mortar 1:2 (1 Lime Putty : 2 find sand) modular bricks.

1.0. Materials & Workmanship

The relevant specifications of item No. 6.12 A and 6.0.03 shall be followed except that the masonry work shall be carried out in lime mortar 1:2 (1 lime : 2 fine sand) using conventional bricks in foundation and plinth.

6.19.(A) Brick work using common burnt clay building brick having crushing strength not less than 35 kg/sq.cm. for super structure above plinth level up to floor two level in cement mortar 1:5 (1 cement: 5 fine sand) modular bricks.**1.0. Materials**

Bricks shall conform to M-15. Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. The relevant specification of item No. 6.12 (A) shall be followed except that the masonry work shall be carried out above plinth level to floor two level i.e. for ground floor.

2.2. The frames of doors, windows, cupboards etc. shall be housed into the brick work at the correct location and level as directed. The heavy steel doors, window frames etc. shall be built in with work, but for ordinary steel doors and windows required opening for frames, hold-fasts, etc., shall be in the wall and frame embedded later on in order to avoid damage to the frames.

2.3. Necessary scaffolding shall be provided. The supports of the scaffolding shall be sound and strong tied, together with horizontal pieces over which the scaffolding plunks shall be fixed. Simple scaffolding shall be allowed normally. In this case scaffolding hole shall rest in hole header horizontal course only. Minimum number of holes be left in brick work for supporting horizontal scaffolding poles. The contractor is responsible for providing and maintaining sufficiently strong scaffolding so as to withstand all loads likely to come upon it.

2.4. For the face of brick work, where plastering is to be done, joints shall be raked out to a depth not less than thickness of joints. The face of brick work shall be cleaned and mortar dropping removed on very same day that brick work is laid.

3.0. Mode of measurements & payment

3.1. The masonry work of G.F. i.e. above plinth level to floor two level shall be measured and paid under this item.

3.2. Brick work in parapet shall be included in the corresponding masonry item of store immediately below the floor above which the parapet is built.

3.3. No deduction shall be made from quantity of brick work nor any extra payment made for embedding in masonry of marking holes in respect of following item.

(1) Ends of joints, beams, posts, girders, rafters, purlins trusses corbel, steps, etc. where cross sectional area does not exceed 500 sq.cm.

(2) Opening not exceed in 1000 sq.cm.

(3) Wall plate sand bed plates bearing of slab, chhajjas, and like whose thickness does not exceed 10 cms. and the bearing does not extend the full thickness of wall.

(4) Drainage holes and recesses for cement concrete blocks to embed hold fasts for doors, window etc.

(5) Iron fixtures, pipes up to 300 mm. dia. hold fasts of doors, and window built into masonry and pipes etc. for concealed wiring.

(6) Forming charges of section not exceeding 350 sq.cm. in masonry.

(7) Apparatuses for fire places, shall not be deducted nor shall extra labour required to make splaying of jumps, throating and making trenches over the aperture be paid for separately.

3.4. The rate shall be for a unit of one cubic meter.

6.19.(B) Brick work using common burnt clay building bricks having crushing strength not less than 35 kg/sq. cm. for super structure above plinth up to floor two level in cement mortar 1:5 (1 cement: 5 fine sand) conventional bricks.**1.0. Materials & Workmanship**

The relevant specification of item No. 6.19(A) shall be followed except that brick masonry work shall be carried out with conventional bricks.

2.0. Mode measurement and payment

2.1. The relevant specification of item No. 6.19 (A) Shall be followed.

2.2. The rate shall be for a unit of one cubic meter per meter.

6.20 Extra for brick in super structure above floor two level.**1.0. Materials and workmanship**

The relevant specifications of item masonry work to be earned out shall be followed except that this work is for additional lift of one floor above two level.

2.0. Mode of measurements and payment

2.1. The relevant specification of item No. 6.19 (A) masonry work shall be followed.

2.2. The extra payment shall be made for additional lift above floor two level to each additional floor over and above the rate of masonry work.

2.3. The rate shall be for a unit of cubic meter per floor.

6.30.I(A) Half brick masonry in common burnt clay building having crushing strength not less than 35 kg/sq.cm. in cement mortar 1:4 {1 cement : 4 coarse sand) for super-structure above plinth level up to floor two level with conventional bricks.**1.0. Materials**

Bricks shall conform to M-15. Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. Relevant specifications of bricks, wetting and laying of bricks, joints, curing etc shall conform to item no. 6.19.(A) except that the brick work of half shall be carried out.

2.2. Cement mortar used in masonry work shall be in proportion of 1 part of cement and 4 parts of sand by volume.

2.3. AH bricks shall be laid stretcher wise, breaking joints with those in the upper and lower courses. The wall shall be taken truly plumb. All courses shall be said truly horizontal and all vertical joints shall be truly vertical. The bricks shall be laid with frogs upwards. A set of masons tools shall be maintained on work as required for frequent checking.

3.0. Mode of measurement and payment

3.1. The half brick masonry work in foundation and plinth shall be measured under this item the limiting dimensions shall not exceed those shown in the plan or as directed. Any work done extra over the specified dimensions shall be ignored.

3.2. The relevant specifications of item no. 6.12. shall be followed. The length shall be measured nearest to one cm.

3.3. The rate shall be for a unit of one sq. meter.

6.30.I.(B) Half brick masonry in common burnt clay building bricks crushing strength not less than 35 kg/sq. cm. in cement mortar 1:4 (1 cement :4 coarse sand) for super-structure above plinth level up to floor two level with conventional bricks.**1.0. Materials and Workmanship**

1.1. The relevant specifications of Item No. 6.30.1 (A) shall be followed for bricks, wetting, laying of bricks, joints, curing, except that the bricks to be used shall be conventional bricks instead of modular bricks.

2.0. Mode of measurement and payment

2.1. The limiting dimensions shall not exceed those shown in the plan or as directed. Any work done extra over specified dimensions shall be ignored.

6.30.II.(A) Half brick masonry in common burnt clay building bricks having crushing strength not less than 35 kg/sq.cm. in cement mortar 1:5 (1 cement : 5 coarse sand) with modular bricks in foundations and plinth.**1.0. Materials & workmanship**

The relevant specifications of item No. 6.30.I (A) shall be followed except the half brick masonry work shall be carried out in cement mortar 1:5 (1 cement : 5 coarse sand) with modular bricks in foundation and plinth.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item no. f, 30. I (A) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

6.30.II.(B) Half brick masonry on common clay building bricks having crushing strength not less than 35 kg/sq. cm. in cement mortar 1:5 (1 cement : 5 coarse sand) in foundation and plinth using conventional bricks.**1.0. Materials & workmanship**

1.1. The relevant specifications of item No. 6.30.I (A) shall be followed for bricks, wetting, laying of bricks, joints, curing, except that the bricks to be used shall be conventional bricks instead of modular bricks.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 6.30.I (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

6.30 HI.(A) Half brick masonry in common burnt clay building having crushing strength not less than 35 kg/sq. cm. in lime mortar 1:15 (1 lime putty : 1.5 coarse sand) in foundation and plinth with modular bricks.

1.0. Materials & workmanship

The relevant specifications of item No. 6.30 (I)-A shall be followed except that the half bricks work shall be carried out in cement 1:5 (1 cement: 5 coarse sand) in foundation and plinth using conventional bricks.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item no. 6.30 (I)-A shall be followed.

2.2. The rate shall for a unit of one sq. meter.

6.30.III(A) Half brick masonry in common burnt clay building having crushing strength not less than 35 kg/sq. cm. in lime mortar 1 :1.5 (1 lime putty : 1.5 coarse sand) in foundation and plinth with modular bricks.**1.0. Materials**

Modular bricks shall conform to M-15 water shall conform to M-1. Lime mortar or proportion L.M. 1:1.5 (1 Lime putty : 1.5 coarse sand) shall conform to M-10.

2.0. Workmanship

The relevant specifications of item No. 6.30 (I) (A) shall be followed except that the half brick masonry work shall be carried out in lime mortar 1:1.5 (1 Lime putty : 1:1.5 coarse sand) in foundation and plinth using modular bricks.

3.0. Mode of measurements & payment

3.1. The relevant specification of item No. 6.30 (I) A shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

6.30.III(8) Half brick masonry in common burnt clay building bricks having crushing strength not less than 35 kg/sq. cm. in mortar 1: 1.5 (1 Lime putty : 1.5 coarse sand) in foundation and plinth with conventional bricks.**1.0. Materials**

Conventional bricks shall conform to M-15, water shall conform to M.1. Lime mortar or proportion L.M. 1:1.5 (1 Lime putty : 1.5 coarse sand) shall conform to M-10.

2.0. Workmanship

The relevant specifications of item No. 6.30 (I)-A shall be followed except that half brick masonry work shall be carried out in Lime Mortar 1:1.5 (1 Lime putty : 1.5 coarse sand) in foundation and plinth using conventional bricks.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 6.30 (I)-A shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

6.30 II(A) Half brick masonry in common burnt clay building bricks having crushing strength not less than 35 kg/sq. cm. in cement 1:5 (1 cement : coarse sand) with hoop iron 25 mm. x 1.6 mm. or equivalent reinforcement at every third coarse embedded in cement mortar in foundation and plinth with modular bricks.**1.0. Materials**

Bricks shall conform to M-15. Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Cement mortar shall conform to M-11. M.S. reinforcement shall conform to M-18.

2.0. Workmanship

2.1. Relevant specifications of bricks, wetting and laying of bricks, joints, curing, scaffolding etc. shall conform to item No. 6.30 (I)-A except the following :

2.2. Cement mortar used in masonry work shall be in proportion to 1 part of cement and 5 parts of sand by volume and shall conform to M-11, and this work is for half brick thickness for partitions walls.

2.3. The hoop iron 25 mm x 1.6 or equivalent reinforcement shall be provided at every third course. The ends of reinforcement shall be fully embedded in main walls on both sides as directed. Reinforcement shall be placed on the top of the bottom most course. Laps shall be of 15 cms. of mild steel bars or hoop iron.

2.4. The joints in the course where reinforcement is placed shall admit of mortar cover to the reinforcement.

3.0. Mode of measurements and payment

- 3.1. The rate shall be for half brick masonry work providing specified reinforcement, the limiting dimensions not exceeding those in the plan or as directed. The length shall be measured nearest to one cm.
- 3.2. Any work done extra over specified dimensions shall be ignored.
- 3.3. The rate shall be for a unit one sq. meter.

6.30.II(B) Half brick masonry in common burnt clay building having crushing strength not less than 35 kg/sq.cm. in cement mortar 1:5 (1 cement : 5 coarse sand) with hoop iron 25 mm. x 1.6 mm. or equivalent reinforcement at every third course embedded in cement mortar in foundation and pith, with conventional bricks.

1.0. Materials & Workmanship

- 1.1. The relevant specifications of item No. 6.30 I (A) shall be followed except that the work is to be carried out with conventional bricks instead of Modular bricks.

2.0. Mode of measurements and payment

- 2.1. The rate shall be for half brick work, including providing specified reinforcement, the limiting dimensions out with conventional bricks instead of Modular bricks.
- 2.2. The work done extra over specified dimensions shall be ignored.
- 2.3. The rate shall be for a unit of one sq. meter.

6.33.(A) Extra for half brick masonry in superstructure above floor two level. Modular bricks.**1.0. Materials & Workmanship**

- 1.1. The relevant specifications for item No. 6.30 A & 6.30. B shall be followed except that this work is for additional lift over and above the payment of work up to floor two level.
- 1.2. The rate shall be for a unit of one sq. meter per floor.

6.33.(B) Extra for half brick masonry work in superstructure above floor two level. Conventional bricks.**1.0. Materials & Workmanship**

- 1.1. The relevant specifications for item No. 6.30 A & 6.30. B shall be followed except that this work is for additional lift of each floor two level using conventional bricks.

2.0. Mode of measurements and payment

- 2.1. The relevant specification of item No. 6.33 (A) shall be followed.
- 2.2. The rate shall be for a unit of one sq. meter per floor

6.55 (1) Half brick thick Honey-comb brick work with burnt work with burnt clay building bricks having crushing strengths not less than 35 kg/sq.cm. in C.M. 1:4 (1 cement : 4 coarse sand)**1.0. Materials**

Bricks shall conform to M-15 Cement mortar of proportion shall conform to M-11.

2.0. Workmanship

The relevant specifications of item No. 6.32(A) shall be followed except that the masonry work shall be carried out Honey-comb in thickness of half bricks in cement mortar 1:4 (1 cement: 4 coarse sand) and as and where directed with all lifts.

3.0. Mode of measurements and payment

- 3.1. The honey-comb work shall be measured in sq. meters. The full area of honey comb work shall be measured without with all lifts.
- 3.2. The rate shall be for a unit of one square meter of wall surface.

SECTION-7**Rubble Masonry Work**

7.6(1) Uncoarsed rubble masonry with hard stone approved quality in foundations and plinth in cement mortar 1:6 (1 cement : 6 coarse sand) including leveling etc. complete.

1.0. Materials:

The cement mortar shall conform to M-11. Stone shall conform to M-16.

2.0. Workmanship

2.1. Dressing of stones:

Stone used for uncoarsed rubble masonry work shall be hammer dressed on the sides, and beds in which such a way as to close with the adjacent stone in the masonry work as strongly as possible. The face stones shall be dressed in such a manner as to give a specified pattern such as polygonal facing etc. The face of the stones shall be so dressed that bushing on the exposed face shall not project by more than 40 mm. from the general wall surface and on the face to be plastered, it shall not project by more than 19 mm., not shall have depressions more than 10 mm. from the average wall surface.

2.2. Laying:

All the stone shall be sufficiently wetted before laying to prevent absorption of water from mortar. The wall shall be built true to plumb (of true to required batter when so specified). All connected walls in a structure shall be raised up informally and regularly. However if for any specific reason, one part of masonry is required to be left behind the wall shall be racked back at an angle not steeper than 45. Vertical toothed joints in masonry shall not be allowed. The work shall be carried out regularly and masonry of any day wall not be raised by more than 1 meter in height.

2.3. The stone shall be laid in an uncoarsed fashion, or random facing etc. However the masonry is required to be brought to level at various stages viz. plinth level window sill level, roof level and any other level specifically shown in the drawings. This may be done first by adjusting the laying of stone to one level and then by providing leveling course of cement concrete 1:6:12 (1 cement: sand : 12 graded stone aggregate 20 mm. nominal size) or as otherwise specified.

2.4. Proper bonding shall be achieved by closely filling in adjacent stones as well as by using bond stones or through stones as described herein below. Face stones shall extend back sufficiently, and bond well with the masonry. The stone shall be carefully set so as to break joints and avoid formation of vertical joints. The depth of stone from the face of wall inwards shall not be less than weight or breadth at the face. The hearing or interior filling of the wall shall consist of rubble stones which may be of any shape. Neither the face stone nor the hearing stone shall be so small to pass through circular ring of 150 mm. internal diameter in any direction nor shall any of them shall have minimum thickness 100 mm.

2.5. All stone shall be carefully laid, hammered down by a wooden mallet into position and solidly embedded in mortar, chips and spawns of stone may be used wherever necessary to avoid thick mortar bends or joints at the same time ensuring that no hollow space is left anywhere in the masonry. The chips used shall not be more than 20% by volume of masonry. The hearting shall be laid nearly level with face stones except that at about one meter intervals vertical bond stone or plumes projecting about 150 to 200 mm. shall be firmly embedded to from vertical bounding in masonry.

2.6. Bond stone:

Bond stones or through stones running right across the thickness of the wall shall be provided in wall up to 600 mm. thick. In thicker walls two stones overlapping each other by at least 150 mm. shall be provided across the thickness of the wall to form bond stones. There shall be at least one bond stone for every 0.5 sq. mt of wall surface. The bond stone shall be marked by a distinguishing letter during construction for subsequent verification and shall be laid staggered in subsequent layers.

2.7. Quoins:

The quoins or corners stones shall be selected stone neatly dressed with hammer and/or chisel to form the required corner angle and laid header and stretcher alternatively, The bed top surface of quoins shall be chiseled dressed to give horizontal joints. The quoins shall have a uniform chisel draft of at least 25 mm. width at four edges of each exposed face, all the edges of the same face being in one plane. No quoins stone shall be smaller than 0.025 cum. in volume.

2.8. Jamb Stones:

The jamb stone shall be made with stone specified for quoins, that the stone provided on the jambs shall have their length equal to thickness of wall up to 600 mm. and a line of headers shall be provided for walls thicker than 600 mm. as specified for bond.

2.9. Joints:

All the joints shall be completely filled with mortar and width shall not exceed 25 mm. when plastering or pointing is not required to be done, the joints shall be struck flush and finished simultaneously while laying the stone. Otherwise the joints shall be raked to a minimum depth of 20 mm. by a racking tools, during progress of laying while the mortar is still green.

2.10. Scaffolding:

Single or double scaffolding shall be used. The scaffolding shall be strong and sound. The holes left in masonry for supporting scaffolding shall be filled and made good before plastering.

2.11. Curing:

Green work shall be protected from rains by covering the same. Masonry shall be kept constantly moist on all the faces for a period of at least 7 days. The top of masonry shall be flooded at close of the day.

3.0. Mode of measurements and payment

3.1. All work shall be measured on the basis of finished dimensions and measured net except where otherwise specified. Only specified dimensions shall be allowed. Anything extra shall be ignored. The masonry work in foundation and plinth shall be measured under this item. No deduction shall be made, not extra payment made for the following:

- (a) Ends of joints, beams, spots, girders, rafters, purloins, trusses, corbles, etc. each up to 500 sq. cm. in section.
- (b) Opening each up to 0.1 sq.m.
- (c) Wall plates and bed plates, bearing of chhaja and like up to 10 cm. depth (bearing of floor and roof slabs shall be deducted from masonry).
- (d) Drain holes and recesses for cement concrete blocks to embed hold fasts for doors windows.
- (e) Building in the masonry iron fixtures pipes up to 300 mm. dia. hole fasts of doors and windows.
- (f) Forming theses in masonry up to section of 350 sq.cm.

3.2. The rate shall be for a unit of one cubic meter.

7.6.(II) Uncoursed rubble masonry with hard stone of approved quality in foundation and plinth in cement mortar 1:5 (1 cement : 5 coarse sand) including leveling up etc. complete.**1.0. Materials and workmanship**

The relevant specification of item No. 7.6(1) shall be followed except that the proportion of cement mortar shall 'be in C.M. 1.5 (1 cement : 5 coarse sand)

2.0. Mode of measurements and payments

2.1. The relevant specifications of item No. 7.6(1) shall followed.

2.2. The rate shall be a unit of one cubic meter.

7.6.(III) Uncoursed rubble masonry with hard stone of approved quality in foundation and plinth in lime mortar 1:1.5 (1 lime putty : 1.5 coarse sand) including leveling etc. complete.**1.0. Materials:**

Lime mortar shall conform to M-10. The rubble shall conform to M-16.

2.0. Workmanship

The relevant specifications of item No. 7.6 (I) shall be followed.

3.0. Mode of measurement and payment

3.1. The relevant specifications of item No. 7.6 (I) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

7.17(A) Coursed rubble masonry with hard stone of approved quality in foundation and plinth in cement mortar 1:6 (1 cement : 6 coarse sang) etc. complete.**1.0. Materials**

Cement mortar shall conform to M-11. The stone shall conform to M-16.

2.0. Workmanship**2.1. Dressing of stones:**

The face stone shall be hammer dressed so as to give approximately rectangular blocks. They shall be squared on bed and side joints. The bed joints shall be rough chisel dressed for a depth of at least 50 mm. back from the faces and the side joints shall be so dressed to a depth of at least 40 mm. back from the face, such that no portion of the dressed surface is more than 10 mm. from a straight edge held against the surface. The remaining portions of surface shall not project above the chisel dressed bed and side joints. The bushing on the face shall not project by more than 40 mm. on an exposed face and 10 mm. on a face to be plastered. The hammer dressed stone shall also have a rough tooling for a minimum width of 25 mm. along the four edges of the face of the stone.

2.2. Laying:

2.2.1. All stones shall be wetted before laying. The wall shall be built up truly plumb (or to required better where so specified.)

All connected masonry in a structure shall normally be raised up uniformly and regularly. However, if for any specific reasons one part of wall is required to be left behind, such wall shall be raked back at an angle not steeper than 45°. vertical toothed joints in masonry shall not be allowed. The work shall be carried up regularly and masonry on any day shall not be raised by more than 1 meter in height.

2.2.2. All the courses shall be laid truly horizontal. The height of course shall not be less than 150 mm. nor more than 300 mm. Face stone shall be laid in alternate header and stretcher fashion. They shall be so arranged as to break joints by at least 75 mm. Stones shall be laid with grains horizontal so that the load is transmitted along the direction of their maximum crushing strength. The depth of stone shall not be less than the height or breadth. The breadth of a face stone shall also be not less than the breadth. The breadth of a face stone shall also be not less than 150 mm. Each face stone shall be of the same height in any give course. The courses shall be not less than 150 mm. Each face stone shall be of the same height in any give course. The courses shall be built in perpendicular to the pressure which the masonry will bear. In case of battered walls (such as retaining walls) the beds of the stone and the plate of courses shall be laid with their bed perpendicular to the battered face.

2.2.3. The hearting or the interior filling of the wall shall consist of flat bedded stones carefully laid on their proper beds in mortar, chips and spawns of stone being used where necessary to avoid excessive use of mortar, care being taken to see that no hollow space is left anywhere in the masonry. Chips shall not be used below the hearting stone to bring these up to the level of stones. The use of chips shall be restricted to be filling of interstices between the hear tiling stone but the volume of chips shall be limited to 15% of the total volume of the masonry.

2.3. Bond Stones:

The relevant specification of item No. 7.6 (I) Para 2.6 shall be followed except that the bond stone shall be provided for at least 1.8. m. length of every courses.

2.2.4. Quoins:

The quoins, which shall be of the same height as the course to which it belongs shall be formed from selected stone of at least 400 mm. length. They shall be laid square or beds on stretchers and headers alternatively. The beds shall be rough, chisel dressed to a depth of at least 100 mm. These stones shall have a minimum uniform chisel draft of 25 mm. width at four edges being in the same plane, quoin stone shall not be smaller than 0.025 cum. in volume and it shall also be not less than 300 mm. in length, 25 % of them being not less 500 mm. in length.

2.5. Joints:

All the bed joints shall be horizontal and all shall be vertical. Face joints shall not be more than 10 mm. thick. All joints shall be properly and completely filled with mortar. On faces where no plastering or pointing is required to be done the joint shall be flush and finished simultaneously while laying stones. In other cases the joints shall be raked to a minimum depth of 20 mm. by raking tools during the progress of work while the mortar is still green.

2.6. Curing:

The relevant specification of item No. 7.6 (I) area Para 2.9 shall be followed

3.0. Mode of measurements & payment

3.1. The relevant specification of item No. 7.6 (I) shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

7.17.(B) Coursed rubble masonry with stone of approved quality in foundation and plinth in cement mortar 1:5 (1 cement : 5 coarse sand) etc. complete.**1.0. Materials & Workmanship**

The relevant specifications of item No. 1.17 (A) shall be followed except that the proportion of cement mortar shall be C.M. 1:4 (1 cement : 5 coarse sand)

2.0. Mode of measurement & payment

2.1. The relevant specification of item No. 7.17 (A) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

7.17 (C) Coursed rubble masonry with stone of approved quality in foundation and plinth in C.M. 1:4 (1 cement : 4 coarse sand) etc. complete)**1.0. Materials & workmanship**

The relevant specifications of item No. 7.17 (A) shall be followed except that the proportion of mortar shall be C.M. 1:4 (1 cement : 4 coarse sand)

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 7.17 (A) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

7.17(D) Coarsed rubble masonry with stone of approved quality in foundation and plinth in c.m. 1:3 (1 cement : 3 coarse sand) etc. complete.

1.0. Materials and Workmanship

1.1. The relevant specification of item No. 7.17 (A) shall be followed except that the proportion of mortar shall be C.M. 1:3 (1 cement : 3 coarse sand)

2.0. Mode of measurement & payment

2.1. The relevant specification of item No. 7.17 (A) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

7.19(A) Coarsed rubble masonry with stone of approved quality for structure above plinth level up to floor two level in C.M. 1:6 (1 cement : 6 coarse sand) etc. complete.

1.0. Materials & Workmanship

1.1. The relevant specification of item No. 7.17 (A) shall be followed except that the coarsed rubble masonry work shall be carried out for superstructure above plinth level up to floor two level.

1.2. Single or double scaffolding may be used. The scaffolding shall be strong and sound. In case single scaffolding is used, the holes shall be carefully made good as directed.

2.0 Mode of measurement & payment

2.1. The relevant specifications of item No. 7.17 (A) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

7.75. Precast concrete block masonry (including quoin block, jamb blocks, closer etc.) with solid concrete blocks of approved size made of cement concrete 1:3:6 Mix. (1 cement : 3 coarse sand : 6 graded stone aggregate of 20 mm. and down gauge) in foundation and plinth in cement mortar 1:6.

1.0. Materials

(a) Aggregate shall conform to M-12. (b) Sand shall conform to M-6. (c) Cement shall conform to M-3.

1.1. The solid cement concrete blocks shall be precast with concrete of 1:3:6 mix (1 cement: 3 coarse sand : 6 graded stone aggregate)

1.2. A block shall be deemed to be solid if the solid materials is not less than 75% of the total volume of the blocks calculated from overall dimensions.

1.3. The concrete mix used for block shall be one of the following:

1.4. The actual size of the block shall be one of the following:

Size : A. 39 x 30 x 19 cms. Size-B 39 x 20 x 19 cms. Size C 39 x 10 x 19 cms.

The size other than those specified above may be used with the approval of Engineer-in-charge.

1.5. The blocks may be either machine made or hand made. The concrete mix, the mixing of concrete the manufacture of blocks, curing and drying shall be in accordance with para-6 to 10 under I.S. : 2185-1967.

1.6. Faces of blocks shall be flat and rectangular Surface finish shall be rendered smooth or plastered with cement mortar 1:3 coarse sand)

1.7. The average compressive strength of eight blocks when determined in the manner described-in I.S. 2185 - 1967 shall not be less than 50 Kg/Sq. Cm. of gross area. The strength of lowest individual block shall not be less than 75 percent of average compressive strength of eight blocks.

1.8. Concrete blocks shall be stored and stacked properly in such a way as to avoid any contact with moisture at site. They shall be stock plied on planks or other supports free from contact with ground and covered to protect against wetting. Cement mortar of proportion 1:6 shall conform to M-11.

2.0. Workmanship

2.1. The blocks need not wetted before of during laying in the walls. In case climatic conditions so required, the top and the sides of block may only be slightly moistures so as to prevent absorption of water from the mortar and ensure the development of required bond with mortar.

2.2. Operations of laying precast cement concrete block masonry shall be carried out in accordance with instructions detailed in I.S. : 6042 -1952. The mortar shall not be spread so much ahead of the actual laying of the units that it tends to stiffen and loose, its plasticity, thereby resulting in poor bond. For most of the work, the joints, both horizontal and vertical shall be 10 mm. thick except in the case of extended joint, construction, the mortar joints shall be struck off flush with wall surface and when the mortar has stated stiffening, it shall be compressed with rounded or U-shaped tool. The mortar shall be pressed against the units with a jointing tool after the mortar has stiffened in effect intimate contact between the mortar and the masonry unit and obtained a weather tight joint.

2.3. Quoins and closures:

Special quoins blocks (with a return face equal to half the length of normal face) shall be cast for all building blocks and slabs for external work. Proper half closures shall be cast and not cut from full size blocks. The returned ends of blocks for door windows reveals and quoins shall be finished with a fair face in the mould.

2.4. Only double scaffolding shall be used. The scaffolding be strong and sound. No holes in the masonry for supporting shall be allowed.

2.5. Curing : The curing of concrete block masonry shall be carried out for 7 days.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 7.6 (I) shall be followed.

3.2. The work of concrete block masonry in foundation and plinth shall be measured under this item.

3.3. The rate shall be for a unit of one cubic meter.

7.82 (A) Precast concrete block masonry in partition walls 10 cms. thick with solid block of approved size (including quoins, blocks, jamb blocks closer etc) made of C.C. 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregates 20 mm. and down gauge) in C.M. 1:4.

1.0. Materials:

1.1. The relevant specification of item No. 7.75 shall be followed except that the precast concrete blocks shall be of size suitable for 10 cms. size partition wall i.e. size c and the proportions of cement mortar shall be in cement mortar 1:4 (1 cement : 4 coarse sand).

2.0. Workmanship

The relevant specifications of item No. 7.75 shall be followed except that the work shall be for precast concrete block partition walls of 10 cms. thickness.

3.0. Mode of measurement & payment

3.1. The relevant specifications of item No. 7.75 shall be followed.

3.2. The rate shall be for a unit of one cubic meter.

7.0.0.1. White stone masonry block in coarse in superstructure with stone of approved quality in lime mortar 1:1.5 (1 Lime putty 1:5 fine sand) including raking out joints etc. complete.

1.0. Materials:

1.1. The stone or bela shall be white hard sand stone or block. The stone shall be sound hard rough and durable. It shall be free from skin. The thickness of bela or block shall not be less than 15 cms. or as directed. The mortar used shall consist. One part of lime putty and 1.50 parts of fine sand. Lime mortar shall conform to M-10.

2.0. Workmanship**2.1. Dressing of stone:**

Stone shall be chiseled on all the sides so that all six sides shall be in a rectangular shape and all the stones shall be so dressed that the bushing of the exposed face shall not project nor depressions for the general wall surfaces. The size of bela or block shall be as per thickness of the wall to be constructed or as directed.

2.3. Laying:

All the stone shall be sufficiently wetted before laying to prevent absorption of water from mortar. All connected Walls in a structure shall normally be raised up uniformly and regularly. The vertical joint shall not be allowed and also it shall not be more than 12 mm. in thickness.

2.3. Proper bonding shall be made by laying bela or block side by side each other with lime mortar on bed as well as in between two bela or block vertically.

2.4. Bond stones:

Bond stones or through stones running right across the thickness of the wall shall be provided in walls up to 450 mm. thick. In thicker walls two bela or blocks or laying each other by at least 150 mm. each other shall be provided across the thickness of the wall to bond stone. Such bond stone shall be at least one for every 1.0 sq. mt. area of the wall surface.

2.5. Joints:

All the joints shall be completely filled up with mortar and their thickness shall not exceed by 12 mm. When plastering or pointing is not required to be done, the joints shall be struck flush and finished, simultaneously while laying the stone. Otherwise the joints shall be raked to a minimum depth of 20 mm. during process of laying while mortar is still green.

2.6. Scaffolding:

Single or double scaffolding shall be used. It shall be strong and sound. The holes left in masonry for supporting shall be made good before plastering.

2.7. Curing:

Green work shall be cured for a period of 7 days continuously.

3.0. Mode of measurements & payment

3.1. The work shall be measured on the basis of finished dimensions. No deduction shall be made nor extra payment shall be made for the following:

(a) Ends of joint, beams, posts, girders, rafters, purlins, corbels etc., each up to 500 sq.cms. in section (b) Opening each up to 0.10 Sq.m.(c) Small plates and bed plates, bearing of chhajas and like up to 10 cms. depth (bearing or floor and roof shall be deducted from masonry), (d) Drain holes and recesses for cement concrete blocks to embedded hold fasts of one cubic meter.

7.0.0.2. White stone bela masonry work in partition walls up to 15 cms. thickness in C.M. 1:4 (1 cement : 4 coarse sand.)

1.0. Materials and workmanship

The relevant specifications of item No. 7.0.0.1 as above shall be followed except that the proportion of mortar shall be in C.M. 1:4 (1 cement : 4 coarse sand.)

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 7.6 (I) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

7.0.0.3. White stone bela masonry block in coarse in superstructure with stone of approved quality in C.M. 1:5 (1 cement: 5 coarse sand) including raking the joints etc. complete.

1.0. Materials and Workmanship

The relevant specifications of item No. 7.0.0.1. as above, except that the proportion of cement mortar shall be in C.M. 1:5 (1 cement : 5 coarse sand)

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 7:6 (I) shall be followed

2.2. The rate shall be for a unit of one cubic meter.

7.0.0.4. White stone bela masonry block in coarse in superstructure with stone of approved quality in C.M. 1:6 (1 cement : 6 coarse sand) including raking the joints etc. complete.

1.0. Materials and Workmanship

The relevant specifications of item No. 7.0.0.1 shall be followed except that the proportion of cement mortar shall be 1:6 (1 cement : 6 coarse sand)

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 7.6. (I) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

SECTION -9**Centering & Form Work**

9.1.(A) Providing form work of ordinary timber planking so as to give a rough finish including centering strutting and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced concrete and plain concrete work in foundation, footings, bases of columns, and mass concrete.

1.0. Materials

1.1. The shuttering to be provided shall be of ordinary timber plank and shall conform to M-26.

1.2. The dimensions of scantlings and battens shall conform to the design. The strength of the wood shall not be less than that assumed in the design.

2.0. Workmanship

2.1. The form work shall conform to the shape lines and dimensions as shown on the plans and be constructed as to remain sufficiently rigid during the placing and compacting of the concrete. Adequate arrangements shall be made by the contractor to safe-guard against any settlement of the form-work during the course of concreting and after concreting. The form work of shuttering, centering, scaffolding, bracing etc. shall be as per design.

2.2. Clearing and Treatment of forms:

2.2.1. All rubbish, particularly chipping shaving and saw dust shall be removed from the interior of the form before the concrete work is placed and the form in contact with concrete shall be cleaned and thoroughly wetted or treated. The surface shall be then coated with soap solution applied before concreting is done. Soap solution for the purpose shall be prepared by dissolving yellow soap in water to get consistency of paint. Alternatively a coat of raw linseed oil shall be applied after thoroughly cleaning the surface. Care shall be taken that the coating does not get on construction joint surface and reinforced bars.

2.3. Stripping time:

2.3.1. In normal circumstances and where ordinary cement is used forms may be struck after expiry of following periods.

- | | | |
|------|---|-----------------|
| (a) | Sides of walls columns and vertical faces of beams..... | 24 to 48 hours. |
| (b) | Beam soffits, (props, left under)..... | 7 days. |
| (c) | Removal of props slabs: | |
| (i) | Slabs spanning up to 4.5. m..... | 7 days. |
| (ii) | Spanning over 4.5 mm..... | 14 days. |
| (d) | Removal of props t beams and Arches: | |
| (i) | Spanning up to 6 mm..... | 14 days. |
| (ii) | Spanning over 6 m..... | 21 days. |

2.4. Procedure when removing the form work:

2.4.1. All form work shall be removed without such shock or vibrations as would damage the reinforced concrete surface. Before the soffits form work and struts are removed, the soffits and the concrete surface shall be exposed where necessary in order to ascertain that the concrete has sufficiently hardened

2.5. Centering:

2.5.1. The centering to be provided shall be got approved. It shall be sufficiently strong to ensure absolute safety of the form work and concrete work before, during and after pouring concrete. Watch should be kept to see that behavior or centering and form work is satisfactory during concreting. Erection should also be such that it would allow removal of forms in proper sequence without damaging either the concrete or the forms to be removed.

2.5.2. The props of centering shall be provided on firm foundation or base of sufficient strength to carry the loads without any settlement.

2.5.3. The centering and form work shall, be inspected and approved by the Engineer-in-charge before concreting. But this will not relieve the contractor of his responsibility for strength, adequacy and safety of form work and centering. If there is a failure of form work or centering, contractor shall be responsible for the damages to property.

2.6. Scaffolding:

2.6.1. All scaffolding, hoisting arrangements and ladders etc., required for the facilitating of concreting shall be provided and removed on completion of work by contractor at his own expense. The scaffolding, hoisting

arrangements and ladders etc. shall be strong enough to with stand all live, dead and impact loads expected to act and shall be subject to the approval of the Engineer-in-charge. However contractor shall be solely responsible for the safety of the scaffolding, hoisting arrangement, ladders, work and workman etc. 2.6.2. The scaffolding, hoisting arrangements and ladder shall allow easy approach to the work spot and afford easy inspection.

2.6.3. The rate is applicable to all condition of working and height up to 4 mts. The rate shall include the cost of materials and labour for various operations involved such as:

- (a) Splayed edges, notching, allowance for overlaps and passing at angles, battens centering, shuttering propping, bolting, wedging easing, striking and removal.
- (b) Filleting to form stop chamfered edges or splayed external angles not exceeding 20 mm: width to beams, columns and the like.
- (c) Temporary openings in the forms for pouring concrete, if required removing rubbish etc.
- (d) Dressing with oil to prevent adhesion of concrete with shuttering and.
- (e) Raking or circular cutting.

2.7. Re-Use:

2.7.1. Before re-use, all form shall be inspected by Engineer-in-charge and their suitability ascertained. The forms shall be scarred, cleaned and joints are gone over, repaired where required. Inside surface shall be retreated to prevent adhesion of concrete.

3.0. Mode of Measurements & Payment

3.1. Form work shall be measured as the area in square meters to shuttering in contract with concrete except in the case of inclined member and portion of curved profile and upper side in which case on area of underside shall be measured for payment.

3.4. Form work to secondary beams shall be measured up to the sides of main beams but no deduction shall be made from the form work of the main beam at the inter section point. No deduction shall be made from the form work of a column at inter section of beams.

3.5. The rate is for the completed item

3.6. The rate shall be for a unit of one sq. meter.

9.1.(A) (i) **Extra for providing from work of ordinary timber planking so as to give a rough finish including centering, shuttering and propping etc., height of propping and centering below supporting floor to ceiling is between 4 to 5 m. and removal of the same for in situ reinforce or plain concrete work in foundations, footings, bases of columns etc. and mass concrete.**

1.0. Materials workmanship

1.1. The relevant specification of item No. 9.1. (A) shall be followed except they the height of propping and centering below supporting floor to ceiling exceeding 4 m. but not exceeding 5 m.

2.0. Mode of measurements and payment

2.1. The payment shall be made extra over and above the payment made up to 4 m. height. The relevant specifications of item No. 9.1.(A) shall be followed. The rate shall be for a unit of one sq. meter.

9.1.(B)(i) **Providing from work of ordinary timber planking so as to give a rough finish including centering, below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced and plain concrete work in flat surface such as soffits of slabs, landing and the like floors etc. up to 200 mm. in thickness.**

1.0. Materials & Workmanship

1.1. Relevant specifications of item 9.1. (A) shall be followed except that work is to be carried out for flat surfaces such as soffits of slabs, landings, and the like for floors etc. up to 200 mm, in thickness.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 9.1 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

9.1.(B)(ii) **Providing form work of ordinary timber planking so as give a rough finish including centering shuttering, strutting and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced and plain concrete work in flat surface such as soffits of slabs, landings, and the like floors etc. above 200 mm. in thickness.**

1.0. Materials and Workmanship

1.1. Relevant specifications of item No. 9.1 (A) shall be followed except that the work is to be carried out for flat surfaces such as soffits of slabs, landings, and the like for floors etc. up to 200 mm. in thickness.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 9.1 (A) shall be followed.

2.2. The rate shall be for a unit of sq. meter.

9.1.(C) Providing form work of ordinary timber planking so as to give a rough finish including centering, shuttering, strutting and propping etc. height of propping and centering below supporting floor to ceiling not excluding 4 m. and removal of the same for in situ reinforced concrete and plain concrete work in vertical surface such as walls (any thickness) partitions.

1.0. Materials and Workmanship

The relevant specifications of item 9.1 (A) shall be followed except that the form work shall be carried out for vertical surfaces such as walls of any thickness, partitions etc.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 9.1 (A) shall be followed"

2.2. The rate shall be for a unit of sq. meter.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No.9.1 (A) shall be followed.

1.2. The rate shall be for a unit on one sq. meter.

9.1.(G)(i) Providing form work of ordinary timber planking so as to give a rough finish including centering, shuttering and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced and plain concrete work columns, pillars, posts, and struts, square rectangular, polygonal in plan.

1.0. Materials and Workmanship

1.1. The relevant specification of item No. 9.1. (A) shall be followed except that the work is for columns, pillars, posts and struts, square, rectangular, polygonal in plan.

2.0. Mode of measurement and payment

2.1. The relevant specification of item No. 9.1. (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

9.1.(H)(i) Providing form work of ordinary timber planking so as to give a rough finish including centering, shuttering, strutting and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced and plain concrete work in side and soffits of beam haunchings, cantilevers, girders, bressumers, and lintels not exceeding 1 m. depth.

1.0. Materials and Workmanship

1.1. The relevant specification of item No. 9.1 (A) shall be followed except that the .work is for sides and soffits of beams, haunting cantilevers girders, bressumers and lintels not exceeding 1 M. in depth.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 9.1 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

9.1.(H)(2) Providing form work of ordinary timber Planking so as to give a rough finish including centering, shuttering, strutting and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced and plain concrete work in sides and soffits of beams, haunchings, cantilevers, girders, bressumers and lintels exceeding 1 m. in depth.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 9.1.(A) shall be followed except that the work is for side and soffits of beam hunchings, girders, bressumers and lintels, exceeding 1 m. in depth.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No 9.1.(A) shall be followed except that the work is for side and soffits of beams haunting cantilevers, girder bressumers and lintels, exceeding 1 m. in depth.

2.2. The rate shall for a unit of one sq. meter.

9.1.(i) Providing from work of ordinary timber planking so as to give a rough finish including centering, shuttering and propping etc. height of propping and centering below supporting floor toe ceiling not exceeding 4 m. and removal of the same for situ reinforced and plain concrete work in edges of slabs and breaks in floor and walls.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 9.1. (A) shall be followed except that the work is for edges of breaks in floors and walls.

2.0. Mode of measurements and payment

2.1. The length and breadth shall be measured nearest to one Cm.

2.2. The rate shall be for a unit of one Sq. meter.

9.1.(K) Providing form work of ordinary timber planking so as to give a rough finish including centering shuttering, strutting and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same in situ reinforced and plain concrete in small surface such as cantilevers ends, brackets and ends of the steps., caps and bases to pilasters and columns and the like.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 9.1.(A) shall be followed except that work is for small as cantilever ends, brackets and ends of steps, caps and bases to pilasters and columns and the like.

2.0. Mode of measurement and payment

2.1. The relevant specification of item No. 9.1.(A) shall be followed.

2.2. The rate shall be unit of one sq. meter.

9.1.(I) Providing form work of ordinary timber planking so as to give a rough finish including centering, shuttering, strutting and propping .etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced and plain concrete in chullah hoods, weather sheds, chhajjas, corbels etc. including edges.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 9.1 (A) shall be followed except that the work is for chullah hoods, weather-sheds, chhajjas, corbels, etc. including edges of the same.

2.0. Mode of measurements and payment

2.1. The relevant specification of item No. 9.1. (A) shall be followed.

2.2. The rate shall be for a unit of one square meter.

9.1.(M) Providing from work of ordinary timber planking so as to give a rough finish including centering, shuttering and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for in situ reinforced and plain concrete work in staircase with slopping or stepped soffits including risers and stringers excluding landing.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 9.1.(A) shall be followed except that the work is for staircases, with slopping or stepped including risers and stringers excluding landing.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 9.1. (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

9.1.(Q) Providing form work of ordinary timber planking so as to give a rough finish including centering shuttering, strutting and propping etc. height of propping and centering below supporting floor to ceiling not exceeding 4 m. and removal of the same for In situ reinforced and plain concrete work in vertical fins and vertical sun-breakers.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 9.1. (A) shall be followed except that the work is for vertical fins and vertical sun breakers.

1.2. The rate shall be for a unit of one sq. meter.

9.7. Extra for providing form work with sweating of steel sheets so as to give a fair finish in :

(A) Foundation, footings, base of columns etc. mass concrete.

(B) Flat surfaces such as soffits, of slab landing and the like.

(i) Floors etc. up to 200 mm. in thickness.

(ii) Floors etc. above 200 mm. in thickness.

(C) Vertical surfaces such as walls (Any thickness) partitions.

(D) Columns, pillars posts and struts.

1. Square, rectangular, bressumers, and lintels not exceeding 1 mm. depth.
2. Sides and soffits and beams, beam haunchings, cantilevers, girders, breassumers and lintels exceeding 1 mm. in depth.
 - (I) Edges of slabs, and breaks in floors and walls.
 - (K) Small surfaces such as cantilever ends, brackets, and ends of steps, caps and bases to pillars and columns including edges.
 - (L) Chollar woods, weather sheds, chhajjas, corrodes etc. and the like.
 - (M) Stair cases sloping or stepped soffits, including risers, skidders excluding landing.
 - (Q) Vertical fine and vertical sun breakers.

1.0. Materials and Workmanship

1.1. The relevant specification of item No. 9.1 .(A) to (Q) shall be followed except that the extra rate shall be paid for using sheathing of steel sheets, and plates of steel or plywood instead of ordinary timber plank, to obtain a desired smooth exposed finish of surface. The surface shall be presentable without further treatment.

2.0. Mode of measurements and payment

2.1. The measurement of form work shall be taken for the work done with steel sheathing, extra over and above the rate of form work of respective item ' from work done. The relevant specification of respective item No. 9.1. (A) to (Q) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

SECTION 10

Wood Work, Doors & Windows

10.1.(A) Providing wood work in frames of doors, windows, clerestory windows and other similar work, Wright, framed and fixed in position, Indian Teak wood.

1.0. Materials

Wooded in frames shall conform to M-29.

2.0. Workmanship

2.1. The item covers the requirement of frames for doors, windows, clerestory windows, their supply and fixing.

2.2. Frames:

2.2.1. All members of frames shall be exactly at right angles. The right angle shall be checked from inside surfaces of the-frames of the respective members.

2.2.2. All members of frames shall be straight without any warp of bow and shall have smooth surfaces well planed on the three sides exposed at right angles to each other. The surfaces touching the wall may not be planed unless it is required in order to straighten up the member or to obtain the overall sizes within the tolerances as specified.

2.2.3. Frame shall have dovetail joints. When clerestory windows in included, it shall be provided by having full length one piece post for door or windows and clerestory window extending the frame on top at the head to the required extent. Horns shall not be provided in the head of the frame. When no sills are provided, the vertical posts of the frame in the ground floor shall be embedded in the sill masonry for 10 cm. on upper floors, the vertical posts shall be fixed in the floor or masonry by forming notches 10 mm. deep. Slight adjustment of spacing as necessary shall be done to have the hold fasts in the joints of masonry; course. The frame shall be erected in position and held plumb with strong support form north sides and built in masonry as it is being built. The transom shall be through tenoned into the mortises of the jamb pot to the full width of the jamb post and the thickness of the tenon shall be not less than 15 mm.

2.3. Tolerance:

Unless specially mentioned otherwise tolerance of + 1.5. mm shall be allowed for each wrought face.

2.4. The tenons shall be closely fitting into the mortises and suitably pinned with wood dowels not less than 10 mm. dia. meter. The depth of rebates for housing the shutter shall be as shown in the detailed drawing or as directed.

2.5. The concrete surface of tenon and mortise shall be treated before putting together with an adhesive of approved make.

2.6. Minimum number of three hold-fasts shall be fixed on each side of door and windows frames, one at the center point and the other two at 30 mm. from the top and bottom of the frames. In case of windows and ventilators frames. The size c. each hold-fast shall be 300 x 25 x 6 mm. and of mild-steel with split end. The hold fasts shall be fixed with screws to frames.

2.7. Mild steel hold fasts shall be protected with a coating of coal asphalt tar. The surface of frame abutting the masonry or concrete faces shall be properly treated by applying a coat of approved coating.

3.0. Mode of Measurements and payment

3.1. The linear dimensions shall be measured correct up to 1 cm. The quantity shall be worked out correct to places of decimals of cu. m.

3.2. The rate shall be for a unit of 10 cu. diameter.

10.4.(A) Providing work in trusses, purloins, falters, posts, post plates, wall plates, and like wrought, framed, hoisted and fixed in position, Indian teak wood.

1.0. Materials

The teak wood shall conform M-29.

2.0. Workmanship

2.1. The relevant specifications of item No. 10.1.(A) shall be followed except that wood work shall be carried mi* in trusses, purloins, falters, posts, plates, wall plates and like wrought framed.

2.2. The work shall be carried out as per detailed drawings supplied by the Department as directed;

2.3. The length of the each member shall be in one piece or as directed.

3.0. Mode of measurement and payment

The length, breadth and depth shall be measured nearest to 1 cm. of unfinished member. The rate shall be for a unit of 10 cubic Decimeter.

10.5. (A) Providing wood work in frames of false ceiling partition etc. swan and put up in position, Indian teak wood.

1.0. Materials

The teak wood shall conform to M-29.

2.0. Workmanship

The relevant specification of item No. 10.1.(A) shall be followed except that the wood work shall be for false, ceiling, partitions, etc. swan and put in position.

3.0. Mode of measurement and payment

3.1. The relevant specifications of item No. 10.1.(A) shall be followed.

3.2. The rate shall be for a unit of Ten cubic Decimeter.

10.12.(A)(i) Providing and fixing 35 mm. thick fully paneled shutters for doors, windows and clerestory windows including anodised aluminum butt hinges with necessary screws. Indian Teak Wood.

1.0. Materials.

1.1. Wood for shutter shall conform to M-29. 2. Glass shall conform to M-38. 3. Anodised aluminum butt hinges shall conform to M-43.

2.0. Workmanship

2.1. The item covers the requirement of preparation of shutters for doors, windows, clerestory windows, their supply and fixing.

2.2. Shutters:

2.2.1. Paneled shutters shall be constructed in the form of timber frame work of styles and rails with panel inserted of type as specified in the detailed drawings. Panel shall be fixed by providing grooves in the style and rails. The styles and rails shall be joined to each other by mortise and tenon joints at right angles.

2.2.2. All members of the shutters shall be straight without any warp or bow and shall have smooth, well planed faces at right angles to each other.

2.2.3. The size of styles and rails shall be as per drawings or as directed. Styles and rails of shutters shall be made of one piece only.

2.3. Timber paneling:

2.3.1. Thickness of the panel shall be as specified in the item as shown in the drawing or as directed. If the panel is made from more than one piece the pieces shall be finished as shown in the detailed drawings and shall be joined with continuous groove with specified size. The end pieces of the panel and the top and bottom of the panel shall be provided with continuous tongue to frame into groove of the frame shutter. An air space of 1.5 mm. shall be left in the groove of frame of shutter while framing the panels in it.

2.3.2. The faces of the panel as well as various pieces of the panel shall be- closely fitted to the sizes of the grooves.

2.3.3. Finishing of the corners of raised panel edges shall be done as shown in drawings or as directed.

2.3.4. The thickness specified shall be finished thickness and no tolerance will be permitted.

2.5. Fixtures and Fastenings:

2.5.1. The rate shall include anodised butt hinges including fixing with iron screws. The size and number of hinges shall be as per table given in annexure-1.

3.0. Mode of measurement and payment

3.1. The rate for shutter includes cost of providing block and cleat for keeping the shutter in open position if directed.

3.2. The dimension of the shutter shall be measured clear size of the shutter in close position between the grooves of the frame.

3.3. The rate shall be for a unit of one sq. meter.

19.12.(A)(II) Providing and fixing 35 mm. thick fully shutters for doors, windows and clear story windows including anodised aluminum but hinges with necessary screws, Indian teak wood.

1.0. Materials

Teak wood shall conform to M-29 Glass shall conform to M-38. Anodised aluminum butt hinges shall conform to M-43.

2.0. Workmanship

2.1. The relevant specifications of item No. 10.12 (A) I shall be followed except that the 35 mm. thick shutters full glazed for doors, windows and clear story windows including anodised aluminum butt hinges with necessary screws.

2.2. Glazing:

2.2.1. The glass panels shall be embedded in putty and secured to the rebate by wooden beads, or moulding shape and size as approved with counter sunk screws of suitable size.

2.2.2. The glass panels shall be properly cut to fit the rebates of the frames and sashes fully with a slight minus margin of about 1.5. mm. on all sides. Before blazing, the frame shall be primed and prepared for painting so that wood may not draw oil out of putty. The rebate shall be putted to an extent to provide bedding all round the glass.

2.2.3. The glass shall then be bedded in putty and fitted to frames with wooden heads or moulding as directed and secured with counter sunk screws. The screws shall be spaced not more than 100 mm. from each corner and not more than 200 mm. apart.

2.2.4. The size of the rebate in the frame and size and shape of beads of moulding shall be as per detailed drawings or as directed. The beads or mouldings shall have mitered corners.

3.0. Mode of measurement and payment

3.1. The relevant specifications of item No. 10.12 (A) (I) shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

10.12(A)(III) Providing and fixing 35 mm. thick partly paneled and party glazed shutters, or doors, windows, including anodized aluminum butt hinges with necessary screws, Indian teak wood.

1.0. Materials

Teak wood shall conform to M-29. Glass shall conform to M-38. Anodised aluminum but hinges shall conform to M-43.

2.0. Workmanship

The relevant specifications of item No. 10.12.(A) (II) shall be followed except that the 35 mm. thick shutter shall be partly paneled and partly glazed for doors, windows, clear story windows etc. as per drawings.

3.0. Mode of measurement and payment

3.1. The relevant specifications of item No. 10.12 (A) (I) shall be followed.

3.2. The rate shall be for a unit of one sq, meter,

10.13.(A)(I) Providing and fixing 35 mm. thick full paneled, shutters for doors, windows and clear story windows including black enameled M.S. Butt, hinges with necessary screws, Indian Teak Wood.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 10.12 (A) (II) shall be followed except that the hinges shall be of black enameled M.S. Butt hinges. The hinges, bolts and other items of iron mongery with moving parts shall be properly oiled by the contractor before handing over the building.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 10.12 (A) (I) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

10.13.(A)(II) Providing and fixing 35 mm. thick full glazed shutters for doors, windows and clear story windows including black enameled M.S. Butt, hinges with necessary screws, Indian Teak Wood.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 10.12 (A) (II) shall be followed except that the hinges shall be of black enameled M.S. Butt hinges. The hinges bolts and other items of iron mongery with moving parts shall be properly oiled by the contractor before handing over the building.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 10.12 (A) (I) shall be followed:

2.2. The rate shall be for a unit of one sq. meter.

10.13(A)(III) Providing and fixing 35 mm. thick partly paneled and partly glassed shutters for doors, windows, and clearstory windows including black enameled M.S. Butt hinges with necessary screws, Indian Teak Wood.

1.0. Materials & Workmanship

The relevant specification of item No. 10.12 (A) (III) shall be followed except that the hinges shall be of black enameled M.S. butt hinges, bolts and other items of ironmongery with moving parts shall be properly oiled by the contractor before handing over the building.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 10.12. (A) (I) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

10.15.(A)(I) Providing and fixing 25 mm. thick paneled, shutters for cup-boards etc. including anodised aluminum butt hinges with necessary screws, Indian Teak Wood.

1.0. Materials

First class Indian teak wood for shutters shall conform to M-29. Glass shall conform to M-38. Anodised aluminum butt hinges shall conform to M.43.

2.0. Workmanship

2.1. The relevant specification of item No. 10.12. (A) (I) shall apply except that the thickness of shutter shall be 25 mm. for cup-boards.

3.0. Mode of measurement & payment

3.1. The relevant specifications of item No. 10.12 (A) (I) shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

10.15.(A)(H) Providing and fixing 25 mm. thick fully glazed shutters for cup-boards etc. including anodised aluminum butt hinges with necessary screws, Indian teak wood.

1.0. Materials & Workmanship

The relevant specifications of item No. 10.12.(A) (I) and 10.12 (A) (II) shall be followed except that the thickness of shutters shall be 25 mm. thick and partly paneled and partly glazed shutters as per drawings for cup-boards.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 10.12 (A)(I) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

10.15.(A)(IH) Providing and fixing 25 mm. thick partly paneled and partly shutters for cub-boards etc. including anodised aluminum butt hinges with necessary screws, Indian teak wood.

1.0. Materials & Workmanship

The relevant specifications of item No. 10.12.(A) (I) and 10.12 (A) (II) shall be followed except that the thickness of shutters shall be 25 mm. thick and partly paneled and partly glazed shutters as per drawings for cupboards.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 10.12 (A)(I) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

10.16.(A)(I) Providing and fixing 25 mm. thick fully paneled, shutters for cup-boards etc., including black enameled M.S. butt hinges with necessary screws, Indian Teak Wood.

1.0. Materials & workmanship

1.1. The relevant specifications of item No. 10.12 (A) (I) shall apply except that the wood for shutters shall be Indian teak wood and black enameled M.S. Butt hinges are to be used instead of anodised aluminum butt hinges and thickness of shutter shall be 25 mm.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 10.12. (A) (I) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

10.16.(A)(H) Providing and fixing 25 mm. thick fully glazed shutters for a cup-boards etc., including black enameled M.S. Butt hinges with necessary screws, Indian Teak Wood.

1.0. Materials & Workmanship

The relevant specifications of item No. 10.15.(A) (I) shall be followed except that the fully glazed shutters of 25 mm. thickness shall be of India Teak Wood fixed in position with black enameled butt hinges for cup-boards.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 10.12 (A) (I) shall followed.

2.2. The rate shall be for a unit of one sq. meter.

10.16.(A)(III) Providing and fixing 25 mm. thick partly paneled and partly glazed shutters for cupboards etc., including black enameled M.S. butt hangs with -necessary screws. Indian Teak Wood.

1.0. Materials

The relevant specifications of item No. 10.15 (A) (I) & 10.15 (A) (II) shall be followed except that the shutters shall partly paneled and partly glazed of 25 mm. thickness of Indian Teak Wood fixed with black enameled butt hinges for cup-boards.

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 10.12 (A)-shall be followed. **12.** The rate shall be for a unit of one sq. meter.

- 10.23. Providing and fixing 35 mm. thick paneled glazed or paneled and glazed shutters for doors, windows, and clearstory windows including anodised aluminum butt hinges with necessary screws. Indian Teak Wood shutters with (A) Plywood,(B) Particle, (C) Hard Board, (D) Asbestos Sheet panels.**

1.0. Materials

Indian teak wood for shutters shall conform to M-29. Glass shall conform to M-38.

- (A) Plywood shall conform to M-37.
 (B) Particle board shall conform to M-40. Anodised aluminum butt hinges shall conform to M-43.
 (C) Hard board shall of best quality and shall be as approved by Engineer-in charge.
 (D) A.C. sheet shall conform to M-24.

2.0. Workmanship

2.1. The relevant specifications of item No. 10.12 (A) (I) shall apply to this item except that the work is shuttered with (A) plywood (B) particle board (C) hard board panels (D) A.C. sheets panels as specified in item.

2.2. The shutter shall be prepared by fittings styles and rails (top, bottom, lock and frieze) as for paneled leaves with simple chamfer on edge only. The styles and rails shall be grooved with just sufficient width for receiving panels and plain panels of specified type panels shall be fitted into the grooves.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 10.12 (A) (I) shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

- 10.24. Providing and fixing 35 mm. thick paneled, glazed or paneled and glazed shutters for doors, windows and clearstory windows including black enameled M.S., butt hinges with necessary screws. Indian Teak Wood shutters with (A) Plywood (B) Particle board (C) Hard Board (D) Asbestos panels.**

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 10.23 shall be followed except that the hinges shall be of back enameled M.S. Butt hinges instead of anodised aluminum butt hinges and shutter with (A) Plywood (B) Particle board (D) Hard Board (D) Asbestos sheet panels as specified in item.

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 10.12 (A) (I) shall-be followed.

2.2. The rate shall be for a unit of one sq. meter.

- 10.30. Providing & fixing flush door shutters, solid core construction with frame of 1st class hard wood with cross band and face veneer or plywood face panels including anodised aluminum butt hinges with necessary screws (B) Non-decorative type and block board core. (2) 35 mm. thick.**

1.0. Materials

Flush door shall conform to M-30. Plywood shall conform to M-37. Anodised aluminum butt hinges shall conform to M-43.

2.0. Workmanship

2.1. The relevant specifications of item No. 10.23 shall be followed except that the shutters be non decorative type and block board core with face veneer or plywood with 35 mm. thickness.

2.2. Ready made shutters shall be of correct size and shall fit into the door or other openings without excessive scraping of edges. Adding of battens etc., to make up to the size shall not be allowed.

3.0. Mode of measurement & payment

3.1. The relevant specification of item No. 10.12 A (I) shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

- 10.37. Extra for using bright finished M.S. Piano hinges instead of anodised aluminum butt hinges in flush door shutter (A) Nickel Plated Piano hinges.**

1.0. Materials and workmanship

1.1. The relevant specification of item No. 10.30 shall be followed except that the nickel plated piano hinges shall be provided and fixed. It shall conform to the latest Indian Standards and shall be got approved by the Engineer-in-charge.

2.0. Mode of measurement & payment

2.1. The extra payment shall be made on sq. M. basis of door over and above item No. 10.30 for providing finish M.S. planed hinges instead of anodised aluminum butt hangs.

2.2. The rate shall be for a unit of one sq. meter.

10.39. Extra for providing vision panel not exceeding 0.1 sq. m. in all types of flush doors. (A) Rectangular square.

1.0. Materials and workmanship

1.1. The relevant specification of item No. 10.30 shall be followed except that the vision panel not exceeding 0.1 sq. m. shall be provided.

1.2. The glass panels shall conform to M-38 and this item is extra work of providing vision panel rectangular or square not exceeding 0.1 sq. in all types of flush doors.

2.0. Mode of measurements & payment

2.1. The payment shall be made over of item No. 10.30 for this extra work on shutter in which visions panels are provided.

2.2. The rate shall be for a unit of one sq. meter of door area.

10.51. Providing and fixing 30 mm. thick wire gauze shutters using galvanised M.S. Wire of I.S. gauze designation 85-G with wire of 0.56 mm. dia butt hinges with necessary screws : Indian Teak Wood.

1.0. Materials

Wire gauze ail shall conform to M-36. The teak shall conform to M-29. Anodised aluminum butt hinges shall conform to M-43.

2.0. Workmanship

2.1. Specification for item No. 10.12 A(l) shall be adopted for shutter and fixtures and fastenings except thru 30. mm. thick wire gauze shutter shall be provided.

2.2. Wire gauze shuttering:

2.2.1. The finished sizes of the wooden components like styles, rails, mountings, shall be as per the paneled doors. Each leaf shall have 2 panels of wire gauze as per drawings or as directed.

2.2.2. The styles, rails etc. shall be rebated 12 mm. along the side where they receive the gauze The galvanised iron webbing of 0.56 mm. dia mesh shall be used unless otherwise specified. The webbing shall be at 90 to 12 mm. along both sides of the rebate and fixed securely to the styles and rails and fillets of the size 10 mm x 10 mm, shall be securely and neatly fixed with small screws, spaced about 7.5. cm. centers round the rebate for each panel of webbing,- After the fillets are pressed well into the angle io hole the gauze hi two faces, the exposed edge of fillets shall be neatly rounded. The gauze shall be tightly stretched during fixing The space between the fillet and the rebate where the webbing is bent shall be neatly finished with putty, so that cut end of webbing may not be visible. Each shutter shall be fitted with a pair of anodised aluminum but! hinges with necessary iron screws.

3.0. Mode of measurement & payment

3.1. The relevant specifications of item No. 10.12 shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

10.53. Providing and fixing 30 mm. thick wire gauze shutters using galvanised M.S. wire of wire gauze designation 85 G with wire of 0.56 mm. dia. for doors, windows, and clerestory windows including bright finished or/and black enameled M.S. butt hinges with necessary screws. Mango wood or equivalent quality.

1.0. Materials & workmanship

The relevant specification of item No. 10.51 shall be followed except that the hinges to be used shall be bright finish or/and black enameled M.S. butt hinges with screws and the wood shall be used of Mango wood or equivalent quality of non teak wood.

2.0. Mode of measurement and payment

2.1. The relevant specification of item No. 10.12 shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

10.54. Extra for providing and fixing galvanised M.S. gauze of I.S. gauge designation 140 G. to doors windows and clerestory windows with wire of dia 0.71 mm. instead of I.S. gauge designation 85 G. with wire of dia. 0.56 mm.

1.0. Materials & workmanship

1.1. The relevant specification for item no. 10,51 & 10.53 shall be followed for this item except that the diameter of wire shall be 0.71 mm. of I.S. gauge designation 140 G. instead of 596 G. diameter I.S. gauge designation 85 G.

2.0. Mode of measurements and payment

2.1. The payment shall be made extra over and above the payment for galvanised M S wire gauge.

2.2. The rate I.S. gauge designation 85 G. shall of one sq. mt of size of doors and windows shuttles

10.74. Providing and fixing 12 mm. thick and 100 mm. wide pellet of flat pressed 3 layer veneered particle board solid core with 25 mm. diameter aluminum curtain rod brackets including fixing with 25 mm. x 3 m. M.S. flat 10 long and plug etc. comp.

1.0. Materials

(1) 3 layers veneered particle board solid core snail-conform to M-40 25. mm. diameter aluminum curtain rod and 25 mm. x 3 mm. x 10 cms. long M.S. flat and plugs shall of best approved quality as directed.

2.0. Workmanship

The work shall be done as per drawing and description given in the item of work. The wooden planks shall be planed smooth and oven on the exposed surface.

The pellet shall be fixed Jo level by means of 10 cms. long x 25 mm. x 3 mm. M.S. flat brackets lent in the form of angle and wooden plug fixed in the walls using wood screws. For pelmet up to 1.5 meter long two such brackets shall be used and additional bracket provided for longer pelmet at the rate of one per meter length extra. The curtain rods be fixed by suitable brackets at the ends to the pelmet as directed.

3.0. Mode of measurement and payment

3.1. Pelmets shall be measured in running meters along the sides and face.

3.2. The rate shall be for a unit of one running meter.

10.84. Providing and fixing 40 mm. paneled, glazed or paneled and glazed partitions fixed to frames with iron screws etc., complete with India teak wood (Frames to be paid separately)

1.0. Materials

Indian Teak wood shall conform to M-29. Glass shall conform to M-38. Iron screws on shall of best approved quality. Plywood asbestos shall conform to relevant specification of materials.

2.0. Workmanship

The work shall be done as per detailed drawing or as directed. The wooden frames shall be of sizes as indicated in the drawing and description of item. They shall be planed and finished smooth and even. The vertical styles and rails shall be framed by tenon and mortise joints.

The panels which may be of planks, asbestos, plywood, glass or any other materials specified shall be fixed in the grooves made in styles and rails or by means of rebate and beading fixed by suitable screws. When glazing is used as panels the glass shall be fixed by using putty in addition to beading, (he putty shall be used before applying material.

3.0. Mode of measurement and payment

Partitions shall be measured in square meters of the net area of the tiller materials provided. The rate shad be for a unit of one sq. meter.

10.85. Providing and fixing decorative plywood 4 mm. thick in portions including fixing to frames with screws etc., complete with 50 mm. x 12 mm. teak wood beading (Frames to be paid separately)

1.0. Materials

4 mm. thick decorative plywood shall be of best approved quality. Teakwood beading and screws shall of best approved quality as directed.

2.0. Workmanship

The relevant specifications shall be same, as per that of item No. 10.84 expect that partitions shall be with 4 rnm. thick decorative plywood and with teakwood beading.

3.0. Mode of measurements and payment

The specifications shall be same as that of item No. 10.84. The rate shall be for a unit of one square meter.

10.86. Providing an fixing plain Asbestos cement sheet 6 mm. thick in partition including fixing to frames with screws etc., complete with 50 mm. x 12 mm. deodar wood beading (Frames to be paid separate)

1.0. Materials

Plain A.C. Sheets shall conform to M-24. Deodar wood beading shall conform to M-29. A.

2.0. Workmanship

The relevant specification of item No. 10.84 shall be followed same except that plain asbestos cement sheet 6 mm. thick shall be used in partition and Deodar wood beading of size 50 x 12 mm. size shall be used.

3.0. Mode of measurement and payment

3.1. The relevant specifications of item No. 10.84 shrill pp followed except that the rate excludes cost of frame work.

3.2. The rate shall be for a unit of one square meter.

10.88. Providing and fixing in partition 4 mm. thick medium hard board approved quality including fixing to frames with screws etc., complete with 50 x 12 mm. Teak wood beading (Frame to paid separated)

1.0. Materials

The hard board shall be 4 mm. thick and of best quality and made as approved. Teak wood beading shall conform to M-29.

2.0. Workmanship

The relevant specifications of item No. 18.84 shall be followed except that the hard board of 4 mm. thickness shall be used in partition and teak wood beading 50 x 12 mm. size shall be used.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 10.84 shall be followed except that the rate excludes cost of frame work.

3.2. The rate shall be for a unit of one square meter.

10.96. 26 mm. thick wooden shelves supported on 40 x 40 x 6 mm. T or Iron brackets fixed at suitable distances not exceeding 75 cms. apart with Mango wood or equivalent quality.

1.0. Materials

The mango wood shall conform to M-29-A. Structural steel shall conform to M-22

2.0. Workmanship

The mango wood or equivalent quality (not teak wood shelves shall be prepared from 25 mm. thick planks. The planks shall be planed smooth. The planks shall be used in single piece up to 30 cms. width. The shelves shall be fitted in position by fixing 40 x 40 x 6 mm. T or L Iron brackets. The spacing of brackets shall not be more than 75 cms. The 40 x 40 x 6 mm. T or L Iron brackets shall be fixed firmly in position by imbedding the same in concrete. The shelves shall be fixed as directed. The season teak wood buttons of size 35 x 12 mm. shall be fixed on open side as directed.

3.0. Mode of measurements and payment

3.1. The shelves shall be measured in Sq. meter. The length and breadth of shelves shall be measured net.

3.2. The rate is inclusive of button provided:

3.3. The rate shall be for a unit of one sq. meter.

10.97. 40 mm. thick wood shelves supported on 40 x 40 x 6 mm. T or L Iron brackets fixed at suitable distance but not exceeding 75 cms. apart with mango wood or equivalent quality.

1.0. Materials & Workmanship

The relevant specifications of item No. 10.96 shall be followed except that the thickness of shelves shall be 40 mm Thick teak wood buttons shall be provided of 50 x 12 mm. on all open sides.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item NO. 10.96 shall be followed.

2.2. The rate shall be for a unit of one square meter.

10.99. Providing and fixing M.S. round or square bars with M.S. flats at required spacing in wooden frames of windows and clerestory windows.

1.0. Materials

M.S. bars and flats shall conform to M-18 and M-22 respectively.

2.0. Workmanship

2.1. The M.S. bars shall be fabricated as shown in the drawing or as directed. It shall conform to I.S. 226-1975 and I.S. 96 and I.S. 1977-1975. The M.S. bars shall be fixed at the required spacing in mild steel flats, after drilling holes in the latter. The diameter and spacing of these bars shall be as mentioned in the drawing or as directed. The bars shall be passed through drill holes drilled into the mild steel flats, fixed in the recess in frames. The flats shall be fixed with iron screws.

3.0. Mode of measurements & payment

3.1. The rate shall be for the M.S. round or square bars with M.S. flats provided and fixed in position as per the specifications for the completed item.

3.2. The rate shall be for a unit of one Kg

10.100.(A) Providing and fixing M.S. Grills of required pattern to wooden frames of windows etc., with M.S. flats at required spacing and frame around, square, or round bars with round headed bolts and nuts or by screws : plain Grill.

1.0. Materials

The structural steel shall conform to M-22

2.0. Workmanship

2.1. The M.S. Grill shall be prepared as per the drawing or as directed for fixing to wooden frames of windows etc.

2.2. The grill shall be fabricated to the designs and patterns shown in the drawings and the weight shall be as directed, and the joints shall be reverted or welded as shown in the plan or as directed. The grill so formed shall be fixed into the frames of the windows etc. before they are erected in position. The outside strip frame of the grill shall be housed to its full thickness into the recess cut into the frame of the windows etc. The grill shall be fixed to the frame with number of bolts and nuts or screws viz. bolt nut/screw per 30 cm. of the length of outer strip subject to minimum of 2 Nos. on each side of the frame or as indicated in the drawing or as directed.

2.3. The bolts and nuts or screws shall be counter sunk and shall be fixed with the top of their heads flush with the face of the frame strips.

3.0. Mode of measurements & payment

3.1. No payment shall be made for weight of screws, bolts nuts etc. only weight of grill shall be paid.

3.2. The rate shall be for a unit of one kg.

10.100.(B) Providing and fixing M.S. Grill of required pattern to wooden frames of windows etc. with M.S. plates, at required spacing and frame around, square or round bars with round headed bolts and nuts or by screws and with ornamental grill.

1.0. Materials & Workmanship

1.1. The relevant specification of item no. 10.100 (A) shall be followed except that the work is for of ornamental grill.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 10.100 (A) shall be followed.

2.2. The rate shall be for a unit of one Kg.

10.102. Providing and fixing hard drawn steel wire fabric 75 x 25 mm. mesh of weight not less than 7.75 kg. per sq.M to window frames etc, including 60 x 20 mm. beading of teak wood.

1.0. Materials

Hard drawn steel wire of 75 x 25 mm. mesh shall conform to M-34. Teak wood beading shall conform to M-29.

2.0. The steel wire fabric 75 x 25 mm. mesh of weight of not less than 7.75 kg per Sq.M. to windows frames etc. shall be fabricated as per detail drawings. The wire fabric shall be fixed to windows frame by teak wood beading of 60 x 20 mm. size be by means of screws.

3.0. Mode of measurements & payment

3.1. The wire mesh (Hard drawn) shall be measured net clear opening of frame of windows in which mesh is fitted. Nothing shall be paid extra for fixing mesh in groove below teak woods-beading.

3.2. The rate shall be for a unit of one sq. meter.

10.103. Providing and fixing fly proof galvanised M.S. Wire gauge of I.S, Gauge designation 85 G. with wire of dia. 0.56 mm. to windows and clerestory windows including 60 x 20 mm. beading of Indian Teak Wood.

1.0. Materials

The fly proof galvanised M.S. wire gauge shall conform to M-36. Teak wood .beading shall conform to M-29. **2.0. Workmanship**

The relevant specifications of item No. 10.102 Shall be followed except that fly proof galvanised M.S. wire gauge of I.S. gauge designation 85-G with wire of 0.56 mm. shall be provided.

3.0. Mode of measurement & payment

3.1. The relevant specifications of item No. 10.102 shall be followed.

3.2. The rate shall be for a unit of one square meter.

10.120. Providing and fixing first class Indian teak wood, 75 x 60 mm. moulded hand rails in , straight lengths completed.

1.0. Materials

First class Indian teak wood shall conform to M-29.

2.0. Workmanship

The teak wood hand rail shall be of size 75 x 60 mm. The hand rail shall be prepared from first class Indian teak wood. The hand rail shall be moulded as per detail drawings. The hand rail shall be fixed in straight length as per detail drawings with screws. The relevant specifications of item No. 10.4 shall be followed except that the teak wood work shall be for a railing of specified size.

3.0. Mode of measurements & payment

3.1. The hand rail shall be measured in running meter.

3.2. The rate shall be for a unit of one running meter.

10.0.0.(I) Providing and fixing glazed louvered Glass windows and ventilators with teak wood frame 10 x 75 mm. size including 3 coats of oil painting to wood work etc. complete,**1.0. Materials**

Indian teak wood shall conform to M-29. Glass shall conform to M-38.

2.0. Workmanship

The relevant specifications of item No. 10.1 (A) shall be followed for frame work except that the frame work of 10 x7 cms. size of required size ventilators shall be provided with glazed glass louvers. The glass louvers shall be provided as directed. In the groove of 1.25 cms. depth made in frames, the thickness of glass shall be 5 mm. and glass shall be glass of best quality. The ventilation blades shall slope done towards the outside at an angle of 450.

3.0. Mode of measurements and payment

3.1. The area of opening within the frame in which louvers are fixed shall be measured in sq. meters.

3.2. The rate included painting 3 coats to wood work with ready mix paint.

3.3. The rate shall be far a unit of one square meter.

10.0.0.(II) Providing & fixing with wooden louvers plank 12 mm. thick windows and ventilators with teak wood frame 10x7 cms. size including 3 coats of oil painting to wood etc complete.**1.0. Materials & Workmanship**

The relevant specifications of item No. 10.00 (I) shall be followed except that the teak wood planks 12.00 thick louvers shall be provided.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 10.00 (I) shall be followed.

2.2. The rate shall be for a unit of one square meter

SECTION-11**Steel Shutters, Windows, Ventilators**

- 11.2. (A) Steel work riveted, in built up sections, framed work including cutting, hosting fixing in position and applying a priming coat of red lead paint. In beam and joints, channels, angles tees, flats, with connecting plates or Angle cleats as in main & cross beams, Hop and jack falters, pralines connected to common rafters and the like.**

1.0. Materials

The structured steel work shall conform to M-22. Red lead paint shall conform to I.S : 102-1962.

2.0. Workmanship

2.1. The steel sections as specified or required, shall be cut, square and to correct lengths, as per drawings and design. The .cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make up the required length of member, except as indicated in the drawing or as directed. All straightening and shaping to form shall be done by application of pressure and not by hammering. Any bending or cutting shall be carried out in suet] a manner as not to impair the strength of the metal. All operations shall be done in cold state unless otherwise directed/permitted.

2.2. Steel riveted or bolted in built up sections, frame work.

2.2.1. The steel structure as shown in the drawings or as per direction of the Engineer-in-charge shall be laid out on a level platform to full scale and to full size in parts. A steel tape shall be used for measurements to ensure maximum accuracy.

2.2.2. Wooden templates 12 mm. to 19 mm. thick or metal sheet template shall be made to correspond to each connecting gussets plate and rivet holes shall be accurately marked on them and drilled. The templates shall be laid on the steel members and holes of the steel members shall also be marked for curing. The base of steel column and the .position of Anchor bolts shall be carefully set out

2.2.3. Ail stiffeners shall be formed by pressure and where practicable the metal shall not to be cut and welded in making these. In major work', or whore so specified, shop drawings giving complete details and information for the fabrication of the component parts of the structure including location, type, size, (origin and details or rivets, bolts or weld shall be prepared in advance of the actual fabrication and as distinctly marked or stenciled with paint with the identification mark as given in the stop drawings. The bars shall be thickened at the ends, so as to provide for screwed threads and gradually tapered off to meet their normal section.

Great accuracy shall be observed in fabrication of various member, so that these can be assembled without being unduly packed, stained, or forced into position and when build up, shall be true and tree from twists, brinks, buckles, or open joints.

Before making holes in individual members for fabrication the steel work intended to be riveted or belted together shall be as ambled or clamped properly and tightly so as to ensure close abutting or lapping or the surfaces of the different members. All softeners shall bear tightly both at top and bottom without being drawn or caulked. The abutting joints shall be cut or crossed true and straight and fitted close together. Web splice plates and tillers under stiffened shall be cut to fit within 3 mm. or flange Angles Web plates of Girders shall have no cover. Plates, shall have their ends flush with the top of angles forming the flanges unless otherwise required. The web plates when spiced ^,hall have clearance of not more than 6 mm. The erection, clearance for created ends of members connecting steel shall preferably be not greater than i.5 mm. The erection clearance at the ends o' beams without web cleats shall not be more than 3 mm. at each end but where for a practical reason greater clearance is necessary, suitably designed seating shall be provided.

Pains and rollers shall be accurately tuned to gauge. These straight and smooth and free from flows. The roller bearing shall be provided with adequate arraignments fur holding the girders or truss resting on it. In columns caps and bases, the ends of shifts together with the attached gussets Angles, channels etc after riveting together shah be accurately mechanized so that the parts connected Butt against each other over the entire surfaces of contact connecting angles or channels shall he fabricated and placed in position with greater accuracy so that they are nut unduly reduced in thickness by machining. The ends of bearing stiffeners shall be mechanized or ground to tit tightly both at the top and bottom, Alt holes shall generally be drilled to the required size and at required, position. Sub punching shall be permitted provided it is done 3 mm. or less in diameter and reamer thereafter to the require size. The holes for rivets and bolts shall be larger by 0 4. to 6 mm. than the nominal diameter of rivets or black bolts depending upon me diameter of rivets.

Holes shall have their axis perpendicular to the surface bored through. The drilling or remarrying shall be free from burrs, and the holes should be clean and accurate holes for counter sunk bolts shall be made in such a mariner that their heads fit flush with the surface after fixing.

The fabrication work shall be completed in workshop as far as it is practicable to do so. Site joints shall be done with rivets and fitted bolts or black bolts, as shown in the drawings or as directed. Generally the following principles shall govern the use of rivets turned and fitted bolts, and black bolts.

- (i) Rivets and turned and fitted bolts shall be used where the connections is such that slip under load has to be avoided.
- (ii) Black bolts may be used very sparingly where a force is carried through a connection without impact, vibration or reversal or stresses.

2.2.4. Riveting:

The parts assembled for riveting shall be in close contact with each other and the bearing stiffeners shall bear tightly both at top and bottom without being drawn or caulked. Members to be riveted shall be properly pinned or bolted and rigidly held to gather while riveting. Drifting of holes shall not be permitted Except to draw the parts together and the drifting tools so used shall have maximum diameter not exceeding, the nominal diameter of rivets or bolts. Drifting done during assembling shall not distort the metal or enlarge the holes.

The shanks of rivets shall project beyond the plate-surface sufficiently so as to fill hole thoroughly and form the required head after riveting.

The riveting shall be done by hydraulic or pneumatic process. However, where such facilities are not available, hand riveting may be permitted. The rivet shall be heated red hot, care being taken to control the temperature of heating so as not to burn the steel. Rivets of diameter less than 10 mm. may be fitted cold. Rivets shall be of heat finish with heads full and of equal size. All loose, burnt or badly formed rivets with concentric or deficient heads shall be cut out and replaced. The heads of rivets shall be central to shanks and shall grip the assembled member firmly. In cutting out rivets, care shall be taken so as not to injure assembled members, caulking or reequipping shall not be permitted.

For testing rivets, a hammer weighing approximately 0.25 kg shall be used. Both heads of the rivets shall be tapped, slack rivets will give a hollow sound and a jar.

All rivet heads shall be painted with red lead paint within a week of their fixing.

2.2.5. All bolt heads and nuts shall be hexagonal and of equal size unless specified otherwise. The screwed heads shall conform to I.S. 1363-1960 and the threaded surface shall not be tapered. The bolts shall be of such length so as to project two clear threads beyond the nuts when fixed in position and these shall fit in the holes without any shakes. The nut shall be fit in the threaded ends of bolts properly.

Where turned and fitted bolts are required to be used in place of rivets shall be provided with washers not less than 6 mm. thick so that the nut when tightened shall not bear on the unthreaded body of the bolt Tapered washers shall be provided for all heads and nuts bearing on leveled surfaces. The threaded portion of the bolt shall not be within the thickness of the parts bolted together, the faces of the bolt heads and nuts abutting against steel members shall be machine finished. Where there is a risk of the nut being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of locknuts, spring washers, cross-cutting or hammering down of threads as directed.

Bolts, nuts, and-washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. The whole steel work shall be painted with a coat of priming coat of red lead, as per relevant specification of painting.

3.0 Mode of measurements & payment

3.1. The steel work shall be measured in general as under:

- (a) All work shall be measured on the basis of finished dimensions as fixed at site and measured net unless specified otherwise.
- (b) The weight of steel sections, steel rods, and steel strips in finished work shall be calculated on standard weight on the same basis on which steel is supplied to Contractor by department or those given in relevant I S : if steel is arranged by the contractor.
- (c) The weight of steel plates and strips shall be taken from relevant I.S. based on 7.35 kg./ sq. meter for every millimeter sheet thickness if steel is supplied to the contractor by department.
- (d) Unless otherwise specified, weight of cleats, brackets, packing pieces, bolts, nuts, washer, distance pieces, separators, diaphragm gusset (taking overall square dimensions) fish plates etc. shall be added to the weight of respective items.
- (e) In riveted work allowance is to be made for weight of rivet heads. No deductions shall be made for rivet or bolts holes excluding holes for anchor or holding down bolts.
- (f) For forged steel and steel castings, weight shall be calculated on the basis of 7850 kg./cum.
- (g) Unless otherwise specified, no allowance shall be made for the weld metal in case of welded steel structure.

- (i) Dimensions other than cross sections and thickness of plates shall be measured to nearest 0.001m
- (j) Mill tolerance shall be ignored when weight is determined by calculation.
- 3.2.** The rate includes cost of all material, labour, erection, hoisting scaffolding, protective measure, required for proper completion of the item of work. This shall also include conveyance and delivery handling, loading, unloading and storing etc. required for completing the item described above including necessary wastage involved.
- 3.3.** The rate shall be for a unit of one quintal.
- 11.2.(D) Steel work riveted in built up section, framed work including cutting, hoisting, fixing in position and applying a priming coat of red lead paint in trusses, and trussed, purlins, upto 25 m. span and 15 m. overall height.**
- 1.0. Materials & Workmanship**
The relevant specifications of item No. 11.2 (A) shall be followed except that the work shall be for trusses and trussed purlins up to 25 m. span and 15 m. overall height.
- 2.0. Mode of measurement & payment**
- 2.1.** The relevant specifications of item No. 11.2. (A) shall be followed.
- 2.2.** The rate shall be for a unit of one quintal.
- 14.4.(A) Steel work welded, in built up sections frame work including, cutting, hoisting, fixing in position and applying a priming coat of red lead paint. In beams and joints, channels, angles tees, flats, with connecting plates or angle cleats as in main and cross beams. Hip and jack rafters, purlins, connected to common fallers and the like.**
- 1.0 Materials & Workmanship**
- 1.1.** The relevant specification of item No. 11.2 (A) shall be followed except that the steel work shall be done by welding.
- 1.2.** Welding shall generally be done by electric process. Gas welding shall be resorted to, using oxyacetylene flame with specific prior approval. Gas welding shall not be permitted for structural steel work.
- 1.3.** The work shall be done as shown in the shop drawings which should clearly indicate various details of the joints to be welded, shop and site welded as well as type of electrodes to be used, symbol for welding on plans and shop drawings shall be according to I.S. 813-1961. As far as possible every effort shall be made to limit the welding that must be done after improper welding that is likely to be done due to heights and difficult positions on scaffoldings etc. The welding work shall conform to I.S. 816-1969.
- 1.4.** Preparation of surfaces : Surfaces which are to be welded together shall be free from loose mill scale, rust, paint, grease or other foreign matter. A coating of boiled linseed oil shall be permitted.
- 1.5.** Assembly for welding : Before welding is commenced, the plates shall first be brought together and firmly clamped or spot welded at specified distance. This temporary connection has to be strong enough to hold the plates accurately in place without displacement.
- 1.6.** Precautions : All operations connected with welding and cutting equipment shall conform to safety requirement given in I.S. 818-1968.
- The following points shall be borne in mind during the process of welding:
- (b) Arc length voltage and amperage shall be suited to the thickness of material type of groove and other circumstances of the work.
- (c) The segments of welding shall be such that where possible the members which offer the greatest resistance to compression are welded first.
- 1.7.** The defective welds which shall be considered harmful to the structural strength shall be cut out and reworked.
- 1.8.** Finished welds and adjacent parts shall be protected with clean boiled linseed oil and after all slag has been removed. Welds and adjacent parts shall not be painted after the same are approved.
- 1.9.** All the members shall be thoroughly cleaned of rust-scales, dust etc. and given a priming coat of red lead paint before fixing them in position.
- Testing of welding to be added in the specification I.N. 12.2.2.12-(i) to (viii)
- 2.0. Mode of measurements & payment**
- 2.1.** The relevant, specification of item No. 11.2 (I) shall be followed.
- 2.2.** The rate shall be for unit of one quintal.
- 11.4.(D) Steel work welded in built up section framed work, cutting, hoisting, fixing in position and applying a priming coat a red lead paint in trusses and trusses purlins up to 25 m. span and 15 m. overall height.**
- 1.0. Materials & Workmanship**
The relevant specification of item No. 11.4.(A) shall be followed except that the work shall be for trusses and trussed purlins up to 25 m. span and 15 m. overall height.

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 11.4 (A) shall be followed.

2.2. The rate shall be for unit for one quintal.

11.6. Providing and fixing in position collapsible steel shutters with vertical channels 20 x 10x2 mm. braced with flat iron diagonals 20 x 5 mm. size with top and bottom rails of T Iron 40 x 40 x 6 mm. with 38 mm. dia steel pulleys complete with bolts, nuts, locking arrangements, stoppers, handles, including applying a priming coat red lead paint.

1.0. Materials

The collapsible steel gate shall conform to M-33.

2.0. Workmanship

J-rails shall be fixed to the floor and to the lintel at top by means of Anchor bolts, embedded in cement concrete-of floor and lintel. The anchor bolts shall be placed approximately at 45 mm. centers alternatively in groove shall be formed along the runner for the purpose. The collapsible gate shall fixed at the sites by fixing the double channels in the T-iron rail and also by hold fasts bolted to the end double channel and fixed in the masonry of the side walls or the otherwise.

In case where the collapsible gate is not required to the lintel beams or slop above, a toe iron suitably designed may be fixed at the top embedded in masonry and provided with necessary clamps and roller arrangement at the top.

All the adjoining work damaged while fixing of gate shall be made good to match the existing work without any extra payment.

All the members of the collapsible gate including T-iron shall be thoroughly cleaned of rust, scales dust etc., and given a priming coat of red lead, before fixing them in position.

3.0. Mode of measurement and payment

3.1. The collapsible gate shall be measured in sq. meter. The height of the gate shall be measured as the length of double channels and breadth from outside to outside of the end fixed double channels in open position of the gate. The rate includes providing handles, arrangements stoppers etc.

3.2. The rate -shall be for a unit of one sq. meter.

11.7. Providing and fixing 1 mm. thick M.S. sheet sliding shutters both frame and diagonal braces of 40 x 40 x 6 mm. Angle iron 3.15. M.S.S. gusset plates at junctions and comers, 25 mm. dia. pulley 40 x 40 x 6 mm. angle and T-iron guide rail at top and bottom respectively with handles, stoppers and locking arraignments etc. including applying priming coat of red lead paint.

1.0. Materials

M.S. sliding shutters shall be fabricated of M.S. component as given in the description of item M.S. sheets 1 mm. thick shall be fixed to the frame with rivets of weld as approved. The shutters shall he provided with top and bottom guide rails of Angles or T-iron as specified and 25 mm. dia. steel pulleys at the-bottom guide black with steel pulleys at the top. The frame shall be riveted and /or welded and wherever riveting shall be done 3.15 mm. gussets plates shall be provided at the junctions.

2.0. Workmanship

2.1. The shutters shall be single or double leaf shutters as specified. The guide rails shall be sufficiently long and continued along the wall on the both ends so that the sliding shutters can rest against walls, living full opening when so required.

2.2. The guide rails shall be fixed to the floor by means of anchor bolts embed in the cement concrete floor. The steel section at the top shall be suitably supported from the walls. Two channel section shall suitably fixed vertically below the extreme clamps in the wall and floor to avoid the shutters from going out of the supports at the top and bottom. A suitable clamping arrangement will be provided at either end of the opening to avoid the shutters from rolling back into opening.

2.3. All the adjoining work damaged while fixing shall be made good to match the existing work.

2.4. All members of the sliding shutter including T-iron shall be thoroughly cleaned of nisi scales dust etc. and given a priming coat of red lead before fixing them in position

3.0. Mode of measurements & payment

3.1. The sliding doors shall be measured on sq. meter. The height of the shutters shall be measured form outside to outside of the guide, rail and width outside of shutters including vertical channels in sides. The rate includes providing handles stopped and locking arrangement etc. complete.

3.2. The rate shall be for a unit of one sq. meter.

SECTION-12**Labour for fixing fixtures & fastening****12.4. Fixing metallic tower bolts of sizes with necessary screws etc. complete (tower bolts and screws to be paid under separate items:)****1.0. Workmanship**

- 1.1. This item provides for labour for fixing metallic tower bolts of any size with screws, mitts etc,
 1.2. The tower bolts shall be fixed in proper position as shown in the drawings or as directed. There shall be fixed truly vertical or horizontal as the case may be.
 1.3. The screws shall be driven home with screw driver. In no case the screws shall be hammered in.
 1.4. All recesses and seats shall be cut to the exact size for counter sinking etc. where so required.
 1.5. Care shall be taken to see that no gaps are left between the fitting and the surface meant to receive the fittings.
 1.6. The fittings shall be properly cleaned and left in original finish after fixing.

2.1. Mode of measurements & payment

- (1) Cutting of holes, recesses, and seats involved in process of fixing.
 (2) Cost of filling and cushioning materials where so required for proper seating of new fittings.
 (3) Cost of nails etc. for temporary positioning of fitting.
 (4) Cost of cleaning materials like old washed dhoti stain remover etc.
 (5) Cost of making good the over cut recesses or holes if any.
 (6) Cost of making hole of required size on the wooden frame for housing the bolt for locking.
 2.2. The rate includes cost of labour involved in all operations required for proper completion of the items including carriage, handling, fixing etc. complete.
 2.3. The rate shall be of unit of one number.

12.5. Fixing metallic flush bolts of size with necessary screws etc., complete (flush bolts and screws shall be paid under separate items):**1.0. Workmanship**

- 1.1. The relevant specifications shall be followed as per item No. 12.4. except for fixing metallic flush bolts instead of tower bolts.

2.0. Mode of measurements and payment

- 2.1. The relevant specifications of item No. 12.4. shall be followed.
 2.2. The rate shall be for a unit of one number.

12.8. Fixing metallic or plastic door handles of sizes with necessary screws etc. complete (door handles and screws to be paid under separate items)**1.0. Workmanship**

- 1.1. The relevant specifications of item No. 12.4. shall be followed except fixing door handles instead of tower bolts.

2.0. Mode of measurements and payment

- 2.1. The relevant specifications of item No. 12.4. shall be followed.
 2.2. The rate shall be for a unit of one number

12.10. Fixing metallic gate and shutter hooks and eyes of sizes (hooks and eyes to be paid under separate items)**1.0. Workmanship**

- 1.1. The relevant specifications shall be followed as per item No. 12.4 except that fixing of eye and hooks instead of tower bolts.

2.0. Mode of measurements and payment

- 2.1. The relevant specifications of item No. 12.4 shall be followed.
 2.2. The rate shall be for a unit of one number (Hook & Eye)

- 12.11. Fixing metallic door latches of size with necessary screws (door latches and screws to be paid under separate items) :**
- 1.0. Workmanship**
- 1.1. The relevant specifications of item No. 12.4 shall be followed except that fixing metallic door latches instead of tower bolts.
- 2.0. Mode of measurements & payment**
- 2.1. The relevant specifications of item No. 12.4 shall be followed.
- 2.2. The rate shall be for a unit of one Number.
- 12.12. Fixing metallic mortise night latches with necessary screws including making necessary crews holes in wooden door shutters etc., complete (mortise night latches and screws to be paid under separate items):**
- 1.0. Workmanship**
- 1.1. The relevant specifications of item No. 12.4 above shall be followed except that the fixing of mortise night latches instead of tower bolts.
- 2.0. Mode of measurements & payment**
- 2.1. The relevant specifications of item No. 12.4 shall be followed.
- 2.2. The rate shall be for a unit of one number.
- 12.18. Fixing metallic ball catchers 100 mm. dia. (Ball catches to be paid under separate item):**
- 1.0. Workmanship**
- 1.1. The relevant specifications of item No. 12.4 shall be followed same except fixing of ball catchers 100 mm dia.
- 2.0. Mode of measurements and payment**
- 2.1. The relevant specification of item No. 12.4 shall be followed.
- 2.2. The rate shall be for a unit of one number.
- 12.20. Fixing metallic casement window fasteners with necessary etc. complete. (Casement window fasteners and screws to be paid under separate items):**
- 1.0. Workmanship**
- 1.1. The relevant specifications of item No. 12.4. shall be followed except fixing metallic casement windows fasteners.
- 2.0. Mode of measurements & payment**
- 2.1. The relevant specifications of item No. 12.4 shall be followed.
- 2.2. The rate shall be for a unit of one number.
- 12.21. Fixing metallic casement stays of sizes with necessary screws etc., complete. (Casement stays and screws to be paid under separate items)**
- 1.0. Workmanship**
- 1.1. The relevant specifications of item No. 12.4 shall be followed except fixing of metallic casement stays.
- 2.0. Mode of measurements & payment**
- 2.1. The relevant specifications of item No. 12.4 shall be followed.
- 2.2. The shall be for unit of one number.
- 12.24. Fixing metallic cupboard of ward robe locks of sizes with necessary screws etc. complete (Locks and screws to be paid separately) :**
- 1.0. Workmanship**
- 1.1. The relevant specifications of item No. 12.4 shall be followed except that fixing metallic cupboard or ward robe locks of size with necessary screws etc. complete.
- 2.0. Mode of measurements & payment**
- 2.1. The relevant specifications of item No. 12.4 shall be followed.
- 2.2. The shall be for a unit of one number
- 12,25. Fixing metallic or plastic cupboard or ward robe knobs of size with necessary screws/ bolts etc., (knobs and screws/bolts to be paid separately) :**

1.0. Workmanship

1.1. The relevant specifications of item No. 12.4 shall be followed except that fixing metallic or plastic cupboard or ward robe knobs of sizes with necessary screws/bolts etc. complete.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 12.4 shall be followed.

2.2. The shall be for a unit of one number.

12.26. Fixing metallic floor stoppers of sizes with rubber cushion, screws etc., to suit shutter thickness complete, (floor door stopper with rubber cushion and screws to be paid under separate items) :

1.0. Workmanship

1.1. The relevant specifications of item No. 12.4 shall be followed except that fixing metallic floor stoppers.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 12.4 shall be followed.

2.2. The shall be for a unit of one number.

12.28. Fixing metallic door handles or knobs for mortise jocks with necessary screws etc. complete (doors, handles/knobs and screws to be paid separately) :

1.0. Workmanship

The relevant specifications of item No. 12.4 shall be followed except that fixing metallic door handles or knobs for mortise with necessary screws etc. complete.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 12.4 shall be followed.

2.2. The rate shall be for a unit of one number.

SECTION-13**Glazing****13.1.(I) Providing and fixing sheet glass, selected quality (type-C) bedded in putty and fixed with wooden beading including cost of wooden beading of first class teak wood and necessary cutting of glass 5 mm. thick.****1.0. Materials**

The glass shall conform to M-38. The wood beading shall conform to M-29, Putty shall conform to I.S. 419-1967.

2.0. Workmanship

The glass shall be sheet glass of selected quality of 5 mm. thick.

2.1. The size of glass for glazing shall allow a clearance of 2.5 mm. between the edges of glass and the wood or metal surrounds. The clearance may be increased, provided the depth of the rebate of groove is sufficient to provide not less than 1.5 m. cover to the glass. The detailed process of glazing shall be as specified in I.S. 3548-1966.

2.2. All stains from the surface of glass shall be removed and cleaned with thinner or spirit without any extra payment.

2.3. Wooden beading :

2.3.1. The size of the wood beads for glass panes shall be 1.5 cms. x 3 cms unless otherwise specified. Beads shall be secured to wooden frames with either panels pins or screws and to metal frames in the way provided for in the frame.

2.3.2. Sufficient putty compound shall be applied to the rebate so that when the glass has been pressed into the rebate, a bed of compound not less than 1.5 mm. thick will remain between the glass and the rebate. There should also be surplus of compound squeezed out above the rebate which should be stripped at an angle not under cut to prevent water accumulating. Beads should be bedded with compound against the glass and wood beads should also be bedded against the rebate. Care should be taken to see that no voids are left between the glass and the bead.

3.0. Mode of measurement & payment

3.1. All measurements of cutting shall, unless otherwise stated, be held to include the consequent waste.

3.2. Each pane' of glass shall be measured to the nearest 0.5 cms. both in width and height/length.

3.3. Irregular shaped or circular panes shall be measured as the smallest rectangular area from which the irregular or circular pane can be cut.

3.4. The rate includes cost of materials, labour required for completion of the item including hoisting, carriage, temporary erections like scaffolding etc.

3.5. The rate also includes :

(i) The wastages and breakage involved in the process.

(ii) Straight cutting on glass and glazing sheets.

(iii) Cost of subsidiary materials required for proper fixing and functioning of glass i.e. nails, spirit, putty, teak wood beading glass, pins, etc. complete.

3.6. The rate shall be for a unit of sq. meter.

13.1.(M) Providing and fixing sheet glass selected quality (Type-C) bedded in putty and fixed with wooden beading including cost of wooden beddings of first class teak wood, and necessary cutting of glass 6 mm. thick.**1.0. Materials and workmanship**

1.1. The relevant specifications of item No. 13.1 (I) shall be followed except that the sheet glass of selected quality shall be 6 mm. thick.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 13.1.(I) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

13.3.(C) Providing and fixing rough cast wired glass 6 mm. thick bedded in putty and fixed with wooden beading including' the cost of wooden beadings of Indian teak wood and necessary cutting of glass wired figures glass.

1.0. Materials :

Wire figure glass shall conform to M-38. Wooden beading shall conform to M-29, Putty shall conform to I.S. 419-1967.

2:0. Workmanship

The relevant specification of item No. 13.1(1) shall be followed except that the wired figured glass of 6 mm. thick shall be used.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 13.1(1) shall be followed.

3.2. The rate shall be for a unit of one sq. nit.

3.5.(3) Providing and fixing sheet glass ordinary quality bedded in putty and fixed with wooden beading including the cost of wooden beadings of first class teak wood and necessary cutting of glass 3 mm. thick.

1.0. Materials

Glass shall conform to M-38. Wooden beading shall conform to M-29. Putty shall conform to I.S. 419-1967. **2.0**

Workmanship

The relevant specification of item No. 13.1 (I) shall be followed except that the wired figured glass of 6 mm. thick shall be used.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 13.1 (I) shall be followed.

3.2. The rate shall be for a unit of one sq. mt.

13.5.(3) Providing and fixing sheet glass ordinary quality bedded in putty and fixed with wooden beading including the cost of wooden beadings of first class teak wood and necessary cutting of glass 3 mm. thick.

1.0. Materials

Glass shall conform to M-38. Wooden beading shall conform to M-29. Putty shall conform to I.S. 419-1967.

2.0. Workmanship

2.1. The specification of this item shall be followed as per item No. 13.1(1) except that the sheet glass of ordinary quality shall be used and thickness of sheet glass shall be 3 mm. thick.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 13.1(1) shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

13.5.(4) Providing and fixing sheet glass ordinary quality, bedded in putty and fixed with wooden beadings including the cost of wooden beadings of first class teak wood and necessary cutting of glass 4 mm. thick.

1.0. Materials and Workmanship

The relevant specifications of item No. 135 (3) shall be followed, except that the thickness of ordinary sheet glass shall be 4 mm.

2.0. Mode of measurements and payment

2.1. The relevant specification of item No. 13.1(1) shall be followed.

2.2. The rate shall be for a unit of one sq. meter,

13.7. Extra for using ground glass (Frosted or obscured on one side) instead of plain glass.

1.0. Materials

Glass shall conform to M-38. Wooden beading shall conform to M-29. Putty shall conform to I.S. 419-1967.

2.0. Workmanship

The specifications of this item shall be followed as per item No. 13.1 except that ground glass (Frosted or obscured on one side) shall be used.

3.0. Mode of measurements and payment

3.1. The payment shall be made on sq. mt. basis extra over and above the payment for plain glass for using ground glass [Routed of obscured).

3.2. The relevant specifications of item No. i3.5 (III) shall be followed.

3.3. The rate shall be for a unit of one sq. meter.

13.11.(A) Difference in cost of material and labour involved in method of glazings if changed in item No. 13.1 to front and back puttied and sprigged 01 fixed with glazing pins :

1.0. Materials and Workmanship

1.1. The relevant specification of item No. 13.1 shall be followed except that the glazing is to be done by front and back puttied and sprigged or fixed with glazing pins.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 13.1 (I) and 13.1 (II) shall be followed.

2.2. The extra rate for extra cost involved shall be paid over and above item No. 13.1(1) & 13.1 (II).

2.3. The rate shall be for a unit of one sq. meter.

13.12. Grinding, polishing and round of edges or glazing sheets.

1.0. Materials

The glass shall conform to M-38.

2.0. Workmanship

The edges of glass or glazing sheets shall be grained, polished and rounded of such that it renders uniform look throughout the length and shall be neatly finished. The work shall be carried out in best workman's like manner.

3.0. Mode of measurements & payment

3.1. The edges of glass round, polished and rounded off shall be measured in meter.

3.2. The rate shall be for a unit of one running meter.

SECTION-14
Paving & Floor Finishing

- 14.2.(A) 40 mm. thick marble chips flooring rubbed and polished (i.e. Terrazzo) to granolithic-finish with under layer 30 mm. thick cement concrete (1:2:4:) (1 cement :2 coarse sand : 4 graded stone aggregate 10 mm. and down gauge) and top layer, 10 mm. thick with white, black or white and black marble chips of required sizes from 1 mm. to 4 mm. nominal size laid in cement marble powder mix 3 : 1 (3 cement : 1 marble powder by weight, in proportion of 4: 7 (4 cement marble powder mix : 7 marble chips by volume): Dark shade pigment with ordinary cement (in top layer only).**

1.0. Materials

Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-G. Stone grit shall conform to M-8.

The pigment incorporated in terrazzo shall be of permanent colour and shall conform to requirement mentioned in Appendix-A in IS: 2114-1962. Marble chips shall conform to M-46. The marble powder shall pass through I.S. Sieve Terrazzo-30.

2.0. Workmanship

2.1. Terrazzo finish shall be laid over a layer of base concrete in case of ground floor. When the terrazzo floor is laid over R.C.C. slabs a cushioning layer consisting of 75 mm. thick lime concrete shall be provided below the terrazzo floor. The terrazzo flooring shall consist of an under layer of cement concrete and layer of terrazzo which shall be paid monolithically.

2.2. Under Layer :

2.2.1. The under layer shall be of cement concrete mix 1:2:4. The maximum size of aggregate used shall not exceed 10 mm. Specification for cement concrete shall be followed as per item No. 5.4.1.

2.3. Terrazzo Topping :

2.3.1. The topping shall have mix of ordinary cement, and marble powder in proportion 3:1 (3 cement : 1 marble powder by weight) and marble aggregate shall be mixed in proportion 4:7 (4 cement marble powder : 7 marble chips by volume). The thickness of concrete and cushioning layer shall not be less than 10 cms. and 7.5 cms. respectively. The minimum thickness of under layer and topping shall be 40 mm.

2.4. Panels :

2.4.1. The floor both while laying the under layer and topping shall be divided into panels not exceeding 2 sq. m. in area so as to reduce the risk of cracking due to differential shrinkage or expansion of terrazzo and sub-floor. The joints be so located that the layer dimensions of any panel do not exceed 2 M. The panels shall preferably be separately. However where the butt joint are provided, the bays shall be laid alternatively allowing for an interval of at least 24 hours between the laying of adjacent bays.

2.5. Mixing of materials :

2.5.1. With a view to avoid variation in colour, mixing shall be done in trough or tub, and the complete quantities of cement and pigment required for one unit shall be mixed at the beginning of the work. Colour cement or cement and pigment mix shall be dry mixed with marble powder. The mix thus obtained shall be mixed with aggregate. Care shall be taken not to get the materials into a heap as this would result in coarser aggregates moving on the sides and cement to the centre. To the dry mix thus prepared, water shall be added in small quantities while materials are being worked to get a mix of proper consistency. The mixture shall be plastic but not so wet as to flow. The wet mix shall be used within half an hour mix of addition of wafer during preparation laying.

2.6. Laying :

2.6.1. The base shall be divided into panels with the help of dividing strips including the strips required for decorative design up to the finished surface level of the floor. Screeds strips shall be used where the dividing strips are not used. The base shall be cleaned of all dust, dirt laitance and any loose materials. It shall be then wetted with water mopped and smeared*with cement slurry at 2.75 kg./sq.mt. Under layer shall be then be spread and leveled with a screening board. The top surface shall be left rough to provide a good bond to die terrazzo.

2.6.2. The terrazzo topping shall be laid while the under layer is still plastic but has hardened enough to prevent cement from rising to the surface. This is normally achieved between 18 to 24 hours after laying of under layer. A cement slurry preferably of the same colour as the topping shall be brushed on the surface immediately before laying the topping. The terrazzo mix shall be laid to a uniform thickness on the screed bed and be completed thoroughly by taping or rolling and trowel led smooth. Excessive troweling or rolling in early stages shall be avoided as it results in working up cement to the surface which will produce a surface liable to cracking and will require more grinding to expose marble chips. The terrazzo surface shall be tamped, trowel led, and brought true to required level by a straight edge and steel floats in such a manner that the maximum amount of marble chips come up and are spread uniform over the surface and no part of the surface is left without chips.

2.7. Curing :

2.7.1. The surface shall be left dry for air curing for a period of 12 to 18 hours. Thereafter water shall be allowed to stand overnight in pools for period of minimum of four days. The floor shall be prevented from being subjected to extreme temperature.

2.8. Grinding and finishing :

2.8.1. Grinding and finishing shall be done either by hand or by machine. In case of manual grinding, the process of grinding shall begin after two days, while in case of machine grinding, the process shall be started after seven days, after completion of laying.

2.8.2. First grinding shall be done by carborundum stones of 60-grit size. The surface shall then be washed clean and grouted with a grout of cement or /and coloring matter in the same mix and proportion as the topping in order to fill any pin holes that appear. It shall be allowed to dry for 24 hours and wet cured for four days in the same manner as mentioned in Para 2.7 above.

2.8.3. The second grinding shall be done with carborundum stone of 80 grit size. The surface shall then be prepared as after first grinding. The third grinding shall be done with carborundum stone of 120 to 150 grit size. The surface shall then be washed again and allowed to dry for 12 hours, and wet cured for four days as before. The fourth grinding shall be done with carborundum stone of 320 to 400 grit size. The surface shall again be washed clean and rubbed hard with felt and slightly moistened Oxalic acid powder @ 5 gms. per sq. meter of floor surface. After the finishing work is over, the surface shall be washed with dilute oxalic acid solution and dried for floor polishing, machine fitted with felt or Hessian bobs shall then be run over it until floor shines. In case wax-polished surface is required, wax-polished shall be applied on the surface with the help of soft linen over a clean and dry surface. The polishing machine fitted with bobs shall be run over it, clean saw dust shall be spread over the floor surface and polishing machine again operated which will remove excess wax and leave glossy surface. Floor shall not be left slippery.

3.0. Mode of measurements and payment

3.1. Terrazzo flooring shall be measured as laid in sq. meters. Length and breadth shall be measured for visible area of work done. No deduction shall be made for nor extra for any opening in floor or area up to 0.10 sq. meter. The rate shall cover laying the floor at different levels in the same room or court-yard and nothing extra shall be paid on that account.

3.2. The rate includes the cost of all materials and labour involved in all operations described above. The rate shall also not include diving strip.

3.3. The rate shall be for a unit of one sq. meter.

14.2.(B) 40 mm. thick marble chips, flooring rubbed and polished (i.e. Terrazzo) to granolithic finish with under layer 30 mm. thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 10 mm. and down gauge) and top layer 10 mm. thick with white, black or white and black marble chips of required sizes from 1 mm. 4 mm. nominal size laid in cement marble powder mix 3 : 1 (3 cement : 1 marble powder by weight) in proportion of 4: 7 (4 cement : marble powder mix : 7 marble chips by volume) light shade pigment with white cement (in top layer only).

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.2 (A) shall be followed except that light shade pigment with white cement shall be used in top layer

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.2 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.2.(C) 40 mm. thick marble chips, flooring rubbed and polished (i.e. Terrazzo) to granolithic finish with under layer 30 mm. thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 10 mm. and down gauge) and top layer 10 mm. thick with white, black or white and black marble chips of required sizes from 1 mm. to 4 mm. nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble power by weight) in proportion of 4:7 (4 cement : marble powder mix : 7 marble chips by volume). Medium shade pigment with approx, 50% white cement and 50% ordinary cement (In top layer only).

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.2. (A) shall be followed except that medium shade pigment with approximately 50% white cement and 50% ordinary cement in top layer only shall be used.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.2. (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.2.(D) 40 mm. thick marble chips, flooring rubbed and polished (i.e. Terrazzo) to granolithic finish with under layer 30 mm. thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 10 mm. and down gauge) and top layer 10 mm, thick with white, black or white and black marble chips of required sizes from 1 mm. to 4 mm. nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble power by weight) in proportion of 4:7 (4 cement : marble powder mix : 7 marble chips by volume). White cement without any pigment (in top layer only).

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.2.(A) shall be followed except that white cement without any pigment in top layer only shall be used.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.2.(A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.2.(E) 40 mm. thick marble chips, flooring rubbed and polished (i.e. Terrazzo) to granolithic finish with under layer 30 mm. thick cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 10 mm. and down gauge) and top layer 10 mm. thick with white, black or white and black marble chips of required sizes from 1 mm. to 4 mm. nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble power by weight) in proportion of 4:7 (4 cement : marble powder mix : 7 marble chips by volume), light < de pigment with ordinary cement (in top layer only).

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.2(A) shall be followed except that the light shade pigment with ordinary cement (in top layer only) shall be used.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.2 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.4.(A) Marble chips skirting (Terrazzo) or dodo rubbed and polished to granolithic finish top layer 6 mm. thick with white black or white and black marble chips of sizes from smallest to 4 mm. nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble by weight) in proportion of 4:7 (4 cement : 7 marble chips by volume) 20 mm. thick with under layer 14 mm. thick in cement plaster 1:3 (1 cement : 3 coarse sand) : Dark shade pigment with ordinary cement (in top layer only).

1.0. Materials

1.1. The relevant specifications of item No. 14.2 (A) shall be followed.

2.0. Workmanship

2.1. Under layer: The under layer for terrazzo on vertical surfaces like skirting and dedos shall be of stiff cement mortar 1:3 (1 cement : 3 coarse sand) finished rough so as to give a good bond to the topping.

2.2. Terrazzo topping shall not be less than 6 mm. thick and the combined thickness of under layer and topping shall be less than 20 mm. The other details shall be followed same as per specifications of item No. C 24 except that the light shade pigment with white cement in top layers shall be used.

3.0. Mode of measurements & payment

3.1. The skirting and dedo shall be measured in square meters correct to two places of decimals. The height shall be measured from the finished level of floor.

3.2. The rate shall be for a unit of one sq. meter.

14.4.(B) Marble chips skirting (Terrazzo) or dedo rubbed and polished to granolithic finish top layer 6 mm. thick with white black or white and black marble chips of sizes from smallest to 4 mm. nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble by weight) in proportion of 4:7 (4 cement : 7 marble chips by volume) 20 mm. thick with under layer 14 mm. thick in cement plaster 1:3 (1 cement : 3 coarse sand) : light shade pigment with white cement (In top layer only).

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.4 (A) shall be followed except that the light shade pigment with white cement in top layers only shall be used.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.4(A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.4.(C) Marble chips skirting (Terrazzo) or dedo rubbed and polished to granolithic finish top layer 6 mm. thick with white black or white and black marble chips of sizes from smallest to 4 mm. nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble by weight) in proportion of 4:7 (4 cement : marble powder mix 7 marble chips by volume) 20 mm. thick with under layer 14 mm. thick in cement plaster 1:3 (1 cement : 3 coarse sand) : medium shade pigment with approximate 50% white cement and 50% ordinary cement (In top layer only).

1.0. Materials and workmanship

1.1. The relevant specifications of item No. 14.4(A) shall be followed except that the medium shade pigment with approximate 50% white cement and 50% ordinary cement in top layers only shall be used.

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 14.4 (A) shall be followed.

2.2. The rate shall be for a unit for one sq. meter.

14.4.(D) Marble chips skirting (Terrazzo) or dodo rubbed and polished to granolithic finish top layer 6 mm. thick with white black or white and black marble chips of sizes from smallest to 4 mm. nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble by weight) in proportion of 4:7 (4 cement : marble powder mix 7 marble chips by volume) 20 mm. thick with under layer 14 mm. thick in cement plaster 1:3 (1 cement : 3 coarse sand) : White cement without any pigment (In top layer only).

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.4 (A) shall be followed except that the white cement without any pigment in top layers shall be used.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.4 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.4.(E) Marble chips skirting (Terrazzo) or dedo rubbed and polished to granolithic finish top layer 6 mm. thick with white black or white and black marble chips of sizes from smallest to 4 mm. nominal size laid in cement marble powder mix 3:1 (3 cement : 1 marble by weight) in proportion of 4:7 (4 cement : marble powder mix 7 marble chips by volume) 20 mm. thick with under layer 14 mm. thick in cement plaster 1:3 (1 cement : 3 coarse sand) : light shade pigment with ordinary cement (In top layer only).

1.0. Materials & workmanship

1.1. The relevant specifications of item No. 14.4 (A) shall be followed and except that the light shade pigment with ordinary cement in top layers only shall be used.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.4 (A) shall be followed and except that the light shade pigment with ordinary cement in top layers only shall be used.

2.2. The rate shall be for a unit of one sq. meter.

4.16 Providing and laying cushioning layer on R.C.C. slab consisting of 75 mm. thick lime concrete using brick aggregate of 20 mm. nominal size 50% mortar comprising of 1 lime : 2 fine sand.

1.0. Materials

1.1. Water shall conform to M-1. Lime mortar or proportion 1:2 shall conform to M-10. Brick aggregate 20 mm. nominal size shall conform to M-14.

2.0. Workmanship

2.1. The relevant specifications of item No. 1.8 shall be followed except that the proportion of mix shall be 50% mortar comprising of 1 lime : 2 coarse sand and the size of brick aggregate shall be 20 mm. nominal size. The lime concrete work shall be carried out in 7.5 Cms. average thickness as a cushioning layer on R.C.C. slab.

3.0. Mode of measurements and payment

3.1. The lime concrete work shall be measured for visible area of work done.

3.2. The rate shall be for a unit of one sq. meter.

14.19.(A) Precast terrazzo (Mosaic) tiles 20 mm. thick with white, black or white and black marble chips of sizes up to 6 mm. laid in floors, treads of steps and landings on a bed of 25 mm. average thickness of lime mortar 1:1.5 (1 lime putty : 1.5 fine sand) or C.M. 1:6 jointed with neat cement slurry mixed with pigment to match the shade of the tiles including rubbing and polishing complete with precast files of light shades, using white cement.

1.0. Materials

1.1. Water shall conform to M-1. Cement shall conform to M-3. Lime Mortar shall conform to M-10 cement mortar shall conform to M-1. The precast terrazzo tiles of 20 mm. thick shall be light shade using white cement and conform to M-47.

2.0. Workmanship

2.1. The work shall be carried out as per I.S. 1443-1972.

2.2. Bedding :

2.2.1. Before spreading the mortar, the sub-base of the floor shall be cleaned of all dirt, scum and loose materials and then well wetted without forming any pools of water on the surface.

2.2.2. In case; of R.C.C. floors, the top shall be left a little rough, all points of level for the finished surface shall be marked out. The lime mortar of proportion 1:1.5 (1 lime putty : 1.5 fine sand) or cement mortar of proportion C.M. 1 : as directed shall be then evenly and smoothly spread over the base. Bedding layer of mortar shall be not less than 10 mm. and average thickness of bedding shall be 25 mm.

2.3. Laying :

2.3.1 Before laying the terrazzo (Marble/Mosaic) tiles, the tiles shall be thoroughly wetted with water. Neat cement grout of required-consistency at 4.4. Kg. cement/sq. mt. shall be spread on the mortar bed. The tiles shall be laid on the neat cement float and shall be evenly and firmly bedded to the required level and slope, There shall be no hollows left. The joints shall be uniform thickness and in straight line as per the pattern.

2.3.2 The surface of flooring shall be checked frequently with a straight edge at least two meters long so as to obtain a true surface with required slope.

2.3.3. The tiles which are fixed in the floor adjoining the wall shall go about 10 mm. under plaster. Skirting or dedo shall be left unfinished for about 50 mm. above finished floor level and unfinished strip then left earlier shall be finished.

2.3.4. In places where full tiles cannot be fixed, the tiles shall be cut to the size and smoothed at edges to give straight and true joints.

2.3.5. After the tiles have been laid, the surplus cement slurry and the joints shall be cleaned and washed fairly deep before cement hardens.

2.3.6. The day after tiles have been laid, the joints shall be cleaned or gray cement grout with a wire brush to a depth of about 5 mm. and then grouted with white cement with or without pigment to match the shade of the topping of tiles. The same cement slurry shall then be spread over the whole surface in a thin coat to protect the surface from abrasive damage and to fill pin holes that may exist on the surface.

2.4. Curing :

2.4.1. The flooring shall be kept wet with damp sand or water for seven days. It shall be kept undisturbed at least for 14 days. The grinding shall normally be commenced after 14 days.

2.5. Polishing :

2.5.1. After the tiles are properly cured, first grinding shall be done with carborundum stone of 48 to 60 grade grit fitted in machine. Water shall be properly used during grinding. When the chips show up and the floor has been uniformly rubbed, it shall be cleaned with water, baring all pin holes. It shall then be covered with a thin coat of white cement mixed with or without pigments to match the colour of the topping of the tiles. Pin holes if any shall thus be filled. This grout shall be kept moist for a week. Thereafter second grinding shall be done when other works are finished. The machine shall be fitted with carborundum of grit 220 to 350 using water in abundance. The floor shall then be washed clean with water. Oxalic acid powder shall then be dusted at 33 grams per square meter on the surface and the surface rubbed with machine fitted with Hessian bobs or rubbed hard with pad of woolen rags. The floor shall then be washed clean and dried with a soft cloth or linen. The finished floor shall not sound hollow when tapped with mallet.

2.5.2. If any tile is disturbed or damaged it shall be refitted or replaced properly jointed and polished.

2.5.3. Testing of the tiles shall be carried out by the contractor at his own cost as per I.S. requirement for required test.

3.0. Mode of measurements & payment

3.1. The terrazzo tiles flooring shall be measured in sq. meters for visible area of work done.

3.2. No deductions shall be made nor extra paid for any opening in the floor area up to 0.1 sq. mt. Nothing extra shall be paid for use of cut tiles or for laying the floors at different levels in the same room or court yard. Mosaic tiles laid in floor borders and bands etc.-shall be measured in the same item and nothing extra shall be payable on account of these or similar bonds formed of half or multiples of half size, standard tiles or other uncut tiles.

3.3. The treads of stairs and steps paved with tiles without nosing shall also be measured under this item.

3.4. Extra rate shall however be paid for such area where width of treads does not exceed 30 cms.

3.5. The rate shall include the cost of all materials, labour involved in all the operations as described above.

3.6. The rate shall be for a unit of one sq. meter.

14.19.(B) Precast Terrazzo (Marble/Mosaic) tiles 20 mm. thick with white, black or white and black marble chips of size up to 6 mm. laid in floors treads of steps and landing on a bed of 25 mm. average thickness of lime mortar 1:1.5 (1 lime putty :1.5 fine sand) or C.M. 1:6 jointed with neat cement slurry mixed with pigment to match the shade of the tiles, including rubbing and polishing complete with precast tiles of medium shades using approximately 50% white cement and 50% ordinary cement.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.19(A) shall be followed except that the precast terrazzo (marble mosaic) tiles shall be of medium shades using approximately 50% white cement and 50% ordinary cement.

2.0. Mode of measurement and payment

2.1. The rate shall be for a unit of one sq. meter.

14.19.(B) Precast Terrazzo (Marble/Mosaic) tiles 20 mm. thick with white, black or white and black marble chips of size up to 6 mm. laid in floors treads of steps and landing on a bed of 25 mm. average thickness of lime mortar 1:1.5 (1 lime putty :1.5 fine sand) or C.M. 1:6 jointed with neat cement slurry mixed with neat cement slurry mixed with pigment to match the shade of tiles including rubbing and polishing complete with precast tiles of dark shade using ordinary cement.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 14,19 (A) shall be followed except that the precast tiles shall be of Dark shade using ordinary Portland cement.

2.0. Mode of measurements & payment

2.1. The mode of measurement and payment shall be same as item No. 14.19 (A)

2.2. The rate shall be for a unit of one sq, meter,

14.21.(A) Precast terrazzo (Marble Mosaic) tiles 20 mm. thick with marble chips of sizes up to 6 mm. in skirting and risers of steps not exceeding 30 cms. in height on 10 mm. thick cement plaster 1:3 C1 cement :3 coarse sand) jointed with neat cement slurry rubbing and polishing complete with tiles of light shades using white cement.

1.0. Materials

Water shall conform to M-1. Cement Mortar shall conform to M-11. The precast terrazzo (Marble/Mosaic) tiles of light shades using white cement tiles 20 mm. thick shall conform to M-47.

2.0. Workmanship**2.1. Laying :**

The work shall be carried out for skirting or dedo. Before fixing precast Terrazzo (Mosaic marble) tiles of shade and size as specified, the surface shall be prepared by heavy scraping, making joints etc, to the required line, level and plumb. The surface shall be thoroughly wetted before commencing the laying work. Thereafter about 10 mm. thick backing of cement mortar in specified proportion shall be applied on the surface in true line and level generally as per specifications of plaster item.

2.2. Fixing :

The back of each tile to be fixed shall be smeared with cement paste of matching colour and the mosaic tiles shall then be gently tapped against the surface, with a wooden mallet. The skirting shall be done only after the flooring is completed. Any pipes coming out of the wall through the dedo or skirting shall only be at the intersection of the horizontal and vertical joints. The tiles shall not have staggered joints. The joints shall be true to entire line both ways and vertical joints shall be in line with joints or flooring. Tiles shall be fixed as close as possible to the adjoining tiles and any difference in the thickness of the mosaic tiles shall be evened out in the cement paste so that all the tiles faces are set in conformity with one another. The skirting shall project uniformly and not more than 6 mm, thickness beyond the finished surface above. Top of skirting or dedo shall be truly horizontal. The risers of steps, skirting or dedo shall rest on top of treads of flooring. Wherever required the tiles shall be cut (sawn) and thin edges smoothed before use.

2.3. Curing :

Curing shall be done for 7 days continuously.

2.4. Finishing:

Skirting and dedo shall be hand polished to have an even smooth and shining surface. In case of skirting only 10 mm. x 10 mm. groove shall be provided at the junction of cement plaster and cement tiles.

3.0. Mode of measurements & payment

3.1. The terrazzo tiles with light shade using white cement base shall be paid under this item. The length shall be measured along finished surface of the riser, skirting or dedo, correct to a centimeter height measured from finished level of treads, or floor to the top (under side of treads in case of steps).

3.2. The rate shall include all materials and labour required for all the operations involved and described above.

3.3. The rate shall be for a unit of one sq. meter.

14.21.(B) Precast terrazzo tiles 20 mm. thick with marble chips of sizes up to 6 mm. in skirting and risers of strips not exceeding 30 cms. in height on 10 mm. thick cement plaster C.M. 1:3 (1 cement :3 coarse sand) jointing with neat cement slurry including rubbing and polishing complete with tiles of : medium shades using approximately 50% white cement and 50% ordinary cement.

1.0. Materials and workmanship

1.1. The relevant specifications of item No, 1*1 21 (A) shall be followed except that the work is for using tiles of medium shades using approximately 5C^j/o white cement and 50% ordinary cement.

2.0. Mode of measurements & payment

2.1. The mode of measurements and payment shall be followed same as item No. 14.21 (A).

2.2. The rate shall be for a unit of one sq. meter.

14.21.(C) Precast terrazzo tiles 20 mm. thick with marble chips of sizes up to 6 mm. in skirting and risers of steps not exceeding 30 cms. in height on 10 mm. thick cement plaster in C.M. 1:3 (1 cement :3 coarse sand) jointing with neat cement slurry including and polishing complete, with tiles of Dark shade using ordinary cement.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.21 (A) shall be followed except that the tiles of dark shade using Portland cement shall be used.

2.0. Mode of measurements and payment

2.1. The mode of measurements and payment shall be followed as per item No. 14.21 (A).

2.2. The rate shall be for a unit of one sq. meter.

14.25.(A) Chequered terrazzo tiles 22 mm. thick with marble chips of size up to 6 mm. in floor on 25 mm. thick bed of lime mortar 1:1.5 (1 lime putty : 1.5 coarse sand) or C.M. 1:6 jointed with neat cement slurry mixed with pigment to match the shade of the tiles including rubbing and polishing etc. complete, light shade using white cement.

1.0. Materials

Water shall conform to M-1. White cement shall conform to M-4. Lime mortar of proportion 1:1.5 shall conform to M-10. Cement mortar shall conform to M-11. Chequered tiles shall conform to M-47 D.

2.0. Workmanship

2.1. The relevant specifications of Item No. 14.21 (A) shall be followed except that chequered tiles of light shade using white cement shall be used.

3.0. Mode of measurement & payment

3.1. The relevant specifications of item No. 14.21 (A) shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

14.25.(B) Chequered terrazzo tiles 22 mm. thick with marble chips of size up to 6 mm. in floor on 25 mm. thick bed of lime mortar 1:1.5 (1 lime putty : 1.5 coarse sand) or C.M. 1:6 painted with neat cement slurry mixed with pigment to match the shade of the tiles including rubbing and polishing etc. complete, medium shade using approximate 50% the cement and 50% ordinary cement.

1.0. Materials and workmanship

1.1. The relevant specification of item No. 14.25 (A) shall be followed except that chequered tiles of medium shade approximate 50% white cement and 50% ordinary cement shall be used.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.25 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.25.(C) Chequered terrazzo tiles 25 mm. thick with marble chips of size up to 6 mm. in floor on 25 mm. thick bed of lime mortar 1:1.5 (1 lime putty : 1.5 coarse sand) or C.M. 1:6 jointed with neat cement slurry mixed with pigment to match the shade of the tiles including rubbing and polishing etc, complete, : Dark shade using ordinary cement.

1.0. Materials and workmanship

1.1. The relevant specification of item No. 14.25 (A) shall be followed except that chequered tiles of dark shade using ordinary cement shall be used.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.25 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.27.(A) Chequered terrazzo tiles 28 mm. thick with marble chips of size up to 6 mm. in treads of stairs and staircases in 12 mm. thick bed of lime mortar 1:5 coarse sand) to C.M. 1:6 jointed with neat cement slurry mixed with pigment to match the shade of the tiles including rubbing and polishing etc. complete, Dark shade using ordinary cement.

1.0. Materials and workmanship

1.1. The relevant specification of item No. 14.25 (A) shall be followed except that chequered tiles 28 mm. thick of light shade using white cement shall be used in trades, stair cases etc.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.25 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.27 (B) Chequered terrazzo tiles 22 mm. thick with marble chips of size up to 6 mm. in floor in on 25 mm. thick bed of lime mortar 1:1.5 (1 lime putty : 1.5 coarse sand) or C.M. 1:6 jointed with neat cement slurry mixed with pigment to match the shade of the tiles including rubbing and polishing etc. complete : Medium shade of using approximately 50% white cement and 50% ordinary cement.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 14.25(A) shall be followed except that the chequered tiles 28 mm. thick of medium shade using approximately 50% white cement and 50% ordinary cement shall be used in treads of stair, staircases etc.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 14.25 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.27.(C) Chequered terrazzo tiles 28 mm. thick with marble chips of sizes up to 6 mm. in treads of stairs and staircases in 12 mm. thick bed of lime mortar 1:1.5 (1 Lime putty: 1.5 coarse sand) or c.m. 1:6 jointed with neat cement slurry mixed with pigment to match the shade of tiles including rubbing and polishing complete : Dark shade using ordinary cement.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 14.25 (A) shall be followed except that chequered tiles 28 mm. thick of dark shade using ordinary cement shall be used in treads of stair, staircase etc.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 14.25 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter,

14.29 White glazed tiles 6 mm. thick in flooring, treads of steps and landings laid on a bed of 12 mm. thick cement mortar 1:3 (1 cement : 3 coarse sand) finished with flush pointing in white cement.

1.0. Materials

Water shall conform to M-1 Cement mortar shall conform to M-11 White glazed tiles shall conform to M-55

2.0. Workmanship**2.1. Bedding :**

2.1.1. The sub grade shall be cleaned, wetted and mopped. The bedding shall then be laid evenly over the surface tamped and corrected to desired level and allowed to harden enough to offer a rigid cushion to tiles and to enable the monsoon to place wooden planks across and squat on it.

2.1.2. The white glazed tiles shall be laid on cement mortar bedding of 12 mm. thick in C.M. 1:3. The mortar shall have sufficient plasticity for laying and there shall be no hard lumps that would interfere with the evenness of bedding. The base shall be cleared and well wetted. The mortar shall then be spread in thickness not less than 10 mm. at any place and average 12 mm. thickness. The proportion of the cement mortar shall be as specified in the item.

2.2. Fixing tiles :

2.2.1. The tiles before laying shall be soaked in water for at least tow hours. Neat gray cement grout at 33 kg/Cement/Sq. mt. of honey like consistency shall be spread over the mortar bedding as directed. The edges of the tiles shall be smeared with neat cement slurry. The tiles shall be well pressed and gently tapped with a wooden mallet till they are properly bedded and in level with the adjoining tiles. There shall be. no hollows in bed or joints. The joints between the tiles shall be as thin as possible in straight line or as per pattern.

2.2.2. The tiles shall not have staggered joints. The joints shall be true to centre line both ways. The Nahni trap coming in the flooring shall be so positioned that its grating shall replace only one tile as far as possible. Where full size tiles cannot be fixed they shall be cut (Swan) to the required size and the edges rubbed smooth to ensure straight and true joints. The joints shall be filled with grey cement grout with wire brush or trowel to a depth of 5 mm. and loose material removed. White cement shall be used for pointing the joints. After fixing the tiles finally in an even plane the flooring shall be kept wet and allowed to nature undisturbed for 7 days.

2.3. Cleaning :

2.3.1. The surplus cement grout that may have come out of the joints shall be cleaned off before it sets. Once the floor has set, it shall be carefully washed, cleared by dilute acid and dried. Proper precautions and measures shall be taken to ensure that the tiles are not damaged in any way till the completion of the .construction.

3.0. Mode of measurements & payment

3.1. The work done shall be measured in sq. mt. for visible area of work done. The length and width of the flooring shall be measured not between the faces of skirting or dedos or plastered face of wall as the case may be. The paving under dedo or skirting shall not be measured. No deduction shall be made not extra paid for any opening in the floor of area-up to 0.1 sq.mt. Nothing extra shall be paid for laying the floors at different levels in the same rooms.

3.2. The rate shall be for a unit of one sq. meter.

14.32. White glazed tiles 6 mm. thick in skirting, risers of steps and dedo on 10 mm. thick cement plaster 1:3 (1 cement :3 coarse sand) and jointed with white cement slurry.

1.0. Materials

Water shall conform to M-1 Cement mortar shall conform to M-11 White glazed tiles shall conform to M-55

2.0. Workmanship

2.1. Preparation of Surface:

In case of brick masonry wall, the joints shall be raked out to a depth of least 15 mm. while the masonry is being laid. In case of concrete wall the surface shall be chiseled and roughed with wire brushes. The surface shall be cleaned and wetted thoroughly before commencing the laying work.

2.2. Laying ;

2.2.1. The wall surface shall be covered with 10 mm. thick plaster of cement mortar 1:3 mix and allowed to harden. The plaster shall be roughened with wire brushes both way. The back of tiles shall be floated with grey cement slurry set and edges with white cement slurry in bedding mortar. The tiles shall be gently tapped in position on after the other keeping the joints as thin as possible. Top of skirting or dedo shall be truly horizontal and the joints vertical or as per required pattern.

2.2.2. Risers of steps, skirting and dedo shall rest on top of treads or flooring. Where full size tiles cannot be fixed, They shall be cut to the required size and the edges be smoothed.

2.2.3. The joints shall be cleaned and flush pointed with white cement. The surface shall be kept wet for seven days. After curing the surface shall be washed clean.

3.0. Mode of measurements and payment

3.1. The rate shall include the cost of all materials and labour required for various operations described above. Risers of steps, skirting and dedo shall be measured in square meters, length and height shall be measured along the finished face of the skirting or dedo including curves, where special such as covers, internal and external angles, etc., used. The length and height shall be measured correct to the centimeter except in case of risers and skirting where height shall be measured correct to 3 mm

3.2. The rate shall be for a unit of one sq. meter.

14.34. Providing and fixing 50 mm. internal or external -angles of white glazed tiles.

1.0. Materials

Water shall conform to M-1. Cement mortar shall conform M-11. Glazed tiles shall conform to M-55.

2.0. Workmanship

2.1. The relevant specifications of item No. 14.32 shall be followed except that the internal or external angles of glazed tiles shall be of thickness not less than the tiles with which they are used. The fixing shall be done as per directions.

3.0. Mode of measurements and payment

3.1. Rate shall be including the cost of materials and labour involved in all the operation described above. Internal or external angles of glazed tiles shall be measured in running meters correct to a centimeter. length being measured on the exposed face of the special at its centre line. No extra payment shall be made for corner places at angles junctions of cover beads and cornices for using cut length of special.

3.2. The rate shall be for a unit on one running meter.

14.36.(A) Providing and laying marble stone slab flooring over 20 mm. (Average) base of cement mortar 1:6 (1 cement : 6 coarse sand) or L. M. 1:1.5 laid and jointed with gray cement slurry including rubbing and polishing compete : Marbles slab 25 mm. thick.

1.0. Materials

Water shall conform to M-1. Lime mortar shall conform to M-10. Cement mortar shall conform to M-1). Marble stone slab 25 mm. thick shall conform to M-51.

2.0. Workmanship

2.1. Dressing of slabs :

Every stone shall be cut to required size and fine chisel dressed to give a smooth and even surface on all sides to full depth. A straight edge laid along the sides of the stone shall be fully in contact with it Chisel dressing shall also be done on top surface to remove any waviness. The sides and top surface of marble

slabs shall be machine rubbed or table rubbed with coarse sand before using. All angles and edges of slabs shall be true, square and free from chipping.

2.2 The thickness of stone shall be 25 mm. The allowable tolerance shall be 2 mm. allowable. The 'tolerance shall \pm 5 mm. in length and breadth.

2.3. Bedding:

Bedding of marble slabs shall either be lime mortar 1:1.5 (1 lime putty : 1.5 coarse sand) or cement mortar 1:6 (1 cement : 6 coarse sand) of average thickness 20 mm. thick as given in description of item. Minimum thickness at any place shall not be less than 10 mm.

2.4. Laying

The surface of sub-grade shall be cleared, wetted and mopped. Mortar of specified mix and thickness shall then be spread on an area sufficient to receive one marble slab. The slab be washed clean before laying. It tie laid on top pressed and tapped gently to bring it in level with other slabs. It shall then be lifted and a side. The top surface of the mortar shall then be corrected by adding fresh mortar at hollows, or depressions. The mortar shall then be allowed to harden it over this surface cement slurry or honey like consistency at 4.4 Kg. of cement per sq. meter. The edges of slabs already paved shall be buttered with gray cement. The slab shall then be gently placed in position and tapped with wooden mallet till it is properly bedded in level with and close to the adjoining slab. The joints shall be as fine as possible. Surplus cement on the surface of the slab shall be removed. The slab fixed in the floor adjoining the walls shall enter not less than 10 mm. under the plaster skirting or dedo. The junction between the walls and floors shall be finished neatly. The finished surface shall be true to level and slopes as directed.

2.5. **Curing** : The floor shall be cured for a minimum period of seven days.

2.6. Polishing and finishing:

Unevenness at the meting edges of slab shall be removed by fine chiseling. Finishing etc. shall be done as per relevant specifications of item No. 14.21 (A) or terrazzo tiles flooring except that cement slurry with/or without pigments shall not be applied on the surface before each polishing.

3.0. Mode of measurements and payment

3.1. Marbles stone flooring with various kinds of marble shall be measured in sq. meter. The length and breadth shall be measured between-the finished face of skirting or dedo or wall plaster No deduction shall fie made nor extra shall be paid for nay opening in the floor or area up to 0.05 sq. mt. Nothing extra shall be paid for laying stone at different levels in the same room. Treads and steps of stairs paved with marble stone slabs shall be also be measured under flooring.

3.2. The rate shall be for a unit of one sq. meter.

14 43.(A) Kota stone slab (Polished, Green colour) flooring over 20 mm. (avage) thick base of cement mortar 1:6 (1 cement : 6 coarse sand, or lime mortar 1:1.5 laid over and jointed with gray cement slurry including rubbing and polishing complete 25 mm. thick.

1.0. Materials

1.1. Water shall conform to M-1. Lime mortar shall conform to M-10. Cement mortar shall conform to M-11 Polished kota stone shall conform to M-49,

2.0. Workmanship

2.1. Each slab shall be cut to the required size and shape and fine chisel dressed at all the edges. The sides trust dressed shall have a full contract if a straight edge is laid along. The sides shall be table rubbed with coarse sand before paving. All angles and edges of the slabs shall be true square and free from chippings and giving a plane surface. The thickness shall be 25 mm. (Average) as specified in the item but not less than 20 mm. at any place of the slab.

2.2. Bedding for the Kota stone slabs shall be of cement mortar 1:6 (1 cement : 6 coarse sand) or L.M. 1:1.5 of average thickness 20 mm given in the description of the item. Sub grade shall be cleaned, wetted and mopped Mortar of the specified mix and thickness shall then be spread on an area sufficient to receive one kota stone slab. The slab shall be washed clean before laying. It shall be laid on top, pressed, tapped gently to bring it in level with the other slabs. If shall then be lifted and laid aside. Top surface of the mortar shall then be corrected by adding fresh mortar at hollows or depressions. The mortar shall then be allowed to harden bit. Over this surface, cement slurry of honey-like consistency shall be applied. The slab shall then be gently placed in position and tapped with wooden mallet till it is properly padded in level with and close to the adjoining slab. The joint shall be as fine as possible. The slabs fixed in the floor adjoining, the

walls shall enter not less than 10 mm. under the plaster, skirting or dedo. The junction between the wan and floor shall be finished neatly. The finished surface shall be true to levels and slopes as directed

2.3. The floor shall be kept wet for a minimum period of 7 days so that bedding and joints set properly

2.4. Polishing shall be normally commenced after 14 days of laying the stone slab. First polishing shall be done with carborundum stones of 120 grade grit fitted in the heavy machine and then second polishing shall be done with carborundum stone of 220 to 350 grade grit fitted in heavy machine. Water shall be properly used during polishing. The stone shall then be washed clean with water. When directed by the Engineer-in-charge, wax polish of approved quality shall be applied on the surface with the help of soft cloth over a clean and dry surface. Then the polishing machine fitted with bobs shall be run over it.

2.5. The holes required for Nahni traps, pipes and any other fittings shall be made, without any extra cost.

3.0. Measurement & payment

3.1. The rate shall include the cost of all materials and labour involved in all the operations described above. The kota stone flooring shall be measured in square meters correct to two places decimal, length and breadth shall be measured correct to a centimeter and between the finished face of skirting dedo plaster and no deduction shall be made nor extra paid for any opening in floor of areas up to 0.1 sq

3.2. The rate shall be for a unit of one sq. meter

14.43.(B) Kota stone slab flooring over 20 mm. (average) thick base of cement mortar 1:6 (1 cement :6 coarse sand) or L.M. 1:1.5 laid over and jointed with gray cement slurry including and polishing complete : 30 mm. thick.

1.0. Materials and workmanship

1.1. The relevant specifications of item No 14.43 (A) shall be followed except that the thickness of stone shall be 30 mm.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No 14.43 (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.44. Kota stone slab 25 mm. thick in riser of steps dedo and pillars laid on 10 mm. thick cement mortar 1:3 (1 cement : 3 coarse sand) and jointed with gray cement slurry including rubbing and polishing etc. complete.

1.0. Materials

Water shall conform to M-1. Cement mortar shall conform to M-11. Kota stone slab 25 mm thick shall conform to M-49.

2.0. Workmanship

2.1. The relevant specifications of item No. 14.43(A) shall be followed except that the kota stone fixed for risers of steps, dedo or skirting in C.M. 1:3 and the polishing shall be done manually instead of machine polishing.

3.0. Mode of measurements and payment

3.1. The risers of steps, skirting or dedo shall be measured in sq. meter. Length shall be measured along the finished faces of risers, skirting or dedo. Height shall be measured from finished level of treads of floor to top. Lining of pillars shall be measured under this item.

3.2. The rate shall be for a unit of one sq. meter.

14.46.(A) Rough chiseled dressed (Kota stone green) stone flooring over 20 mm. thick base of cement mortar 1:5 (1 cement :5 coarse sand), or L.M. 1:1.5 including pointing with cement mortar 1:2 (1 cement : 2 stone dust) etc. complete 25 mm. thick.

1.0. Materials

Water shall conform to M-1. Lime mortar shall conform to M-10. Cement mortar shall conform to M-11. Rough chisel dressed stone shall conform to M-48.

2.0. Workmanship

2.1. The relevant specifications of item No. 14.43 (A) shall be followed except that the rough chisel dressed stone of 25 mm. thickness of approved quality are to be fixed on cement mortar bedding in CM 1:5 or L.M. 1:1.5 of 25 mm. average thickness.

2.2. Dressing of stone slab :

Every stone slab shall be cut to the required size and shape and rough chisel- dressed on top, if required, so that the dressed surface shall not be more than 6 mm, from straight edge placed on it. The sides shall

also be chisel-dressed to a minimum depth of 20 mm. so that the dressed edge shall at no place be more than 30 mm. from straight edge butted against it. Beyond this depth, the sides may be dressed slightly splayed so as to form an inverted V shaped joint with adjoining also. The surface shall be reasonable true and plane and all the angles and edges shall be square and free from chippings. Where the stone slabs are to be used for nosing, exposed edges shall be rough chisel-dressed to full depth and cut to the uniform thickness.

2.3. Thickness of the stone slab shall be 25 mm. with permissible tolerance of ± 2 mm.

2.4. Laying :

The surface of the sub-grade concrete shall be cleaned, wetted and mopped. The bedding of specified mortar mix shall be spread under each slab to the specified thickness. The slab shall be washed clean before laying. It shall be laid on top, pressed and so that all hollows underneath filled surplus mortar works up through the joints. The top shall be tapped and brought level to the adjoining slab. The thickness of the joints shall not exceed 5 mm. Subsequent slabs shall be laid in the same manner

2.5. Curing & Finishing :

Any surplus mortar on the surface of the slab shall be cleaned off and joints-finished flush. The joints shall be raked out uniformly to a minimum depth of 12 mm. under the plaster, skirting or dado. The junctions between wall plasters and floor shall be finished neatly and without waviness. The pointing shall be done with C.M. 1:2. The pointing shall be cured for a minimum period of seven days. The finished floor shall not sound hollow when tapped with wooden mallet and the finished surface shall be true to level and slopes as directed.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 14.43 (A) shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

14.46.(B) Rough chisel dressed (Kota stone green) stone flooring over 20 mm. thick base of cement mortar 1:5 (1 cement : 5 coarse sand) or Lime Mortar 1:1.5 including pointing with cement 1:2 (1 cement : 2 stone dust) etc., complete-40 mm. thick.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 14.46 (A) shall be followed except that the thickness of stone slabs shall be 40 mm. thick.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No 14.46(A) shall be followed.

2.2. The rates shall be for a unit of one sq. meter.

14.71.(A) Cement concrete flooring for I.P.S, 1:2:4 (for Indian Patent Stones) (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) laid in one layer finished with a floating coat of neat cement 40 mm. thick.

1.0. Materials

Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Stone aggregate 20 mm. nominal size shall conform to M-12. Cement concrete of 1:2:4 proportion measured by volume shall conform to relevant specifications of ordinary grade 1:2:4 concrete.

2.0. Workmanship

2.1. The cement concrete flooring of 40 mm thick (Average) is to be laid as per the site condition. The concrete shall be mixed in a mechanical mixer at the work. Hand mixing may however be allowed for smaller quantities of work and in case of failure of machineries or as permitted by the Engineer-in-charge. It shall be carried out on a water tight platform and care shall be taken to ensure that mixing is continued until the mass is uniform in colour and consistency. However in such cases 10% more cement than otherwise required shall have to be used without any extra cost. The mechanical mixing shall be done for period of 1.1/2 to 2 minutes. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the purpose, Flooring or specified thickness shall be laid in accordance with approved pattern or as directed. Finishing operation shall depend upon the temperature

and atmospheric conditions. The surface shall be left for some time till moisture disappears from it. Fresh quantity of cement shall be mixed with water to form a thick slurry and spread over the surface while the concrete is still green. Use of dry cement or cement and sand mixture sprinkled on this surface to stiffen the concrete or absorb excessive moisture shall not be permitted. The cement slurry shall then be properly pressed twice by means of iron floats, once when the slurry is applied and the second time when cement setting and finished floated smooth. The surface shall be marked with string or B.R.C. fabric jali to make the surface non-slippery as and when directed. The junction of floors with wall plaster, dado or skirting shall be rounded off where so

required up to 25 mm. radius. Flooring in lavatories and bath rooms shall be laid after fixing of water closet and squatting pans and floor traps which shall be plugged while laying the floors and opened after the floors are completed. Any damage done to water supply or sanitary fittings during execution of work shall be made good.

2.2. After the final set, the concrete shall be kept continuously wet. if required by ponding for a period of not less than 7 days from the date of placement.

2.3. The form work shall be provided if necessary as directed by Engineer-in-charge. Concreting shall be done as per alternate bay method with necessary centering either by mastic or cement mortar as directed

3.0. Mode of measurements & payment

3.1. The rate shall include the cost of all materials and labour involved in all the operations described above. No deduction shall be made or extra paid for any opening up to 0.1 sq. mt. In area in the floor, nothing extra shall be paid for laying the floor at different levels in the same room or the counter yard.

3.2. The rate shall be for a unit of one sq. meter.

14.71.(B) Cement concrete flooring (Indian patent stone) 1:2:4 coarse sand 4: graded stone aggregate 20 mm. nominal size) laid in one layer finished with floating coat of neat cement : 50 mm. thick.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 14.71 (A) shall be followed except that the thickness of concrete flooring shall be 50 mm.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 14.71. (A) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

14.74. Cement concrete payment (25 mm. to 50 mm. thick) with 1:2:4 (1 cement : 2 coarse sand : 4 stone aggregate 20 mm. nominal size) including finishing with a floating coat of neat cement complete.

1.0. Materials and workmanship

1.1. The relevant specifications of item No. 14.71 (A) shall be followed except that the thickness of concrete flooring vary from 25 mm. to 50 mm.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No.14.71 (A) shall be followed except that thickness shall be measured correct up to 1 mm. flooring laid in borders, margins and treads of steps, shall be measured under item of flooring in respective of width.

2.2. The rate shall be for a unit of one cubic meter.

14.81.(C) 20 mm. thick precast concrete tile with aggregate of sizes up to 6 mm. laid in floors, treads of steps and landings on 20 mm. thick bed of cement mortar 1:6 (1 cement : 6 coarse sand) or L.M. 1:1.5 jointed with neat cement slurry with pigment to match the shade of the tiles complete with precast tiles of Dark Shades ordinary cement.

1.0. Materials

Water shall conform to M-1. Cement shall conform to M-2. Sand shall conform to M-6. Lime mortar 1:1.5 shall conform to M-10. Cement shall conform to M-11. Tiles shall conform to M-47 (A) cement concrete tiles shall conform to I.S. 1237-1959 and pigments to be admixed with mortar or for grouting shall conform to I.S. 2114-1962

2.0. Workmanship

2.1. The tiles shall be laid on the sub-grade of concrete of the R C.C. slab. Bedding shall be in the mortar 1:1.5 or cement mortar (1:6). The amount of water added shall be minimum required for sufficient plasticity and workability C.M. or lime mortar where the ingredients shall be thoroughly mixed dry hard lumps removed and water added to give a good workability.

2.2. The base shall be cleaned of all dust, dirt and scum and properly wetted without allowing water pools. For a bedding of cement mortar shall be then spread evenly over the base of two rows of tiles and three to five meters in length. The top shall be kept rough so that cement slurry can be absorbed. The thickness of the bedding shall be not less than 10 mm. at any place. The laying of tiles shall be commenced with neat cement slurry of honey-like consistency and shall be spread over the mortar bed over an area sufficient to receive about 20 tiles. The tiles shall then be fixed in this grout one after the other, each tile being gently tapped and properly bedded in line and level with the adjoining tiles. The joints shall be as narrow as possible and normally shall not exceed 1.5 mm. After the day's work the excess cement slurry on top shall be cleaned as also the joints with a broom struck and washed before the slurry sets hard. Next day the joints shall be filled with the cement grout of the same shade as the matrix of the tiles. Tiles which are fixed in the floor adjoining the wall shall go a minimum of 10 mm. under the wall plaster, skirting or dedo. For the purpose, plaster etc. may be left unfinished by about 50 mm. above the proposed finished level of the floor. The unfinished strip shall be plastered after laying the floor tiles. Where full tile cannot be used, tile shall be cut to the size to be used.

2.3. The flooring shall be cured for 7 days.

3.0. Mode of measurements and payment

3.1. The rate shall include the cost of all materials and labour involved in all the operations described above.

3.2. The rate shall be for unit of one sq. meter.

14.86. Chequered precast cement concrete tiles 22 mm. thick with aggregate of sizes up to 6 mm. in floors, treads of steps and landings on 20 mm. thick bed of C.M. of 1:6 (1 cement : 6 sand) or lime mortar 1:1.5 (1 Lime putty : 1.5 coarse sand) jointed with cement slurry with pigment to match the shade of tiles.

1.0. Materials

1.1. The relevant specifications of item No. 14.25 (A) shall be followed.

2.0. Workmanship

2.1. The relevant specifications of item No 14.21 (A) shall be followed except that chequered precast cement concrete tiles 22 mm. thick shall be used in floors, treads of steps and landings on average 20 mm. thick bed of C.M. 1:6 or L.M. 1:1.5.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 14.21 (A) shall be followed.

3.2. The rate shall be for unit of one sq. meter.

14.87. Extra for polishing and polishing the precast cement concrete tiles in flooring, skirting or dedo.

1.0. Workmanship

1.1. Grinding and rubbing shall normally be commenced after 14 days of laying the tiles, except for skirting or small areas, machine shall be used for the purpose.

1.2. First grinding shall be done with carborundum stones of 48 to 60 grade grit fitted in machine. Water shall be properly used during grinding. When the chips show up and the floor has been uniformly rubbed, it shall be cleaned with water baring all pin holes It shall then be covered with a thin coat of gray or white cement mixed with or without pigments to match the colour of the topping of the tiles Pin holes if any shall thus be filled. This grout shall be kept moist for sufficient period as directed. Thereafter, second grinding shall be started with carborundum of 120 grit. Grouting and curing shall be followed again. Final grinding shall be done when other works are finished. The machine shall be fitted with carborundum of grit 220 to 350 using water in abundance. The floor shall then be washed clean with water Oxalic acid powder shall then be dusted as needed on the surface and the surface rubbed with machine fitted with Hessian bobs 01 rubbed hard with pad of woolen rags. The floor shall then be washed, cleaned and dried with a soft cloth of linen. The finished floor shall not sound hollow when tapped with a mallet.

1.3. If any tile is disturbed or damaged it shall be refitted or replaced properly jointed and polished. 1.4. For skirting, dedo or small areas where it is not possible to do machine polishing all the above operations are to be done manually.

2.0. Mode of measurements and payment

2.1. The rate shall include the cost of all materials and labour involved to all the operations as described above.

2.2. The rate shall be for a unit of one sq, meter.

14.90. Providing and laying brick on edge flooring laid dry, grouted with C.M. 1:6 (1 cement : 6 coarse sand) including finishing the joints flush, curing etc. complete.

1.0. Materials

Water shall conform to M-1. Cement mortar shall conform to M-11. Burnt bricks shall conform to M-15.

2.0. Workmanship

2.1. The flooring shall be laid on concrete sub grade where so provided. The slope in the floor shall be provided in the sub-grade. Where sub-grade is not provided, the earth below shall be properly sloped, watered, rammed and consolidated. Before laying the flooring it shall be moisture. Plinth masonry off-eta shall be depressed so as to allow the sub grade concrete to rest on it.

2.2. Laying :

The brick shall be laid in plain, diagonal herring bond, or other pattern as directed. The bricks shall be dry laid properly and set home by gently tapping. On completion of the portion of flooring the vertical joints shall be grouted with C.M. 1:6 and all joints shall be finished flush. The joints shall be as fine as possible and not exceeding 5 mm. These points shall be filled with cement mortar 1:6.

2.3. Curing :

The brick paving shall be cured for 7 days.

3.0. Mode of measurements and payment

3.1. The length and breadth shall be measured correct to a centimeter between skirting dedo or wail plaster. No deductions shall be made nor extra paid for any opening up to 0.1 sq.mt. in area in the floor Nothing extra shall be paid for laying the floors at different levels in the same room or courtyard.

3.2. The rate shall be for unit of one sq. meter.

SECTION-15
Roof Covering

- 15.1. Providing corrugated G.I. sheets roofing fixed with galvanized iron 1J' or 1L' hook bolts and nuts 8 mm. dia. with bitumen and G.I. limpet washers filled with white lead complete excluding the cost of purline, rafters and trusses (1) 0.8 mm. thick sheet.**

1.0. Materials :

Corrugated G.I. sheets shall conform to M-23.

2.0. Workmanship

2.1. Spacing of purlines : One purline shall be provided at the ridge and one at the eaves. The spacing of other purlines for 0.8 mm. thick G.I. sheets shall not exceed 1.80 meters. The purline shall coincide with the centre line of the end lap. The ridge purlines shall be placed in such a way that the ridges can be fixed properly. The portion overhanging the wall support shall not be more than one fourth of the 'spacing of purlins.

2.2. The top surfaces of the purlines shall be painted before the sheets are fixed over them. Embedded portions of purlins shall be finished with tow coats of coal-tar.

2.3. Laying of sheets :

2.3.1. The sheets shall be laid in purlins to a true plane with the line of corrugations truly parallel or normal to the sides of area to be covered. The sheets shall not generally be built into gables and parapets. They shall be bent up along their side edges close to the wall, and the junction shall be protected by suitable flushing or by projecting drip course.

2.3.2 The laps at end shall be provided 150 mm. minimum for roof slopes 1 in 2 (1 vertical : two horizontal) and steeper but 200 mm. shall be provided for flatter slopes than those above. The side lap shall be provided two ridges of corrugations at each side.

2.3.3. The sheets shall be cut to the dimensions or the shape of the roof either along their lengths or their width or in slant across the line of corrugations at hips and valleys. The sheets shall be cut carefully with a straight edge and chisel to give straight finish. The sheets shall be laid such that the laps are turned away from the usual direction of local heavy rain.

2.3.4. Fixing of sheets :

2.3.4.1. Sheets shall be fixed to the purlins or other roof members such as hips or valley rafter etc. with 1J' or 1L' galvanized hook bolts, and galvanized nuts 8 mm. dia. with bitumen limpet washers and G.I. washers. Limpet washers with white lead shall be used. Length of hook bolt shall be varied to suit the site requirement. Bolts shall be sufficiently long so that after fixing the project above the top of their nuts by not less than 12 mm the grip of 1J' or 1L' hook bolts on the sides of purlins shall not be less than 25 mm. There shall be minimum of three hooks bolts placed at the ridge of corrugations in each sheet in every purlin and their spacing shall not exceed 300 mm. Coach screw shall not be used for fixing the sheets to purlin, where the slopes of roof are not less than 2.1/2 degree (1 vertical and 2.1/2 horizontal). Sheets shall be jointed together at the side laps by galvanized iron bolts and nuts 25 mm. x 6 mm. size each bolt with a bitumen and G.I. limpet washer filled with white lead. Where the overlaps at the sides extend to two corrugations, these bolts shall be placed zigzag over lapping corrugations, so that the ends of the overlapping sheets are drawn tightly towards each other. The spacing of same bolts shall not exceed 600 mm. along each of the staggered rows.

2.3.5. Holes for all bolts shall be drilled and not punched in the ridges of the corrugations from the under side, while the sheets are on the ground. The holes in the sheets shall be at least 50 mm. from the edge. ' Sheets drilled wrongly shall be rejected. The holes in the washers shall be of the exact diameter of the hook bolts or the beam bolts. The nuts shall be tightened from above to give a leak-proof roof

3.0. Mode of measurements and payment

3.1. The measurements of the C.G.L sheet roof shall be taken for finished work in superficial area in general plane (not girthed on the roof). The laps between the C.G.I. Sheets both at their ends and along the side edges shall not be measured. The overlaps of C.G.I, sheets over the valley piece and their under lap under the ridge, hip and flashing piece shall be included in the measurements.

3.2. No deductions in measurements shall be made for openings for chimney stacks, sky light etc., of area up to 0.40 sq. mt. nor extra be paid for labour in cutting and for wastage etc. in forming such openings.

3.3. The rate of roof shall include the cost of all materials and labour involved in all operations described above. The rate also includes the cost of provision, erection and removal of the scaffolding, benching, ladders, templates and tools required for the proper execution and erection of the work. The rate includes the cost of purlins, rafters and trusses.

3.4. The rate shall be for a unit of one sq. meter.

15.7. Providing ridges of hips 600 mm. overall in plain G.I. sheets fixed with G.I. 'J' or 'L' hooks bolts and nuts 8 mm. dia. G.I. limpet and bitumen washer etc. complete. 0.80 mm. thick sheet.

1.0. Material

The G.I. valley gutters and ridges shall conform M-23 A.

2.0. Workmanship

2.1. The relevant specification of item No. 15.1 shall be followed except that the work shall be carried out for ridges or hips. The overlaps for ridges and hips on either side over the C.G.I. sheets and end legs shall be minimum 225 width of the ridges and hips shall be as described in the item.

2.2. Ridges shall be fixed to the purlins with same 8 mm. dia. G.I. hook bolts and nuts and bitumen and G.I. limpet washers, which fix the sheets for the pureline. Hips shall be fixed to the roof members with the same 8 mm. dia G.I. hook bolts and nuts and bitumen and G.I. limpet washers which fixed the sheets. At least one of the fixing bolts shall pass through the end laps of the ridges and hips on other sides. If this is not possible, extra hook bolt shall be provided. End laps of ridges and lips shall be jointed together by galvanized iron seam bolts and G.I. Washers. There shall be at least two such bolts in each end lap.

2.3. Ridges and hips shall fit in squarely on the sheets.

3.0. Mode of measurements and payment

3.1. The measurements of ridges or hips shall be taken for finished work in length along their centre lines.

3.2. No laps shall be measured.

3.3. The payment for ridges and hips shall be made in a similar way as in case of C.G.I, sheet roofing.

3.4. The rate shall be for a unit of one running meter.

15.8. Providing valleys 900 mm. overall in plain 1.6 mm. thick G.I. Class-3 fixed with 'J' or 'L' hook bolts and nuts galvanized from 'J' or 'L' hook bolts and 8 mm. dia. G.I. limpet and bitumen washers complete.

1.0. Materials

1.1. The G.I. valleys 900 mm. overall in galvanized plain sheet of 1.6 mm. thickness shall be of class-3. The valleys shall be 900 mm. wide overall and flashing shall be 380 mm. wide overall. There shall be bent to the required shape without damage to the sheets in the process of bending.

2.0. Workmanship

2.1. The relevant specifications of item NO. 15.1. shall be followed except that the work shall be carried out for G.I. valleys 900 mm. overall with G.I. sheets 1.6 mm. thickness.

2.2. Wherever the edge of a roof sheeting or valley gutter is turned up against a wall, the edge shall be weather proofed with a flashing. Flashing shall be bent to shape and fixed. Lap over the sheet shall be not less than 150 mm. over the roofing sheets. The end between the flashing sheets shall not less than 225 mm.

2.3. The flashing shall be inserted into brick work or masonry joints to a depth of 50 mm. These joints shall be filled with cement mortar (1:3). The flashing shall be well secured to the masonry. Whenever flashing has to be laid at a slope, it shall be stepped at each course of masonry, the step being out back at angle or not less than 30 degrees to the vertical.

2.4. Valleys shall be bent to shape and shall have end lap projection on either side under C.G.I, sheet not less than 225 mm. Valleys shall be fixed to the roof member below, with same 8 mm. dia. G.I. hook, bolts and nuts and bitumen and G.I. limpet washer which fix the sheets to these members. At least one of the fixing bolts shall pass through the end laps of the valley piece. If necessary extra bolts shall be provided for this purpose.

3.0. Mode of measurements and payment

3.1. The measurements for valley shall be taken for finished work in length along their centre lines.

- 3.2. No laps shall be measured.
- 3.3. The rate excludes the cost of boarding underneath which shall be paid separately.
- 3.4. The rate of flashing includes the cost of mortar for fixing in wall and other labour and materials required for it.
- 3.5. The rate shall be for a unit of one running meter.

15.10.(I) Providing and fixing 150 mm. wide 450 mm. overall semicircular plain, G.I. sheets clas-3 Gutter with iron brakes 40 mm. x 3 mm. size bolts nuts, washers etc. including making necessary connections with rain water pipes : 0.80 mm. thick.

1.0. Materials

1.1. These shall be of plain galvanized sheets Class-3 of 0.80 mm. thickness. The gutter shall be designed to carry the maximum discharge from the roof without flowing over and shall be constructed wherever possible with sunk channel or gutter.

2.0. Workmanship

2.1. The longitudinal edges shall be turned back to the extent of 12 mm. and beaten to form a rounded edge. The ends of the sheets at junctions of pieces shall be hooked into each other and beaten flush to avoid leakages.

2.2. The size of gutters shall be as specified in the item.

2.3. The gutter shall be laid with a minimum fall in 120. Gutter shall be true to line and slope and shall be supported on fixed M.S. Flat iron brackets bent to shape or any other suitable bracket.

3.0. Mode of measurements and payment

3.1. The measurements of gutters shall be taken for finished work in length along their centre lines. No. laps shall be measured.

3.2. The rate gutter shall include the cost of all labour and materials specified above including all specials such as angles, junctions, drop ends or funnel shaped connecting pieces, stop ends etc. flat iron brackets and bolts and nuts required for fixing the latter to the roof members.

3.3. The rate shall be for a unit of one running meter.

15.20.(A)(I) Providing asbestos cement sheets, roofing fixed with G.I. plain and bitumen washers complete excluding cost of purlins, fakers and trusses : 7 mm. thick, corrugated sheet.

1.0. Materials :

1.1. Asbestos cement sheets shall conform to M-24.

2.0. Workmanship

2.1. The maximum spacing of purlins shall be 1.6 meters in case of 7 mm. thick A.C. sheets and 1.4 meters for 6 mm. thick A.C. sheets.

2.2. Laying & fixing of Sheets

The sheets shall be laid on the purlins and other roof members as per cods practice. The top bearing surfaces of all purlins and other roof members shall be in one plane so that the sheets when being fixed shall not be required to be forced down to rest on the purlins. The finished roof shall present uniform slope and the line of corrugation shall be straight and true. The sheets shall be laid with smooth side upwards. Corrugated sheets shall be valid starting at the eaves either from left to right or right to left depending upon the direction of wind. Before actual laying of the sheets is started, the purlins spacing and the size of sheets shall be checked to ensure that the arrangements shall provide the laps required and the specified overhang at the eaves. In case the sheets are laid from right to left, the first sheet shall be laid uncut but the remaining sheets in the bottom row shall have the top left hand corners cut or mitered. The sheets in the second and other immediate rows shall have bottom right and corner of the first sheet cut. All other sheets except the last sheets shall have both bottom right hand corner of the first sheet cut. All other last sheet shall have only top left hand corner cut. The last of the top row sheets shall have the bottom right hand corner cut with exception of the last sheet which shall be left uncut. If the sheets are laid from left to right, the first sheet shall be laid and cut and the remaining procedure shall be reversed.

2.3. The free overhang of the sheets at the eaves shall not exceed 400 mm. in case of 7 mm. thick sheets and 300 mm. in case of 6 mm. thick sheets.

2.4. The meter described above is necessary to provide snug fit. Where 4 sheets meet at a lap the length of meter shall be 150 mm. and the width of miter shall be equal the width of the side lap. The cutting may be done with ordinary wood-saw at site.

2.5. Laps :

The sheets shall be laid with an end lap of 150mm. minimum. In case of roof with a' pitch flatter than 1 vertical to 2.1/2 horizontal (Approx. 22) or in the case of very exposed situations appropriate larger Taps may be provided. The sheets shall be laid with side lap of half a corrugation.

2.6. Fixing Accessories : The sheets shall be secured to the purlins and other roof members by means of 8 mm. dia galvanized iron bolts (J) type hook bolts in case of angle iron purlins and 'L' type bolts in case of R.S. joints, precast concrete, or timber purlin, and nuts bearing on galvanized iron washers and bitumen washers. The grip of 'J' or 'L' bolts on the side of purlins shall not be less than 25 mm, Each galvanised iron 'J' or 'L' hook bolts shall have bitumen washer and galvanised iron washer placed over the sheets before the nuts is screwed down from above. On each purlin there shall be one hook bolt on the crown adjacent to the side lap on either side bitumen washer shall be of approved quality. The G.I. flat washer shall be 25 mm. in diameter and 1.60 mm. thick and bitumen water shall be 35 mm. in dia. and 1.5 mm. thick with hole to suit the required size of fixing accessory. Each nut shall be screwed lightly at first. After a dozen or more sheets are laid, the nuts shall be tightened to ensure a leak proof joint and also nuts tightened only to extent so as to prevent damage to the sheets. The length of the 'J' bolts or crank bolts shall be 75 mm. more than the depth of purlins for single sheet fixing and 90 mm. more where two sheets overlap or where ridges or other accessories are to be fixed. The minimum length of coach screw for timber purlins shall be 110 mm.

2.7. Holes :

The holes for fixing the sheet shall be drilled in the centre of end lap to sheets to suit the purlins i.e. on the centre line of the purlin, if these are of timber and square head coach screws are used, or as close as possible to the back of purlins if 'J' or 'L' bolts are used as with steel angles or precast concrete or timber purlins. Holes for hook bolts etc. shall be 2 mm. more than diameter of the fixing bolts. No holes shall be nearer than 40 mm. to any edge of sheet or accessory.

3.0. Mode of measurement & payment

3.1. The relevant specifications of item 15.1 shall be followed, except that the over lap of the corrugated sheets over valley gutters, roof lights, caves, filler piece and underlay of the corrugated sheets below ridges, hips north light curves, flashing pieces, roof light sheets and large board shall be included in the measurement. No deduction shall be made for holes cut for extractor or cowl type ventilators. Deductions shall be made for roof light sheets.

3.2. The rate shall be for a unit of one sq. meter.

15.20.(A)(III) Providing asbestos cement sheets roofing fixed with G.I. plain and bitumen washers complete excluding the cost of purlins, rafters and trusses: 6 mm. thick corrugated sheets.**1.0. Materials and Workmanship**

The relevant specifications of item No. 15.20 (A)(I) shall be followed except that the thickness of A.C. sheets shall be 6 mm.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 15.20 (A)(I) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

15.25.(D) Providing and fixing ridges and hips in asbestos cement sheets roofing with G.I. 'J' or 'L' hook, bolts and nuts 8 mm. dia. G.I. plain and bitumen washers complete. North tight adjustable ridges.**1.0. Materials**

1.1. The ridges and hips of Asbestos cement sheets roofing shall conform to M-24.

2.0. Workmanship

2.1. The relevant specifications of item 15.20 (A) (I) shall be followed except that the work is to be carried out for ridges and hips in A.C. sheet roofing.

2.2. The ridges shall be laid as per manufacturer's instructions with rolls of the two wings in case of adjustable ridges, fitting closely and with a separation of serrated ridges registering correctly with the sheet underneath. The staggered lapping of two wings of adjustable ridge section and the lap between the adjustment pieces on the same wing of ridges shall be as per manufacturer's instructions. The end portion of the wing of the adjustable ridges which project beyond the verges of the roof shall be cut and trimmed off neatly.

2.3. Hips :

In laying hip pieces, serrations to suit the corrugations in the sheets below should be cut in them so that they shall be snug fit over the sheets. The wings of ridges shall be fixed to the sheet below with seam bolts and nuts 8 mm. dia. G.I. 'J' or 'L' hook bolts and bitumen and G.I. washers which fix the sheets to the purlins. In addition, in north light adjustable ridges, the roll of the two wings shall be jointed together at their crown, with 8 mm. dia G.I. seam bolts and nuts at the rate of two numbers per pair wings. Each seam bolt shall be provided with one bitumen and a pair of G.I. washers. Where the plain wing angular or plain C.C. (1.2:4) up to a full length of the overlaps. The exposed face shall be finished perpendicular to the sheeting. Wings of hips shall be fixed to the roof members below with the same 8 mm. dia. G.I. 'J' or 'L' bolts end nuts which fix the sheets to the member. In addition, they shall be secured to the sheet below with 8 mm. dia G.I. seam bolts, nuts and washers so that taken together with hook bolts, there shall be bolt on each wing at least at every fifth Corrugation of the sheets below in case of corrugated and at least every second corrugation of the sheet below in case of semi corrugated sheets. Each seam bolt shall be provided with one bitumen and pair of G.I. washers.

3.0. Mode of measurements & payment

3.1. Measurements of ridges, hips and other accessories shall be for finished work and the length shall be taken along the centre line. The lap shall not be measured. The under lap of ridges under expansion joint pieces shall be measured.

3.2. The rate of ridges and hips shall not include the cost of expansion joint pieces, closing of gap, between plain ridge and the sheet corrugation with concrete.

3.3. The rate shall be for a unit of one running meter.

15.26. Filling cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 12.5 mm. nominal size) in gaps of A.C. sheet corrugation and wing of ridges.**1.0. Materials**

Water shall conform to M-1. Cement shall conform to M-3. Coarse sand shall conform to M-6. Stone grit shall conform to M-8.

2.0. Workmanship

2.1. The relevant specifications of item No. 5.4.1 of C.C. shall be followed except that the work shall be for filling gaps of A.C. sheet corrugation and wings of ridges.

3.0. Mode of measurements & payment

3.1. The measurements of filling gaps in ridges, hips of A.C. sheet corrugation and wings of ridges shall be for finished work. The length shall be measured along the centre line.

3.2. The rate shall be for a unit of one running meter.

15.27 (III) Providing and fixing asbestos cement roofing accessories with galvanised iron 'J' or 'L' hook bolts and nuts, G.I. plain and bitumen washer etc. complete : North light and ventilator curves.**1.0. Materials and Workmanship**

1.1. The relevant specifications of item No. 15.10 (I) shall be followed except that the work is carried out for accessories for asbestos cement roofing north light and ventilator curves.

1.2. The accessories such as north light and ventilator curves shall be laid and secured with same G.I. hook bolt to secure the sheets to the roof, or with separate G.I. hook bolts to the roof members below and/ or with 8 mm. dia. G.I. bolts nuts and washers to the sheeting, generally as per manufacturer's written instructions.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 15.25 (D) shall be followed.

2.2. The rate shall be for a unit of one running meter.

15.29.(I) Providing and fixing asbestos cement socketed half eaves gutter with bolts, nuts, bitumen washer etc. and flat iron brackets 40'mm. x 3 mm. size including asbestos rope and plastic roofing compound in joints complete : 150 mm. nominal size.**1.0. Materials & Workmanship**

1.1. The relevant specifications of item No. 15.10(f) shall be followed except that the asbestos cement socketed half round eaves gutter shall be provided. The size of gutter shall be 150 mm. nominal.

1.2. Gutters shall be laid with a minimum fall of 1 in 120 which should be increased where possible. Gutters shall be true to line and slope and shall be laid with requisite accessories such as drop ends, stop ends, nozzles, m angles and union slips, as directed. The size of outlet of drop ends and nozzles shall be the same as the size of rain water pipe into which they discharge water. Gutters and their accessories shall be supported by m.s. flat iron bracket. Where these are required to be fixed to the side of rafter they shall be fixed with 40 mm. by 3 mm. section bent to shape and fixed rigidly to the sides of the rafter with 3 Nos. of 10 mm. dia. bolts, nuts and washers. The brackets shall overlap the rafter not less than 300 mm. and connecting bolts be 115 mm. centers.

1.3. Where the brackets are to be fixed with purlins, these shall consist of 40 x 3 mm. M.S. flat iron bent to shape with one/and turned at a right angle and fixed to the purlins face with a 10 mm. dia bolt, nut and washer. The perpendicular overhang portion of 40 mm. x 3 mm. bracket shall be stiffened by another 40 x 3 mm. flat bent to right angle shape with its longer leg connected to the bracket with two numbers of 6 mm. dia. M.S. Bolts nuts and washers and its shorter legs fixed to the face of purlins with one number 10 mm. dia bolt nuts and washers. The overhang of the vertical portion of the flat iron bracket from the face of the purlin shall not exceed 225 mm.

1.4. Requisite slope in the gutter shall be given in the line of bracket. The brackets shall be placed at not more than 900 mm. centers.

1.5. The gutters shall be fixed to the brackets with 2 Nos. 8 mm. G.I. seam bolts and nuts, each bolt and nut being equipped with a pair of bitumen and G.I. washers. These connection bolts shall normally be above the water line of the gutter..

1.6. Spigot and socket end of gutters of socketed half round gutter and their accessories shall be connected together at their laps with one row of 8 mm. dia. G.I. bolts and nuts. Each of the bolts and nuts shall be provided with a pair of bitumen and a pair of G.I. washers. The gap between socket and spigot shall be packed with approved plastic roofing compound and flanked on the both sides with 6.35 mm. dia asbestos rope. The connecting G.I. Bolt shall be then tightened so that the lapped joint becomes leak-proof. The outer face of packed asbestos rope shall not be further than 6 mm. from the edges of the spigot and socketed ends. Where both ends of gutters and / or their accessories to be connected together are spigot ends, they shall be laid as butt jointed with 1.5 mm. gap in between over union clips. The union clips connected to the two butt ends of the gutter or other sections with two rows. The gap between union clips and ends of gutter sections or accessories shall be packed with plastic roofing compound flanked with edges of 6.35 mm. dia asbestos ropes as before. The whole joint shall be made leak-proof by tightening the bolts.

2.0. Mode of measurements & payment

2.1. The asbestos socketed half round eaves gutter shall be measured for finished work and the length shall be measured along the centre line. -

2.2. The rate of gutters shall include the cost of providing and fixing accessories such as drops ends, stop ends, nozzles, and fixing union clips together with bolts, nuts and washers.

2.3. The rate shall be for a unit of one running meter.

15.29.(II) Providing and fixing Asbestos cement socketed half round eaves gutters with bolts, nuts, bitumen washers etc. and flat iron brackets 40 mm x 3 mm. size including Asbestos rope and plastic roofing compound in joint etc. complete. 300 mm. nominal size.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 15.29 (I) shall be followed except that the size of the Asbestos socketed eaves half round gutter shall be 300 mm. nominal size.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 15.29(1) shall be followed.

2.2. The rate shall be for a unit of one running meter.

15.51. Tiled roofing with Mangalore pattern roof tiles including teak reefers of size 50 mm. x 25 mm.

1.0. Materials

(1) Mangalore pattern roof tiles shall conform to M-25, (2) Teak wood batten shall conform to M-29.

2.0. Workmanship

2.1. Laying

The maximum distance between centre to centre of rafters shall be not more than 500 mm. Teak wood reefers 50 mm. x 25 mm. be nailed to each rafter at central distances suited to the size of the tiles by

means of nails 50 mm. long. The reapers shall be of well seasoned teak wood and shall be straight pieces of uniform size and colour and not shorter than the length necessary to cover at least four rafter. The under face and sides of the reapers shall be planned before fitting up. Joints shall come over the rafter. The joints of two adjacent rows of reapers shall not come over the same rafter. At the eaves, there shall be two reapers of such thickness and shape that the uniformity of the top slope of the roof shall be preserved.

2.2. The work of valleys shall be executed as under :

Galvanized iron sheet 1200 mm. wide and 1.25 mm. thick shall be used for valleys. The sheet shall be extended by about 450 mm. under the tiles on either side in a depth of 100 mm. at centre. The sheet shall be carried 75 mm. into the wall and set with cement mortar unless flushing is specified. The laps, if any, on the slope shall be 300 mm. The sheets shall be laid over the reapers and nailed. Two reapers 50 mm x 25 mm. each shall be fixed over the galvanized iron sheet 150 mm. away from the centre line of the valley, on either side to keep the tiles and mortar from falling into the gutter of the valley.

2.3. Laying :

The tiles shall be laid from the eaves towards the fidges after fitting of the reapers, the rebate of the tiles resting fully against the reapers. The joints of the hips and ridges tiles and also those between them and the plain tiles shall be set in and well grouted with lime mortar and the mortar surface painted and finished off with a mixture of red paint and port land cement or preserve informality of colour. The finished slope of roof shall be uniform from ridges to eaves. The eaves line shall be perfectly straight, horizontal and parallel to each other. The end over gales shall be protected by lime borders and neatly finished.

2.4. At the side of valleys and for 230 mm. on either side of the roof at valleys cement plastering 12 mm. thick shall be done to prevent the rain water from the gutter leaking by the sides of valleys.

2.5. At the eaves, wide tie shall be placed over the ends of the last tiles and secured by means of galvanized iron washers and screws 25 mm. into the rafter to prevent tiles from being blow up. Care shall be taken to put the screws in the, ridges and not in the gutter or the tiles, Where full tiles are not necessary, half tiles manufactured for the purpose shall be used.

3.0. Mode of measurements and payment

3.1. The measurement of the roof shall be taken for finished work for superficial area flat in the plane, of the roof and not girthed. Laps shall not be measured.

3.2. No deduction in measurements of roofed shall be made for openings of area up to 0.40 sq. mt. nor shall any extra be paid for labour and wastage in forming such openings.

3.3. The rate includes the cost of all materials and labour including ridges, hips, eaves and bottoms.

3.4. The rate shall be for a unit of one square meter.

15.75 Providing and fixing five courses water proofing treatment with bitumen felt consisting/ of second and fourth course of blown bitumen or/and residual bitumen applied hot 1.20 kg./sq. mt. of area for each course and first course with fiber base bitumen saturated underlay type and third course with fiber base self finished felt type 2 Grade-I, fifth and final course of stone grit 6 mm. and down size or pea sized gravel spreaded at 0.008 cum/sq.mt. including preparation of surface, excluding grading complete.

1.0. Materials

The tar felt shall conform to M-76. The bitumen primer shall conform to I.S. 3388-1965. The bitumen shall conform to I.S. 702-1961. The grit or gravel shall conform to M-8.

2.0. Workmanship

2.1. Preparation of surface :

2.1.1. Well defined cracks other than hair cracks in the roof structure shall be cut to V section cleaned and filled up flush with cement sand slurry or with bitumen conforming to I.S. 702-1961. The surface to be treated shall have minimum slope of 1 in 120. The grading shall be carried out prior to the application of water proofing treatment by cement mortar or lime surkhi mortar or as specified in description of item.

2.1.2. The surface or room, part of parapet and gutters, drain mouths etc. over which the water proofing treatment is to be applied shall be cleaned or all foreign matter such as funguses, moss and dust by wire brushing and dusting.

2.1.3. Drain outlet shall suitably placed with respect to the roof gradient to ensure rapid drainage and prevent local accumulation of water on the roof, surface, masonry drain mouth shall be widen sufficiently and rounded with cement mortar.

2.1.4. For cast iron drain outlets, a groove shall be cut all round to touch the treatment.

2.1.5. When a pipe passes through a roof on which water proofing treatment is to be laid a cement concrete angle fillet shall be built round it and the water proofing treatment taken over the fillet.

2.1.6. In case of parapet wall over 450 mm. in height for trucking in the water proofing treatment a horizontal groove 75 mm. wide and 65 mm. deep at minimum height of 150 mm. above roof level shall be left in the vertical face at the time of construction. The horizontal face of the groove shall be shaped with cement mortar 1:4.

2.1.7. In case of low parapet where the height does not exceed 450 mm. no groove shall be provided and the water proofing treatment shall be carried right over the top.

2.1.8. In case of existing R.C.C. and stone and vertical face of the parapet wall, a fillet 75 mm. in radius shall be constructed.

2.1.10. At the drain mouths the fillet shall be suitably cut back and rounded off for easy application of water proofing treatment and easy flow of water.

2.1.11. Outlet at every low dividing wall about less than 300 mm. in height cut open to full depth and the bottom and the sides shall be rounded smooth and corners rounded off for easy application of water proofing treatment.

2.2. Priming coat:

2.2.1. Bitumen primer shall conform to I.S. 3335-1965. A priming coat consisting of bituminous solution of low viscosity shall be applied with brush on the roof and wall surface at specified weight per unit area to assist adhesion to bonding materials as specified in the description of the item.,.

2.2.2. Where a floating treatment to water proofing with self finished bitumen felt is required i.e. where water proofing treatment is required to be isolated from the roof structure, a layer of bitumen saturated felt (under lay) shall be spread over the roof surface and tucked into the flashing grooves. To keep the underlay free from the structure nonbonding materials shall be used below underlay. Overlapping to the adjoining strip of underlay shall be minimum of 75 mm. as sides and 10 mm. at ends, and shall be sealed with the same bonding materials, as used for self finished felt treatment. The underlay shall be of type I saturated felt conforming to I.S. 1322-1970.

2.3. Laying of Felt :

2.3.1. The self finished tar felt shall be cut to the required lengths, brushed clean to dusting materials, laid out flat on the roof to eliminate curls and subsequent sketching. The felt shall be laid in lengths running at right angles to the direction of run off gradient commencing at the lowest level and working up to crest, so that the lower laps of the adjacent felt layer offer minimum obstruction to the flow of water. The felt shall not be laid in a single piece of very long lengths as it is likely to shrink. 6 to 8 meters are suitable length. The roof shall be cleaned and dried before the felt treatment is begun. Each length shall be laid in position and rolled up for a distance of half its-lengths. The hot bonding materials heated to correct working temperature as specified by manufacturer shall be poured on the roof across the full width of the felt as the latter is steadily unfolded and pressed down. The excess of bonding materials which squeezes out at the ends shall be removed as the laying proceeds. The pouring shall be so regulated that the correct weight of the bonding materials as per unit area is spread uniformly over the surface. When the first half of the tar felt has been bonded to the roof, the other half shall be rolled up and then unrolled on the hot bonding materials in the same way. Subsequent strips shall also be laid in the same manner. Each strip shall overlap the preceding one by at least 75 mm. at the longitudinal edges and 100 mm. at the ends. All overlaps shall be firmly bonded with hot bitumen. Streaks and trailing of bitumen near edges or laps shall be leveled by heating the overlaps with blow lamp and leveling down unevenness.

2.3.2. Third layer of bonding materials in four course treatment shall be carried out in similar manner after the flashing has been complete.

2.3.3. Water proofing treatment shall be carried out in the drain pipe or out-lets by at least 100 mm. The Water proofing treatment laid on the surface shall overlap the upper edge of water proofing treatment in the drain outlets by at least 100 mm. Flashing felts shall be laid as flashing. Wherever junction of vertical horizontal surfaces occurs longitudinal laps shall be 100 mm. The lower layer of flashing felt shall overlap the roofing felt by 100 mm on vertical and sloping faces. Last course of flashing should not be of stone grit or pea sized gravel but it shall be replaced by providing two coats of bitumen solution of approved quality.

2.3.4. The lower edge of flashing shall overlap the flat portion for the roof and the upper edge of the flashing shall be trucked into the horizontal groove 75 mm. thick wide, 65 mm. deep provided at minimum height of 150 mm. from top of the roof surface. The flashing treatment shall be firmly held in place in the grooves with wooden wedges at intervals and the grooves shall be filled with cement mortar 1:4 (1 cement : 4 coarse sand) or cement concrete (1:2:4) (1 cement : 2 coarse sand : 4 graded stone aggregate 6 mm. nominal size) and surface finished smooth with the rest of wall. The cement work shall be cured of bituminous solution shall be applied on the vertical and sloping surface of flashing.

2.3.5. After the top flashing felt layer has been laid, the penultimate layer of bonding material shall be applied over the roofing felt and horizontal overlap, and vertical and sloping surfaces of flashing shall be spread uniformly over the hot bounding materials on the horizontal roof surface and pressed into it with wooden roller.

2.3.6. The material for surface finish shall be spread as described in the item over top layer.

2.3.7. If ballooning occurs the defects may be rectified as under.

2.3.8. Remove the gravel on the ballooned surface. The cut open and squeeze out the trap vapor by firm pressure applied by hand, seal the bitumen felt so lifted back on the surface by applying additional bitumen, finally seal the cut with piece of bitumen felt with bitumen application.

3.0. Mode of measurements & payment

3.1. The measurements for this item shall be taken as under:

(a) Water proofing of roof with bitumen shall be measured in sq. mt. length and breadth shall be measured correct to centimeter.

(b) Measurement shall be taken for the superficial area of roofing and flashing treatment including flashing over the parapet wall, low dividing walls and expansion joints and at the pipe projection etc. Overlapping and tucking into flashing grooves shall not be measured.

(c) Slopping and vertical surface of water proofing treatment shall be measured under the four or five course treatment as the case may be irrespective of the fact that the final course of grit or gravel is replaced by bitumen primer.

(d) In measurements, no deductions shall be made for either openings or recesses for chimney stacks, roof lights etc. for areas up to 0.40 sq. mt. not anything extra shall be paid for extra labour and materials in forming such openings. For similar area exceeding 0.04 sq. mt. deduction shall be made in measurements for full opening but nothing extra shall be paid for extra labour and materials in forming such openings.

(e) The grading (coba bedding) shall be paid separately but cleaning of surface and treatment shall not be measured or paid separately.

3.2. The rate includes cost of all materials and labour.

3.3. The rate shall be for a unit of one sq. meter.

15.87(A) Providing and fixing on wall face C.I rain water pipe including filling the joints with spun yarn soaked in neat cement slurry and cement mortar 1:2 (1 cement : 2 fine sand) 75 mm. dia.

1.0. Materials

Water shall conform to M-1. The C.I. rain water pipes and fittings shall conform to M-68. Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. C.I. rain water pipes shall be of the specified diameter and shall be in full lengths of 1.8 meters including socket ends of the pipes unless shorter lengths are required at junction with fittings.

2.2. Fixing :

The pipe and fittings shall be fixed in vertical alignment unless otherwise specified and shall be secured to the walls at joints with M.S. clamps. The clamps shall be M.S. sheet 30 mm. bent to required shape and size so as to fit tightly on the socket of pipe when tightened with screw bolts. It shall be formed out of two semi-circular pieces, hinged with 6 mm. dia M.S. pin on one side and provided flanged ends on the other side with holes to fit in the screw bolt and nut 40 mm. long. The clamps shall be provided with hook made out of 275 mm. long, 10 mm. dia M.S. bar invested to the ring at the centre of one semicircular piece. The clamps shall be fixed to the walls. The clamps shall be kept above 25 mm. clear of finished face of wall so as to facilitate cleaning and painting the pipes.

2.3. The pipe shall be fixed vertically. The spigot of the upper pipe shall be properly fitted in the socket of the lower pipe such that there is uniform annular space filling with the jointing material. The annular space between the spigot and socket shall be filled with, a few turns of spun yarn soaked in cement slurry or with stiff cement mortar 2:1 (1 cement : 2 fine sand) well pressed with caulking tools and finished smooth at top at an angle of 45°, shopping up. The joint shall be kept wet at least for 7 days by tying four fold of gunny bag to pipe and keeping it moist constantly.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 15.93(B) of A.C. rain water pipes shall be followed except that the C.I. rain water pipe shall be fixed.

3.2. The rate shall be for a unit of one running meter.

15.88.(A) Providing and fixing M.S. Holder bat clamps of approved design to C.I. or S.C.I, pipes embedded and including cement concrete blocks (108 mm. x 100 mm. size) in 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) and cost of cutting holes and making good the wall etc. complete : 75 mm. dia.

1.0. Materials of Workmanship

1.1. The relevant specifications of item no. 15.94(6) shall be followed except that the M.S. holder bat clamps of approved design shall be C.I. rain water pipe-75 dia.

1.2. The bat clamps shall be fixed as directed with C.C. blocks of 100 mm. x 100 mm. The relevant specification of item No. 5.4.1 shall be followed for concrete work.

2.0. Mode of measurements and payment

2.1. The bat clamps of M.S. holder suitable for 75 mm. dia shall be measured for finished item.

2.2. The rate includes cost of all materials and labour etc. required for satisfactory completion of this item.

2.3. The rate shall be for a unit of one number.

15.90(A) Providing and fixing and embedding sand C.I. rain water pipe in the mason surrounded with 12 mm. thick cement mortar of the same mix as that of masonry : 75 mm. dia. pipe.

1.0. Materials

Water shall conform to M-1. Cement mortar shall conform to M-11. The C.I. pipe and fittings shall conform to M-68.

2.0. Workmanship

2.1. The relevant specifications of item No. 15.87 (A) shall be followed except that C.I. pipe 75 mm. dia shall be embedded in masonry surrounded with 12 mm. thick cement mortar.

2.2. The pipes shall be fixed in the masonry work as it proceeds. The pipe shall be kept vertical or to the line as directed. The pipe shall have minimum surroundings of 12 mm. thick cement mortar at every portion of external surface. The length shall be caulked with spun yarn and cement mortar as soon as the next length of pipe is placed in position. The socket end of the pipe shall be kept closed till the next length of pipe is fitted and jointed to prevent any brick-bats or concrete or pieces of wood falling in and cocking the pipes.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 15.87 (A) shall be followed.

3.2. The rate shall be for a unit of one running meter.

15.93(6) Providing and fixing on wall face asbestos cement rain water pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 cement : 2 coarse sand) complete : 80 mm. dia.

1.0. Materials

1.1. Asbestos cement pipes of 80 mm. dia shall conform to I.S. 1626-1960 for pipes fixed on wall face. A.C. pipe shall conform to M-74.

2.0. Workmanship

2.1. Asbestos cement rain water pipes and fittings shall be of the diameter, size and type specified in the item. The pipe shall be full lengths of 2 meter as far as possible. All the pipes shall be fixed on wall face at locations indicated on drawings or as ordered by the Engineer-in-charge. Pipe shall be secured to face of wall below all joints by M.S. clamps with wooden gut ties.

2.2. The spigot of the upper pipe shall be properly fitted into the socket of the lower pipe such that there is uniform annular space for fitting with the jointing materials. One third depth of annular space between the

item. The pipe shall be full lengths of 2 meter as far as possible. All the pipes shall be fixed on wall face at locations indicated on drawings or as ordered by the Engineer-in-charge. Pipe shall be secured to face of wall below all joints by M.S. clamps with wooden gut ties.

2.2. The spigot of the upper pipe shall be properly fitted into the socket of the lower pipe such that there is uniform annular space for fitting with the jointing materials. One third depth of annular space between the socket and the spigot shall be filled with spun-yarn soaked in bitumatic jointing compound and shall be pressed home by means of caulking tool. The remaining 2/3 depth of the joints shall be filled in with stiff cement mortar 1:2 and shall be pressed with caulking tool and finished smooth at top at an angle of 45 sloping up.

3.0. Mode of measurements and payment

3.1. The pipe shall be measured including all fittings along its length in running meter. No allowance shall be made for the portion of pipe length entering the sockets of the adjacent pipe or fittings.

3.2. The rate includes the cost of all materials and labour involved in all the operations including jointing.

3.3. The rate shall be for a unit of one running meter.

15.93.(C) Providing and fixing on wall face asbestos cement rain water pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 cement : 2 coarse sand) complete : 100 mm. dia.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 15.93 (B) shall be followed except that the diameter of pipes shall be 100 mm.

2.0. Mode of measurements & payment

2.1. The pipe shall be measured including all fittings along its length in running meter. No allowance shall be made for the portion of pipe length entered into the sockets of the adjacent pipe or fittings.

2.2. The rate includes the cost of all materials and labour involved in all the operations including jointing.

2.3. The rate shall be for a unit of one running meter.

15.94.(B) Providing and fixing for A.C. pipe on wall plugs and standard holder bat clamps comprising of two semi circular halves of flat iron and cast iron base screwed on wooden plugs : 80 mm. dia.

1.0. Materials and workmanship

1.1. The bat clamps shall consist of a iron base with a projecting 1 shaped lay, teeth web of which the semicircular halves of the flat iron clamps are bolted. The base on the holder bat clamp shall be screwed on a pair of wooden plugs fixed in the wall with screw slotted driven through the holes in the base. The ' screws shall be not less than 75 mm. long-for 80 mm. diameter pipes and 100 mm. diameter pipes. The plugs shall be fixed in the wall to a depth of 150 mm. in cement mortar, 1:2 centrally to the holes in the base of the bat clamps and with their front face projecting to such a length' from the brick face that when the bat clamps is fixed, the outer base of its base shall be flush with the plaster face of the wall. The plugs shall be 110 mm. x 50 mm. wide at face increasing to 160 mm. x 70 mm. width at rear and shall be 70 mm. deep through out.

2.0. Mode of measurement & payment

2.1. The work shall be measured on number basis of clamps prescribed with accessories including cost of all materials and labour involved in all the operation including jointing etc. complete fixing in position etc. complete.

2.2. The rate shall be for a unit of one number.

15.94 (C) Providing and fixing for A.C. pipe on wall plugs and standard holder bat clamps comprising of two semi circular halves of flat iron and cast iron base screwed on wooden plugs : 100 mm. dia.

1.0. Materials and workmanship

1.1. The relevant specifications of item No. 15.94 (B) shall be followed except that the standard holder bat clamps shall be for A.C. pipe of 100 mm. dia.

2.0. Mode of measurements and payment

2.1. The work shall be measured on number basis of clamps including cost of all materials and labour involved in all the operation including jointing, fixing in position etc. complete.

2.2. The rate shall be for a unit of One Number.

15.95.(A) Providing and fixing on wall face asbestos cement fittings for rain water pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 cement : 2 coarse sand). Bend of required degree. 80 mm. dia without door. 100 mm. dia. without door.

1.0. Materials

1.1. The bend of required degree and size as specified in item shall be of best quality and made as approved by the Engineer-in-charge. The fittings shall conform to I.S, 1626-1960.

2.0. Workmanship

2.1. The fitting (bend of required degree) shall be fixed as per relevant specifications of item No. 15.93 (B), except that the A.C. bends of required degree shall be provided instead of pipe.

3.0. Mode of measurements and payment.

3.1. The rate shall be for a unit of One Number.

15.95.(B) Providing and fixing on wall face asbestos cement fittings for rain water pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 cement: 2 coarse sand) off set 50 mm. (2) 80 mm. dia. (3) 100 mm. dia.

1.0. Materials & Workmanship

1.1. The relevant specification of item No. 15.95 (A) shall be followed except the off set 50 mm. of specified size of A.C. pipe shall be used instead of bends.

2.0. Mode of measurements & payment

2.1. The rate shall be for a unit of One Number

15.95.(C) Providing and fixing on wall face asbestos cement fittings for rain water pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 cement : 2 coarse sand) off set 75 mm. (2) 80 mm. dia (3) 100 mm. dia.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 15.95 (A) shall be followed except that off-set 75 mm. of specified size of A.C. Pipe shall be provided instead of bends.

2.0. Mode of measurements & payment

2.1. The rate shall be for a unit of One Number.

15.95.(J) Providing and fixing on wall face Asbestos cement fittings for rain water pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 cement : 2 coarse sand) junction equal angle. (3) 80 mm. dia without door (5) 100 mm. dia. without-door.

1.0. Materials and workmanship

The relevant specifications of item 15.95 (A) shall be followed that junction of equal of angle of specified size of A.C. pipe shall be provided instead of bends.

2.0. Mode of measurements & payment

2.1. The rate shall be for a unit of One Number.

15.95.(K) Providing and fixing on wall face Asbestos cement fittings for rain water pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 cement : 2 coarse sand) : junction of equal double angle. (3) 80 mm. dia. without door (5) 100 mm. dia. without door.

1.0. Materials and workmanship

1.1. The relevant specification of item 15.95 (A) shall be followed except that junction of equal double angles of A.C. rain water pipe of specified size shall be provided instead of A.C, Bend.

2.0. Mode of measurement & payment

2.1. The rate shall be for a unit of One Number.

15.95.(L) Providing and fixing on wall face Asbestos cement fittings for rain water pipe including jointing with spun yarn soaked in bitumen and cement mortar 1:2 (1 cement : 2 coarse sand) : Standard shoe. (2) 80 mm. dia. (3) 100 mm. dia.

1.0. Materials and workmanship

1.1. The relevant specification of item No. 15.95 (A) shall be followed except that the standard shoe of A.C. pipe of specified size shall be provided instead of bend.

2.0. Mode of measurement & payment

2.1. The rate shall be for a unit of One number.

SECTION-16
Ceiling Lining

16.3.(A) Providing and fixing wooden planks ceiling with long Lied and grooved jointing and Wood screws (Frame work and cover fillets to be measured and paid separately) : Indian Teak Wood (i) 12 mm. thick (ii) 20 mm. thick (iii) 25 mm. thick.

1.0. Materials

1.1. The Indian Teak wood shall conform to M-29.

2.0. Workmanship

2.1. General

The planks shall be clean sawn in the direction of the grain, cut square and straight. Each plank shall have tongued and grooved jointing. On exposed faces, it shall be planed for full face.

2.2. The frame for supporting the ceiling may be wooden or metal and the size and the other details of frame work shall be as directed, Suspenders of M.S. angles or other sections may be used for suspending the frame. Use of wooden suspenders shall be permitted. The bottom surface of the frame shall be checked and corrected to true surface and slope.

2.3. Fixing :

Planks of a specified timber and thickness shall be used. The width of the planks shall not be more than 100 mm. up to 20 mm. thick planks and 150 mm. for planks above 20 mm. thick and length shall not exceed 3 meters. The planks shall be of uniform width except in the first and last lines of planks adjacent to the two walls where remaining additional odd width shall be adjusted equally on both sides. The minimum, length of planks in finished work shall be such that it will span at least two spacing of the supporting frame work except where shorten lengths are unavoidable. The planks shall be planed true on the exposed sides.

2.4. The longitudinal edges of the planks shall be jointed with tongued and grooved type joints as described in the item.

2.5. The outer lines of planks shall be accurately fixed parallel and close to be wall. Each subsequent plank shall be carefully jointed up. The plank shall be fixed to the frame above with two screws at each and joints of frame and one at every intermediate joint. (The screws shall not be thinner than designations 8 and of a length not less then twice the thickness of the boards). The screws shall be counter sunk and the screw holes filled with putty or-sloping out way. The unexposed face of planks shall be treated with wood preservative before the board is fixed.

3.0. Mode of measurement & payment

3.1. The supporting frame, cover fillets, and suspenders shall not be included in rate of ceiling.

3.2. No deductions in measurements shall be made for opening not exceeding 0.46 sq. m. and no extra payment shall be made for forming such openings.

3.3. Each type of work in ceiling shall be measured separately.

3.4. The rate shall be for a unit of One sq. meter.

16.4. Providing and fixing Fiber insulation board lining with butt jointing and nails (Frame work and cover fillets to be measured and paid separately) (i) 12 mm. thick (ii) 18 mm. thick (iii) 25 mm. thick.

1.0. Materials

1.1. The fiber insulation board of specified thickness shall conform to I.S. 3348-1965.

2.1. Fixing :

The work shall be carried out as per detailed drawings for panel arrangements.

2.2. All boards are subject to slight movements due to moisture and temperature changes, and this shall be allowed for in fixing. Preferably the board shall be stored up for at least 24 hours before use in the same environment as the one in which they are to be fixed.

2.3. Frame work :

The studs and grounds for fixing the boards shall be spaced at 300 mm. to 450 mm. centers both ways the .actual spacing selected depending on the width of the cut board in the panel arrangements. All edges of the boards shall be supported. Intermediate supports shall be provided at dedo heights for picture rails and cornices etc.

2.4. Planked battens 40 mm. x 20 mm. shall toe used for grounds on solid walls. The batten shall be plugged to wall as described-under. The batten snail be fixed on tapering plugs with 50 mm. long wood screws. The tapering plug shall be trapezoidal in shape having base 50 x 50 mm. at bottom 38 x 38 mm. at top with depth of 50 mm. Plugs shall be embedded in C.M. 1 : 3 and shall be placed at 450 x 500 mm. centers. The plugs shall treated with coal tar and battens shall be treated with wood preservative before use. On uneven wall faces the battens shall be plugged and fitted with packing pieces at the back where necessary. The frame shall be treated with wood preservative before boards are nailed on.

Nailing shall be done by nails having a shank diameter of 2.5 mm. and head diameter of about 8 mm. Nails shall have length as per requirements. The nails shall be placed at supports at 100 mm. to 150 mm centre to centre and at edges 75 mm. centers. Minimum clearance for nails from edges shall be 10 mm. The nails shall be rustles where the nail heads are exposed. Where the joints are to be covered with beading, felt headed (clout) nails shall be used instead of lost head nails.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 16.3.(A) shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

16.13(1) Providing and fixing plywood lining with butt jointing and nails (frame work and cover fillets to be measured and paid for separately) 6 mm. thick play.**1.0. Materials :**

6 mm. thick plywood shall conform to M-37.

2.0. Workmanship

The relevant specifications of item 16.4 shall be followed except that 6 mm. thick plywood shall be fixed in lining.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item 16.4 shall be followed.

3.2. The rate shall be for a unit of One sq. meter,

16.13(11) Providing and fixing plywood lining with but jointing and nails (frame work and cover fillets to be measured and paid for separately) 9 mm. thick ply.**1.0. Materials & Workmanship**

1.1. The relevant specifications of item No. 16 13 (I) shall be followed except that the thickness of plywood to be fixed shall be 9 mm.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 16.4 (I) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

16.21(1) Providing and fixing plain asbestos sheet lining with butt jointing and wood screws (frame work and cover fillets to be paid for separately), Class-A-6.5 mm. thick.**1.0. Materials**

1.1. Plain A.C. Sheets 6.5. mm. thick shall be conform to M-24.

2.0. Workmanship

2.1. The relevant specifications of item No. 16.4. shall be. followed except that the plain A.C. sheets class A of 6.5 mm. thickness shall be fixed in lining.

2.2. In fixing asbestos cement sheets, care shall be taken to avoid rigid fixing as this may cause cracking if the supporting structure expands or shrinks. The sheet shall be fixed with wood screws to wooden ground

and the screw holes shall be drilled slightly longer than the screws. Asbestos sheet may also be advantageously fixed on to walls with cement plaster backing. The screws shall be fixed at 150 mm. to 200 mm. at supports. The boards shall be fitted either with wooden cover fillets or asbestos strips as described in item.

3.0. Mode of measurement and payment

3.1. The relevant specifications of item No. 16.4 shall be followed.

3.2. The rate shall be for a unit One sq. meter.

18.21 (II) Providing and fixing plain asbestos sheet lining with butt jointing to wood screws (frame work and cover fillets to be paid for separately), Class-B-5 mm. thick.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 16.21 (I) shall be followed except that the plain A.C. sheet of Class-B 5 mm. thick shall be fixing in lining.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 16.21 (I) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

SECTION-17
Plastering and Paints

17.58 (I) 10 mm. thick cement plaster in single coat on fair side of brick concrete walls for interior plastering up to floor two level and finished even and smooth in (i) C. M. 1:3.

1.0. Materials

1.1. Water shall conform to M-1. The cement mortar of proportion 1:3 shall conform to M-13.

2.0. Workmanship

2.1. Scaffolding:

Wooden bullies, bamboos, planks, trestles and other scaffolding shall be sound. These shall be properly examined before erection and use. Stage scaffolding shall be provided for ceiling plaster which shall be independent of the walls.

2.2. Preparation of back-ground :

2.2.1. The surface shall be cleaned of all dust, loose mortar droppings, traces of algae, efflorescence and other foreign matter by water or by brushing. Smooth surface shall be toughened by wire brushing if it is not hard and by hacking if it is hard. In case of concrete surface, if a chemical retarded has been applied to the form work, the surface shall be roughened by wire brushing and all the resulting dust and loose particles cleaned off and care shall be taken that none of the readers if left on the surface. Trimming of projections on brick/concrete surfaces where necessary shall be carried out to get an even surface.

2.2.2. Raking of joints in case of masonry where necessary shall be allowed to dry out for sufficient period before carrying out the plaster work.

2.2.3. The work shall not be soaked but only damped evenly before applying the plaster. If the surface becomes dry, such area shall be moistened again.

2.2.4. For external plaster, the peasting operation shall be started from top floor and carried downwards. For internal plaster, the plastering operations may be-started wherever the building frame and cladding work are ready and the temporary supports of the ceiling resting on the wall of the floor have been removed. Ceiling plaster shall be completed before starting plaster to walls.

2:3. Application of plaster:

2.3.1. The plaster about 15x15 cms. shall be first applied horizontally and vertically at not more than 2 meters intervals over the entire surface to serve as gauge. The surfaces of these gauges shall be truly in plane of the finished plastered surface. The mortar shall then be applied in uniform surface slightly more than the specified thickness, then brought to a true surface by working a wooden straight edge reaching across the gauges with small upward and sideways movements at a time. Finally, the surface shall be finished off true with a trowel or wooden float according as a smooth or a smooth or a sandy granular texture is required Excessive troweling or overworking the float shall be avoided. All corners, arises, angles and junctions shall be truly vertical or horizontal as the case may be and shall be carefully finished. Hounding or chamfering, corners, arises junctions etc. shall be carried out with proper templates to be size required.

2.3.2. Cement plaster shall be used within half an hour after addition of water. And mortar or plaster which is partially set shall be rejected and removed forthwith from the site.

2.3.3. In suspending the work at the end of the day, the plaster shall be left out clean to the line both horizontally and vertically, when recommencing the plaster, the edges of the old work shall be scraped clean and wetted with cement putty before plaster is applied to the adjacent areas to enable the two to properly join together. Plastering work shall be closed at the end of the day on the body of the wall and nearer than 15 cm. to any corners or arises. It shall not be closed on the body of features such as plaster bands and cornices not at the corners or arises. Horizontal joints in plaster work shall not also occur on parapet tops and copings as these invariably lead to leakage. No portion of the surface shall be left out initially to be packed up later on.

2.3.4. Each coat shall be kept damp continuously till the next coat is applied or for a minimum period of 7 days. Moistening shall commence as soon as plaster is hardened sufficiently. Soaking of walls shall be avoided and only as much water as can be readily absorbed shall be used, excessive evaporation on the sunny or windward side of building in hot air or dry weather shall be prevented by hanging matting or gunny bags oh the outside of the plaster and keeping them wet.

3.0. Mode of measurements & payment

3.1. The rate shall include the cost of all materials, labour and scaffolding etc. involved in the operations described under workmanship.

3.2. All plastering shall be measured in square meters unless otherwise specified. Length breadth or height shall be measured correct to a centimeter.

3.3. Thickness of the plaster shall be exclusive of the thickness of the key i.e. grooves or open joints in brick work, stone work etc. or space between laths. Thickness of plaster shall be average thickness with minimum 10 mm. at any point on this surface.

3.4. This item includes plastering up to floor two level.

3.5. The measurement of wall plastering shall be taken between the walls or partition (dimensions before plastering being taken) for length and from the top of floor or skirting to ceiling for height. Depth of cover of cornices if any shall be deducted.

3.6. Soffits of stairs shall be measured as plastering on ceilings, following soffits shall be measured separately.

3.7. For jambs, soffits, sills etc. for openings not exceeding 0.5 sq. met each in area for ends of joints beams, posts, girders, steps etc. not exceeding 0.5 sq. mt each in area and for openings exceeding 0.5 sq. mt and not exceeding 3.00 sq. mt. in each area deductions and additions shall be made in the following manners.

(a) No deductions shall be made for ends of joints, beams, posts etc. and openings not exceeding 0.5 sq. mt each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings, for finish to plaster around ends of joints, beams posts etc.

(b) Deduction for openings exceeding 0.5 sq. mt but not exceeding 3 sq.mt. each shall be made as follows and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings, (i) When both faces of all wall are plastered with same plaster, deduction shall be made for one face only, (ii) When two faces of wall are plastered with different types of plasters or if one face is plastered and the other pointed, deductions shall be made from the plaster or pointing on the side of frame for door, window etc. on which width of reveals is less than that on the other side but no deductions shall be made on the other side. Where width of reveals on both faces of all are equal, deductions of 50% of area of opening on each face shall be made from areas of plaster and / or pointing as the case may be.

3.8. For openings having door frames equal to or projecting beyond the thickness of wall, full deduction for opening shall be made from each plastered face of the wall.

3.9. In case of openings of area above 3 sq. mt. each, deduction shall be made for openings but jambs, soffits and sills shall be measured.

3.10. The rate shall be for a unit of One sq. meter.

17.58 (II) 10 mm. cement plaster in single coat on fair side of brick/concrete walls for interior plastering up to floor two level and finished even and smooth in C.M. 1:4.

1.0. Materials & workmanship

1.1. The relevant specifications of item No. 17.58 (I) shall be followed except that the proportion of mortar is C.M. 1 :4 instead of C.M. 1:3.

2.0. Mode of measurements & payment

2.1. The mode of measurements and payment shall be the same as for item No. 17.58 (I)

2.2. The rate shall be for a unit of One sq. meter.

17.58 (III) 10 mm. cement plaster in single coat on fair side of brick/concrete walls for interior plastering' up to floor two level and finished even and smooth in C.M. 1:6.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 17.58 (I) shall be followed except that the proportion of mortar is cement mortar 1:6.

2.0. Mode of measurements & payment

2.1. The mode of measurement and payment shall be followed same as item No. 17.58(1)

2.2. The rate shall be for a unit of one square meter.

17.61.(I) 20 mm. thick cement plaster in single coat on rough side of single or half brick wall for interior plastering up to floor two level, finished even and smooth in cement mortar 1:3 (1 cement : 3 sand).

1.0. Materials & workmanship

1.1. The relevant specifications of item No. 17.59 (I) shall be followed except that the thickness of cement plaster shall be 20 mm. The plastering work shall be in single coat on rough side of half brick wall for interior plastering up to floor two level, finished even and smooth in C.M. 1:3.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 17.59(1) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

17.61.(II) 20 mm. thick cement plaster in single coat on rough side of single or half brick wall for interior plastering up to floor two level, finished even and smooth in cement mortar 1:4 (1 cement : 4 sand).

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 17.59. (II) shall be followed except that the thickness of plastering shall be 20 mm. in C.M 1:4.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 17.59 (I) shall be followed.

2.2. The rate shall be for a unit of one sq. meter

17.61 (III) 20 mm. thick cement plaster in single coat on rough side of single or half brick wall for interior plastering up to floor two level, finished even and smooth in C.M. 1:6 (1 cement : 6 sand).

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 17.59 (III) shall be followed except that thickness of plaster shall be 20 mm. C.M 1:6.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 17.59 (I) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

17.69 Extra over items 51 to 65 for finishing with a floating coat of neat cement slurry.

1.0. Materials & workmanship

1.1. The relevant specification of item No. 17.58 and 1761 shall be followed for materials and workmanship except that this work is only providing smooth cement finish with floating coat of neat cement slurry

1.2. The coat of cement and fine sand mortar of proportion V1 (1 5 mm thick about) shall be applied to the plastered surface with a trowel to provide uniform texture while the base coat is still plastic.

1.3. In any continuous face of wall the finishing treatment should be carried out continuously and day lo day breaks made to coincide with architectural breaks in order to avoid unsightly Junctions

1.4. Curing : All the plaster work shall be kept damp continuously for a period 7 days

2.0. Mode of measurements and payment

2.1. The payment shall be made for a unit of 1.0 sq. mt of work done over an above the finishing of work of base coat.

2.2. The relevant specifications of item of base coat shall be followed for measurements and payment.

2.3. The rate shall be for a unit of One sq. meter.

17.70. Extra over item 17.58 to 17.61 for providing and mixing water proofing materials m cement mortar in proportion recommended by the manufacturers.

1.0. Materials and Workmanship

The relevant specification of item No 17.58 to 1761 shall be followed except that the water proofing materials of approved made shall be added to the cement at the rate specified or as directed by The Engineer-in-charge. The proportion proofing materials of water to be mixed with 50 kg bags shall be as recommended by the manufacturers of the water proofing material

2.0. Mode of measurements & payment

2.1. The payment shall he made extra for this work over and above the plaster work

2.2. The rate shall he for a unit or 1 Kg of water proofing materials used in 1 bag of weighing 50 Kg cement used extra over the rate of plastering work

17.91. Extra over item No. 17.59 to 17.61 for plastering on ceiling and soffits of stair up to floor two level instead of plastering on walls.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No 17.59 (1) shall no followed except that this work is for ceiling, soffits of stairs up lo two floe

1.2. The smooth concrete surface shall be suitable roughened to provide bond before plastering.

2.0. Mode of measurement and payment

2.1. The payment shall be made for a unit of One sq meter of work done extra over and above the payment of plaster work on wall surfaces.

2.2. The rate shall be for a unit of one sq. meter.

17.94(1) Extra over item No. 1 to 69, 71 to 87 and 90 for interior plastering above floor two level for every additional storey height (i) Single coat plaster.

1.0 Materials and Workmanship

1.1 The relevant specification of Item No. 17.59 (1) shall be followed except that the whole work is to be carried out above floor two level.

2.0. Mode of measurements and payment

1.2. The mode of measurement and payment shall be same as item No. 17.59(1).

2.2. The extra payment shall be made over and above the floor two level rate for every additional floor height.

17.94 (II) Extra over item 1 to 69, 71 to 87 and 90 for interior plastering above floor two level for every additional storey height. Tow coat plaster.

1.0. Materials & workmanship

1.1. The relevant specifications of item No. 17.94 (I) shall be followed except that extra payment for work shall be for a two coat plaster.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 17.94(1) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

17.94(111) Extra over item 1 to 69, 71 to 87 and 90 for interior plastering above floor two level for every additional storey height. Floating coat of neat cement.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 17.94 (I) shall be followed except that the extra payment shall be made for work of floating coat of neat cement slurry.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 17.59 (I) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

17.95. 20 mm. thick sand face cement plaster on walls up to height of 10 mm. and above ground level consisting of 12 mm. thick backing coating of C.M. 1:3 (1 cement : 3 sand) and 8 mm. thick finishing coat in C.M. 1:1 (1 cement : 1 sand) etc. complete.

1.0. Materials

1.1. Water shall conform to M-1. Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. The work shall be carried out in the coats. The backing coat (base coat) shall be 12 mm. thick in C.M. 1:3. The relevant specifications of item No. 17.58(I) shall be followed except that the thickness of back coat shall be 12 mm. average. Before the first coat hardens its surface shall be beaten up by edges of wooden tapers and close dents shall be made on the surface. The subsequent coat shall be applied after this coat has been allowed to set for 3 to 5 days, depending upon the weather conditions. The surface shall not be allowed to dry during this period.

2.2. The second coat shall be completed to 8 mm. thickness in C.M. 1:1 as described above, including raising sand facing by bushing. The sample of sand face shall be got approved before the work is started. The whole work shall be carried out uniformly as per sample approved.

2.3. Curing :

The curing shall be started overnight after finishing of plaster. The plaster shall be kept wet for a period of 7 days. During this period, it shall be protected from all damages.

3.0. Mode of measurement & payment

3.1. The relevant specifications of item No. 17.58 shall be followed except that the sand face plaster on outside up to 10 m. above ground level shall be measured under this item.

3.2. The rate shall be for a unit of One sq. meter.

17.116(A) Pointing on brick work with cement mortar 1:3 (1 cement : 3 coarse sand) flush pointing.

1.0. Materials

1.1. Water shall conform to M-1. Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. The flush pointing work shall be carried out with cement mortar of proportion 1:3(1 part of cement and 3 part of coarse sand) by volume.

2.2. Preparation of surface.

2.2.1. The joints shall be raked to such a depth that the average of new mortar measured from either the sunk surface to finished pointing or from the -edge of the brick shall be average 10 mm.

2.3. Application of Mortar and Finishing :

2.3.1. The mortar shall, be pressed in to the raked out joints with a pointing trowel according to the types of pointing specified in item. The mortar shall not spread over the corner edges or surface of the masonry. The pointing shall then be finished with the pointed tools.

2.4. Curing :

2.4.1. The pointing shall be kept wet for 7 days. During this period, it shall be suitably protected from all damages.

3.0. Mode of measurements & payment

3.1. No deductions shall be made end of joints, beams and posts etc. and openings not exceeding 0.5 s. mt. each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings.

3.2. Deductions for openings exceeding 0.5 sq. mt. but not exceeding 3 sq. mt. each shall be paid as follows and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings : (i) When both faces of walls are pointed with same type of pointing, deduction shall be made for one face only, (ii) When two faces of walls are pointed with different type of pointing or if one face is plastered and the other is pointed, deduction shall be made in the plaster or pointing on the side of frame for door, windows etc. on which the width of reveals is less than that on the other side but no deduction shall be made from plaster or pointing on the other side.

(iii) When only one face is treated and the other face is not rested, full deduction shall be made, if the width of the reveals on the treated side is less than on the untreated side, but if the width of the reveal is more then no deduction shall be made nor any addition shall be made for reveals/jambs, soffits, sills etc. **3.3.** In case of openings of area above 3 sq. mt each deduction shall be made for opening but jambs, sills, and soffits, shall be measured.

3.4. The rate shall be for a unit of One sq. meter.

17.116(8) Pointing on brick work with cement mortar 1:3 (1 cement : coarse sand) Ruled pointing.**1.0. Materials & Workmanship**

1.1. The relevant specifications of item No. 17.116 (A) shall be followed except that the pointing to be done ruled pointing as under:

1.2. The joints shall be initially formed as for flush pointing and then while the mortar is still green, a groove of specified shape shall be formed by running forming tool straight along the centre line of joints till a smooth and hard surface is obtained. The vertical joints shall also be finished in a similar way. The pointing lines shall be uniform in width and truly horizontal and parallel in case of floor and ceiling.

2.0. Mode of measurements & payment

2.1. The mode of measurements and payment shall be the same as per item No. 17.116(A).

2.2. The rate shall be for a unit of One sq. meter.

17.117(A) Pointing on brick work with cement mortar 1:4 (1 cement : 4 sand) Flush pointing.**1.0. Materials & Workmanship**

1.1. The relevant specifications of item No. 17.116 (A) shall be followed.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item-No. 17.116 (A) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

17.117(6) Pointing on brick work with cement mortar 1:4 (1 cement : 4 sand) Ruled pointing.**1.0. Materials & Workmanship**

1.1. The relevant specifications of item No. 17.116(6) shall be followed except that the proportion of C.M. 1:4 shall used for ruled pointing.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 17.115 (A) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

17.140.(A) Pointing on coursed stone masonry with cement mortar 1:3 (1 cement : 3 sand) flush pointing.**1.0. Materials and workmanship**

1.1. The relevant specifications of item No. 17.116 (A) shall be followed except that the pointing shall be done on coursed stone masonry with C:M. 1:3 and the mortar shall be simply struck off with a trowel and the work left showing the natural irregularities in line and the surface of the stones themselves.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No.17.116 (A) shall be followed.

2.2. The rate shall be favor a unit of One sq. meter.

17.140(B) Pointing on course stone masonry with cement mortar 1:3 (1 cement ; 3 sand) Ruled pointing.**1.0. Materials and Workmanship**

1.1. The relevant specifications of item No. 17.140 (A) and 17.116 (B) shall be followed.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 17.116(A) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

17.44.(A) Pointing on uncoarsed stone masonry with cement mortar 1:3 (1 cement : 3 sand) Flushing pointing.**1.0. Materials & Workmanship**

1.1. The relevant specifications of item No 17 116(A) shall be followed except that the flush pointing shall be done on uncoarsed rubble masonry work if C.M 1 3 and the mortar shall be simply Struck off with a trowel and the work left showing the natural irregularities in line and the surface of the stone themselves.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 17.116(A) shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

17.144.(B) Pointing on uncoarsed stone masonry with cement mortar 1:3 (1 cement : sand) Ruled pointing.**1.0. Materials & Workmanship**

1.1. The relevant specification of item No 17 116 (Aj and 17 144 (A) shall be followed except that the ruled pointing work -shall be carried out on uncoarsed rubble masonry work in CM 1.3.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 17.116(A) shall be followed.

2.2. The rate shall be for a unit of One sq. meter

17.0.0.1 Providing cement vata (10 cms x 10 cms) size quarter round in cement mortar 1:1 including neat cement finishing, watering, etc. complete.**1.0. Materials**

1.1. Water shall conform to M-1 .Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. The work of cement vata of 10 cms x 10 cms. size shall be earned out at Functions of parapets and terraces as directed. The vata shall be finished in quarter round shape. The work shall be earned out in the neat workman like manner. The inter portion of rain water pipe shall be rounded off properly during constructing the vata. The work shall be cured for 7 days.

3.0. Mode of measurements and payment

3.1. The work shall be measured for finished item in running meter.

3.2. The rate shall be for a One running meter.

SECTION-18**White Washing & Distemping**

18.11. White washing with lime on undecorated wall surfaces (two coats) to give an even shade including thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter.

1.1. Materials

1.1.1. The clear Cole shall be made from glue and boiling water by mixing 1 Kg. mixture shall be suitably tinted where required for use under coloured distemper it directed. Glue shall conform to I.S. 352-1959 (Specifications for animal glue)

1.1.2. Lime used shall be Freshly burnt class 'C' Lime (fat lime) and white in colour conforming to I S. 712-1973. Water shall conform to M-1. Best quality of gum shall be used in (the preparations of white wash. Ultramarine blue or Indigo : This shall conform to I.S. 55-1970 for points, and shall be used for preparation of white was, Pigments. Mineral colours, not affected by lime shall be used in preparing colour wash.

2.0. Workmanship

2.1. Preparation of white wash solution Surface already white or colour. The fat lime shall be slaked as site and shall be mixed and stirred with about five liters of water for 1 kg. of unslaked lime to made a trim cream This shall be allowed to stand for d period of 24 hours and then shall be screened through a clean coarse cloth, 4 Kg. of gum dissolves in hot water shall be added to each cubic meter of lime cream Small quantity of ultramarine blue (Up to 3 gins, per kg. of lime) shall also-be added to the last two coats of white wash solution and the whole solution shall be stirred thoroughly before use.

2.2. Preparation of surface:

2.2.1. The surface shall be thoroughly cleaned of all dust, dirt, mortar cropping and other foreign matter before white wash is to be applied.

2.2.2. The surface spoiled by smoke soot shall be scrapped with steel wire brushes or steel scrapers 01 shall be rubbed with over-burnt surkhi or brick bats. The surface shall be then broomed to remove all dust dirt and shall he washed with clean water.

2.2.3. Oil or grease spots shall be removed by suitable chemical and smooth surface shall be rubber with wire Crushes.

2.2.4. All unsound portion of the surface plaster shall be removed to full depth of plaster in rectangular patches and plastered again after raking the masonry joints properly. Such portion shall he wetted and allowed to dry. They shall then be given one coat of white wash

2.2.5. All unnecessary nails shall be removed the holes, cracks, patches etc. shall be made good with material similar in composition to the surface to be prepared

2.3. Scaffolding :

Wherever scaffolding is necessary it shall be erected in such a way that as far as possible on part of scaffolding shall rest against the surface to be white or colour washed A properly secured strong and well tied suspended platform (Zoola) may be used for white washing. Where ladders are used pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the floors and walls. For white washing of ceilings, proper stage scaffolding shall be erected where necessary.

2.4. Application of white wash :

2.4.1. On the surface so prepared the white wash shall be applied with 'Moon' brush. The first stroke of the brush shall be from top downwards, another from bottom upwards over the first stroke and similarly one stoke from the right another from the left, over the first stroke brush before it dries. This will form one coat each coat shall be allowed to dry before and uniform finish free from brush marks and it should not come oft easily when rubbed with finger

2.4.2. Splashing and dropping if any on the doors and windows, ventilators etc shall be removed and the surface cleaned.

2.4.3. Priming and Alkali resistant treatments, scraping of surface washing etc. surface spoiled by smoke soot removed of oil and grease spots, treatment for infection with efflorescence moulds moos, fungi, algae and lichen and patch repairs to plaster wherever done shall not be paid extra.

3.0. Mode of measurement & payment

3.1. All the work shall be measured in the decimal system as under:

- (a) Dimensions shall be measured to the nearest 0.01 m.
- (b) Area in individual item shall be worked out to the nearest 0.01 sq.m.

All the work shall be measured in sq. mt. Deductions for jambs, soffits, sills etc. for openings not exceeding 0.5 sq. mt. each in area, for ends of joists, posts, beams, girders, steps etc. not exceeding 0.5 sq mt. each in area and for openings exceeding 0.5 sq. mt. and not exceeding 3.0. sq. mt. each in area, deductions and additions shall be made as under.

3.2. No deductions shall be made for ends of joists, beams, posts, etc. and openings not exceeding 0.5 sq mt. each. No addition shall be made for reveals, jambs, soffits, sills etc. of these openings not for finish around ends of joints, beams, posts etc.

3.3. No deductions for openings exceeding 0.5 sq.mt. but not exceeding 3 sq. mt. each shall be made as follows and no addition will be made for reveals, jambs, soffits etc. of these openings :

- (a) When both the faces of walls are provided with finish, deduction shall be made for one face only.
- (b) When each face of wall is provided with different finish, deduction shall be made for that side of frame for door, windows, etc. on which width of reveals is less than that of the other side. Where width of reveals on both faces of wall are equal, deduction of .50% of area of opening on each face shall be made from total area of finish.
- (c) When only one face of wall is treated and the other face is not treated, full deduction shall be made if the width of reveal on the treated side is less than that on the untreated side, but if the width of the reveal is equal or more than on the untreated side neither deductions nor additions to be made for reveals, jambs, soffits, sills etc.

3.4 In case of area of openings exceeding 3 sq. mt. each, deductions shall be made for openings but jambs, soffits, sills shall be measured.

3.5. No deductions shall be made for attachment such as casing, conducts, pipe, electric wiring and the like.

3.6. Corrugated surfaces shall be measured flat as fixed and not girth. The quantities so measured shall be increased by the following percentage and the resultant shall be included with the general areas:

- (a) Corrugated steel sheets..... 14%
- (b) Corrugated A.C. sheets..... 20%
- (c) Semi corrugated A.C. Sheets..... 10%
- (d) Nainital pattern roof (Plain sheeting sheets)..... 10%
- (e) Naintial pattern roof (with corrugated sheets)..... 25%

3.7. Cornices and other wall features, when they are not picked out in a different finish/colour shall be girthed and included in the general area.

3.8. The rate shall include the cost of ail materials, labour, scaffolding, protective measures etc. involved in all the operations described above.

3.9. The rate shall be for a unit of One sq. meter.

18.12. **White washing with lime on decorated wall surface (One coat) to give an even shade including thoroughly brooming in the surface to remove dust, mortar, drops and loose scales of lime wash and other foreign matter.**

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.11 shall be followed except that the white washing work shall be carried out on decorated wall surface single coat.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 18.11 shall be followed.

2.2. The rate shall be for a unit of One sq. meter

18.13 **Extra over items 18.11 and 18.12 for every subsequent coat of white washing with lime on wall surfaces.**

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.11 shall be followed except that this work is for extra coat over and above two coats on wall surface.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.11 shall be followed except that the payment of subsequent coat shall be made extra over and above the item No. 18.11 for every subsequent coat applied.

2.2. The rate shall be for a unit of One sq. meter.

18.14. Extra over item 18.11 for white washing with the lime on ceiling and / or sloping roof.**1.0. Materials and Workmanship**

1.1. The relevant specifications of item No. 18.11 above shall be followed except that this work is for ceiling and / or sloping roof.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.11 shall be followed except that extra payment for white washing on ceiling and/or sloping roof shall be made over and above the payment of item No. 18.11

2.2. The rate shall be for a unit of One sq. meter.

18.15 Extra over 18.12 for white washing with lime on decorated dealings and sloping roofs.**1.0. Materials and Workmanship**

1.1. The relevant specifications of item No. 18.12 shall be followed except that the white washing work shall be carried out on decorated ceilings and/or sloping roofs.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.52 shall be followed except that extra payment for white washing on ceiling and/or sloping roof shall be made over and above the payment of item No. 18.12.

2.2. The rate shall be for a unit of one sq. meter.

18.16. Extra over the item No. 18.13 for every subsequent coat of white washing with lime on ceiling and /or sloping roofs.**1.0. Materials and Workmanship**

1.1. The relevant specifications of item No. 18.11 and 18.13 shall be followed except that this work is for extra coat over and above two coats of ceiling and / or sloping roofs.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.11 and 18.13 shall be followed except that the extra payment for white washing shall be made for sloping roof or/and ceiling for every subsequent coat applied over and above item 18.11 and 18.13.

2.2. The rate shall be for a unit of one sq. meter.

18.17. Colour washing with lime on undecorated wall surfaces (Two coats) over and including priming coat of white washing to give even shade including thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter. The relevant specifications for the materials and workmanship 18.11 shall be followed except that it shall be for colour wash.**1.0. Materials**

1.1. Clear-Cole : This shall be made from glue and boiling water by mixing 1 kg. of glue to every 15 liters of water. The mixing shall be suitably tinted to match with colour of colour washing as directed. Glue shall conform to I.S. 852-1969.

1.2. Lime : Lime used shall be freshly burnt class 'C' lime (Fat lime) and white in colour conforming to I.S. 712-1973.

1.3. Water : Water shall conform to M-1.

1.4. Gum ; Best quality of gum shall be used in the preparation of white or colour wash. The colour pigment of required tint and shade shall be mixed in lime cream. The mineral colour not affected by lime shall be used in preparing the colour wash.

2.0. Workmanship

2.1. Sufficient quantity of colour wash enough for the complete job shall be prepared in one operation to avoid any difference in shade. The basic white wash solution shall be prepared in accordance with item 18.11 Mineral colours not affected by lime shall be added to the white wash solution. No colour wash shall be done until a sample of the colour has been approved. It shall be noted that small samples of colour appears lighter in shade than when the same shades are applied precisely to large surface. The colour shall

be of event, tint, over the colour shall be of event tint, over the whole surface. If it is patchy or otherwise badly applied, it shall be rejected. Preparation of the colour wash with pigment shall be as under:

(a) With Yellow and Red Ocher :

Solid lumps if any in the powder shall be crushed to powder and solution in water prepared and then added to white wash sieving it through a coarse cloth, mixed evenly and thoroughly to white wash in-small quantities till required shade is obtained.

(b) With Blue Vitriol :

Fresh crystals of hydrous copper sulfate (i.e. vitriol) shall be ground to fine power and dissolved in small quantity of water. Sufficient quantity of solution enough to produce the colour wash of required shade shall be strained through a clean cloth, the filtrate being mixed evenly and thoroughly to the white wash.

(c) Colour wash from other colouring pigment shall be prepared in accordance with the instructions of the manufacturer.

2.2. Preparation of Surface :

The surface shall be prepared by removing mortar dropping and foreign matter and thoroughly cleaned with wire of fiber brush or any other suitable means as directed by the Engineer-in-charge. All loose pieces and scales shall be scrapped off and holes filled with mortar.

2.2.1. For scaffoldings and application of colour wash, relevant specification of item No. 18.11. above shall be followed. The colour wash shall be applied as under:

The colour wash shall be applied in accordance with the procedure given in item No. 18.11. "Application of white wash for colour washing on undercoated surface after the surface has been prepared. The first primary coat shall be of white wash and subsequent coats (minimum two) shall be colour wash and the entire surface shall represent a smooth and uniform finish. To start with, patch of 0.1 sq. mt. on prepared surface shall be colour washed with first coat of white wash and subsequent coats of colour wash solution entire work of colour washing is taken up in hand, it shall be noted that small areas of colour wash will appear lighter than when the same shade is applied to the large surface.

2.2.2. For colour washing on decorated surfaces, after (he surface has been prepared, a coat of white wash shall be applied for the patches and repairs. Then one coat or more of colour wash shall be applied over the entire surface, such that the colour washed surface shall present a uniform colour shade. No primary coat is needed for a decorated surface bearing colour of same shade on surface required change of colour after the surface has been prepared as described above. Two coats of white wash shall be applied before application of specified number (minimum two) of coats of colour wash of the new shade.

2.3. Protective measure :

The surface of doors, windows, floors, articles, of furniture etc. and such other parts of the building not to be white washed shall be protected from being splashed upon. Such surfaces shall be cleaned of white wash splashed if any.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 18 11 shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

18.18. Colour washing with lime on decorated wall surfaces (one coat) to give even shade including thoroughly brooming the surface to remove all dirt, dust, mortar drops and loose scales of lime wash and other foreign matter.

1.0. Materials and Workmanship

The relevant specifications item No 18.17 shall be followed except that the colour washing shall be carried out on decorated wall surface in one coat

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No 18.7 shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

18.19. Extra over item No 13.17 and 18.18 for every subsequent coat of colour wash with lime on wall surfaces.

1.0 Materials and Workmanship

1.1 The relevant specifications item No. 18.17 shall be followed except that this work is for extra coat of colour wash over and above two coats on wall surface.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 18.17 shall be followed except that the extra payment for every subsequent coat of white wash shall be made over and above the rate of item. 18.17 and 18.18.

2.2. The rate shall be for a unit of one sq. meter.

18.20. Extra over item 18.17 for colour washing on ceilings and /or sloping roofs.**1.0. Materials and workmanship**

1.1. The relevant specifications of item No. 18.17 shall be followed except that this work is for colour washing on ceiling and/or sloping roofs.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.17 shall be followed except that the-rate shall be paid extra over and above the rate of item No. 18.17 for providing colour washing on ceiling and /or sloping roof.

2.2. The rate shall be for a unit of One sq. meter.

18.29. Cement washing with port land cement slurry on undecorated wall surfaces, (one coat) to give a smooth finish including thoroughly brooming the surface to remove all dirt, dust, mortar drops and other foreign matter.**1.0. Materials**

1.1. Water shall conform to M-1. Part land cement shall conform to M-3.

2.0. Workmanship

2.1. The relevant specification of item No. 18.11 for preparation of surface, scaffolding, application of wash etc. shall be followed except that the cement wash shall be applied, instead of white wash. Cement applied with brushes to form a smooth bodied opaque surface.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 18.11 shall be followed.

3.2. The rate shall be for a unit of one sq. meter.

18.30. Extra over item No. 18.29 for every subsequent coat of cement washing with port land cement slurry.**1.0. Materials Workmanship**

1.1. The relevant specifications of item No. 18.29 shall be followed except that the work of cement slurry wash shall be provided for every subsequent coat above item No. 18.29 to be applied.

2.0. Mode of measurements and payment

2.1. The relevant specification of item No. 18.29 shall be followed except that the extra rate shall be paid for every subsequent coat and above the rate of item No. 18.29.

2.2. The rate shall for a unit of One sq. meter.

18.33. Removing dry or oil bound distemper by washing scraping and sand papering the wall surface smooth including necessary repairs to scratches complete.**1.0. Materials and Workmanship**

1.1. All loose places and scaled shall be removed by sand papering and surface shall be cleared of all greasycay, dust, dirt, etc. on decorated wall surfaces. Where heavy scaling has taken place, the entire surface shall be scrapped by means of steel scrappers so as to remove all accumulated distemper, leaving clean surfaces. Necessary repairs to the scratches shall be made as directed.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.11. shall be followed.

2.2. The rate shall be for a unit of One sq. meter,

13.34. Extra over item No. 18.33. for removing dry oil bound distemper on ceiling and sloping and roofs.**1.0. Workmanship**

1.1. The relevant specifications of item No. 18.33 shall be followed except that removing dry/oil bound distemper from sloping roof/ceiling is to be carried out.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.33 shall be followed except that the payment shall be made for removing dry/oil bound distemper from ceiling/sloping roof over and above the rate of item No. 18.33.

2.2. The rate shall be for unit of one Sq. meter.

18.38. Distemping with dry (water bound) Distemper of approved brand and manufacture (two coats) and of required shade on undecorated wall surfaces to give an even shade, over and including a priming coat of white washing after thoroughly brooming the surface free from mortar droppings and other foreign matters.

1.0. Materials

1.1. The dry distemper and primer shall be of approved brand and manufacture. The dry distemper shall be of required colour and shade and the same shall conform to I.S. 427-1965. Writing shall conform to I.S. 63-1964.

2.0. Workmanship

2.1. Scaffolding : Where scaffolding is required it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be distempered. A properly secured strong and well tied suspended platform (Joolas) may be used for distemping. Where ladders are used- pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. \For distemping to ceiling, proper stage scaffolding shall be erected where necessary.

2.2. Preparation of Surface.

2.2.1. The undecorated surface to be distempered shall be thoroughly brushed free from dust, dirt, grease, mortar, droppings and other foreign matter and sand papered smooth. New plaster surface shall be allowed to dry at least 2 months before application of distemper.

2.2.2. All unnecessary nails shall be removed. Pitting in plaster shall be made good with plaster of Paris mixed with dry distemper of the colour to be used. The surface shall then be rubbed down again with a fine grades and paper and made smooth. The surface affected by moulds, moss, fang, algae lichens, efflorescence etc. shall be treated in accordance with I.S. 2395 (Part-I) 1966 before applying distemper. Any unevenness shall be made good by applying putty made of plaster of Paris mixed with water on entire surface including filling up the undulations and then sand papering the same after it is dry.

2.3. Priming coat :

2.3.1. A priming coat of whitening shall be applied as per item No. 18.11 over the prepared surface in case of new work on undecorated surface. No coat of white washing with lime shall be used as a priming coat for distemper.

2.3.2. Application of plaster shall be done as under:

The primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical stokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours before oil bound distemper or paint is applied.

2.3.3. Distemper is not recommended to be applied within six months of the completion of wall plaster.

2.4. Proportion of Distemper : The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturers only. Sufficient quantity of distemper required for one day's work shall be prepared.

2.5. Application of Distemper coat :

2.5.1. For undecorated surfaces after the primer coat is dried for at least 48 hours, the surfaces shall be lightly sand papered to make them smooth for receiving the distemper, taking care not to rub out the priming coat. All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed immediately by vertical strokes which together shall constitute one coat. The subsequent coats shall be applied after a time interval strokes which together shall constitute one coat. The subsequent coats shall be applied after a time interval of at least 24 hours between consecutive coats to permit proper drying of the preceding coat. The finished surface shall be even and uniform without patches, brush marks, distemper drops etc.

2.5.2. Sufficient quantity of distemper shall be mixed to finish on room at a time. The application of a coat in each room snail be finished in one operation and no work shall be started in any room which cannot be completed, on the same day.

2.5.3. 15 cm. double bristle distemper brush shall be used. After the day's work, brushes shall be thoroughly washed in hot water with soap solution and hang down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

2.6. Protective Measures : The surfaces of doors, windows, floors, articles of furniture etc. and such other parts of the building as are not to be distempered shall be a plashed form being splashed upon. Such surfaces shall be cleaned of distemper a plashes if any.

3.0. Mode of measurements and payment

3.1. Pruning coal of distemper primer, scraping of surface spoiled by smoke soot, removal of oil and grease spots, treatment for infraction of effloresces, mould moss, fungi, algae and lichens and patch repairs to plaster shall be included in this item for which nothing extra shall be paid.

3.2. All the work shall be measured net in the decimal system as in places subject to the following limits unless otherwise stated hereinafter:

(a) Dimensions shall be measured to the nearest 0.01 m.

(b) Area in individual items shall be worked out to the nearest 0.01 sq. m. All work shall be measured in sq. meter. No deductions shall be made for ends of joints, beams, posts, etc. of these openings nor for finish around the ends of joints, beams, posts etc.

3.3. Deductions of openings exceeding 0.5 sq.m. but not exceeding 3 sq. m. each shall be made as follows and no addition shall be made for reveal, jambs, soffits etc. of these openings:

(a) When both the faces of walls are provided with the same finish deductions shall be made for one face only.

(b) When each face of wall is provided with different finish, deduction shall be made for that of frame for door, windows etc. on which width of reveal is less than that of the other side but no deductions shall be made on the other side. Where the width of reveals on the both the faces of wall are equal, deduction of 50% of area of opening on each face shall be made from area of finish.

(c) When only one face of wall is treated and the other face is not treated, full deductions shall be made if the width of the reveal on treated side is less than that on untreated side but if the width of the reveals is equal or more than that of untreated side neither deductions nor additions to be made for reveals, jambs, sills and soffits shall be measured

3.4. In case of openings of area exceeding 3 sq.m. each, deduction shall be made for openings, but jambs, sills and soffits shall be measured.

3.5. No deductions shall be made for attachments such as casing, conduits, pipes, electric wiring and the like.

3.6. Item includes removing nails, making good holes, cracks, patches with materials similar in composition to the distemper.

3.7. The rate includes cost of all materials, labour, scaffolding, protective measures etc. involved in all the operations described above This shall also include conveyance, delivery, bundling, unloading storing etc.

3.8. The rate shall be for a unit of One sq. meter.

18.39. Distemping with dry (wafer bound) distemper of approved brand and manufacture (one coat) and of required shade, on decorative wall surface to give an even shade after thoroughly brushing the surface clean of all grease dirt, loose pieces of scales including preparing the surfaces and even sand papered smooth.

1.0. Materials and workmanship

The relevant specifications of Kern No. 18,38 shall be followed except that the dry distemper shall applied on decorative wall surface in on coat.

2.0. Mode of measurements and payment

2.2. The rate shall be for a unit of One sq. meter.

18.40. Extra over item 38 and 39 for every subsequent coat of distemper with dry distemper of approved brand and manufacture.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.38 shall be followed except that the extra work for applying subsequent coat of dry distemper is to be carried out over and above the work of item No. 18.38 and 18.39.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.38 shall be followed except that extra rate shall be paid for every subsequent coat applied over and above the rate of item No. 18.38 and 18.39.

2.2. The rate shall be for a unit of One sq. meter.

18.41. Extra over item 38 for distempering with dry distemper on ceiling and sloping roofs.**1.0. Materials and workmanship**

1.1. The relevant specifications of item No. 18.38 shall be followed except that the dry distempering shall be carried out on ceiling and sloping roofs of undercoats surface.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 18.38 shall be followed except that extra rate shall be paid for carrying outwork on ceiling/sloping roof on undecorated surface over and above the rate of item 18.38.

2.2. The rate shall be for a unit of One sq. meter.

18.42. Extra over item 39 and 40 for distempering with dry distemper on ceiling/sloping roofs.**1.0. Materials and Workmanship**

1.1. The relevant specifications of item No. 18.39 shall be followed except that the work shall be carried out on ceiling/sloping roofs on decorated surfaces.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.39 shall be followed except that the extra rate shall be paid for the distempering work carried out by dry distempered on ceiling/sloping roofs with decorated surfaces over and above the rate of item N. 18.39.

2.2. The rate shall be for a unit of One sq. meter.

18.44. Distempering (two coats) with oil bound distemper of approved brand and manufacture and of required shade on undecorated wall surfaces to give an even shade, over and including a priming coat with distemper primer of approved brand and manufacture after thoroughly brushing the surface free from mortar droppings and other foreign matter and also including preparing the surface even and sand papered smooth.**1.0. Materials**

1.1. Oil bound washable distemper and primer shall be of approved brand and manufacture. The distemper shall be of required colour and shade and the same shall conform to I.S. : 428-1969.

2.0. Workmanship**2.1. Scaffolding**

Where scaffolding is required, it shall be erected in such a way that as far as possible no part of scaffolding shall rest against the surface to be distempered. A properly secured and well tied suspended platform (Joola) may be used for distempering. Where ladders are used, pieces of old gunny bags shall be tied at top and bottom to prevent scratches to the walls and floors. For distempering to ceiling, proper stage scaffolding shall be erected where necessary.

2.2. Preparation of surface :

2.2.1. The undecorated surface to be distempered shall be thoroughly brushed from dust, dirt, grease, mortar dropping and other foreign matter and sand papered smooth. New plaster surface shall be allowed to dry for at least 2 months before applications of distemper.

2.2.2. All unnecessary nails shall be removed. Pitting in plaster shall be made good with plaster again with a fine grade sand paper and made smooth. A coat of distemper shall be applied over the patches. The surface shall be allowed to dry thoroughly before the regular coat of distemper is allowed. The surface affected by moulds, moss, fungi, algae lichens, efflorescence etc. shall be treated in accordance with I.S; 2395 (Part 01) 1966. Before applying distempering, any unevenness shall be made good by applying putty made of plaster of paris mixed with water on entire surface including filling up the undulation and then sand papering the same after it is dry.

2.3. Priming coat :

2.3.1. A priming coat of distemper primer of approved manufacture and shade shall be applied over the papered surface in case of new work on undecorated surface. If the distemper priming is done after the wall surface dries completely, the distemper primer shall be applied.

2.3.2. Application of primer shall be done as under: The primer shall be applied with a brush on the clean dry and smooth surface. Horizontal strokes shall be given first and vertical strokes shall be applied immediately afterwards. This entire operation will constitute one coat. The surface shall be finished as uniformly as possible leaving no brush marks. It shall be allowed to dry for at least 48 hours before oil bound distemper or paint is applied.

2.3.3. Oil bound distemper is not recommended to be applied within six months of the completion of wall plaster.

2.4. Preparation of oil bound distemper :

2.4.1. The distemper shall be diluted with water or any other prescribed thinner in a manner recommended by the manufacturer only. Sufficient quantity of distemper required for a days work shall be prepared.

2.5. Application of Distemper coat:

2.5.1. For undecorated surfaces, after the primer coat is dried for at least 48 hours, the surface shall be lightly sand papered to make it smooth for receiving the distemper, taking care not to rub out priming coat. All loose particles shall be dusted off after rubbing. Minimum two coats of distemper shall be applied with brushes in horizontal strokes followed immediately by vertical strokes which together shall constitute one coat. The subsequent coats shall be applied after a time interval of at least 24 hours between consecutive coats to permit proper drying of the preceding coat. The finished surface shall be even and uniform without patches, brush marks, distemper drops etc.

2.5.2. Sufficient quantity of distemper shall be mixed to finish one room at a time. The application of a coat in each room shall be finished in one operation and no work shall be started in any room which cannot be completed on the same day.

2.5.3. 15 cm. double bristled distemper brush shall be used. After day's work brushes shall be thoroughly washed in hot water with soap solution and hung down to dry. Old brushes which are dirty and caked with distemper shall not be used on the work.

2.6. Protective measurements : The surfaces of doors, windows, floors, articles of furniture etc. and such other parts of the buildings as are not to be distempered shall be protected from being splashed upon. Such surfaces shall be cleaned of distemper splashes if any.

3.0. Mode of measurements and payment

3.1. Priming coat of distemper primer, scraping of surface spoiled by struck roots, removal of oil and grease spots, treatment for infraction of effloresces., mould moss, fungi, algae and lichen and patch repairs to plaster shall be included in this item for which nothing extra shall be paid.

3.2. All the work shall be measured net in the decimal system as in place subject to the following limits unless otherwise stated hereinafter:

(a) Dimensions shall be measured to the nearest 0.01 m.

(b) Area in individual items shall be worked out to the nearest 0.01 sq. m. All work shall be made for ends of joints, beams, posts etc., and openings, not exceeding 0.5 sq.mt. each and no addition shall be made for reveals, jambs, soffits, sills etc. of these openings not for finish around ends of joints, beams, posts etc.

3.3. Deductions of opening exceeding 0.5 sq.m. but not exceeding 3 sq. m. each shall be made as follows and net addition shall be made for reveals, jambs, soffits etc. of these openings :

(a) When both the faces of wall are provided with same finish, deductions shall be made for one face only.

(b) When each face of wall is provided with different finish, deduction shall be made for that side of frame for doors, windows etc. on which width of reveals is less than that of the other side but no deduction shall be made on the other side. Where the width of reveals on the both the faces of wall are equal, deduction of 50% of area of opening on each face shall be made from area of finish.

(c) When only one face of wall is treated and the other face is not treated, full deductions shall be made if the width of the reveal on treated side is less than that on untreated side but if the width of the reveal is equal or more than that on untreated side neither deductions nor additions to be made for reveals, jambs, soffits, sills etc.

3.4. In case of opening of area exceeding 3 sq. m. each deduction shall be made for openings but jambs, sills and soffits shall be measured.

- 3.5. No deductions shall be made for attachments such as casings, conduits, pipes, electric wiring and the like.
- 3.6. Item includes removing nails, making good holes, patches with materials similar in composition of distemper.
- 3.7. The rate includes cost of ail materials, labours, scaffolding, protective measures etc. involved in all the operations described above. This shall also include conveyance, delivery, handing , unloading, storing work etc
- 2.8. The rate shall be for a unit of one sq. meter
- 18.45. Distempering (two coats) with oil bound washable distemper of approved brand and manufacture and of shade required on undecorated wall surfaces to give an even shade, over and including a priming coat with alkali resistance primer of approved brand and manufacture after thoroughly brushing the surface free from mortar droppings and other foreign matter and also including preparing the surface even and sand papered smooth.**
- 1.0. Materials and Workmanship**
- 1.1. The relevant specifications of item No. 13.44 shall be followed except that the primer of alkali resistance primer of approved brand and manufacture shall be used instead of distemper primer.
- 2.0. Mode of measurements and payment**
- 2.1. The mode of measurements and payment shall be the same as for item No. 18.44 above.
- 2.2. The rate shall be for a unit of one sq. meter.
- 18.46. Distempering (one coat) with oil bound washable distemper of approved brand of required shade on decorated wall surfaces to give an even shade after thoroughly brushing the surfaces clean of all grease, dirt, loose pieces of scales and also including distempering with oil bound washable distemper of preparing the surface even and smooth.**
- 1.0. Materials and Workmanship**
- The relevant specifications of item No. 18.44 shall be followed except that the distempering with oil bound washable distemper shall be carried out on decorated wall surfaces in on coat.
- 2.0. Mode of measurement and payment**
- 2.1. The relevant specification of item No. 18.44 shall he followed.
- 2.2. The rate shall be for a unit of one sq meter.
- 18.47. Extra over item 18.44 to 18.46 for every subsequent coat of distempering with oil bound washable distemper of approved brand and manufacture.**
- 1.0. Materials and Workmanship**
- 1.1. The relevant specifications of item No. 18 44 shall be followed except that this work is for providing extra coat of oil bound distempering over and above two coats of distempering.
- 2.0. Mode of measurements and payment**
- 2.1. The relevant specification of item No, IS K shall be followed except that the extra rate shall be paid over and above the rate for every subsequent coats over two coats of item 18.44 and 18.46.
- 2.2. The rate shall be for a unit of one sq. meter.
- 18.48. Extra over item 18.44. and 18.45 for distempering with oil bound washable distemper on ceiling and sloping roofs.**
- 1.0. Materials and Workmanship**
- The relevant specifications of item No. 18.44 shall be followed except that the distempering shall be carried out on ceiling/sloping roofs.
- 2.0. Mode of measurements and payment**
- 2.1.1. The relevant specifications of item No. 18.44 shall be followed except that the extra rate shall be paid for carrying our distempering work on ceiling/sloping roofs over and above the rate of item No. 18.44 and 18.45.
- 2.2. The rate shall be for a unit of one sq. meter.
- 18.49. Extra over item 18.46 and 18.47 for every subsequent coat of distempering on ceiling and sloping roofs.**

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.44 shall be followed except that the distemping work shall be carried out for subsequent coats over item No. 18.46 and 18.47.

2.0. Mode of measurements and payments

2.1. The relevant specifications of item No. 18.46 shall be followed except that the extra rate shall be paid for every subsequent coat of distemper applied over and above the rate of item No. 18.46 and 18.47.

18.51. Finishing wall with water proofing cement paint of an undecorated wall surfaces (two coats) to give an approved brand and manufacture and of required shape, even shade after thoroughly brushing the surface to remove.

1.0. Materials

1.1. The water shall conform to M-1. Cement water proofing paint shall conform to I.S. 5410-1969.

2.0. Workmanship

2.1. **Scaffolding** : The relevant, specifications of item No. 18.11 shall be followed.

2.2. Preparation of surface :

The relevant specifications of item No. 18.11 shall be followed except that the word white wash colour wash shall be substituted with water proofing cement paint. The surface shall be thoroughly wetted with clean water before cement water proofing paint is applied.

2.3. **Preparation of paint:** Portland cement paint shall be prepared by adding paint powder to water and stirring to obtain a thick paste, which shall then be diluted to a brush able consistency. Generally, equal volumes of paint powder and water make a satisfactory paint. In all cases, The manufacture's instructions shall Site followed. The paint shall be mixed in such quantities as can used up within an hour of mixing as otherwise the mixture will set and thickness, affecting flowing and finish. The lids of cement paint drums shall be kept tightly when not in use.

2.4. Application of Paint:

2.4.1. No painting shall be done when the paint is-likely to be exposed to a temperature of below 7⁰ c within 48 hours after application.

2.4.2. When weather conditions are such as to cause be carried out in the shadow as far as possible. This helps the proper hardening of the paint film by keeping the surface moist for a longer period.

2.4.3. To maintain the uniform mixture and to prevent segregation, the paint shall be stirred frequently in the bucket.

2.4.4. For undecorated surfaces, the surface shall be treated with minimum two coats of water proof cement paint. Not less than 24 hours shall be allowed between two coats. Next coat shall not be started until the proceeding coat has become sufficiently hard to resist marking by the brush being used. In hot dry weather, the proceeding coat shall be slightly moistened before applying the subsequent coat.

2.4.5. The finished surface shall be even and uniform in shade, without patches, brush marks, paint drops etc.

2.4.6. The cement paint shall be applied with a brush with relatively short stiff hog or fiber bristles. The paint shall be brushed in uniform thickness and shall be free from excessively heavy brush marks. The lamps shall be brushed out.

2.4.7. Water proof cement paint shall not be applied on surface already treated with white wash, colour wash, distemper dry or oil bound varnishes, paint etc. It shall not be applied on gypsum, wood and metal surfaces.

2.5. **Curing** : Painted surfaces shall be sprinkled with water two or three times a day. This shall be done between coats and for at least two days following the final coat. The curing shall be started as soon as the point has hardened so as not be damaged by the sprinkling of water say about 12 hours after the application.

2.6. Protection measures shall be taken as per item No. 18.11 Para 2.6.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 18.11. shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

18.53. Extra over item 18.51 for every subsequent coat of water proofing cement paint of approved brand and manufacture.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.51 shall be followed except that the work is for applying subsequent coat of cement water proofing paint.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.51 shall be followed except that the extra rate shall be paid for applying every subsequent coat of cement water proofing paint over and above the rate of item No. 18.51.

2.2. The rate shall be for a unit of One Sq. meter.

18.54. Extra over item 18.51 for finishing with cement paint on ceiling/sloping roofs.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.51 shall be followed except that the cement water proofing paint shall applied on ceiling and sloping roofs.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.51 shall be followed except the extra shall be paid for applying cement water proofing paint on ceiling and sloping roofs, over and above the rate of item No. 18.51.

2.2. The rate shall be for a unit of One sq. Meter.

18.56. Extra over 18.53 for every subsequent coat of finishing with cement paint on ceiling and sloping roofs.

1.0. Materials and Workmanship

1.1. The relevant specification of item No. 18.51 shall be followed except that the work shall be carried out for subsequent coat on ceiling and sloping roofs.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.53. shall be followed except that extra rate shall be paid for every subsequent coat applied with cement water proofing paint over and above the rate of item No. 18.53.

18.57. Wall painting (two coats) with plastic emulsion paint of approved brand of manufacture on undecorated wall surfaces to give an even shade including thoroughly brushing the surface free from mortar droppings and other foreign matter and sand paper smooth.

1.0. Materials

Water shall be conform M-1. The plastic emulsion shall conform to I.S.: 5411-1969 (part-I).

2.0. Workmanship

2.1. Scaffolding : The relevant specifications of item-No. 18.11 Para 2.1 shall be followed.

2.2. Preparation of surface : The relevant specification of item No. 18.44 Para 2.2 shall be followed.

2.3. Preparation of Mix :

This shall be done as per manufacture's instructions. The thinning of emulsion is to be done with water and not with turpentine. The quantity of thinner to be added shall be as per manufacturer instructions.

2.4. Application :

2.4.1. Before pouring into small containers for use, the paint shall be stirred thoroughly in item container. When applying also, the paint shall be continuously stirred in the smaller container, so that its consistency is kept uniform.

2.4.2. The paint shall be laid on evenly and smoothly by means of crossing and laying off the crossing and consist of covering the area over with paint, brushing the surface hard for the first time over and then, brushing alternately in opposite direction two or three times and then finally brushing lightly in direction at right angles to the same. In this process, no brush Marks shall be left after the laying off is finished. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings, etc. shall be left on the work. The full process of crossing and laying off will constitute one coat.

2.4.3. The paint shall be applied with brush or rollers. For undecorated surfaces, the surface shall be treated with minimum two coats of cement water proofing paint. The second or subsequent coat shall not

be started until the proceeding coat as become sufficiently hard to resist marking by brushing being used.

2.4.4. The surface on finishing shall present a flat velvety smooth finish. It shall be even and uniform in shade without patches, brush marks, paint drops etc.

2.5. Precautions :

(a) Old brushes if they are to be used with emulsion paints, shall be completely dried of turpentine or oil paint by washing in warm soap water. Brushes shall be quickly washed in water immediately after use and kept immersed in water fusing break periods to prevent the paint from hardening on the brush.

(b) In the preparation of wall for plastic emulsion painting, no oil base petals shall be used in filling cracks, holes etc.

(c) Splashes on floors etc. shall be cleaned out without delay as they will be difficult to remove after hardening.

(d) Washing or surfaces treated with emulsion paint shall not be done within 3 to 4 weeks of application

2.6. Protective payment : The relevant specifications of item No. 18.11 shall be followed.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 18.11 shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

18.59. Extra over item No. 18.57 for every subsequent coat of wall painting with plastic emulsion paint of approved brand.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.57 shall be followed except that the painting work shall be for subsequent coat of plastic emulsion paint.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.57 shall be followed except that the extra payment shall be done on ceiling and sloping roofs.

2.2. The rate shall be for a unit of One sq. meter.

18.60. Extra over item 18.57 for painting with plastic emulsion paint of approved brand on ceiling and sloping roofs.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.57 shall be followed except that the painting shall be done on ceiling and sloping roofs.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.57 shall be followed except that the extra payment shall be made for applying plastic emulsion paint on ceiling and sloping roofs over and the rate of item No. 18.57.

2.2. The rate shall be for a unit of One sq. meter.

18.62. Extra over item 18.59 for paint ceiling and sloping roofs.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 18.57 shall be followed except that the work for subsequent coat of plastic emulsion paint shall be carried out on ceiling and sloping roofs.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 18.57 shall be followed except that the extra rate shall be paid for carrying out painting on sloping roofs and ceiling with plastic emulsion paint over and above the rate of item No. 18.59

2.2. The rate shall be a unit of One sq. meter.

SECTION-19
Paintings & Polishing

19.7. Painting two coats (excluding priming coat) on new steel and other metal surfaces with enamel paint, brushing, interior to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials

The enamel paint shall conform to M-44 B.

2.0. Workmanship

2.1. General : The materials required for work of painting work shall be obtained directly from approved manufacturers or approved dealer and brought to the site in maker's drums; kegs. etc. with seal unbroken.

2.1.2. All materials not in actual use shall be kept properly protected, lids of containers shall be kept closed and surface of paint in open or partially open containers covered with a thin layer of turpentine to prevent formation of skin. The materials which have become state or flat due to improper and long storage shall not be used. The paint shall be stirred thoroughly in its container before pouring into small containers. While applying also, the paint shall be continuously stirred in smaller container. No left over paint shall be put back into stock tins. When not in use the containers shall be kept properly closed.

2.1.3. If for any reasons, things is necessary, the brand of thinner recommended by the manufacturer shall be used.

2.1.4. The surface to be painted shall be thoroughly cleaned and dusted. All rust, dirt and grease shall be thoroughly removed before painting is started. No painting on exterior or other exposed part o the work shall be carried out in wet, damp or otherwise unfavorable weather and all the surfaces shall be thoroughly dry before painting work is started.

2.2. Application of paint:

2.2.1. Brushing operations are to be adjusted to the spreading capacity advised by the manufacture of particular paint. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing the surface hard for the first time over and then brushing alternately in opposite directions two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the -laying off is finished. The full process of crossing and laying off will constitute one coat.

2.2.2. Each coat shall be allowed to dry completely and lightly rubbed with very fine grade of sand-paper and loose particles brushed off before next coat is applied. Each coat shall vary slightly in shade and shall be got approved from Engineer-in-charge before next coat is started.

2.2.3. Each coat the last shall be lightly rubbed down with sand paper of fine pumice stone and cleaned of dust before the next coat is applied. No hair marks from the brush or clogging of paint puddles in the corners of panels, angles of moldings etc. shall be left on the work.

2.2.4. Special care shall be taken while painting over bolts, nuts, rivets, overlaps etc. Approved best quality brushes shall be used.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 19.12 shall be followed for mode of measurements and payment. The rate is excluding priming coat.

3.4. The rate shall be for a unit of One sq. meter.

19.15. Extra over item No. 19.7 and 19.11 for every subsequent coat of paint.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 19.7 shall be followed except that the work of painting shall be carried out for subsequent coat.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.7 shall be followed except that the extra rate shall be paid for every subsequent coat of paints applied over and above the rate of item No. 19.7 and 19.11.

2.2. The rate shall be for a unit of One sq. meter.

19.11. Painting one coats Excluding priming coat) on previously painted steel and other metal surface with enamel paint, brushing to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials and Workmanship'

1.1. The relevant specification of item No 19.7 shall be followed except that painting shall be carried out in one coat with enamel paint on previously painted steel and metal surface.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No, 19.7 shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

19.12. Applying priming coat over new steel and other metal surfaces after and including preparing the surface by thoroughly cleaning oil, grease, dirt and other foreign matter and secured with brushes, fine steel, wool scrapers and sand paper, with ready mixed priming paint, brushing red lead.

1.0. Materials

1.1. The ready mixed primer, brushing red shall conform to I.S. 102-1962.

1.2. The thinner (linseed oil) shall conform to I.S. 75-1973. If for any reason, thinning is necessary in case of ready mix paint the brand of thinner recommended by manufacturer shall be used.

2.0. Workmanship

2.1. Preparation of surfaces : The surfaces painting shall be cleaned of all rust, scale, dirt and other foreign matter sticking to it with wire brushes, steel wool, scrapers, sand paper etc. This surface shall then be wiped finally with mineral turpentine which shall also remove grease and perspiration of hand marks. The surface shall then be allowed to dry.

2.2. Application of primer :

2.2.1. After the preparation of the surface, the priming coat shall be applied immediately. The brushing operations are to be adjusted to the spreading capacity advised by the manufacturer of the particular primer. The paint shall be applied evenly and smoothly by means of crossing and laying off. The crossing and laying off consists of covering the area over with paint, brushing alternately in opposite directions, two or three times and then finally brushing lightly in a direction at right angles to the same. In this process, no brush marks shall be left after the laying off is finished. The full process of crossing and laying off will constitute one coat.

2.2.2. During painting, every time, after the priming coat has been worked out of the brush bristles or after the brush has been unloaded, the bristles of the brush shall be opened up by striking the brush against portion of the unpainted surface with the end of the bristles, held at right angles to the surface, so that bristles thereafter will collect the correct amount of paint when dipped again in to a paint container. The primary coat shall be allowed to dry completely before painting is started.

2.2.3. No hair marks from the brush or clogging at paint puddles in the corner of panels angles of molding etc. shall be left on the work.

2.2.4. Special care shall be taken while painting over bolts, nuts, rivets, overlaps etc.

2.2.5. The container when not in use shall be kept close and free from air so that paint does not thicken and also shall be kept guarded from dust.

3.0. Mode of measurements & payment

3.1. The new steel and other metal surface shall be measured under this item.

3.2. All the work shall be measured net in the decimal system, as executed subject to the following limits unless otherwise stated hereinafter.

(a) Dimensions shall be measured to the nearest 0.01 meter.

(b) Areas shall be worked out to the nearest 0.01 sq. meter.

3.3. No deductions shall be made for openings not exceeding 0.5 sq. mt. each and no addition shall be made for painting to beddings, moldings, edges, jambs, soffits, sills etc. of such opening.

3.4. In case of fabricated structural steel and iron work, priming coat of paint shall be included with

frabation. In case of trusses if measured in sq. m. compound girders, stanchions, lattices, grader and similar work, actual area shall be measured in sq. m. and no extra shall be paid for painting on bolts heads, nuts, washers etc. No addition shall be made to 1 he weight calculated for the purpose of measurements of steel and iron works for paint applied on shop or at site.

3.5. The different surfaces shall be grouped into one general item, areas of uneven surfaces being converted into equivalent plain areas in accordance with the table given as per Annexure-II for payment.

3.6. The rate shall be for a unit of One sq. meter.

19.19. Painting two coats (excluding priming coat) on new steel and other metal surfaces with synthetic enamel paints, brushing to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials

Synthetic enamel paint shall conform to I.S. 1932-1964.

2.0. Workmanship

2.1. The relevant specifications of item No. 19.7 shall be followed except that the painting shall be carried out with synthetic enamel paint.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 19.7 shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

19.21. Painting one coat (excluding priming coat) on previously painted steel and other metal surfaces with synthetic enamel paint brushing to give an even shade including cleaning the surface of all dirt, dust and other foreign matter.

1.0. Materials and Workmanship

2.1. The relevant specifications of item No. 19.19 shall be followed except that the painting shall be carried out on previously painted steel and other metal surfaces using synthetic enamel paint in one coat.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.19 shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

19.13. Extra over item No. 19.19 and 19.21 for every subsequent coat of paint.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 19.19 shall be followed except that the extra rate shall be paid for out for subsequent coat of point.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 19.19 shall be followed except-that the work shall be paid for applying subsequent coat of oil paint over and above the item No. 19.19 and 19.21.

19.50.(B) Painting two coat (excluding priming coat) on external of new rain water, soil, waste and vent pipe and fittings with ready mixed bituminous paint, brushing, black anticorrosive to give an even shade including cleaning of all dirt, dust and other foreign matter (75 mm. dia.)

1.0. Materials

1.1. Ready mixed bituminous pain shall conform to I.S. 158 : 1968.

2.0. Workmanship

2.1. The relevant specifications of item No. 19.7 shall be followed except that the paining work of external surfaces of 75 mm. dia rain water pipe, soil, waste, and vent pipe and fittings with ready mixed bituminous paint snail be earned out.

3.0. Mode of measurements and payment

3.1. The rate is excluding the cost o priming coat but including painting of all fittings coming in line.

3.2. The rate shall be for a unit of one running meter,

19.50.(C) Painting two coats (excluding priming coat) on external of rain water, soil, waste and vent pipe and fittings with ready mixed bituminous paint brushing black anticorrosive to give an even shade including cleaning off all dirt, dust and other foreign matter : 100 mm. dia.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 19.50 (B) shall be followed except that the pipes to be painted on is 100 mm. dia. meter.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 19.50(B) shall be followed. The rate is excluding the cost of priming coat but including cost of painting all fittings coming in line.

2.2. The rate shall be for a unit of one running meter.

19.59.(B) Applying priming coat over wood and wood based surfaces after and including preparing the surface by thoroughly oil, grease, dirt and other foreign matter, sand papering and knotting : Ready mixed paint, brushing wood primer pink.

1.0. Materials

1.1. The ready mixed paint, brushing, wood primer pink shall conform to I.S. 3536-1966

2.0. Workmanship**2.1. Preparation of Surfaces :**

2.2.1. AH wood work shall be dry and free from any foreign matter incidental to building operations. Nails shall be punched well below the surface to provide a film key for stopping. Moldings shall be carefully smoothed with abrasive paper and projecting fibers shall be removed. Flat portions shall be smoothed off with abrasive paper used across the grain prior to painting and with the grain prior to staining or if the wood is to be left in its natural colour, wood work which is to be stained may be smoothed by scraping instead of by glass papering if so required.

2.2.2. Any knots, resinous, streaks or bluefish sap wood that are not large enough to justify cutting out shall be treated with two coats of pure shellac knotting applied thinly and extended about 25 mm. beyond the actual area requiring treatment.

2.2. Application of primer :

2.2.1. The relevant specifications of item No. 19.12(A) shall be followed for application of primer.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 19.12 shall be followed except that work done on wood and wood based surfaces shall be paid under this item.

3.2. The rate shall be for a unit of One sq. meter.

19.59.(D) Applying priming coat over new wood and wood based surface after and including preparing the surface by thoroughly cleaning oil, grease, dirt and other forging matter sand papering and knotting : Ready mixed paint brushing priming, for enamel.

1.0. Materials

1.1. The ready mixed paint for brushing priming for enamels wood shall conform to I.S. 106-1962.

2.0. Workmanship

2.1. The relevant specifications of item No. 19.59 (B) shall be followed except that ready mixed paint brushing priming for enamel shall be used instead of ready mixed paint brushing wood primer pink.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 19.12 shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

19.62.(B) Extra over item 59.59 (B) for every subsequent coat of priming coat. Ready mix paint, brushing wood primer work.

1.0. Materials and workmanship

1..1. The relevant specifications of item No. 19.59 (B) shall be followed except that the painting work shall be carried out with ready mix paint instead of wood primer pink for subsequent coat.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.59 (B) shall be followed except that the extra rate shall be paid for every subsequent coat applied with Ready mix paint, brushing wood primer pink over and above the rate of item No. 19.59 (B).

19.62.(D) Extra over item No. 19.59 for every subsequent coat of priming coat ready mix paint brushing priming for enamel.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 19.59(D) shall be followed except that the painting work shall be carried out with ready mix paint brushing priming for enamel.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.59(D) shall be followed except that the extra rate shall be paid for every subsequent coats of priming coat with ready mixed paint, brushing priming for enamel.

2.2. The rate shall be for a unit of One sq. meter.

19.71. Painting two coats (excluding priming coat) on new wood and wood based surfaces with enamel paint interior to give an even shade including the surface off all dirt, dust and other foreign matter and papering and stopping.

1.0. Materials

1.1. The enamel paint shall conform to I.S. 133-1975.

2.0. Workmanship

2.1. The relevant specifications of 19.7 shall be followed for general and application of paint, except that the enamel paint shall be used for painting on new wood/wood based surfaces.

2.2. In painting doors and windows, the putty, round the glass panes also be painted but care shall be taken to see that no paint, stain etc. are left on the glass. Top of shutters and surfaces in similar hidden locations shall not be left out in painting.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 19.12 shall be followed, for mode of measurements and payments. The rate excludes cost of priming coat.

3.2. The rate shall be for a unit One sq. meter.

19.73. Painting one coat (excluding priming coat) on previously painted wood and wood based surfaces with enamel paint to give even shade including cleaning of all dirt, dust and other foreign matter.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 19.71 shall be followed except that the painting work shall be carried out on previously painted wood and wood based surfaces with enamel paint to give even shade in one coat.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.71 shall be followed

2.2. The rate shall be for a unit of One sq meter.

19.75. Extra over item 19.71 and 19.73 for every subsequent coat of paint.

1.0. Materials and Workmanship

1.1. The relevant specifications of item 19.71 shall be followed except that painting work shall be for subsequent coat with paint.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.71 shall be followed except that the extra rate shall be paid.

2.2. The rate shall be for a unit of One sq. meter.

19.77. Painting two coats (excluding priming coat) on new wood and wood based surfaces with ready mixed paint brushing, oil gloss, semi-gloss, to give an even shade including cleaning of all dust, dirt and other foreign matter sand papering and stopping.

1.0. Materials

The ready mixed paint shall conform to M-44. The ready mixed paint brushing gloss, semi-gloss shall conform to KS. 129-1962 and I.S. 117-1364.

2.0. Workmanship

2.1. The relevant specification of item 19.71 shall be followed for general and application of paint, except that ready mixed paint brushing, oil gloss and semi-gloss shall be used of approved colour and shade instead of enamel paint.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item 19.12 shall be followed for measurements and payment. The rate excludes cost of priming coat.

3.2. The rate shall be for a unit of One sq. meter.

19.84. Varnishing two coats (excluding priming coat) on new wood and wood based surfaces undercoating with flattening varnish and finishing coat with varnish to give an even surface cleared of all dirt, dust and sand papering so as to produce a smooth dry surface.

1.0. Materials

The varnish shall conform to I.S. 338-1962.

2.0. Mode of measurements & payment

2.1.1. The surface to be varnished shall be prepared to produce a smooth, dry neat surface. The previous coat of paint, if any shall be allowed to dry and rubbed down slightly whipped off and allowed to dry.

2.1.2. The operation of varnishing calls for careful attention to cleanliness. All dust and dirt shall be removed from the surface to be varnished and also from the neighborhood. If surfaces are dampened to avoid razing of dust, they shall be allowed to dry thoroughly before varnishing is commenced. Damp Exposure to extreme of heat or cold, or to a damp atmosphere will spoil the work.

2.1.3. In handling and applying varnish care should be taken to avoid forming forth or air bubbles. Brushes and containers shall be kept scrupulously clean.

2.2. Application

2.2.1. The varnish shall be applied liberally with a brush and spread evenly over a portion of the surface with a short light strokes to avoid froth in. It shall be allowed to flow out while the next section is being laid in. Excess varnish then be scrapped out of the brush and the first section be crossed, re crossed and the laid of lightly. Too much or too little varnish left on the surface will mar the appearance of the finish. The varnish, once it has begun to set, shall not be retouched. If a mistake is made, the varnish shall be removed and the work started afresh.

2.2.2. In case of two coats of varnish work, the first shall be hard drying, under coating or flattening varnish, this shall be allowed to dry hard and then be flattened down before applying the finishing coat. If two coats are applied, sufficient time shall be allowed between two coats.

2.2.3. When flat varnish is used for finishing a preparatory coat of hard drying under coating or flattening varnish shall be first applied and shall be allowed to harden thoroughly, It shall then be lightly rubbed down before the flat varnish is applied. Section of the work such as panels, shall be cut in clearly, so as to avoid any overlapping during applications, as this is likely to impart some measure, of gloss to partially dried area, worked up in lapping. On larger area the flat varnish shall be applied rapidly and the edges of each patch applied shall not be allowed to set but shall be followed up whilst in free working conditions-

3.0. Mode of measurements & payment

3.1. The relevant specifications of item 19.71 shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

13.86. Extra over item No. 19.84 for every subsequent coat of varnish.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No.19.84 shall be followed except that the work shall be for subsequent coat of varnishing.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item 19.84 shall be followed except that the extra rate shall be paid for every subsequent coat of varnishing done over and above the rate of item No. 19.84.

2.2. The rate shall be for a unit of One sq. meter.

19.87. Polishing with polish on new wood and wood based surface to give an even surface including cleaning the surface of all dirt, dust and sand papered smooth and including a coat of wood filler

1.0. Materials

1.1. The French polish required tint and shade shall be prepared with the below mentioned ingredients and other necessary materials : (i) Chandra (ii) Shellac (ic) Pigment. The French polish so prepared shall conform to I.S. 348-1968.

2.0. Workmanship**2.1. Preparation of surface :**

2.1.1. All unevenness shall be rubbed down to smoothness with sand paper and the surface shall be well dusted. The proper in the wood shall be filled up with a filler made of a paste of whiting in water or methylated spirit (with a suitable pigment like burnt sienna or umber if required) : otherwise the French polish will get absorbed and a good gloss will be difficult to obtain.

2.2. Application

2.2.1. A pad of wooden cloth covered by a fine cloth shall be used to apply the polish. The pad shall be moistened with polish and rubbed hard on the surface in a series of overlapping circles applying the polish sparingly but uniformly over the entire area to give an even surface. A trace of linseed oil on the face of the pad may be added which shall facilitate this operation. The surface shall be allowed to dry and the remaining coats applied in the same way. To finish off, the pad shall be covered with a fresh pieces of clean fine cloth, slightly dampened with methylated spirit and rubbed lightly and quickly with circular motions. The finished surface shall present a uniform texture and high loose.

3.0. Mode of measurements and payment

3.1. The relevant specification of item 19.12 shall be followed for mode of measurements and payment.

3.2. The rate includes cost of wood filler etc. complete.

3.3. The rate shall be for a unit of One sq. meter.

19.88. Polishing with French polish on previously polished wood and wood based surface to give an even surface including cleaning the surface of all dirt, dust and sand papered smooth including a coat of wood filler.

1.0. Materials & Workmanship

1.1. The relevant specifications of item No. 19.87 shall be followed that the French polish shall be applied on previously polished wood and wood based surface.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.87 shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

19.91. Applying wax polish on new Wood work and wood based surfaces with bees wax polish in proportion 2 : 1.5 : 1 : 0.5 (2 Bees Wax : 1.5 linseed oil: 1 Turpentine oil : 0.5 Varnish by weight) by give an surface including cleaning the surface of all dist, dust and sand papered smooth.

1.0. Materials

Bee's Wax shall conform to I.S. : 1504-1968. Linseed oil shall conform to I.S. : 75-1967. Turpentine shall conform to I.S. 83-1950. Varnish shall conform in I.S. 337-1952.

2.0. Workmanship**2.1. Preparation of bees wax :**

2.1.1. In case of, bees wax it shall be prepared locally with following specification.

2.1.2. Pure bees wax free from paraffin on strain adulterants shall be used. The polish shall be prepared from mixture of bees wax, linseed oil, turpentine, and varnish in proportion 2:1.5:1:0.5 by weight. The bees wax and boiled linseed oil shall be heated of a slow fire, when the wax is completely dissolved the mixture shall be cooled till it is just warm and turpentine and varnish added to it in the required proportions and entire mixture shall be well stirred.

2.2. Preparation of surfaces .

2.2.1. The surface to be waxed shall he prepared to produce a smooth, dry, matt surface. Previous coat of paint of stain if any shall be allowed to dry and be rubbed down lightly wiped off and allowed to dry ail dust and dirt shall be removed from the surface to waxed and also from the neighborhood. Damp atmosphere and draughts shall be avoided, for waxing, normal dry day snail be chosen.

2.3. Application :

2.3.1. The polish shall be applied evenly with clean soft pad of cotton cloth in such a w«y that the surface is completely and fully covered. The surface shall then be rubbed continuously for half an hour After well rubbing in one coat of wax polish, the work shall be covered with dust proof sheet. (Cloth for preventing dust falling on the work). Subsequent coat shall be applied after the surface is quite dry arid shall be rubbed off with soft flannel until the surface has assumed a uniform gloss and in dry showing no sign of Stickiness.

2.3.2. The final polish depends on the amount of rubbing which shall be continuous and with uniform pressure with frequent changes in the direction.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 19.12 shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

19.92. Applying wax polish on previous wax polished wood and wood based surfaces with bees wax polish in proportion of 2:1.5;1:0.5 (2 Bees wax 1.5 linseed oil : 1 Turpentine : 0.5 Varnish by weight) to give an even surface including cleaning the surface of all dirt, dust and sand papered smooth.

1.0. Materials and workmanship

1.1. The relevant specifications of item No. 19.91 shall be followed except that the wax polishing shall be carried out on previously wax polished wood and wood based surfaces with bees wax polish.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.91 shall be followed.

2.2. The rate shall be for a unit of One sq. meter.

19.98. Coat tarring two coats on new wood and wood based surfaces using 0.15 and 0.12 liters of coal tar per sq. m. in the first and second coat respectively to give an even shade including cleaning of all dirt, dust and other foreign matter ;

1.0. Material : The coal tar shall conform to I.S. 290-1961.

2.0. Workmanship

2.1. 200 cms. of unslaked lime shall be added to every liter of coal tar and heated till it begins to boil. It shall then be taken off the fire and kerosene oil added to it slowly the rate of 1 part kerosene oil and 6 parts or more parts of coal tar by volume and stirred thoroughly. The addition of lime is for preventing the tar from running.

2.2. Preparation of Surface :

2.2.1. The surface to be painted shall be allowed to dry sufficiently. Any existing fungus or mould growth shall be completely removed. All major cracks or defects in the plaster shall be cut out and made good. Before primer is applied holes and undulations shall be filled up with plaster of paris and rubbed smooth.

2.3. Application of paint:

2.3.1. The coat tar shall be applied as per relevant specifications of applying mixed paint item No. 19.7 except coat tarring is used instead of enamel paint.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 19.12 shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

19.119.(I) Writing letter of figures on any surface with black Japan paint (stops, commas, hyphens and the like not to be measured and paid for separately) : block (Letters/figures).

1.0. Materials

1.1. Ready mixed the black Japan paint shall conform to I.S. 341-1952.

2.0. Workmanship

2.1. The letters and figures shall be to the heights and widths as per approved drawings or as directed. These shall be stenciled or drawn in pencil and got approved before painting. They shall be of uniform size and finished neatly. The edges shall be straight or in pleasant smooth curves,

3.0. Mode of measurements and payment

3.1. Letters, figures and similar items etc. stops, commas, hyphens and the like shall be deemed to be included in the item. 9

3.2. The rate per cm. height of letter shall hold good irrespective of width of the letters of figures or the thickness of the lettering.

3.3. The rate shall be for a unit of per letter cm. height.

19.119(II) Writing letter of figure? on any surface with black Japan paint (stops, commas, hypes and the like not to be measured and paid for separately ; Indian (Letters/figures).

1.0. Materials and Workmanship

The relevant specifications of item No. 19.119 (I) shall be followed except the writing of letter shall be Indian letters/figures.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.119 (I) shall be followed.

2.2. The rate shall be for a unit of per letter per cm. height.

19.126(1) Painting lines, dashes, arrows, letters etc. on roads, airfields and like in two coats with road marking paint, brushing including cleaning the surface of all dirt, dust and other foreign matter : Over 10 cms. in width.

1.0. Materials

1.1. The road marking paint shall conform to. I.S. 164-1951.

2.0. Workmanship

2.1. The relevant specifications item No. 19.119(1) shall be followed except that the painting lines, dashes, arrows and letters on roads, air fields and like shall be carried out with road marking paint in two coats : over 10 cms. in width.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 19.119 (I) shall be followed.

3.2. The rate shall be for a unit of One sq. meter.

19.126.(II) Painting lines, dashes, arrows, letters etc. on roads, fields and like in two coats with road marking paint brushing including cleaning the surface of all dirt, dust and other foreign matter: Up to 10 cms. in width.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 19.126 (I) shall be followed except that painting work shall be up to 10 cms. width.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.119 (I) shall be followed.

2.2. The rate shall be for a unit of one running meter.

19.127.(A) Painting lines, dashes, arrows letters etc. on roads, airfields, and like in one coat with road marking paint, brushing including cleaning the surface of all dirt, dust and other foreign matter : over 10 cms. in width.

1.0. Materials and workmanship

The relevant specifications of item No. 19.126(1) shall be followed except that the painting shall be done in one coat over 10 cms. in width.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item No. 19.126 (I) shall be followed.

2.2. The rate shall be for a unit of One Sq. meter.

19.127. (B) Painting lines, dashes, arrows, letters etc. on roads, air fields and like in one coat with road marking paint, brushing including cleaning the surface of all dirt, dust and other foreign matter : Up to 10 cms. in width.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 19.126 (I) shall be followed except that the painting shall be done in one coat upon 10 cms. in width.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 19.126 (I) shall be followed.

2.2. The rate shall be for a unit of one running meter.

SECTION-20
Demolition & Dismantling

20.1.(i) Demolition and disposal of unserviceable materials with all leads and lifts : Lime Concrete.

1.0. Workmanship

1.1. The demolition shall consist of demolition of one or more parts of the building as specified or shown in the drawings. Demolition implies taking up or down or breaking up. This shall consist of demolishing whole or part of work including all relevant items as specified or shown in the drawings.

1.2. The demolition shall always be planned before hand shall be done in reverse order to the one in which the structure was constructed. This scheme shall be got approved form the Engineer-in-charge before starting the work. This however will not absolve the contractor from the responsibility of proper and safe demolition.

1.3. Necessary propping, shoring and under pinning shall be provided for the safety of the adjoining work or property, which is to be left intact, before dismantling and demolishing is taken up and the work shall be carried out in such a way that no damage is caused to the adjoining property.

1.4. Wherever required, temporary enclosures or partitions shall also be provided. Necessary precautions shall be taken to keep the dust nuisance down as and where necessary.

1.5. Dismantling shall be commenced in a systematic manner. All materials which are likely to be damaged by dropping from a height or demolishing roof, masonry etc. shall be carefully dismantled first. The dismantled articles shall be properly stacked as directed.

1.6. All materials obtained from demolition shall be the property of Government unless otherwise specified and shall be kept in safe custody until handed over to the Engineer-in-charge.

1.7. Any serviceable materials, obtained during dismantling or demolition shall be separated out and stacked properly as directed with all lead and lift. All unserviceable materials, rubbish etc., shall be stacked as directed' by the Engineer-in-charge.

1.8. On completion of work, the site shall be cleared of all debris rubbish and cleaned as directed.

2.0. Mode of measurements and payment

2.1. Measurements of all work except hidden work shall be taken before demolition or dismantling and no allowance for increase in bulk shall be allowed. The demolition of lime concrete shall be measured under this item. Specification for deduction for voids, openings etc. shall be on same basis as that employed for construction of work,

2.2. All work shall be measured in decimal system as fixed in its place subject to the following limits; unless otherwise stated hereinafter : (a) Dimensions shall be measured to the nearest 0.01 mt. (b) Area shall be worked out to the nearest 0.01 sq. mt.(c) Cubical contents shall be worked out to the nearest 0.01 Cu.m.

2.3. The rate shall include cost of all labour involved and tools used in demolishing and dismantling including scaffolding. The rate shall also include the charges for separating out and stacking the serviceable materials properly and disposing the unserviceable materials with all lead and lift. The rate also includes for temporary shoring for the safety of the portion not required to be pulled down or of adjoining property and providing temporary enclosures or portions where considered necessary.

2.4. The rate shall be for a unit of one cubic meter.

20.1.(ii) Demolition and disposal of unserviceable materials with all leads and lifts : Un reinforced cement concrete.

1.0. Workmanship

The relevant specifications of item 20.1.(i) shall be followed except that the un reinforced cement concrete work is to be demolished instead of lime concrete.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 20.1(i) shall be followed.

2.2. The rate shall be for a unit of one cubic meter.

20.3. Demolition including of serviceable materials and disposal of unserviceable materials with all leads and lifts : R.C.C. work.

1.0. Workmanship

1.1. The relevant specifications of item 20.1 (i) shall be followed except that demolition of R.C.C. work is to be done.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 20.(i) shall be followed except that the demolition of reinforced concrete structure is to be done. The unserviceable materials shall be disposed of at all leads and lifts. The rate excludes scraping straightening of reinforcement but includes cutting of reinforcement.

2.2. The rate shall be for a unit of one cubic meter.

20.11 (ii) Demolition of brick work and stone masonry including stacking of serviceable materials and disposal of unserviceable materials with all leads and lift : in lime mortar.**1.0. Workmanship**

1.1. The relevant specifications of item No. 20.1.(i) shall be followed except that demolition of brick or stone masonry in lime mortar is to be done.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 20.1(i) shall be followed except that the wall and independent piers or columns of brick or stone masonry shall be measured in cubic meters. All copings, corbels, combs and other projections shall be included with the wall measurements.

2.2. In measuring thickness of plastered walls, the thickness of plaster shall be included. The unserviceable materials shall be disposed off with all lead and lift. Ashlars face stones dressed stone etc., if required to be taken down intact shall be dismantled and measured separately in cubic meters.

2.3. The rate is exclusive of cleaning of bricks or stones. Honey comb works or hollow block walling shall be measured as solid.

2.4. The rate shall be for a unit of one cubic meter.

20.11. (iii) Demolition of brick work and stone masonry including stacking of serviceable materials and disposal of unserviceable materials with all leads and lift : in cement mortar.**1.0. Workmanship**

1.1. The relevant specifications of item 20.1.(i) shall be followed except demolition of brick or stone masonry in cement mortar is to be done.

2.0. Mode measurements and payment

2.1. The relevant specifications of item 20.11 (ii) shall be followed. The unserviceable materials shall be stacked as directed by Engineer-in-charge with all leads and lifts.

20.22. Demolition in terrace including stacking or serviceable materials and disposal of unserviceable materials with all lead and lift : Brick tiles covering.**1.0. Materials**

1.1. The relevant specifications of item No. 20.1 (i) shall be followed except that the demolition of terrace brick tiles is to be done.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 20.1(i) shall be followed except that the brick tiles covering of terrace shall be measured in sq. mt. The unserviceable materials shall be stacked as directed at all leads and lifts.

2.2. The rate shall be for a unit of one sq. meter.

20.23. Dismantling tiled or stone floors laid in mortar including stacking of serviceable materials and disposal of unserviceable materials with all lead and lifts.**1.0. Workmanship**

1.1. The relevant specification of item 20.1 (i) shall be followed except the dismantling of tiled or stone floors laid on mortar shall be done. Dismantling implies carefully taking up or down or removing without damage. The articles shall be passed by hand where necessary and lowered and where these are fixed by nail, screws, bolts etc., these shall be taken out with proper tools.

2.0. Mode of measurements and payment

2.1. The supporting materials such as joints, beams if any etc. shall be measured separately. The relevant specifications of item No. 20.1 (i) shall be followed, The rate shall include staking the unserviceable materials as directed with all lead and lift.

2.2. The rate shall be for a unit of one sq. meter.

20.25. Dismantling of wooden floors, including, stacking of serviceable materials and disposal of unserviceable materials with all lead and lifts.

1.0. Materials

1.1. The specifications of item 20.1(i) shall be followed except that wooden floors shall be dismantled.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 20.1 (i) same shall be followed. The supporting members such as joints, beams etc. shall be measured separately. The rate shall include disposal of unserviceable materials as directed for and with all lead and lift.

2.2. The rate shall be for a unit of one sq. meter.

20.27.(i) Dismantling of sheet including ridges, hips, valleys gutters etc. stacking of serviceable materials and disposal of unserviceable materials with leads with lifts : G.I. sheet roofing.**1.0. Materials**

1.1. The relevant specifications of item 20.1.(i) shall be followed except that G.I. sheet roofing shall be dismantled instead of concrete work.

2.0. Mode of measurements and payment

2.1. The area of G.I. sheets roofing shall be measured in sq. meter. Ridges, hips and valleys shall be girded and included with roof area. Corrugated and semi-corrugated surfaces shall be measured flat and not girthed.

2.2. Supporting members such as rafters, purlins, beams, joints, trusses etc. shall be measured separately.

2.3. The rate shall include disposal of unserviceable materials with all leads and lifts and stacking the serviceable materials as directed.

2.4. The rate shall be for a unit of one sq. meter.

20.27 (ii) Dismantling of sheet roofing including ridges, hips, valleys gutters etc. stacking of serviceable materials and disposal of unserviceable materials with all leads and lifts : A.C. Sheet roofing.**1.0. Workmanship**

1.1. The relevant specifications of item 20.27 (i) shall be followed except that dismantling work of A.C. sheet roofing is to be done.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item 20.27 (i) shall be followed except that the A.C. sheets .roofing shall be measured in this item.

2.2. The rate shall be for a unit of one sq. meter.

20.28. Dismantling Manglore or country tile roofing with battens, boarding etc. including stacking of serviceable materials and disposal of unserviceable materials with all lead and lifts.**1.0. Workmanship**

1.1. The relevant specifications of item 20.1 (i) shall be followed except that the country tile roof or Mangalore roof shall be dismantled.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 20.1 (1) shall be followed.

2.2. The supporting members shall be measured separate item.

2.3. The rate includes labour required for disposal of unserviceable item with ail leads and lifts.

2.4. The rate shall be for a unit of one sq. meter.

20.30. Dismantling cement asbestos/hard board in ceiling or partition walls, wooden trellis work including frames, stacking of to serviceable material and disposal of unserviceable materials with all leads and lifts.**1.0. Workmanship**

1.1. The relevant specifications of item 20.1 (i) shall be followed except that the cement asbestos hard board in ceiling or partition walls, wooden trellis, work etc. shall be dismantled.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 20.1 (i) shall be followed. The serviceable materials shall be stacked as and where directed and the unserviceable materials shall be disposed off with leads and lifts.

2.2. The rate shall be for a unit of one sq. meter.

20.35 Dismantling wood wrought, framed and fixed in frames, trusses including stacking the materials with all lead and lift.

1.0. Workmanship

1.1. The relevant specifications of item No. 20.1 (i) shall be followed except that the wood work, wrought framed and fixed in frames, trusses etc. shall be dismantled.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 20.1 (i) shall be followed.

2.2. The materials shall be stacked as and where directed with all leads and lifts.

2.3. The rate shall be for a unit of one cubic meter.

20.39. Dismantling expanded metal or I.R.C. fabric with necessary battens and beading including frame work and stacking the serviceable materials with all lead and lift.**1.0. Workmanship**

The relevant specifications of item No. 20.1 (i) shall be followed except that the dismantling of expanded metal or I.R.C. fabric shall be done

2.0. Mode of measurements & payment

2.1. The relevant specifications of in item No. 20.1 (i) shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

20.43. Dismantling steel work including dismembering and stacking the materials with air leads and lifts.**1.0. Materials**

1.1. The relevant specifications of item No. 20.1 (i) shall be followed except that the dismantling of steel work shall be carried out.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 20.1 (i) shall be followed.

2.2. The weight of the member shall be computed from standard table unless the actual weight can be readily determined.

2.3. Riveted works where rivets are required to be cut. the same shall be carried out under this item and nothing extra shall be paid.

2.4. In framed still gate, the weight of any covering material or filling such as iron sheets and expanded metal shall be added to the weight of the main articles if such covering is not ordered to be taken out separately.

2.5. The rate includes stacking the materials as and where directed with all leads and lifts.

2.6. The rate shall be for a unit of one Kg.

20.49.(i) Dismantling doors, windows, ventilators etc. (wood or steel) shutters including chowkhats, Architraves, hold fasts and other attachments etc. complete and stacking them within all leads & lift. No exceeding 3 sq. meters in area.**1.0. Workmanship**

The relevant specifications of item No. 20.1 (i) shall be followed except that the door, windows, ventilators etc. (wood or steel) shutters including chowkhats, architraves, hold fasts and other attachments etc. are to be dismantled.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 20.1 (i) shall be followed.

2.2. The doors, windows, ventilator etc. not exceeding 3 sq. mt. in area (each) including shutters and chowkhats. Architraves, hold fasts and other attachments to frames etc. will be dismantled and measured under this item.

2.3. The rate includes stacking the serviceable materials as and where directed with all leads and lifts.

2.4. The rate shall be for a unit of One number.

20.49.(II) Dismantling doors, windows, ventilators etc. (wood or steel) shutters including chowkhats. Architraves, hold fasts and other attachments etc. complete and stacking them within all leads and lift : Exceeding 3 sq. meters in area.**1.0. Workmanship**

The relevant specifications of item No. 20.49(I) shall be followed except that the area of doors, windows, ventilators, exceeding 3 sq. meters are to be dismantled under this item.

2.0. Mode of measurements of payment

2.1. The relevant specifications of item No. 20.49 (l) above shall be followed.

2.2. The rate shall be for a unit of One number.

20.51. Dismantling barber wire fencing including making rolls and also including dismantling facing posts including all earth work, concrete in the base and making good the disturbed ground stacking useful materials as directed and disposing all the unserviceable materials with all leads and lifts.

1.0. Workmanship

The relevant specifications of item No. 20.1 (i) shall be followed, except that the dismantling of barbed wire fencing shall be carried out.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 20.1. (i) shall be followed.

2.2. The rate includes making rolls of dismantled wires and including dismantling fencing posts, concrete work, in base and making good the disturbed ground etc. complete.

2.3. The serviceable materials shall be stacked as and where directed and end unserviceable materials shall be disposed with all leads and lifts.

2.4. The rate shall be for a unit of One running meter.

20.56. Dismantling (C.I. Pipes, G.S.W. Pipes and A.C. rain water pipes with fittings and clamps, including stacking the materials with all lead and lift, (for any dia. of pipe).

1.0. Workmanship

The relevant specifications of item No. 20.23 shall be followed except that the dismantling work of pipes lines of C.I., G.S.W. & A.C. Pipes with fitting shall be carried out.

2.0. Mode of measurements and payment

2.1. The relevant specifications of No. 20.1 (i) shall be followed.

2.2. Water pipe lines, including rain water pipes, with clamps and specials, swear pipe lines, (Salt glazed ware or concrete) etc. shall be measured in running meter inclusive of joints. (The measurements shall be taken along the centre line of pipe and fittings).

2.3. The rate shall be for a unit of One running meter.

20.00.1. Dismantling sanitary fittings like wash basin, W.C. Pan, Indian & European Type flushing tank, etc. including stacking the materials with all lead lift.

1.0. Workmanship

The relevant specifications of item No. 23.23 shall be followed except that the dismantling work of sanitary fittings such as wash basin, W.C. Pan (all type of pans), Flushing tanks etc. shall be carried out.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 20.1 (i) shall be followed.

2.2. The rate shall be for a unit of one number.

20.00.2. Scraping oil paint steel and other metal surfaces and making the surface even (with hand scraping).

1.0. Workmanship

The old paint from steel and other surface shall be scraped thoroughly with hand scraper followed by wire brushing (first with coarse and then with fine brushes) and finally sand papering with coarse and paper (No.3) steel wood (No.2) or emery paper (No.3) or with emery clothes. This shall then be wiped finally with mineral turpentine to remove grease and perspiration of hand marks etc. and allowed to dry. The surface shall be made even and smooth.

2.0. Mode of measurements and payment

2.1. The work shall be measured in actual area of work done.

2.2. The rate shall be for a unit of one sq. meter.

SECTION-21

Repairs to Buildings

21.8. Providing and fixing M.S. fan clamps of shape and size as specified in existing R.C.C. slab including cutting chase and making good.

1.0. Materials

1.1. M.S. Bar shall conform to M-18.

2.0. Workmanship

2.1. The shape and size of fan clamp shall be directed!

2.2. The fixing M.S. fan clamp in existing R.C.C. slab a chase of size 150 mm. x 75 mm. shall be cut from the ceiling so as to expose the reinforcement and up to 25 mm. clear round the reinforcement bar. This shall be done without any damage to adjoining portion of ceiling. The two arms of the ends of the clamp shall be passed through the space over reinforcement bar from the bottom of the slab. Then the two arms shall be bent down about 15 mm. by means of crow bar. The clamp shall be held in position and the chase in ceiling filled with cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size). The ceiling shall be then finished to match the existing surface and properly cured.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all materials and labour required for satisfactory completion of this item as described above.

3.2. The rate shall be for a unit of One number.

21.23. Cutting our cracks, of roof terrace to V. section, Cleaning out, wetting, grouting with cement and sand slurry 1:3 (1 cement : 3 sand)

1.0. Materials

(1) Water shall conform to M-1. (2) Cement shall conform to M-3. (3) Sand shall conform to M-6.

2.0. Workmanship

2.1. The cracks shall be cleaned out and trimmed to V shaped cuts at least 6 mm wide on top. The cracks shall be cleaned off and then cracks shall be thoroughly flooded with water, water allowed to a soak in cracks, and then grouted with cement and sand slurry in proportion 1:3. The required cracks shall be cured at least 7 days.

3.0. Mode of measurements and payment

3.1. The rate shall includes cost of all materials and labour required for satisfactory completion of item as described above.

3.2. The rate shall be for a unit of One running meter.

21.24. Cutting out cracks of roof terrace to V-Section out, and filling solidly with a hot mixtures of bitumen and clean dry sand (1:1 weight).

1.0. Materials

(1) Bitumen shall be 85/25 penetration (2) Sand shall conform to M-6.

2.0. Workmanship

2.1. The relevant specifications of item No. 21.23 shall be followed for opening cracks and cleaning.

2.2. The cracks shall be absolutely dried and cleaned and filled solidly with a hot mixtures of 85/25 penetration and sand in ratio of 1; 1 by weight. The filler shall be well filled into cracks with the edges of a trowel and left flush with surface of roof. Repaired cracks shall cause no ridges the direction of the slope of roof.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 21.23 shall be followed.

3.2. The rate shall be for a unit of One running meter.

SECTION-22

Misc. Building Items

22.20. Providing and fixing 1.20 meter fencing with 2 meter long M.S. angle posts 40 mm. x 40 mm. x 6 mm. and oil painting 3 coats fixed at 2.5 M C/C with five horizontal lines, and two diagonals of galvanised steel barbed wire weighing 9.38 Kg. per 100 meter. (Min.) stained and fixed to posts with G.I. staples including fixing the posts in ground with 0.5 x 0.5 x 0.5 M block in C.C. 1:5:10 (cement : 5 sand : 10 graded brick aggregate 40 mm. nominal size) etc. complete.

1.0. Materials

(1) Water shall conform to M-1. (2) Cement shall conform to M-3. (3) Sand shall conform to M-6. (4) Brick bats aggregate shall conform to M-14, (5) Oil paint shall conform to M-44. (6) Barbed wire shall conform to M-78.

2.0. Workmanship

2.1. The pits of the size 0.5 x 0.5 m. x 0.5 shall first be excavated, true to line and level to receive the post at 2.5 C/ C. The relevant specifications of item 4.00.1 shall be followed for excavation work.

2.2. The pits shall be filled with a layer 0.15 m. thick with lean concrete 1:5:10 (1 cement: 5 sand : 10 graded brick bat aggregate 40 mm. nominal size). The M.S. angles 40 mm. x 40 mm. x6 mm shall be filled in with lean concrete 1:5:10 and rammed properly so as to form total 0.5 m. x 0.5 m. x 0.5 m, concrete block. The concrete shall be cured for 7 days to allow it to set.

2.3. The barbed wire shall be stretched and fixed in 5 horizontal rows and two diagonals. The bottom row shall be 140 mm. above ground and the rest at 125 mm. centre to centre. The diagonal shall be stretched between adjacent post from top wire of one post to the bottom wire of 2nd post. The wires shall be fixed to posts by means of staples. The M.S. Angle posts shall be painted with 3 coats of old paint of approved tint and shade.

3.0. Mode of measurements and payment

3.1. The work shall be measured for the finished work from centre to centre of the posts.

3.2. The rate shall include the cost of labour and materials involved in the operations described above.

3.3. The rate shall be for a unit of One running meter.

22.00.1. Construction of B.B. masonry paniara 23 cm x 75 mm wall including fixing pre cast R.C.C. marble Mosaic (Terrazzo) slab of 75 mm. thickness on top and smooth finishing to walls in cement plaster in C.M. 1:3 curing etc. complete including drainage out, waste water arrangements.

1.0. Materials

(1) Water shall conform to M-1. (2) Cement shall conform to M-3. (3) Sand shall conform to M-6. (4) Burnt bricks shall conform to M-15. (5) Pre cast marble mosaic terrazzo paniara of 75 mm thickness shall be of best quality. The width of paniara shall be directed.

2.0. Workmanship

2.1. The brick masonry shall be constructed for paniara for the size as directed in C.M. 1 :6. The thickness of wall shall be 23 cms. thick and height shall be 75 cms. The relevant specifications of B.B. masonry at item 6.13 (b) shall be followed for B.B. masonry work.

2.2. The B.B. masonry shall be covered with pre cast marble terrazzo paniara at top, of width and length as specified or as directed. The terrazzo mosaic paniara shall be T'S mm, thickness.

2.3. The whole masonry work shall be finished smooth with C.M. 1:3 on both sides the relevant specifications of item No. 1.7.59 (l) shall be followed.

2.4. The drainage outlet and water arrangement shall be made as directed.

3.0. Mod& of measurements and payment

3.1. The work shall be measured for the finished work.

3.2. The rate shall be include the cost of labour and materials involved in the operations described above.

3.3. The rate shall be for a unit of One Running meter.

22.00.2. Constructing a chowkadi with C.Q. over 12 cm. thick B.B. masonry in front and dwarf wall 1 M high and 23 cms. thick cement plaster to masonry in C.M. (1:3) and cement concrete flooring in 1:2:4 with 5 cm. dia. A.C. Drain pipe etc. complete

1.0. Materials

1.1. Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Burnt bricks shall conform to M-15. Stone aggregate 20 mm. nominal size shall conform to M-2. (a) A.C. Drain pipe of 5 cms. dia shall conform to M-74.

2.0. Workmanship

2.1. The chowkadi shall be constructed of specified size and as directed. The slab shall be cast on B.B. masonry wall 12 cms. thick and dwarf wall 1 M high and 23 cms, thick shall be constructed in proportion of C.M. 1:6. The relevant specifications of item 6.3. (I) shall be followed for masonry partition work and 5.4.1. (c) shall be followed for reinforced concrete work.

2.2. The whole masonry work shall be finished with cement mortar 1:3 and finished smooth. The relevant specifications of item No. 17.59 (I) shall be followed for plastering work,.

2.3. The A.C. pipe of 5 cms. dia shall be fixed as drainage pipe. The bottom shall be finished with C.C. 1:2:4 finished with cement slurry.

3.0. Mode of measurements and payment

3.1. The work shall be measured for finished work.

3.2. The rate includes cost of all materials, labour etc. required for carrying out satisfactory completion of work.

3.3. The rate shall be for a unit of one square meter.

22.00.3.(I) Constructing cooking platform 60 cm. width and 70 cm. height resting on B.B. Masonry wall 23 cms. thick in C.M. 1:6 with fixing of pre cast 1:2:4. R.C.C. 0.0 M. thick slab with marble mosaic chips set in GM. (Terrazzo) with plastering on exposed faces to wall in C.M. 1:4 etc. complete.

1.0. Materials

Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Burnt brick shall conform to M-15. Marble Mosaic chips shall conform to M-46. Stone aggregate 20 mm. nominal size shall conform to M-12. (a) M.S. Bars shall conform to M-18.

2.0. Workmanship

2.1. The cooking platform of size as directed shall be constructed in 60 cms. width and 70 cms. height. The brick masonry wall, in C.M. 1 :6 shall be constructed in 23 cms. thickness up to full depth. The relevant specifications of item 6.13 (B) shall be followed for masonry work.

2.2. The R.C.C. slab of 8 cms. thickness and of adequate design and size shall be precast and the same shall be put up on the B.B. masonry work.

2.3. The top and exposed sides of the R.C.C. slab shall be finished with marble mosaic terrazzo 8 mm. thick with required colour pigment. The work of terrazzo shall be carried out as per relevant specifications of item 14.4 (E).

2.4. The whole masonry work shall be finished with cement mortar in C.M. 1 :4. The relevant specification of item 17.59 (II) shall be followed.

3.0. Mode of measurements and payments

3.1. The work of cooking platform shall be measured for finished work.

3.2. The rate includes cost of all labour and materials, etc. required for satisfactory completion of this item as described above.

3.3. The rate shall be for a unit of One running meter.

22.00.3.(II) Constructing cooking platform of 60 cm. width and 70 cms. height resting on B.B. masonry walls 23 cm thick in C.M. 1:1 with fixing black kadapa stone surface laid on pre cast R.C.C. slab 1:2:4 with plastering on exposed faces to wall in C.M. 1:4 etc. complete.

1.0. Materials and Workmanship

1.1. The relevant specification of item No. 22.00.3 (I) shall be followed except that the cooking platform shall be constructed by providing black kadapa stone of 25 mm. to 30 mm. thickness on pre cast R.C.C. 1:2:4 slab 8 cms. thick. The black stone shall be provided in single piece up to 1.8 M in length and specified width. All the exposed edges of stone shall be machine cut.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item 22.00.3.(I) shall be followed.

2.2. The rate includes providing machine cut edges on exposed face of kadapa stone.

2.3. The rate shall be for a unit of One running meter.

22.00.4. Providing and fixing Rajula stone 75 mm. thick 60 cm x 45 cms. size including fixing in cement mortar as directed.

1.0. Materials

Water shall conform to M-1. Cement mortar shall conform to M-11. Rajula stone of specified, size shall be of best quality and free from any defects. The stone shall not be less than 75 mm in thickness.

2.0. Workmanship

2.1. The Rajula stone of size 60 x 45 cms. size shall be fixed as and where directed in cement mortar in 1:3. All the edges of the stone shall be fixed with cement mortar in C.M. 1:3 and sloped at 45° and finished smooth. The work shall be cured for 7 days after fixing.

3.0. Mode of measurements and payment

3.1. The work shall be measured for finished work.

3.2. The rate includes cost of all labour and materials required for satisfactory completion of this item.

3.3. The rate shall be for a unit of one number.

22.00.5. Providing and laying Bilimora type brick facing in C.M. 1:1 laid over bedding of cement mortar 1:3 (13 mm. thickness) including cleaning, watering, scaffolding etc. complete.**1.0. Materials**

1.1. Water shall conform to M-1. Cement mortar of specified proportion shall conform to M-11. Bilimora type bricks shall be approved before collection the same on site.

2.0. Workmanship

2.1. The surface on which the Bilimora type bricks is to be provided shall be cleaned of all dust, dirt, etc. and finished with CM 1:3 in 13 mm, thickness. The relevant specifications of item 17.59 (I) shall be followed except that the thickness of finishing shall be 13 mm. The top surface shall be roughened by wire brushes to give proper grip to the tiles to be fixed.

2.2. The Bilimora type bricks shall be fixed with CM 1:1. The tiles shall be properly wetted before fixing. The horizontal and vertical joints shall be maintained in true line and level by providing 12 mm or 20 mm. sq. bars as directed. The tiles shall be tamped by trowel so that there shall not be any hollows left behind the tiles.

2.3. The tiles shall be cut to the required size on ends of at top bottom of beams in best workman like manner.

2.4. The whole work shall be cured for 7 days.

3.0. Mode of measurements and payment

3.1. The work shall be measured as per relevant specification of item No. 17.58(1)

3.2. The rate includes cost of all materials, wastage etc. occurring due to cutting of tiles and ends as top and bottom of beams etc. including base coat.

3.3. The rate shall be for unit of One sq. meter.

22.00.6. Providing and fixing teakwood rail of 60 mm. x 20 mm. size and 50 cms. length incl. 3 coats of oil paint to wood work with set of 3 pegs.

1.0. Materials : Teak wood battens of specified size shall conform to M-29. Oil paint shall conform to M-44. Wall pegs of aluminum 3 Nos. of approved quality and make shall be provided.

2.0. Workmanship

2.1. The teakwood battens of size 60 mm. x 20 mm. and 50 cms. long be planed on all sides. The anodized aluminum wall pegs of approved 'make shall be fixed on wooden batten prepared with screws as directed. The wall pegs unit shall be fixed on wall with wooden gut ties and screws as directed. The wooden battens shall be painted with 3 coats of ready mix paint of approved colour and shade.

3.0. Mode of measurements and payment

3.1. The work shall be measured for finished work.

3.2. The rate shall be for a unit of one number.

22.00.7. Treating the bottom and sides (up to a height of 300 mm.) of the excavations made for the masonry foundations and basement with chemical emulsion at the rate of 5 liters per Sq. meter of the surface area.

1.0. Materials : The chemicals used for the soil treatment shall be only one of the following with concentration shown against each in aqueous emulsion.

	Chemicals	Concentration
1.	Aldrin	0.50% (by weight)
2.	Heptachlor	0.50% (by weight)
3.	Chlordane	1.00% (by weight)

2.0. Workmanship

2.1. The chemicals barrier shall be complete and continuous under whole of the structure to be protected.

2.2. The bottom and the sides of foundations up to a height of 30 cms. from the bottom of excavation made for masonry foundation and for basement column pits shall be treated with the chemical emulsion at the rate 5 liters/ sq. meter of the surface area.

2.3. The chemical treatment shall be-carried out when the surfaces is quite dry. Chemical treatment shall not be carried out when it is raining or when the soil wet with rain or sub soil water.

2.4. Once formed, treated soil berries shall be not disturbed. If by chance, treated soil barriers are disturbed, immediate steps shall be taken to restore the continuing and compactness of the barrier system

2.5. The treatment against termite infection shall remain fully effective for a period not less than 10 years from date of issue of the final certificate to completion of work. If at any time during this period, any defects in treatment are revealed or any evidence of infection in any part of the building or structure is noticed, the contractor shall be rectify the concerned defects within 14 days on receipt of notice from Engineer-in-charge. On contractor's failure to do so, the Engineer-in-charge may get the same rectified through any other agency at contractor's risk and cost, and decision of Engineer-in-charge as to the cost payable by contractor for the same shall be final and binding to the contractor.

2.6. A guarantee bond on appropriately stamped paper shall be given by the contractor to the department in the manner and form prescribed below:

FORM OF GUARANTEE BOND

I/We..... (Contractor) hereby guarantee that work will remain unaffected and will not be any way damaged by termite or any other germs of similar types, for a period for 10 years after completion of the work of anti-termite as per the terms and conditions of the contract and or damage that might be caused on account of termite and or other similar type of germs and hereby Guarantees to make good any loss of damages suffered by the Government of Gujarat and further guarantee to redo effective work without claiming any extra cost.

2.7. This guarantee shall remain in force for the period of 10 years from the completion of the work under the contract and it shall remain binding to the contractor for period of 10 years.

2.8. The deposit at the rate of 50% of the cost of this item from the running and final bills shall be recovered and retained for the first one year after completion of the work and 10% shall be retained for the balance of guarantee period and shall be refunded only after the completion of the guarantee period.

3.0. Mode of measurements & payment

3.1. The length and breadth shall be measured correct to a cm. as per the dimensions of sanctioned plans. No deduction shall be made nor extra paid for any opening for pipes etc. up to 0.1.sq. mt. The rate shall include the cost of all labour and materials required for the operation involved for satisfactory completion of this item. The sides of the trenches 30 cms, each side and bottom shall be measured under this item.

3.2. The rate shall be for a unit of One sq. meter.

22.00.8. Treating the backfill immediately in contact with foundation structure with chemical emulsion at the rate 7.5 liters per sq. mt. of vertical surface of the sub structure of each side (In case of R.C.C. columns, beams and R.C.C. basement walls, treating the sides of 50 cms. from ground level with chemical emulsion at the rate of 7.5 Liters/sq. meter).

1.0. Materials

1.1. The specifications of the item 22.00.7. shall be followed.

2.0. Workmanship

2.1. After masonry foundations and retaining walls of basement come up , the backfill immediate in contact with foundation shall be treated with the chemical emulsion at the rate of 7.5 liters per sq. m. of the vertical surface of the sub structure for each side. The filling of earth is usually carried out in layers and the treatment shall be directed towards the concrete or masonry surfaces of the columns and walls so that the earth contact with these surfaces is well treated with chemical.

2.2. In case of R.C.C. framed structure with columns and plinth beams and R.C.C. basements the treatments shall start at the depth of 50 cms. below ground level from this depth backfill around the columns, beams, and R.C.C. basement walls shall be treated at 7.5 lit/sq. m. of vertical surface. The relevant specifications shall be followed same as item 22.00.7.

3.0. Mode of measurements and payment

3.1. The area of substructure in contact with backfill to be measured. The length and breadth shall be measured correct to a cm. dimension of sanctioned plans for the surfaces in contact with backfill.

- 3.2. No deduction shall be made nor extra paid for any opening for pipes, etc. up to 0.1 sq. m.
- 3.3. The rate includes cost of all labour, materials required for satisfactory completion of this item.
- 3.4. The rate shall be for a unit of One sq. meter.,
- 22.00.9. Treating the top surface of the plinth filling with chemical emulsion at rate of 5 liters sq. meter, before the sand bed or sub grade is laid.**
- 1.0. **Materials** : The relevant specifications of item 22.00.7. shall be followed.
- 2.0. **Workmanship**
- 2.1. The relevant specifications of item 22.00.7 shall be followed that the top surface of the consolidated earth within the walls, shall be treated with the chemical emulsion at the rate of 5 liters/sq. metre of the surface before the sand bed or sub-grade is laid. If the filled earth has been well rammed and the surface does not allow the emulsion to seep through, holes up to 50 to 75 mm. deep at 150 mm. centers both ways may be made with 12 mm. dia. M.S. rod on the surface to facilitate absorption of the emulsion.
- 3.0. **Mode of measurements & payment**
- 3.1. The length and breadth shall be measured clean for the area actually treated.
- 3.2. No deduction shall be made nor extra paid for any opening for pipes, etc. up to 0.1 sq. m.
- 3.2. The rate shall be for a unit of One sq. meter.
- 22.00.10. Treating the junctions of wall and floor area with chemical emulsion at the rate of 7.5 liter/sq. mt. by making holes at junction of walls, and columns, with the floor before laying sub grade to a depth to 15 cms. by making holes.**
- 1.0. **Materials** : The relevant specifications of item 22.00.7 shall be followed,
- 2.0. **Workmanship**
- 2.1. The relevant specifications of item 22.00.7 shall be followed except that the junction of walls columns with floor shall be treated with the chemical emulsion at the rate 7.5 liters/sq. meter. Special care shall be taken to establish continuity of the vertical chemical barrier on inner wall surface from the ground level be taken to establish continuity of the vertical chemical barriers on inner wall surfaces from the ground level up to the level of filled earth surface. To achieve this, a small channel 3x3 cm. shall be made at the junctions of the wall and columns with floor (before laying the sub 2 grade) and rod holes made in the channels up to the ground level 15 cms. apart and the rod moved back ward and forward to breakup the earth an chemical emulsion poured along the channel at the rate of 7.5 liters per sq. m, of the vertical wall or column surfaces of sub-structures so as to soak the soil right to the bottom. The soil should be tamped back into place after this operation.
- 3.0. **Mode of measurements and payment**
- 3.1. The relevant specifications of the item 22,00.7. shall be followed.
- 3.2. The vertical area of sub-structure in contact with filled up earth above ground level to top filled up earth shall be measured for payment.
- 3.3. The rate shall be for a unit of One sq. meter.
- 22.00.11. Treating the earth along the external perimeter of the building by making holes 15 cms., apart up to a depth of 30 cms. with chemical emulsion at the rate of 7.5 liters per sq. meter along the wall.**
- 1.0. **Materials** : The relevant specification of item 22.00.7 shall be followed.
- 2.0. **Workmanship**
- 2.1. The relevant specifications of the item 22.00.7. shall be followed except that the external perimeter of the building shall be treated with chemical emulsions. After building is complete, the earth along the . external perimeter of the building should be treated at intervals of 15 cms. and to a depth of 30 cms. The rods shall be moved backward and forward parallel to the wall to breakup the earth and chemical emulsion poured along the wall at the rate of 7.5 liters per sq. meter of vertical surfaces. After the treatment the earth shall be tamped back into place the earth out side of the building should be graded on compaction of building, this treatment shall be carried out on the completion of such grading. In event of filling being more than 30 cms. the external perimeter and treatment shall be extended to the full depth of filling up to ground level so as to ensure continuity of the chemical barrier.
- 3.0. **Mode of measurements and payment**
- 3.1. The relevant specifications of item No. 22.00.7 shall be followed.
- 3.2. The vertical surfaces area so sub-structure 30 cms. in depth from finished ground level in external periphery only shall be measured and paid under this item. The depth of wall treated under back filled shall not be included in this item.

3.3. The rate shall be for a unit of One sq. meter.

22.0.12. Providing treatment along outside of foundation using chemical emulsion at 7.5 liters per sq. m. of vertical surface (for each side) of sub-structure.

1.0. **Materials** : The chemical used for the soil treatment shall be any one of the following with concentration shown against each in aqueous emulsion :

	Chemicals	Concentration
1.	Aldrin	0.50% (by weight)
2.	Heptachlor	0.50% (by weight)
3.	Chlordane	1.00% (by weight)

2.0. Workmanship

2.1. The surface of consolidated earth around the existing building shall be treated with chemical emulsion at the rate 7.5 liters/sq. m. of vertical surface of sub-structure. The minimum height to substructure shall be considered 60 cms. for treatment. If the earth along the perimeter does not allow emulsion to seep through, holes up to 300 mm. deep at 150 mm. centers both ways be made by 12 mm. dia. mild steel rod on the surface to facilitate saturation of the soil with chemical emulsion.

2.2. The chemical barrier shall be complete and continuous under whole on the structure to be protected.

2.3. The chemical treatment shall be carried out when the surface quite dry. Chemical treatment shall not be carried out when it is raining or when the soil is wet with rain or sub soil water.

3.0. Mode of measurements and payment

3.1. The length shall be measured along the periphery of the sub-structure. The depth shall be taken 0.60 m.

3.2. No deduction shall be made not extra paid for any opening for pipes etc. up to 0.1 sq. m.

3.3. The rate includes cost of all labour and material required for the operations involved for satisfactory completion of this item.

3.4. The rate shall be for a unit of One sq. meter.

22.0.13. Providing treatment along external wall perimeter below concrete or masonry apron using chemical at 5. lit/linear including drilling and plugging etc.

1.0. **Materials** : The relevant specifications of item No. 22.0.12 shall be followed.

2.0. Workmanship

2.1. The relevant specification of item No. 22.0.12 shall be followed except that the treatment shall be carried out along external wall perimeter below concrete or masonry apron, using chemical at rate of 5 lit/ running meter.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No. 22.0,12 shall be followed.

3.2. The rate including drilling and plugging holes in apron etc. complete.

3.3. The rate shall be for a unit of One running meter.

22.0.14. Treatment of soil below existing floor using chemical at 1 liter per hole at 300 mm. a part including drilling plugging holes etc.

1.0. **Materials** : The relevant specifications of item No. 22.0.12. shall be followed.

2.0. Workmanship

2.1. The relevant specifications of item No. 22.00.9. shall be followed except that the termite control treatment shall be carried out in soil below existing floors.

2.2. The holes of 12 mm. dia rod shall be drilled in floor up to 150 mm. depth at 300 mm. part both ways. The chemical shall be then injected with pressure at the rate of 1 liters/hole of the surface area.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item 22.0.9 shall be followed.

3.2. The rate shall includes cost of drilling holes and plugging.

3.3. The rate shall be for a unit of One sq. meter.

22.0.15. Treatment of voids in masonry using chemical at 1 Lit/hole at 300 mm. apart including drilling holes and plugging.

1.0. **Materials** : The relevant specifications of item 22.0.12 shall be followed.

2.0. Workmanship

2.1. The walls affected by termite shall be cleaned off all live forms binding inside and the holes of voids in masonry wall surface shall be treated by chemical emulsion at rat 1 Lit. hole. The holes in cracks in surface of wall shall be drilled at 300 mm. apart.

3.0. Mode of measurement & payment

3.1. The rate shall be for a unit of One number of voids treated.

22.0.16. Treatment to wood work by chemical emulsion in oil or kerosene based including 6 mm. dia downward slanted holes 150 mm. C/C. and plugging the same with cement mortar.

1.0. Materials : The relevant specifications of item No. 22. 00.7 shall be followed.

2.0. Workmanship

2.1. The wood work effected by Ants shall be cleaned of lives form hiding inside. The whole wood surface shall be then treated with oil or kerosene based chemical emulsion. The holes in 6 mm. dia. shall be drilled slanted downwards at 150 mm. centers to centers and chemical emulsion shall be poured into holes by means of funnels specifically prepared for the same and allowed to seep. After finales become empty, another dose of chemicals shall be poured in them. This process shall be done repeatedly till the whole wood work is fully saturated with chemical.

2.2. The holes drilled in wood work shall be filled in with putty and other similar materials as directed and the whole wooden surface shall be made good as before.

3.0. Mode of measurements & payment

3.1. The work shall be measured for the finished work in sq. meter, including frame.

3.2. The out of frame shall be measured as width ad form top of flooring to top of frame shall be as height. This area includes for treating frame and shutters both.

3.3. The rate includes cost of all labours and materials, required for satisfactory completion of this item.

3.4. The rate includes drilling holes plugging the same after treatment completed and making good as before.

3.5. The rate shall be for a unit One sq. meter.

SECTION-23

Water Supply, Plumbing and Sanitary Fittings

23.2. Providing and fixing to wall, ceiling and floor galvanised mild steel tube (Medium grade) of the following nominal bore, tube fittings and clamps including making good the wall ceiling and floor (A) 15 mm. dia (B) 20 mm. dia (C) 25 mm. (D) 32 mm. (E) 40mm. (F) 50 mm.

1.0. Materials

1.1. Galvanised mild steel tubes of specified dia nominal bore shall conform to I.S. 1239-1968.

1.2. The galvanised fittings, clamps, etc. required for specified dia. bore pipes shall be of best quality and makes as approved by the Engineer-in-charge.

2.0. Workmanship

2.1. Cutting, Laying & Jointing

2.1.1. When the tubes are to be cut or rethreaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The ends of the tubes shall then be threaded conforming to the requirements of I.S. 554-1955 with pipe dies and taps carefully in such a manner that it will not result in slackness of joints when the two pieces are screwed together.

2.1.2. The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack as the latter procedure may not result in the watertight joint. The screw threads for tube and fitting shall be protected from edge until they are fitted.

2.1.3. In jointing the tubes, the inside of the socket and the screwed end of the tubes shall be oiled and smeared with white or red lead and wrapping around with a few turns of fine spun yarn round the screwed end of the tube. The end shall then be tightly screwed in the socket, tees, etc. with a pipe wrench. Care shall be taken that all times free from dust, and dirt during fixing. Burr from the joints shall be removed after screwing. After laying the open ends of the pipes shall be temperately plugged to prevent access of water, soil, or any other foreign matter.

2.1.4. Any threads exposed after jointing shall be painted or in the case of underground piping thickly coated with approved anti-corrosive paint to prevent corrosion.

2.2. Fixing of tube fittings to wall ceiling & floors.

2.2.1. In case of fixing of tubes and fittings to the walls or ceilings, these shall run on the surface of the wall, or ceiling (not in chase) unless otherwise specified. The fixing shall be done by means of standard pattern, holder clamps keeping the pipes about 15 mm. clear of the wall. When it is found necessary to pattern, holder clamps keeping the pipes about 15 mm. clear of the wall. When it is found necessary to conceal the pipes and when specified so, chasing may be adopted or pipe fixed in ducts or recesses etc. provided that there is sufficient space to work on the pipe with usual tools. The pipe shall not ordinarily be buried in walls or solid floors, where unavoidable, pipe may be buried for short distances provided that adequate protection is given against damage and where so required joints are not buried. Where required M.S. tube sleeve shall be fixed at a place a pipe is passed through a wall or floor for expansion and contraction and other movements. In case the pipe is embedded in walls or floors, it should be painted with anti-corrosive bitumastic paint of approved quality. The pipe should not come in contact with lime mortar or lime concrete as the pipe is affected by lime. Under the floors, the pipe shall be laid in layer of sand filling.

2.2.2. All pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable. The pipes shall be fixed to walls with standard pattern clamps of required size and shape, one end of which shall be properly plugged or cemented into walls with cement mortar 1:3 (1 cement : 3 coarse sand) and the other tightened round the pipes to hold it securely. These clamps shall be spaced at regular intervals in straight lengths at 2 MC/C interval in horizontal run and 2.5 m. interval in vertical run. For pipe of 15 mm. dia. up to 25 mm. dia the holes in the walls and floors shall be made by drilling with chisel or jumper and not by dismantling the brick work or concrete. However for bigger diameter pipes the holes shall be carefully made cement : 3 coarse sand), and properly finished to match the adjacent surface.

2.3. Testing of joints :

2.3.1. After laying and jointing, the pipes and fittings shall be inspected under working conditions of pressure and flow. Any joints found leaking shall be redone, and all leaking pipes removed and replaced without extra cost.

2.3.2. The pipes and fittings after they are laid shall be tested to hydraulic pressure of 6 Kg./Sq cm. The pipe shall be slowly and carefully charged with water allowing all air to escape and avoiding all shocks and water hammer. The draw off takes and stop cock shall then be closed and specified hydraulic pressure shall be applied gradually. The pressure gauge must be accurate. The pipes and fittings shall be tested in sections as the work laying proceeds, keeping, the joints exposed for inspection during the testing.

3.0. Mode of measurements and payment

3.1. The description of e, item shall, unless otherwise stated be held to include where necessary, conveyance, and delivery, handling, unloading, storing fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting in position straight, cutting and waste return of packing etc.

3.2. The length shall be measured on running meter basis of finished work. The length shall be taken along the centre line of the pipe and fittings. The pipes fixed to wall, ceiling, floors etc shall be measured and paid under this item.

3.3. All the work shall be measured in decimal system as fixed in its place, subject to tolerance given below unless otherwise stated.

(i) Dimension shall be measured to the nearest 0.01 meter. (ii) Area shall be worked out to the nearest 0.01 sq. meter.

3.4. All measurements of cutting shall unless otherwise stated by held to include the consequent waste

3.5. In case of fitting of unequal bore, the targets bore shall be measured for the test.

3.6. Testing of pipe lines fittings, and joints include for providing all plant appliances necessary for obtaining access to the work to be tested and carrying out the tests

3.7. The rate includes galvanised steel tubing with screwed socket joints. to gather with all fittings (such as bends, sockets springs, elbows, test, crosses, short pieces, clamps and plugs, unions etc.) and fixing complete with clamping wall hooks, wooden plug etc. and also curing, screwing and waste and for making forged (or hand made) bends on piping as required. Connector shall be inserted where required or directed. The rate also includes cutting through walls, floors etc. and their making good and painting exposed threads with anti-corrosive paint as above and testing where tubes are to be fixed to wall ceiling and flooring, the rates shall not include painting of pipes, providing sleeves and sand filling under floor for which separate payment shall be made.

3.8. The rate shall be for a unit of one running meter.

23.4. Providing and laying in trenches galvanised mild steel tubes (Medium grade) of the following nominal bore and tube fittings-earth work in trenches to be measured and paid for separately ; (A) 15 mm. dia. (B) 20 mm. (C) 25 mm. (D) 40 mm. (E) 60 mm. (F) 80 mm.

1.0. Materials

1.1. Galvanised mild steel tube of specified dia. nominal bore and fittings shall conform to I.S. 1239-1968

2.0. Workmanship

2.1. The relevant specifications of Item 23.2 (A) shall be followed for cutting laying and jointing testing of joints except that the fixing of tube shall be done in trenches,

2.2. The width and depth of the trenches for different diameters of the tubes shall be as under, For 15 to 80 mm. dia tube width of trenches shall be 30 cms. and depth of trenches 60 cms,

2.3. All joints, the trench width, shall be widened where necessary. The work of excavation and refilling shall be done true to line, and gradient in accordance with general specifications of earth work in trenches

2.4. The pipes shall be painted with two coats of anti-corrosive bitumastic paint of approved quality. The pipe shall be laid on a layer of 75 mm. sand filled upto 150 mm. above the pipe of so specified. The remaining portion of trench shall be then filled with excavated earth. The surplus shall be disposed off as directed.

2.5. When the excavation is done in rock the bottom shall be cut deep enough to permit the pipe to be laid and cushion of sand 75 mm. in case of bigger diameter of tube where the pressure is very high thrust block of cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 grade stone aggregates of 20 mm nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground and spreading it over a sufficient area if so specified.

3.0. Mode of measurement

3.1. The relevant specifications of item No. 23.2 (A) shall be followed. The authorised quantities shall be

3.2. For purpose of calculating cubic content cross section shall normally be taken at suitable intervals i.e. at manhole or wall chamber intervals except in abnormal cases like sudden change in strata or undulating ground etc., when they may be taken at closer intervals as approved by the Engineer-in charge whose decision shall be final, conclusive and binding.

3.3. Authorised width :

(a) Up to the meter depth, the width of the trenches for the purpose of measurements of excavation shall be arrived at by adding 40 cms. to the external diameter of the tube (not the socket) where a pipe is laid on concrete bed/ Cushioning layer, the authorised width shall be the external diameter of tube plus 40 cms. or the width of the concrete bed cushioning layer whichever is more.

(b) For depths exceeding one meter an allowance of 5 cms. per meter of depth for each side of the trench shall be added to the authorised width (i.e. external diameter of pipe of plus 40 cms) This allowance shall apply to the entire depth of the trench. The authorised width in such cases shall therefore be, equal to the depth of trench, plus external diameter or tube plus 40 cms.

(c) Where more than one tube is laid, the diameter shall be reckoned as the horizontal distance of outside to outside of the outermost pipes.

(d) Where sheeting etc. has been provided the authorised width of the trenches at bottom shall be increased to accommodate for sheeting etc. so that the clear width available between faces of sheeting is as per previous ness of (a), (b) & (c) above.

(e) If the sides of the trench are not vertical, the tones of side slopes shall end at the top of the pipe and vertical sided trench of authorised width as per (a), (b), (c) and (d) above shall be excavated from these down to the bed of trenches.

3.4. Where the tubes are laid in trenches, the work of excavation and refilling and round tubes for which separate payment shall be made, the length shall be measured on running meter, basis.

3.5. The rate shall be-for a unit of One running meter.

23.6. Marking connection of galvanised M/S. distribution branch with galvanised mild steel main 80 mm. nominal bore by providing and fixing tee including, cutting and threading the pipes etc. complete.

1.0. Materials The fittings required of specified dia. of pipe shall conform to I.S. 1237-1986.

2.0. Workmanship

2.1. A pit of suitable dimensions shall be dug at the point where the connection is to be made with the main and earth removed up to 150 mm. below the main. The flow of water in water main shall also be disconnected by closing the sluice or wheel valves on the main. The main shall first be cut. Water if any, collected in the pit shall be bailed out and ends of the pipe threaded.

2.2. The connections of distribution pipe shall be made by fixing malleable galvanised mild steel tee of the required size and fitting such as jam nut, socket, connecting piece etc,

2.3. The testing of the joints shall be done as per relevant specifications of item No. 23.2 (A).

3.0. Mode of measurements and payment

3.1. The rate includes cost of all labour, materials, tool and plant required for satisfactory completion of 'this item.

3.2. The rate shall be for a unit of One number.

23.8. Providing and fixing to wall ceiling and floor 6 Kgs/Sq. Cm. working pressure polythene pipes of the following outside diameter, low density complete with special flag compression type fittings wall clips etc. including making good the wall/ceiling and floor. (A) 20 mm. dia. (B) 25 mm. dia (C) 32 mm. dia. (D) 40 mm. dia. (E) 50 mm. dia.

1.0. Materials

1.1. The low density polythene pipe of specified diameter with 6 Kg/Sq. Cm, working pressure shall conform to I.S. 3076-1968. The specials and fittings required shall be of best quality.

2.0. Workmanship

2.1. The P.V.C. pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid ' P.V.D. pipes, due allowance shall be made particularly in over ground pipe lines for any change in length of pipe line which may occur during installation or when pipe line which may occur during installation or when pipe line is in service.

2.2. Above ground installation of rigid P.V.C. pipe should be under taken after preparations are observed for their protection against direct sun rays and mechanical damage.

2.3. The rigid P.V.C. pipe lines should not be kept exposed above ground when it passes through public places, railway lines, road side and foot paths.

- 2.4. P.V.C. pipes shall be supported at the following intervals :
 -20 mm. dia 500 mm. -25 mm. dia 750 mm. -32 mm. dia.900 mm.
- 2.5. Closer support spacing shall be provided if recommended by the manufacture.
- 2.6. The guide lines indicated by the manufacturer regarding handling, transportation, storing, laying and jointing of pipes shall be kept in view during execution.
- 2.7. P.V.C. pipes shall be fixed on wall with wooden plugs and suitable plastic clamps.
- 2.8. Jointing the pipes :**
- 2.8.1. The pipes and sockets shall be accurately cut. The ends of the pipes and fittings should be absolutely free from dirt and dust. The outside surface of the pipes and the inside of the fittings shall then be roughened with emery paper, and then solvent cement joint. Since solvent cement is aggressive to P V.C. care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped off after jointing. Empty solvent cement tins, brushes, rags, or paper impregnated with cement should not be buried in the trenches. They should be gathered not left scattered about, as they can prove to be a hazard to animals, which may chew them.
- 2.8.2. If any manufacturer recommends its own methods of jointing the same shall be adopted after necessary approval from the Engineer-in-charge.
- 2.9. Laying pipes in Trenches :**
- 2.9.1. The pipes shall be laid over uniform relatively soft fine grained soil found to be free of presence of hard object such as large flints, rocky projections, large tree roots etc. The width of the trenches shall be minimum width required for working.
- 2.9.2. The pipes laid underground shall not be less than one meter from the ground level. The pipe shall be positioned in the trenches so as to avoid any induced stresses due to deflection. Any deviation required shall be obtained by using proper type of rubber ring joints.
- 3.0. Mode of measurements & payment**
- 3.1. The relevant specifications of item 23.2. (A) shall be followed except that the P.V.C. pipes of specified dia. shall be paid under this item.
- 3.2. The unit rate shall be for a unit of One running meter.
- 23.111.(A)(I) Providing and fixing water closet squatting pan (Indian type W.C. Pan) size 580 mm. (Earth work, bed concrete, foot-rests and trap to be measured and paid for separately). Vitreous china. Long pattern white colour.**
- 1.0. Materials**
- 1.1. Water closet squatting pan (Indian type W.C. Pan) shall conform to M-62. Cement mortar shall conform to M-11
- 2.0. Workmanship**
- 2.1. The pan shall be sunk into the floor and embedded in a cushion of average 15 cm. cement concrete 1:5:10 (1 cement : 10 graded stone aggregate or brick aggregate 40 mm. nominal size) or and its bed concrete, the floor should be left 115 mm.-below the top level of the pan so as to allow for flooring and its bed concrete. The floor should be suitably stopped so that the waste water is drained into the pan. The pan shall be provided with 100 mm. 'P' or 'S' trap as specified in the item No. 23.113 with approximately 50 mm seal-The joints between the pan and the trap shall be made leak-proof with cement mortar 1:1 (1 cement : 1 fine sand).
- 3.0. Mode of measurements and payment**
- 3.1. The rate shall include the cost of all materials and labours involved in the operations described under workmanship.
- 3.2. The rate shall be for a unit of One number.
- 3.3. The 'P' or 'S' trap unit of One number.
- 23.79. Providing and fixing cast spigot and sockets soil, waste, and ventilating pipes of the following normal size (B) 75 mm. dia. (C) 100 mm. dia.**
- 1.0. Materials**
- 1.1. The specified dia. C.I. Spigot and socket soil or waste pipe shall conform M-68.

2.0. Workmanship

2.1. The fixing of C.f. spigot and sockets soil, waste and ventilating pipe shall be carried out as per relevant specifications of item 15.93 (B) except the C.I. spigot and socket shall be fixed. The joints shall be filled with cement mortar 1:2 (1 cement : 2 sand) spun yarn. The joints shall be filled with cement mortar 1.2 (1 cement : 2 sand) and spun yarn. The pipes without care shall be fixed to wall with M.S. clamps. The pipes will be secured with 40 mm before steel or iron barrel distance pieces or bolts and stout galvanised iron nails 10 cms long into hand wool plug fixed in walls. Access doors to fittings shall be provided with 3 mm. rubber insertion packing and secured without screws to make air and water tight.

2.2. All soil pipes shall be earned up above the roof and shall have a wire ball on guard or a cowl.

2.3. The ventilating pipe or shaft shall be carried out to a height of at least one meter above the outer covering of the roof of the building or in the case of windows in a gable wall or a dormer windows, it shall be carried up to a ridge of the roof or at least two meters above the top of the windows. In case of flat roof to which access for use is provided, it shall be carried out up to a height of at least one meter above the parapet or two meters measured vertically from the top of any windows or opening which any exist up to a horizontal distance of five meters from the vent pipe into such building and in no case shall be carried out to a height less than three meters.

2.4. Where ventilating pipes are carried in pipe shafts, the shaft shall be of a minimum size of one meter. If shells are also used to give light and air to rooms, the ventilating pipes must be carried out to a horizontal distance at roof level not less than five meter from the site of the shaft.

2.5. The sand cast iron pipes above parapet shall be fixed with M.S. clamps and stays. The clamps shall be made from 1.5 mm. thick MS flat or 3 mm. width band to the required shape and size to fit tightly on the sockets when tightened with screw bolts. It shall be formed of two semi circular pieces with flanged ends on both sides, with holes to fit in the screw bolts and nuts 40 mm. dia. M.S. Bars, One end of the stay shall be bent to form a hook to be fixed with clamps by means of bolts and the other end shall be bent for embedding in wall in cement concrete block of size 200 mm. x 100 mm. x 100 mm. in 1:2:4 mix. The concrete shall be finished to match the surrounding surfaces.

2.6. The connection between the main pipe and branch pipes shall be made by using branches and bends with access doors for cleaning.

2.7. The waste from lavatories, kitchens basins, sinks, baths and other floor traps shall be separately connected to respective stacks of upper floor. The waste stack of lavatories shall be connected directly to main hole while the waste stack of other shall be separately discharged over gulley trap.

3.0. Mode of measurements and payment

3.1. The length of pipe shall be measured including all fittings along its length in running meters correct to a centimeter. No allowance shall be made for the portion of pipe length entered in the sockets of the adjacent pipe or fittings.

3.2. The rate includes all labour, and materials, tools and plant etc. required for satisfactory completion of this item.

3.3. The rate shall be for a unit of One running meter.

23.87. Providing and fixing cast iron (spun) Nahni trap of the following nominal diameter of self cleaning design with C.I. Screwed down or hinged grating including cost of cutting and making good the waifs and floors : 100 mm. Inlet and 50 mm. outlet.

1.0. Materials

1.1. The cast iron (spun) Nahni trap shall conform to M-69. The C.I. hinged or screwed down cover shall be of best quality.

2.0. Workmanship

2.1. The Nahni trap with 100 mm. dia inlet and 50 mm. dia. outlet shall be fixed as per drawing or as directed.

2.2. The Nahni trap shall be jointed with C.I. Pipe, 75 mm. dia. with lead joints. The lead joints shall be done in conformation with I.S. 782.-1976.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all labour, materials, tools and plants etc. required for satisfactory completion of this item including lead, jointing and testing.

3.2. The rate shall be for a unit of one number.

23.112.(A)(I) Providing and fixing wash down water closet (European type W.C. Pan) with integral 'P' or 'S' trap including jointing the trap with soil pipe in C.M. 1:1 (1 cement : < fine sand) (seat and cover to be measured and paid for separately) ; Vitreous china pattern : In white colour,.

1.0. Materials

Wash down water closet (European type W.C. Pan) shall conform to M-60. Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. The closet shall be fixed to the floor by means of 75 mm. long 6.5 mm. diameter counter sunk bolts and nuts embedded in the floor concrete using rubber or before washers so as not to allow any lateral displacement The joint between the trap of W.C. and soil pipe shall be made with C M. 1:1 (1 cement : 1 fine sand).

3.0. Mode of measurements and payment

3.1. The rate shall include the cost of all materials and labour involved in all the operations described under workmanship.

3.2. The rate includes cost of all labour for fixing pans and seat and cover, inlet, connections etc. complete including testing the same. The payment of seat and cover shall be made separately.

3.3. The rate shall be for a unit of One number.

23.113.(A) Providing and fixing 100 mm. size 'P' or 'S' trap for water closet squatting pan including jointing the trap with the pan and soil pipe in cement mortar 1:1 (1 cement : 1 fine sand) Vitreous China.

1.0. Materials : The 100 mm. size 'P' or 'S' trap for water closet shall conform to M-62. Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. The 'P' or 'S' trap shall be fixed with pan cast iron pipe with C.M. 1:1. The pan shall be provided with a 100 mm. 'P' or 'S' trap as specified in the item with an approximately 50 mm. seal The joint between the pan and the trap shall be made leak-proof with cement mortar 1:1(1 cement : 1 fine sand).

3.0. Mode of measurements and payment

3.1. The rate shall include the cost of all materials and labour involved in the operations described under workmanship including testing.

3.2. The rate shall be for a unit of one number.

23.114. Providing and fixing in C.M. 1:3 (1 cement : coarse sand) a pair of white vitreous china 250 mm. x 130 mm. 30 mm. foot rest for long pattern squatting pan water closet.

1.0. Materials

1.1. The pair of white vitreous china foot-rests shall conform to M-62 Cement mortar shall conform to M-11.

2.0. Workmanship

2.1. After laying the floor, the floor shall be suitably sloped so that the waste water is drained into the pan A pair of foot-rests of size 250 mm. x 130 mm. x 30 mm. of white vitreous china shall be set in cement mortar 1:3 (1 cement ; 3 coarse sand). The foot-rests shall be fixed at a distance of 175 mm. from the inner edge of the back side of the pan and shall be fixed at convenient angle.

3.0. Mode of measurements & payment

3.1. The rate shall include the cost of all materials and labours involved in all the operations described under workmanship.

3.2. The rate shall be for a unit of One pair.

23.115.(A)(I) Providing and fixing 12.5 liters low level flushing cistern with a pair of C.I. or mild steel brackets complete with fittings such as lead valve less syphon, 15 mm. nominal size brass ball valve with polythene float, C.P. brass ball handle, unions and couplings for connections with inlet, outlet and overflow pipes, 40 mm. dia. porcelain enameled flush bend including cutting holes in walls and making good the same and connecting the flush bend with cistern and closet (overflow pipe to be measured and paid for separately) : Vitreous China. In white colour.

1.0. Materials

1.1. The low level vitreous china (Enamel) flushing tank shall conform to M-65 except that the flushing cistern shall be 12.5 liters low level type as mentioned in the item.

2.0. Workmanship

2.1. The low level cistern shall be firmly fixed on two C.I. or mild steel, brackets which shall be firmly embedded in the wall in C.M. 1:4 (1 cement : 4 fine sand).

2.2. The height of the bottom of the cistern from the top of the pan shall be 30 cms of low level flushing cistern shall be connected to the closet by means of 40 mm. dia, white porcelain enameled flush bend using Indian rubber adapts joints. The flush pipe shall be securely connected to the cistern outlet by means of coupling nut made of any non-corrosive materials, non-ferrous metal or galvanised steel. The flush pipe from the cistern shall be connected to the closet by means of cement of red-lead.

3.0. Mode of measurements & payment

3.1. The rate shall include the cost of all materials fitting and labour involved in all the operations described under workmanship including testing.

3.2. The rate shall be for a unit of One number.

23.116. Providing and fixing 12.5 liters level C.I. flushing with a pair C.I. or mild steel brackets, complete with fittings such as syphonic arrangement, 15 mm. nominal size brass ball valve with polythene flat, lever. G.I. China (60 cms.) and pull unions and couplings for connections with inlet, outlet and overflow pipes etc. including cutting holes in walls and making good the same (overflow pipe to be measured and paid for separately).

1.0. Materials

1.1. The high level C.i. flushing cistern shall conform to M-66, except that the flushing cistern shall be of 12.5 liters high level C.I. cistern as mentioned in the item.

2.0. Workmanship

2.1. The cistern shall be fixed on two C.I. or mild steel brackets which shall be firmly embedded in the wall in cement mortar 1:4 (1 cement : 4 fine sand).

2.2. The height of the bottom of the cistern from the top of the pan shall be two meters.

2.3. The W.C. Pan shall be connected to the cistern by galvanised steel flush pipes of 32 mm. nominal internal diameter. The flush pipe shall be fixed to wall by using clamps. The flush pipe from the cistern shall be connected to the closet by means of cement of red-lead. The flush pipe shall be securely connected to the cistern outlet by means of coupling nut made of any non-corrosive materials non-ferrous metal or galvanised steel.

2.4. The chain and the pull union shall be fixed to the protruding level arm of the flushing cistern.

2.5. The whole installation shall be tested for leak-proof joints and satisfactory functioning.

3.0. Mode of measurements & payment

3.1. The rate shall include the cost of all materials, fittings, and labour involved in all the operations described under workmanship including testing.

3.2. The rate shall be for a unit of One number.

23.117. Providing and fixing in position with clamps etc. 32 mm. nominal internal dia. galvanised steel tube flush pipe for high level flushing cistern including connecting the flush pipe with cistern and closet and making good the walls and floors.

1.0. Materials

1.1. The 32 mm. nominal internal dia, galvanised steel tube flush pipe shall conform to M-56.

2.0. Workmanship

2.1. The W.C. pan shall be connected to the cistern by galvanised steel flush pipe of 32 mm nominal internal diameter. The flush pipe shall be fixed to wall by using clamps.

2.2. The flush pipe from the cistern shall be connected to the closet by means of cement or red-lead.

2.3. The flush pipe shall be securely connected to the cistern outlet by means of coupling nut made of any non-corrosive materials, non-ferrous metal or galvanised steel.

3.0. Mode of measurements and payment

3.1. The rate shall include the cost of all materials, fittings and labour involved in all the operations described under workmanship including testing.

3.2. The rate shall be for a unit of One running meter.

23.120. Providing and fixing G.I. inlet connection for flush pipe with W.C. Pan.

1.0. Materials

1.1. The G.I. inlet connection for flush pipe shall conform to M-56.

2.0. Workmanship

2.1. The flush pipe from the cistern shall be connected to the closet by means of cement or red-lead.

3.0. Mode of measurements & payment

3.1. The rate shall include the cost of all materials, fittings and labour involved in all the operations described under workmanship including testing.

3.2. The rate shall be for a unit of One number.

23.127. Providing and fixing wash basin with single hole for pillar top white C.I. or M.S, brackets painted white including cutting holes, and making good the same but excluding fittings, vitreous china flat back wash basin 550 mm. x 400 mm. in white colour.

1.0. Materials

1.1. The white glazed earthenware wash basin shall be 550 mm. x 400mm. of 1st quality and make as approved by the Engineer-in-charge. The wash basin shall conform to M-59.

2.0. Workmanship

2.1. The washbasin shall be fixed on the wall as and where directed. The wash basin shall be supported on a pair of M.S. or C.I. brackets fixed in C.M. 1:3 (1 cement : 3 sand). The bracket shall conform to I.S. : 775-1962. The wall plaster on the rear shall be cut to rest the top edge of the washbasin. After fixing the basing, plaster shall be made good and surface finished to match the existing one.

2.2. The brackets shall be painted white with ready-mixed paint.

2.3. The C.I. brass trap and union shall be connected to 32 mm. dia. waste pipe which shall be suitably bent towards the wall and which shall discharge into an open drain leading to a gully trap or direct in to gully-trap on the ground floor and shall be connected to a waste pipe through a floor trap on the upper floors. C.P. brass trap and union may not be provided where the surface drain or a floor trap is placed directly under the basin and the waste is discharged in to vertically.

2.4. The height of the front edge to the wash basin from the floor level shall be 80 cms.

2.5. The necessary inlet, outlet connections and fittings such as pillar cocks, CP dress waste trap waste pipe, stop cock, chain wish rubber plug etc. shall be fixed.

2.6. The payment of fittings shall be made separately under separate items.

3.0. Mode of measurements & payment

3.1. The rate includes cost of all labour, materials, tool3 and plant etc. required for satisfactory completion of this item as specified in workmanship.

3.2. The rate shall be for a unit of One number.

23.130.(C) Providing and fixing kitchen sink with C.I. or M.S. brackets painted white including cutting holes in walls and making good the same of but excluding fittings. Vitreous china sink 600 mm. x 450 mm. x 150 mm. size.

1.0. Materials

1.1. White glazed vitreous china sink 600 mm. x 450 mm. x 150 mm. size shall conform to M-63.

2.0. Workmanship

2.1. The kitchen sink shall be supported on a pair of M.S. or C.I. brackets fixed in cement mortar 1:3 (1 cement : 3 coarse sand). The M.S. or C.I. brackets shall conform to I.S. 775-1962. The wall plaster on the rear shall be cut to rest over the top edge of the sink. After fixing the sink, plaster shall be made good and he surface finished to match with the existing one.

2.2. The C.P. brass trap and union shall be connected to 40 mm. nominal bore galvanised mild steel waste pipe which shall be suitably bent towards the wall and which shall discharge into an open drain leading to gully-trap or direct into the gully-trap on the ground on floor and shall be connected to a waste pipe through a floor trap on the upper floors. C.P. brass trap and union may not be provided where surface drain or a floor trap is placed directly under the sink and the waste is discharged to it vertically.

2.3. The height of front edge of the wash basin from the floor, level shall be 80 cms.

3.0. Mode of measurements & payment

3.1. The rate includes cost of all labour, materials, tools and plant and other equipment required for satisfactory completion of this item as described in workmanship.

3.2. The rate shall be for a unit of One number.

23.135 (A) Providing and fixing 32 mm, dia. C.P. brass waste for wash basin or sink.

1.0. Materials

1.1. The C.P. brass trap and unions shall be of 32 mm. dia. and of best quality and make as approved by the Engineer-in-charge

2.0. Workmanship

2.1. C.P. brass waste trap and union shall be connected to 32 mm dia waste pipe which shall be suitably bent towards the wall which shall discharge into drain through a floor trap The C.P brass waste trap shall be provided for wash basin or sink as the case may be.

3.0. Mode of measurement & payment

3.1. The rate includes all labours and providing C.P. brass waste trap and union including waste couplings of 32 nun fin. The rate excludes the cost of waste pipe of 32 mm. dia.

3.2. The idle shall be for a unit of One number.

23.135.(B) Providing and fixing 40 mm dia. C.P. Brass waste for wash basin or sink.

1.0. Materials & Workmanship

1.1. The relevant specifications of item 23.135 (A) shall be followed except that the diameter of C.P. brass waste is 40 mm dia.

2.0. Mode of measurements & payment

2.1. Thu rate shall be for a unit of One number.

23.136.(A) Providing and fixing 32 mm. dia. M.I. union for wash basin or sink.

1.0. Materials

1.1. Tho 32 mm dia M.1. Fisher union shall be of best quality and made as approved by the Engineer-in-charge.

2.0. Workmanship 2.1. The 32mm dia M I. Fisher union shall be fixed to wash basin or sink in best workman like manner.

3.0. Mode of measurements and payment

3.1. The rate includes all labours .and materials, tools and plants etc. required for satisfactory completion of the item.

23.136.(B) Providing and fixing 40 mm, dia. M.I. fisher union for wash basin or sink.

1.0. Materials and Workmanship

1.1. The relevant specifications of item No. 23, 136 (A) shall be followed except that the diameter of M I fisher union shall be 40 mm. dia.

2.0. Mode of measurements of payment

2.1. The rate shall be for a unit of One number

23.139. Providing and fixing 100 mm. dia, sand cast iron grating for gulley floor or Nahni tarp.

1.0. Materials

1.1. The- 100 mm. dia. sand cast iron gratings for gulley, floor or Nahni trap shall be of best quality and make as approved.

2.0. Workmanship

2.1. The CAST IRON grating shall he provided to gulley trap floor or Nahni trap as the case may be in best workmen like manner.

3.0. Mode of measurements and payment

3.1. The rate shall includes cost of all labour, materials, tools and plants, etc. required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number.

23 :141.(A) Providing and fixing 100 mm. dia, C.P, brass shower rose with 15 mm or 20 mm. inlet.

1.0. Materials

1.1. 100 mm. dia C P. brass shower lose shall confirm to I S. 2556-1972 part - XI and of best quality and makes as approved by engineer-in-charge. The inlet of shower rose shall be 15 mm dia. or 20 mm dia. as directed.

2.0. Workmanship

2.1. The C.P. brass shower rose shall be fixed as directed with 15 mm. dia. or 20 mm. dia. G.I. inlet pipe as the case may be.

3.0. Mode of measurements and payment

3.1. The rate includes all labours and materials, tools and plant etc. required for satisfactory completion of this item

3.2. The rate shall be for a one number.

23.143. Providing and fixing 600 mm. x 450 mm. beveled edge mirror of superior glass mounted on 6 mm. thick A.C. Sheet or plywood sheet and fixed to wooden plugs with C.P brass screws and washers,

1.0. Materials

1.1. The 600 mm. x 450 mm. size mirror shall be of superior glass with edge rounded over beveled as specified. It shall be free from flaws specks, or bubbles and its thickness shall not be less than 6 mm. The glass for the mirror shall be uniformly silver plated at the back and shall be free from silvering defects Silvering shall have a protective uniform covering of red lead paint. The 6 mm thick plywood shall conform to M-37. The 6 mm. thick A.C. sheets shall conform to M-24.

2.0. Workmanship

2.1. The mirror of 600 mm. x 450 mm. size mounted on A.C. Sheet or plywood 6 mm thick with C.P. brass clips shall be fixed as directed, by fixing wooden plugs in wall and C.P brass screws and washers. The work shall be carried out in best workman like manner.

3.0. Mode of measurements & payment

3.1. The rate includes cost of all labour and materials, tools and plant etc. required for satisfactory completion of this item. The rate shall be for a unit of One number.

23.144.(B) Providing and fixing 600 x 20 mm. C.P. brass towel rail complete with C.P. brass brackets fixed to wooden plugs with and C.P. brass screws.

1.0. Materials

1.1. The C.P. brass towel rail shall be 600 x 20 mm. of best quality as approved by the Engineer-in-charge The brackets shall be of C.P. brass. The rail shall conform to I.S. 1068-1958.

2.0. Workmanship

2.1. The brackets of the towel rail shall be fixed by means of C.P. brass screws to wooden plugs firmly embedded in the wall with C.M. 1:3 (1 cement : 3 coarse sand). The towel rail shall be fixed as and where directed.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all labour and materials, tools and plant etc. required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number.

23.145. Providing and fixing 600 mm. x 120 mm. glass shelf with C.P. brass brackets and guard rail complete, fixed to wooden plugs with C.P. brass screws.

1.0. Materials : The glass shelf of 600 mm. x 120 mm. size shall be of 5 mm. thick plate glass. The edge of the glass shall be ground. The C.P. over brass guard rail shall be best quality and make.

2.0. Workmanship

2.1. The C.P. brass brackets of the glass shelf shall be fixed with C.P. screws to wooden plugs firmly embedded in the wall C.M. 1:3 (1 cement : 3 coarse sand). The C.P. guard rail shall be fixed to glass shelf as directed.

3.0. Mode of measurement and payment

3.1. The rate includes all labour and materials tools and plant etc. required for satisfactory completion of this item,

3.2. The rate shall be for a unit of One number.

23.146.(A) Providing and fixing C.P. brass toilet paper holder.

1.0. Materials : The toilet paper holder shall be of best quality and make, chromium plating shall be of grade 'B' type conforming to I.S. 1068-2958.

2.0. Workmanship

2.1. The toilet paper holder shall be fixed in position by means of screws and wooden plugs embedded in wall with cement 1:3 (1 cement : 3 coarse sand).

3.0. Mode of measurements and payment

3.1. The rate includes cost of all labour and material, tools and plant etc. required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number.

23.92.(A)(I) Providing and fixing brass screw down bib taps of following size. Polished bright : 14 mm. dia.

1.0. **Materials** : 15 mm. dia. brass screw down with bright polished finished shall conform to I.S. 781-1977. The bib cock shall be best Indian make and quality.

2.0. Workmanship

2.1. The screw down bib cock 15 mm. as specified above shall be fixed as directed. The threaded portion shall be smeared with white or red lead and around with a few turns of fine spun yarn round the screwed end of the pipe. The bib cock shall be then screwed and fixed to water tight position.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all labour, materials, tools and plant etc. required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One Number.

23.92.(A)(II) Providing and fixing brass screw down bib taps of following size : Polished bright: 20 mm. dia.**1.0. Materials and Workmanship**

The relevant specifications of item 23.92 (A) (i) shall be followed except that the bib taps of 20 mm. dia shall be fixed.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item 23.92 A(i) shall be followed.

2.2. The rate shall be for a unit of One number.

23.92.(B)(I) Providing and fixing chromium plated brass screw down bib taps of the following size : 15 mm. dia.**1.0. Materials and workmanship**

The relevant specification of item No. 23.92 (A) (I) shall be followed except that the brass chromium plated screw down tap of 20 mm. dia. shall be fixed.

2.0. Mode of measurements & payment

2.1. The rate of shall be for a unit of One number.

23.92.(B)(II) Providing and laying chromium plated brass screw down bib taps of following size : 20 mm. dia.**1.0. Materials and workmanship**

The relevant specifications of item No. 23.92 (A) shall be followed except that the brass chromium plated screw down tap of 20 mm. dia. shall be fixed.

2.0. Mode of measurements & payment

2.1. The rate shall be for a unit of One number

23.92.(C)(I) Providing and fixing gun metal screw down bib taps of the following size : 15 mm. dia.**1.0. Materials and workmanship**

1.1. The relevant specification of item No. 23.9*3 (A) (I) shall be followed except that the 15 mm. dia. gun metal screw down bib tap shall be fixed.

2.0. Mode of measurements & payment

2.1. The rate shall be for a unit of One number,

23.92.(C)(II) Providing and fixing gun metal screw down bib taps of following size : 20 mm. dia.**1.0. Materials & Workmanship**

1.1. The relevant specifications of item 23.92 (A) (i) shall be followed except that the 20 mm. dia. gun screw down bib tap shall be fixed.

2.0. Mode of measurements & payment

2.1. The rate shall be for a unit of One number.

23.95(A) Providing and fixing pillar tap capstan head screw down high pressure with screw shank and back nuts : (A) 14 mm. dia. (B) 20 mm. dia.

1.0. **Materials** : The capstan head pillar tap of specified dia. of C.R over brass shall be best quality and shall conform to I.S. : 1975 - 1961. The pillar taps shall be tested quality.

2.0. Workmanship

2.1. The capstan head pillar tap of specified dia. shall be fixed as directed with required washers of selected leather or rubber asbestos composition or of plastic as directed. The cock shall fixed with pipe line white Zink end spun yarn, to make joint water tight. The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

3.1. The rate shall be for a unit of one number.

23.96(A) Providing and fixing brass screw down stop cock (A) 15 mm. dia. (B) 20 mm. dia. (C) 25 mm. dia.

1.0. Materials : The brass screw down stop cock of specified dia shall conform to IS. : 781 -1977 The stop cock shall be of tested quality.

2.0 Workmanship

The stop cock shall be fixed in position by means of Jam nut and socket. The stop cock shall be fixed near the inlet of the water meter or as directed. The joints shall be done with white zinc and spun yarn. The joint shall be tested for leak proofing.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all labours, materials, tools and plant etc. required for satisfactory completion of this item.

23.99. Providing and fixing gunmetal check or non-return valve. (A) 15 mm. dia. (B) 20 mm. dia. (C) 25 mm. dia. (D) 32 mm. dia. (E) 40 mm. dia.

1.0. Materials : The gun metal check or not return full way wheel valve or specified dial, shall conform to I.S. : 778-1964. The non-return valve shall be of tested quality.

2.0. Workmanship

2.1. The gun metal check or non return valve shall be fully cleared of all foreign matter before fixing. The fixing of shall be done by means of bolts nuts and 3 mm. rubber insertions with flaps of spigot and socketed tail pieces, drilled to the same specifications as in case of socket and spigot flanges in case of flanged pipes. The joining shall be done leak proof.

3.0. Mode of measurements and payment

3.1. The rate includes all labours, **materials, tools and plant etc. required for** satisfactory completion of this item.

3.2. The rate shall be for a unit of **One number.**

23.00. Providing and fixing chromium plated brass half turn flush cock of approved quality including fixing in pipe line etc. complete (I) 20 mm. dia. (II) 25 mm. dia. (III) 32 mm. dia.

1.0. Materials : Chromium plated brass half turn flush cock shall conform to M-67.

2.0. Workmanship

The half turn flush cock of specified diameter shall be fixed as directed. The flush cock shall be fixed in G.I. pipe line with necessary fittings. The joints shall be made leak proof by using spun yarn and white Zink. The fixing work shall be carried out as per relevant specifications of item No. 23.2(4).

3.0. Mode of measurements and payment

3.1. The rate includes cost of all materials and labour required for satisfactory completion of this item including fittings.

3.2. The rate shall be for a unit of One number.

23.00.4. Providing and fixing chromium plated bottle trap with necessary coupling of approved quality for wash basin.

1.0. Materials : The chromium plated bottle trap shall be approved make and of best quality. The bottle trap shall be provided with coupling.

2.0. Workmanship

The bottle trap shall be fixed on wash hand basin with wooden gullies and screws as directed. The work shall be carried out in best workman like manner.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all materials and labour involved for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number.

23.122.(A) Providing and fixing urinal of approved quality including connecting the urinal with waste pipe trap etc. complete : whit earthenware flat back or corner type size 430 mm. x 260 mm. x 350 mm.

1.0. **Materials:** The white earthenware flat back or corner type urinal of size 430 mm. x 260 mm. x 350 mm. shall conform to M-64.

2.0. Workmanship

2.1. The urinals shall be fixed in position by using wooden plugs and screws and shall be at a height 65 cms. from the Moor level to the top of the lip of urinal, unless otherwise directed. The wooden plugs shall be of 50 mm. x 50 mm. at base tapering to 38 mm. x 38 mm. at top 50 mm. in length shall be fixed in wall in steel waste pipe which shall discharge in the channel or floor a tap. The connection between the urinal and flush or waste pipe shall be made by means of putty or white lead mixed with chopped hemp.

3.0. Mode of measurements and payment

3.1. The rate shall includes cost all labours, materials, tools and plants etc. required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number.

23.124.(A) Providing and fixing urinal of approved quality including connection with trap and with integral longitudinal flush pipe squatting plate pattern white earthenware 550 mm. x 300 mm.

1.0. **Materials :** The squatting plate pattern, white glazed earthenware urinal of 550 mm x 300 mm shall conform to I.S. 771-1063. It shall be test India make.

2.0. Workmanship

2.1. The squatting plate urinal shall be fixed as directed.

2.2. The top edge of the squatting plate shall be flush with the finished floor level adjacent to it. It shall be embedded on a layer of 25 mm. thick cement mortar 1:8 (1 cement: 8 fine sand) laid over a bed of burnt brickbat cement 1:5 :10(1 cement: 5 fine sand, 10 graded brick aggregate 20 mm. nominal size). There shall be 100 mm. dia. glazed earthenware or vitreous china channel as specified with stop and outlet pieces suitably fixed in floor in cement mortar 1:3 (1 cement: 3 coarse sand) and joint finished with white cement. The earthenware vitreous china shall discharge into 65 mm. C.P. brass outlet grating. The trap and fitting shall be fixed as directed.

3.0. Mode or measurements and payment

3.1. The rate includes .cost of all materials, tools and plants and labour required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number

23.134 Providing and fixing rubber plug for sink or wash basin.

1.0. **Material:** The rubber plug for sink or wash hand, basin shall be best quality and make as approved by the Engineer-in-charge.

2.0. Workmanship -

2.1. The rubber plug with plain shall be fixed in wash basin or sink as directed.

3.0. Mode of measurements and payment

3.1. The rate shall be for a unit of One number.

23.00.5.(A) Providing and fixing ball cock of approved quality as directed {Copper metal} : (I) 25 'mm. dia. (II) 50 mm. dia;**1.0. Materials :**

The ball cock of specified diameter shall conform to M-75

2.0. Workmanship

The ball cock of specified diameter shall be fixed as directed. The fixing of ball cock shall be carried out as per relevant specification of item No. 23 (A) for joints etc.

3.0. Mode of measurement & payment

3.1. The rate includes-cost of all materials and labour involved for carrying out satisfactory work.

3.2. The rate shall be for a unit of One number.

23.00.5.(B) Providing and fixing ball cock of approved quality as directed : Ebonite. (I) 25 mm. dia. (II) 50 mm. dia.)

1.0. **Materials & Workmanship** : The relevant specifications of item No. 23.00.5 (A) shall be followed except that the ball cock of specified dia of Ebonite shall be fixed.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item NO. 23.00.5 (A) shall be followed.

2.2. The rate shall be for a unit of One number.

23.00.6. Providing and fixing C.I. Manhole cover 0.60 C.M. x 0.45 C.M. size having weight not less than 35 kg.**1.0. Materials**

C. I. Manhole cover of 0.60 x 0.45 Cms. size shall be of best quality. The eight of C.I. cover and frame shall into be less than 35 Kg. The C.I. manhole cover shall be of light duty and conform relevant I.S.

2.0. Workmanship

2.1. The C.I. Manhole cover shall be fixed as per relevant specifications of item No. 24.44 except that the C.I. cover shall be fixed ad and where directed.

3.0. Mode of measurements and payment

3.1. The rate includes cost of all laobur and materials required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number.

23.00.7. Providing and fixing G.I. water spout of 50 mm. dia. and 30 cms length.

1.0. **Materials** : G.I.M.S. type of 50 mm. dia. shall conform to M-56.

2.0. Workmanship

2.1. The G.I. pipe of 30 cms. fixed as rain water pipe as directed. The pipe shall be fixed about 1/4 dia. below the floor level so as to make approach of water easy. The inlet of pipe shall be rounded off for easy entry of rain water pipe. The pipe shall be fixed in C.M. 1:3.

3.0. Mode of measurements & payment

3.1. The rate includes of all labour and materials required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number.

23.8. Providing and fixing to wall ceiling and floor 6 Kg/ Sq. cm, working pressure outside diameter, low density completion with special flange compression type fittings wall clips etc. including making good the wall, ceiling and floor. (A) 20 mm. dia. (B) 25 mm. dia. (C) 32 mm. dia. (D) 40 mm. dia. (E) 50 mm. dia.

1.0. **Materials** : The low density polythene pipe of specified diameter with 56 Kg/f. Sq. Cm. working pressure shall conform to I.S. 3076-1968. The specials and fittings required shall be of best quality.

2.0. Workmanship

2.1. The P.V.C Pipes of specified diameter shall be fixed as directed. Due to thermal expansion of rigid P-V.C. Pipes, due allowances shall be made particularly in over-ground pipe line for any change in length of pipe line which may occur during installation or when pipe fine is in service.

2.2. Above ground installation of rigid P.V.C. pipe should be undertaking after precautions are observed for their protection again dirt, sun rays and mechanical damage.

2.3. The rigid P.V.C. tines should not be kept exposed above ground when it passes through public places, railway lines, roads, road side and foot paths.

2.4. P.V.C. pipe shall be supported at the following intervals ;
-20 mm dia 500 mm. -25 mm. dia. 750 mm. -32 mm. dia. 900 mm.

2.5. Close support spacing shall be provided if recommended by the manufacturer.

2.6. The guide lines indicated by the manufacturer regarding handling, transportation, storing, laying and jointing of pipes shall be kept in view during execution.

2.7. P.V.C. pipes shall be fixed on wall with wooden plugs suitable plastic clamps.

2.8. Jointing the pipes :

2.8.1. The pipes and socket s shall be accurately cut. The ends of the pipes and fittings should be absolutely free from dirt and dust. The outside surface of the pipes and the inside of the fittings shall then be roughened with emery paper, and then solvent cement shall be applied to the matching surface and pushed home and joint. Since solvent cement is aggressive to P.V.C. care must be taken to avoid applying excessive cement to the inside of pipe sockets as any surplus cement cannot be wiped off after jointing. Empty solvent cement tins, brushes, rags of paper impregnated with cement should not be buried in the trenches. They should be gathered, not left scattered about, as they can prove to be a hazard to animals, which may chew them.

2.8.2. If any manufacturer recommends its own methods of jointing the same shall be adopted after necessary approval from the Engineer-in-charge.

2.9. Laying pipes in trenches:

2.9.1. The pipes shall be laid over uniform relatively soft fine grained solid found to be free of presence of hard object such as large feints, rocky projections, large tree roots etc. The width of the trenches shall be minimum width required for working.

2.9.2. The pipes laid underground shall not be less than one meter from the ground level. The pipe shall be positioned in the trenches so as to avoid any inducted stresses due to retraction. Any deviation required shall be obtained by using proper type of rubber ring joints.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item No. 23.2. (A) shall be followed except that the P.V.C. pipes of specified dia. shall be paid under this item.

3.2. The unit rate shall be for a unit of One running meter.

SECTION-24

24.1.(A) Providing any laying (two level or slopes) and jointing with stiff mixture of cement mortar in proportion 1:1 salt glazed stone-ware pipes, following nominal internal diameters including testing of pipes and joints complete : 100 mm. dia.

1.0. Materials

(I) Water shall conform to M-1(2) Cement mortar of proportion 1:1 shall conform to M-11. (3) 100 mm. dia. glazed stoneware pipe shall conform to M-71.

2.0. Workmanship

2.1. The trenches for stoneware pipe drains shall be carried out as per relevant specifications of item No. 23.4 (A) except that the work is for stoneware pipes of 100 mm. dia.

2.2. Laying:

2.2.1. The pipes shall be laid accurately and perfectly true to line, levels and gradients, Great care shall be taken to prevent sand etc. from entering the pipes. The pipes between two manholes shall be laid truly in a straight line without vertical or horizontal undulation. All junctions and changes in direction and diameter shall be made inside manholes by means of curved tapered channels formed in Cement concrete finished smooth and benched on both sides. The body of the pipe shall rest for its entire length, on a even level bed grips being made or left on the bed to receive the sockets of the pipes.

2.3. Jointing:

2.3.1. Tarred gask in or yarn soaked in neat cement slurry shall first be placed around the spigot to each pipe and the spigot shall then be placed well home into the socket of the pipe previously laid. The pipe shall then be adjusted and fixed in the correct position and gaskin caulked home so as to fill not more than 1/4th of the total depth or (13 mm. in depth) of the socket.

2.3.2. The remainder of the sockets shall be filled with stiff mixture of cement mortar in proportion of one part of cement and one part of sharp sand. When the socket is fillet, a filled shall be formed round the joints with a trowel, forming an angle of 45° with the barrel of the pipe.

2.3.3. The mortar shall be mixed as necessary for immediate use.

2.3.4. After the joint is made, any extraneous materials shall be removed from the inside of the joints with a suitable scraper or "badger". The newly made joints shall be protected, until set, from the sun, dry winds, rain or frost, sacking or other suitable materials which shall be used for the purpose.

2.3.5. The mortar shall be cured for 10 days.

2.4. Testing of Joints:

2.4.1. If any leakage is visible the defective part of the work shall be made good at no extra cost. The pipe line shall be tested as directed.

2.4.2. A slight amount of sweating which is uniform may be overlooked, but excessive sweating from a particular pipe or joints shall be watched for and taken as indicating a defect to be made good.

3.0. Mode of measurements and payment

3.1. Pounding or buttering of the fit trenches bed to the lower part of the pipe and "Grips" dug to take socket, collars etc. are included in the rate of laying the pipes.

3.2. The measurements shall be net without any allowance for cutting, and waste. The length of bends, junctions, and other connections shall be included in the total length of the drain pipes. Nothing extra shall be paid for the same. The rate includes necessary excavation refilling trenches etc. complete,

3.3. The rate shall be for a unit of One running meter.

24.1.(B) Providing and laying and jointing salt glazed stoneware pipes with lime concrete 1:2:4 (1 lime :2 fine sand : 4 graded brick aggregate 40 mm, nominal size)bedding with necessary form work and curing etc. complete : 150 mm. dia.

1.0. Materials & Workmanship : The relevant specifications of item 24.1.(A) shall be followed except that the diameter of pipe shall be 150 mm. dia.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No, 24.1. (A) shall be followed.

2.2. The rate shall be for a unit of One running meter.

24.2.(A) Providing and laying cement concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone : aggregate 40 mm. nominal size) bedding for stoneware pipe of following internal diameter with necessary form work and curing complete : 100 mm. dia. 300 mm. width (112 mm. average bed thickness).

1.0. Materials : (1) Water shall conform to M-1 (2) Cement shall conform to M-3. (3) Sand shall conform to M-6 (4) Stone aggregate 40 mm nominal size shall conform to M-12.

2.0. Workmanship

2.1. The relevant specifications of item 5.3.4. shall be followed except that the concrete work shall be carried out in trenches as bedding for stoneware pipes. The width of concrete shall be 300 mm. and average thickness of bedding shall be 112 mm The concrete shall be brought up at least to the invert level of the pipe to form a cradle and to avoid line contact between the pipe and the bed.

3.0. Mode of measurements & payment

3.1. The rate includes cost of all labour and materials required for satisfactory completion of this item.

3.2. The rate includes cost of necessary form work required if any

3.3. The rate shall be for a unit of One running meter.

24.2.(B) Providing and laying cement concrete 1:5:10 (1 cement : 5 fine sand : 10 graded stone aggregate 40 mm. nominal size) bedding for stoneware pipe of following internal diameter with necessary form work and curing complete : 150 mm. dia. 450 mm. width (166 mm. average bed thickness),

1.1. Materials & Workmanship : The relevant specifications of item 24.2 (A) shall be followed except that the cement concrete work shall be carried out for bedding of stoneware pipe of 150 mm. dia. The average thickness of bedding shall be- 166 mm. and width shall be 450 mm.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item 24.2 (A) shall be followed.

2.2. The rate shall be for a unit of One running meter.

24.19(1) Providing and fixing S.W. gully trap with C.I. grating brick masonry chamber and watertight C.I. cover with frame of 300 mm. x 300 mm. size (Inside) with standard weight : (A) square mount taps 100 mm. x 100 mm. size P. type

1.0. Materials : (1) Water shall conform to M-1. (2) Cement mortar of proportion 1:5 shall conform to M-11. (3) Burnt brick shall conform to M-15. (4) The S.W. Gully trap of 100 mm. x 100 mm. size shall conform to M-70.

2.0. Workmanship

2.1. Excavation for gully trap shall be done true to dimensions and levels as indicated on plans or as directed. The excavation work shall generally be done as per relevant specifications of item 4.0.0. of earth work.

2.2. Fixing:

2.2.1. The gully trap shall be fixed over cement concrete 1:5:10 (1 cement : 5 sand : 10 graded brick aggregate 40 mm nominal size) foundation. 650 mm square and 100 mm. thick The depth of top of concrete below the ground level shall be 675 mm. The jointing of gully outlet to the branch drain shall be done similar to jointing of S.W. pipe as described in item No. 24.1 (A).

2.3. Brick masonry chamber : After fixing and testing gully and branch drain, a brick masonry 300 x 330 mm. inside with bricks in CM 1:5 (1 cement : 5 sand) shall be built with a 100 mm. brick work round the gully trap from the top of bed concrete up to ground level. The space between the chamber walls and

the trap shall be filled with cement concrete 1:5:10. The upper portion of the chamber i.e. above the top level of the trap shall be plastered inside with cement mortar 1:3 (1 cement: 3 sand) finished with floating coat of neat cement. The corners and bottom of the chamber shall be rounded off so as to slope towards the grating.

2.4. C.I. cover with frame 300 mm, x 300 mm. (inside) size shall then be fixed on the top of the brick masonry with C.c. 1:2:4 (1 cement : 2 coarse sand : 4 graded aggregate 20 mm. nominal size) 40 mm. thick and rendered smooth. The finished top of the cover shall be left about 40 mm. above the adjoining ground level so as to exclude the surface water from entering the gulley trap.

3.0. Mode of measurements & payment

3.1. The rate includes cost of all labour, materials, tools and plant etc. required for satisfactory completion of this item as described above.

3.2. The rate shall be for a unit of one number basis.

24.22. Providing and laying (to level or slopes) and jointing reinforced concrete light duty non-pressure pipes I.S. class N.P. 2 of the following internal diameters with collars and butt ends prepared for collar joints including testing of joints etc. complete. (B) 150mm. (C) 250 mm. (D) 300 mm. (E) 450 mm. (F) 500 mm. (G) 600 mm. (H) 900 mm.(K) 1000mm. (M) 1200 mm.

1.0. Materials : The reinforced concrete light duty non-pressure pipes of specified diameter shall conform to I.S. 458-1971.

2.0. Workmanship

2.1. The relevant specifications of item No. 24.1. A shall be followed for work of trenches except that the excavation in trenches shall be for reinforced concrete pipes of specified diameter.

2.2. Laying

2.2.1. The pipes shall be lowered into the trenches carefully. Mechanical appliances may be used. Where necessary pipe shall be laid in straight lines or with easy curves and true to line and gradient as specified. The laying of pipe shall proceed upgrade of a slope. In the pipe spigot and socket joints, the socket ends shall face upstream. In case of pipes with joints to be made with loose collars, the collars shall be slipped on before the next pipe is laid.

2.2.2. In case where the foundation conditions are unusual such as the proximity of trees or holes, under existing or proposed all round in 150 mm. thick cement concrete 1:5; 10 (1 cement: 5 fine sand : 10 graded stone aggregate 40 mm. nominal size) or compacted sand or gravel:

2.2.3. In case where the natural foundation is inadequate the pipes shall be laid either in concrete cradle, supported on proper foundations or on any other suitably designed structure. If concrete bedding is used, the depth of concrete below bottom of the pipe shall be at least 1/4th of the internal diameter of the pipe subject to a minimum of 100 mm. and a maximum 300 mm. The concrete shall be extended up the sides of the pipe at least to a distance of 1/4th of the outside diameter for pipes 300 mm. and over in diameter.

2.2.4. The pipes shall be laid in the concrete bedding before the concrete has set. Pipes laid in trenches in earth shall be bedded evenly and firmly and as far as up to the haunches of the pipe as to safely transmit the load expected from the back fill through the pipe to the bed. This shall be done either by excavating the bottom of the trenches to fit the curve of the pipe or by compacting the earth under a round curve of the pipe to form an even bed, Necessary provision shall be made for joints wherever required.

2.3. Jointing

2.3.1. The joints shall be done by slipping the collar over and clear of the end of the pipe. The recess of the end of the pipe shall be filled with jute braiding in hot bitumen. The new pipe shall then be brought forward until the bitumen ring in recess of first pipe is set into the recess of the second pipe. The process shall be repeated for two or three pipes which shall then jacked up so as to thoroughly compress the bitumen. The quantity of jute and bitumen shall be just enough to fill the recess when pressed hard by jacking, care being taken that no offset of the jute braiding shall be visible either outside or inside of pipe. The collar shall then be set up over the joints covering equally both the pipe and leaving, an even caulking space all round. Cement and sand mortar: 1: 1.1/2 shall then be well punched or pressed home with a caulking tool within this caulking space. Care shall be taken that the underside of the joints is properly filled with mortar.

2.4. Curing

2.4.1. Every joints shall be kept wet for about 10 days for maturing. The section of the pipe line laid and jointed shall be covered immediately to protect from weather effects. Minimum bore of 100 mm. is considered adequate.

2.4.2. The joints shall be left exposed for observation.

2.5. Testing of Joints :

2.5.1. The testing of joints shall be done as per relevant specifications of item No. 24.1 (A) **except that** the testing of reinforced concrete pipes shall be done.

3.0. Mode of measurements & payment

3.1. The relevant specifications of item 24.1 (A) shall be followed except that the rate includes for laying to level or slope in trenches etc. (measured separately), making the joints a; Seated and testing to stand the water test.

3.2. The measurements shall be net without any allowance for cutting and waste. The length of bends, junctions and other connections (measured along the centre line) shall be included in the total length of the pipes, the connections being numbered afterwards and paid for extra over pipes.

3.3. The size of bend, junctions, etc, shall suit the size of pipe. The bore (internal diameter of pipe) shall be the criterion for payment.)

3.4. Nothing extra shall be paid separately for the use of mechanical appliances, where necessary, as described above.

3.5. The rate shall be for a unit of One running meter.

2.4.27. Costing Manhole with R.C.C. Top slab in 1:2:4 mix (1 cement: 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) foundation concrete 1:3:6 (1 cement : 3 coarse sand : 6 bricks bats 40 to 50 mm. size) inside plastering 15 mm. thick with C.M. 1:5 (1 cement : 5 coarse sand) finished with floating coat of neat cement and making channels in C.C. 1:2:4 mix (1 cement : 2 coarse sand : 4 stone aggregate 20 mm. nominal size) finished smooth complete including curing and testing (I) inside size 900 mm. x 120 mm. and 1.5 mm. deep, including C1 cover with frame size 560 mm. diameter, total weight of cover and frame to be not less than 128 Kgs. (Wt. of cover 64 Kg. and Wt. of frame 64 Kg.) (A) With 230 mm. thick walls of brick masonry using bricks having crushing strength not less than 35 kg/sq. cm. in C.M. 1:5 (1 cement : 5 coarse sand)

i.	A type depth	0.90 meter for	150 mm. sewer
ii.	B type depth	1.50 meter for	150 mm. sewer
iii.	C type depth	2.25 meter for	150 mm. sewer
iv.	D type depth	3.15 meter for	150 mm. sewer

1.0. Materials : Water shall conform to M-1. Cement shall conform to M-6. Burnt bricks shall conform to M-15. Brick bats of 40 to 50 mm. size shall conform to M-14. Stone coarse aggregate of 20 mm. nominal size shall conform to M-12. Grit shall conform to M-8. Cement mortar of specified proportion shall conform to M-11. The cast iron manhole cover of 560 mm. dia. with frame shall conform to I.S. 1726-1966.

2.0. Workmanship

2.1. The manholes of different types and sizes as specified shall be constructed in sewer line at such places and to such levels and dimension as shown in drawings of as directed.

2.2. The manholes shall be built on a bed of cement concrete 1:3:6 (1 cement : 3 coarse sand : 6 brick bats) (40 to 50 mm. nominal size) to the thickness of the bed concrete shall be 15 cms. for manhole up to 1. M. depth and 20 cms. for manholes over meter and up to over meter and up to 2 meters, depth and 30 cms. for manholes o greater depth.

2.2.2. Projection of bed concrete beyond the masonry wall shall be 15 cms.

2.3. Walls

2.3.1. The walls of manhole shall be carried out with burnt bricks using having bricks. crushing strength not less than 35 Kg/Cms in C.M. 2 in C.M. 1:5 (1 cement : 5 coarse sand). The thickness of brick masonry wall shall be 230 mm. The jointing face of such .brick shall be well buttered with cement mortar before laying so as to ensure a full joints.

2.4. Plaster

2.4.1. The inside of waits shall be plastered 15 mm. thick with C.M. 1:5 (1 cement : 5 coarse sand) and finished with floating coat of neat cement. All angles shall be rounded to 7.50 cms. radius and all rendered internal surfaces shall have hard impervious finish obtained by using a steel trowel. The external joints of masonry shall be finished smooth.

2.5. Channels & Benching :

2.5.1. Channels shall be semicircular in the bottom half and of diameter equal to the sewer. Above the horizontal diameter, the sides shall be extended vertically to the same level as the crown of the out going pipe and the top edge shall be suitably rounded off. The branch channels shall also be similarly constructed with respect to the benching but at their junction with the main channel an appropriate fall suitably rounded off in the direction of flow. The main channel shall be given.

2.5.2. The channel and benching shall be done in C.C. 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) rising at a slope in line from edges of channel. The channels of the bottom of the chamber shall be plastered with C.M. 1:2 (1 cement : 2 coarse sand) and steel troweled smooth.

2.6. Cover slab:

2.6.1. The cover slab of R.C.G. 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate 20 mm. nominal size) 15 cms. thick reinforced with 10 mm. bars at 15 cms. C/C both ways, surface and edges finished fair. Full bearing equal to the width of wall shall be given to the slab on all sides. The frame of manhole cover shall be embedded firmly in R.C.C. slab so that the top of the frame remains flush with the top of R.C.C. slab.

2.7. Testing:

2.7.1. Manhole shall be tested by filling with water to a depth not exceeding 1.2 M. as directed.

2.7.2. After completion of work, manhole cover shall be sealed by means of thick grease.

3.0. Mode of measurements and payment

3.1. The depth of manholes shall be distance between the top of the manhole cover and the invert level of the main drain. The rate includes all labours, materials, tools, and plant etc. required for satisfactory completion of this item as directed above.

3.2. The rate shall be for a unit of the One number.

24.28.(I) Extra rate for constructing B.B. masonry for every additional depth of 0.1 M. or part thereof over item 24.47 (I) for depth from 0.90 to 1.5 M.

1.0. Materials and Workmanship

The relevant specifications of item No. 24.27 (I) shall be followed for excavation same, except that the depth of manhole shall be done 0.1 M. or part thereof more than 0.90 meter up to 1.5 M. The extra payment shall be made for additional depth of 0.1 M. or part thereof manhole done over and above the depth 0.90 meter.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 24.27 (I) shall be followed except that the extra rate shall be paid for every additional depth of 0.1 M. and part thereof shall be paid over and above the rate of item No. 24.27 (I)

2.2. The rate shall be for a unit of One number.

24.28.(II) Extra rate for constructing B.B. masonry for every additional depth of 0.1 M. and Part thereof over item 24.27 (II) for depth from 1.5 M. to 2.25 M.

1.0. Materials and Workmanship : The relevant specifications of item No. 24.27 (II) shall be followed except that the depth of manhole shall be done 0.1 M. or part thereof more than 1.5 M. up to 2.25 M. The extra payment shall be made for additional depth of 0.1 M. or part thereof manhole done over and above the depth 1.50 M. up to 2.25 M.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No. 24.27 (II) shall be followed except that the extra rate shall be paid for 0.1 M. or part thereof additional depth of manhole provided over and above item 24.27 (II).

2.2. The rate shall be for a unit of One number.

24.28.(III) Extra rate for constructing B.B. masonry for every additional depth of 0.1 M. or part thereof over item 24.27 (III) for depth from 2.25 to 3.15 M.

1.0. Materials and Workmanship : The relevant specifications of item No. 24.27 (III) shall be followed except that the depth of manhole shall be done 0.1 M. or part thereof more than 2.25 M. up to 3.15 M. Extra payment shall be made for additional depth of 0.1 M. or part thereof manhole done over and above depth 2.25 M. up to 3.15 M.

2.0. Mode of measurements & payment

2.1. The relevant specifications of time No. 24.27 (III) shall be followed except that the extra rate shall be paid for every addition 0.1 M. or part thereof depth provided over and above it -m 24.27 (III).

2.2. The rate shall be for a unit of One number.

24.28.(IV) Extra rate for constructing B.B. masonry for every additional depth of 0.1 M. or part thereof over item 24.27 (IV) for depth above 3.15 M.

1.0. Materials and Workmanship : The relevant specifications of item No. 24. 27 (IV) shall be followed except that the depth of manhole shall be done 0.1 M. or part thereof more than 3.15 M above. 1.2. Extra payment shall be made for additional depth of manhole 0.1 M. or part thereof done above 3.15 M. and above depth.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 24.27 (IV) shall be followed except that extra rate shall be paid for every additional 0.1 M. or part thereof depth provided for an above item 24.27 (IV).

2.2. The rate shall be for a unit of One number.

24.33. Providing and fixing C.I. steps of sizes 500 x 150 mm. 22.5 mm. and painting with two coats of anti-corrosive paint etc. complete.

1.0. Materials : The C.I. steps of size 500 x 150 x 22.5 mm. size shall conform J.S. 5455-1969. Paint shall conform to M-44.

2.0. Workmanship

2.1. The C.I. steps of size 500 x 150 x 22.5 mm. size shall be fixed in manhole as and where directed. The steps shall be staggered in vertical runs 380 mm. apart horizontally. The top step shall be 450 mm. below the manhole cover and lowest not more than 300 mm. above the benching. The steps shall be embedded in wall of manhole with C.C. : 1:3:6 up to 200 m. depth and the surface finished with cement plaster 15 mm. thick in C.M. 1:5. The steps shall be painted with two coats of anti-corrosive paint.

3.0. Mode of measurements & payment

3.1. The rate includes all labour, materials, tools and plants etc. required for satisfactory completion of this item.

3.2. The rate shall be for a unit of One number.

24.39. Providing and erecting at the site of work steel ventilating column of 150 mm. internal dia. and 12.20 M. high from G.L. to bottom of top grill, including C.I. grill and base plate, bolts and nuts etc. and excavation in foundation of size 120 x 120 x 165 cms. and filling the pit with 1st layer of cement concrete 1:3:6 mix (1 cement: 3 coarse sand : 6 graded stone aggregate 20 mm. nominal size) of size 120 x 120 x 90 cm. and remaining pit with B.B,C.C. 1:3:6 mix (1 cement : 3 coarse sand : 6 brick bats 40 to 50 mm. size) and providing filled in cement concrete : 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) at G.L. and 3 coats of silver paint etc. complete.

1.0. Materials :

The steel ventilating column internal dia. 150 mm. 12.20 m. high shall be of standard many and best quality as approved. Stone aggregate of 20 mm. nominal size shall conform to M-12. Brick-bats-40 to 50 mm. nominal size shall conform to M-4. Cement shall conform to M-3. Water shall conform to M-1. Silver (Aluminum) paint shall conform to I.S. 2339-1963.

2.0. Workmanship

2.1. The vent shaft shall be provided at the starting point of main sewer and at such points where the flow of sewerage is disturbed i.e. at falls, siphons etc. As far as possible, the location shall be at such a place where it receive Sundays for the maximum period of the day.

2.2. A pit of 120 x 120 x 165 ms. size shall be dug The cement concrete of 1:3:6 (1 cement : 3 coarse sand : 6 graded stone aggregate 20 mm. nominal size) shall be first laid in the pit to form 90 cms. thick

concrete foundation which shall be allowed to set for 24 hours. The vent shaft shall then be erected at the centre of the pit truly in plumb by means of such as shear legs, pullies, backless and rope etc.

2.3. The connection with sewer man-hole shall be made using 150 mm. diameter cement concrete pipe. After the connection is completed, the pit shall be filled with cement concrete : 1:3:6 (1 cement: 3 coarse sand : 6 brick bats 40 to 50 mm. nominal size) round the vent shaft up to ground level except top 150 mm. which shall be filled with C.C. 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) and rendered smooth. The junction of vent shaft with cement concrete shall be grouted with cement mortar 1:1 (1 cement : 1 sand). The concrete work shall be cured for 7 days.

2.4. The steel shaft shall be painted with silver paint (aluminum paint) 3 coats. The relevant specifications of item of painting shall be followed for painting.

3.0. Mode of measurements and payment

3.1. The rate shall include the cost of all labours and materials, tools and plant etc. required for satisfactory completion of this item as directed above.

3.2. The rate shall be for a unit of One number.

24.00.1.(A) Providing and laying lime concrete 1:2:4 (1 Lime Putty : 2 fine sand : 4 graded brick aggregate 40 mm. nominal size) bedding for stoneware pipes of following internal diameters with necessary form work and curing complete : 100 mm. dia (112 mm. average, bed thickness).

1.0. Materials : Water shall conform M-1. Lime mortar shall conform to M-10. Brick aggregate 40 mm. nominal size shall conform to M-14.

2.0. Workmanship

The relevant specifications of item No 5.1.8 shall be followed except that the proportion of mix shall be 1:2:4 (1 Lime Putty : 2 fine sand : 4 graded brick bats aggregate 40 mm. nominal size) and the concrete work shall be done in trenches for bedding of stoneware pipes of 100 mm. dia. The width of concrete shall be 300 mm. and the thickness of bedding shall be 112 mm. average.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item 24.2 (A) shall be followed.

3.2. The rate shall be for a unit of One running meter.

24.00.1(B) Providing and laying lime concrete 1:2:4 (1 Lime Putty : 2 fine sand : 4 graded brick aggregate 40 mm. nominal size) bedding for stoneware pipes of following internal diameters with necessary form work and curing complete :150 mm. dia. (166 mm. average bed thickness).

1.0. Materials and workmanship : The relevant specifications of 24.00.1 (A) shall be followed except that the concrete bedding shall be carried out for 150 mm. dia. stoneware pipe. The width of concrete bedding shall be 450 mm. and the average thickness shall be 166 mm.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 24.2 (A) shall be followed.

2.2. The rate shall be for a unit of One running meter.

24.27(1) Extra over item 24.1 for providing salt glazed stoneware fittings : Bends of required degree (Any Radius) of following internal diameters : A-100 mm. dia. B-150 mm. dia.

1.0. Materials & Workmanship

The relevant specifications of item 24.1 (A) shall be followed that the salt glazed stoneware bends of any degree of specified diameter shall be provided.

2.0. Mode of measurement & payment

2.1. The relevant specifications of item No. 24.1 (A) shall be followed except that extra payment shall be made for providing salt glazed stoneware bend of specified diameter or required degree of any radius over above the of item No. 24.1.

2.2. The rate shall be for a unit of One number.

24.17.(I)(A) Extra over item 24.1 for providing salt glazed stoneware fittings : Taper bend of required degree of following internal diameter. 100 mm. x 150 mm.

1.0. Materials & Workmanship : The relevant specifications of item 24.1 (A) shall be followed except that the salt glazed stoneware taper bend of required degree of 100 mm. x 150 mm. shall be fixed.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item No, 24.1 (A) shall be followed except that extra payment shall be made for providing salt stoneware taper bend of required degree of 100 mm. x 150 mm. size over and above the rate of item No. 24.1.

2.2. The rate shall be for a unit of One number.

24.17.(III) Extra over item 24.1 for providing salt glazed stoneware fittings : Single junction of required angle of following internal diameter (A) 100 mm. dia. (B) 150 mm. dia.

1.0. Materials & Workmanship

The relevant specification of item 24.1 (A) shall be followed except that the salt glazed stoneware single of junction required angle of specified diameter shall be fixed.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item 24.1 (A) shall be followed except that the extra rate shall be paid for providing salt glazed stoneware single junction of required angle for specified diameters over and above the rate of item 24.1.

2.2. The rate shall be for a unit of One number.

24.18. Providing and laying, jointing and jointing and pointing with stiff mixture of C.M. 1 : 1 (1 cement : 1 fine sand) 150 mm. internal diameter salt glazed stoneware half round channels.

1.0. Materials and Workmanship : The relevant specifications of item 24.1 shall be followed except that the half round channels of 150 mm. internal diameters shall be fixed in cement mortar 1:1.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 24.1 (A) shall be followed.

2.2. The rate shall be for a unit of One running meter.

24.35. Supplying and fixing C.I. cover 300 x 300 mm. without frame for gully trap (Standard pattern), weight of cover shall not be less than 4.53 Kg.

2.0. Workmanship

The C.I. cover 300 x 300 mm. size without frame shall be fixed on top of the brick masonry with cement concrete : 1:2:4 (1 cement : 2 sand : 4 graded stone aggregate 20 mm. nominal size) 40 mm. thick and rendered smooth. The finished top of the cover shall be left about 40 mm. above the adjoining ground level so as to exclude the surface water from entering the gully trap.

3.0. Mode of measurements and payment

3.1. The relevant specifications of item No, 24.19 shall be followed.

3.2. The rate shall be for a unit of One number.

24.40. Constructing brick masonry road gully chamber 500 mm. x 450 mm. x 600 mm. including 500 mm. x 450 mm C.I. horizontal grating with frame complete.

1.0. Materials : Water shall conform to M-1. Cement shall conform to M-3. Sand shall conform to M-6. Brick shall conform to M-15. C.I. Grating of 500 x 450 mm. size of standard make shall be of approved quality. Stone aggregate 40 mm. nominal size shall conform to M-12. coal tar shall conform to relevant M-5.

2.0. Workmanship

2.1. The chamber shall be of size 500 mm. x 450 mm. internal clear dimensions between the masonry wall faces. The height of 500 mm. shall be measured from the top of the bed concrete to the top of the C.I.

frame. The size of grating indicate the clear internal dimensions of the C.I. frame of the grating.

2.2. The excavation shall be done to true dimensions and levels.

2.3. The foundation concrete shall consist of 150 Cms x 100 Cms x 15 cms thick C.C. 1:5:10(1 cement : 5 sand : 10 graded stone aggregate 40 mm. nominal size).

2.4. The wall of the chamber shall be constructed in brick work C.M. 1:5 and 23 Cms. thick as per relevant specifications of item 6.12(8).

2.5. The walls and the bed concrete of chamber shall be plastered inside with 12 mm. thick cement plaster 1 : 3 (1 cement : 3 coarse sand) finished smooth.

2.6. The gully grating cover shall be hinged to frame to facilitate its opening for cleaning and repairs. The frames of the gully grating g shall be fixed on the top of masonry wall of the chamber in 15 cms. thick C.C. 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. nominal size) laid over the full thickness of walls..

2.7. The chamber shall have connection pipe, the length of which in meter between the road gully chamber and the manhole of the drain shall not be less than 1/40 times the nominal diameter of the pipe in MM. i.e. for 150 mm* connection pipe the length shall not be cement plaster on the bed concrete.

2.8. Painting : After the completion of the work of exposed surface of the grating of the frame shall be painted with a thick coat of coal tar.

3.0. Mode of measurements and payment

3.1. The cost of connection pipes is not included in the item and shall be paid separately. However, fixing the connection pipes in the walls of gully chamber is included in the rate for gully chambers and nothing extra shall be paid for this separately.

3.2. The rate shall be for a unit of One number.

24.41. Constructing brick masonry road gully chamber 450 mm. x 450 mm. x 775 mm. with vertical grating complete.

1.0. Materials and Workmanship : The relevant specifications of item 24.40 shall be followed except size of road gully chamber is 450 mm x 775 mm. with vertical grating complete.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 24.40 shall be followed.

2.2. The rate shall be for a unit of one number.

24.42. Constructing brick masonry road gully chamber 1100 mm. x 500 mm. x 775 mm. including 500 mm. x 450 mm. C.I. horizontal grating with frame and vertical grating complete.

1.0. Materials and Workmanship : The relevant specifications of item 24.40 shall be followed except that the size of road gully chamber shall be 1100 mm. x 500 mm. x 775 mm. including 500 mm. x 450 mm. C.I. horizontal grating with frame and vertical grating complete.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item No. 24.40 shall be followed.

2.2. The rate shall be for a unit of one sq. meter.

24.44(1) Constructing brick masonry chamber for underground C.I. inspection chamber and bends with brick having crushing strength not less than 35 Kg/ Cm. 2 in C.M/ 1:5 C.I. cover with frame (light duty) 455 x 610 mm. internal dimensions, total weight of cover with frame to be not less than 38 Kg. (Wt of cover 23 Kg. and Wt of frame 15 Kg.) R.C.C. top slab C.C. 1:2:4 mix (1 cement : 2 coarse sand : 4 graded aggregate 20 mm. size) foundation concrete 1:5:10, inside plaster 15 mm. thick with C.M. 1:3 finished smooth with a finishing coat of neat cement on walls and bed concrete etc. complete : Inside dimensions 455 mm. x 610 mm. and 450 mm. deep for single pipe-line.

1.0. Materials : Water shall conform to M-1. Cement shall conform to M-3. Coarse sand shall conform to M-5. Brick shall conform to M-15. Stone aggregate shall conform to M-12. Brick bat shall conform to M-14. M.S. bar shall conform to M-18.

2.0. Workmanship

2.1. C.I. inspection chamber with provision of C.I. bends of specified size with bolts, nuts and felt washers for underground drain shall be enclosed in masonry chamber which shall be constructed as under:

2.2. The excavation shall be done true to dimensions and level shown in one the plans or as directed.

2.3. Bed concrete shall be 15. Cms, thick C.C. 1:5:10 (1 cement : 5 coarse sand : 10 graded brick bat aggregates. The projection of bed concrete beyond the masonry walls shall be 7.5 cms.

2.4. Masonry walls and plaster work shall be carried out as per relevant specifications of item 24.40.

2.5. The cover slab shall be constructed as per relevant specifications of 24.27 (I).

3.0. Mode of measurements and payment

3.1. The earth work in excavation, providing and laying C.I. inspection chamber and bends shall be measured and paid for separately.

3.2. The rate shall be for a unit of One number.

24.44.(II) Constructing brick masonry chamber for underground C.I. inspection chamber and bends with brick having crushing strength not less than 35 Kg/ Cm. 2 in C.M/ 1:5 C. cover with frame (light duty) 455 x 610 mm. internal dimensions, total weight of cover with frame to be not less than 38 Kg. (Wt of cover 23 Kg. and Wt of frame 15 Kg.) R.C.C. top slab with 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm size) foundation concrete 1:5:10, inside plaster 15 mm. thick with C.M. 1:3 finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete : Inside dimensions 500 mm. x 700 mm. and 450 mm. deep for pipe the with one or two inlets.

1.0. Materials and Workmanship : The relevant specifications of item 24.24 (I) shall be followed except that the inside dimension of brick masonry chamber shall be 500 mm. x 700 mm. and 450 mm. deep for pipe the with on two inlets.

2.0. Mode of measurement and payment

2.1. The relevant specifications of item 24.44 (I) shall be followed. 2.2 The rate shall be for a unit of one number.

24.44.(III) Constructing brick masonry chamber for underground C.I. inspection chamber and bends with brick having crushing strength not less than 35 Kg/ Cm. 2 in C.M/ 1:5 C.I. cover with frame (light duty) 455 x 610 mm. internal dimensions, total weight of cover with frame to be not less than 38 Kg. (Wt of cover 23 Kg. and Wt of frame 15 Kg.) R.C.C. top slab with 1:2:4 mix (1 cement : 2 coarse sand : 4 graded stone aggregate 20 mm. size) foundation concrete 1:5:10, inside plaster 15 mm. thick with C.M. 1:3 finished smooth with a floating coat of neat cement on walls and bed concrete etc. complete : Inside dimensions 600 mm. x 850 mm. and 450 mm. deep for pipes line with three or more inlets.

1.0. Materials and workmanship : The relevant specifications of item No. 24 .44 (I) shall be followed except that the inside dimensions of chamber shall be 600 mm, x 850 mm. and depth 450 mm. for pipe lines with three or more inlets.

2.0. Mode of measurements & payments

2.1. The relevant specifications of item 24.44(1) shall be followed.

2.2. The rate shall be for a unit One number.

24.46. Extra over item 24.44 for every additional depth of 1 M. or part thereof beyond 450 mm. depth for brick masonry chamber, (i) For 455 mm. x 610 mm. size (ii) For 500 mm. x 700 mm. size (iii) For 600 mm. x 850 mm. size.

1.0. Materials & Workmanship : The relevant specifications of item 24.44 (i),(ii) (iii) shall **be followed** same except that **extra** depth of 0.1 M. or part thereof shall be constructed over and above the depth of respective items.

2.0. Mode of measurements & payment

2.1. The relevant specifications of item 24.44 (I) shall be followed except that the extra shall be paid for, providing additional depth of 0.1 M. or M. or part thereof over and above the item No 24.44. (I) 24.44 (II) 24.44 (III) as the case may be.

2.2. The rate shall be for a unit of One number.

24.00.2.(A) Providing soak pit of 2 cum. volume including excavating and filling brick bats with dry masonry work at top for 450 cms. height including covering, the top with stone including providing Vatas in C.M. 1:3 with finishing curing etc. complete as directed.

1.0. Materials : Water shall conform to M-1. Cement mortar con form to M-11. Burnt Bricks shall conform to M-15. Rough stone slab 40 x 50 mm. thick shall conform to M-48. Brick bat shall conform to M-14.

2.0. Workmanship

2.1. The excavation for soak pit shall be carried out as. per relevant specifications of item. 4.G0.1 (A) except that the size of soak pit such that the clear volume 'Shall* remain 2 cum. The diameter and depth shall be as directed.

2.2. The periphery of the sock pit shall be provided with dry masonry wall with burnt bricks in 23 cms. thick. The masonry wall shall be done with best workman like manner in true line and plumb.

2.3. The soak pit shall be filled in with brick bats of burn brick 40 mm. nominal size in 45 cms. height. The work of filling brick-bats shall be done in such a way that no dry masonry shall be damaged during filling of brick bats.

2.4. The top of the soak pit shall be covered with rough kotah stone slab 40 to 50 mm. thickness. The length of the stone shall be in single piece in length.

2.5. The cement mortar 1:3 shall be used to fill up the joints and preparing vata as directed.

2.6. The cement work shall be cured for 4 days.

3.0. Mode of measurements and payment

3.1. The rate includes costs of all labour and material required for satisfactory completion o this item as described above.

24.00.2.(B) Providing soak-pit of 5 cum. Volume inc. excavating and filling brick bats with dry masonry work at top for 45 cms. height including covering the top with stone including providing vatas in C.M. 1:3 with finishing curing etc. complete as directed.

1.0. Materials and workmanship : The relevant specifications of item 24.00.2 (A) shall be followed except that the volume of soak pit shall be 5 cum. clear.

2.0. Mode of measurements and payment

2.1. The relevant specifications of item 24.00.2 (A) shall be followed.

2.2. The rate shall be for a unit of One number.

EQUIVALENT PLAIN AREAS OF UNEVEN SURFACES
(Vide specifications for items relating to : Painting & Polishing)

Sr. No.	Description of work	How measured	Multiplying Factor
1.	Paneled or framed and braced on ledged and battened or ledged and braced joinery.	Measured flat (not girthed) including chowkhat or frame edges, chocks clients etc. shall be deemed to be included in item.	1.30 (For each said)
2.	Flush joinery	Measured flat (not girthed) including chowkhat or frame. Edges, Chocks, cleats, etc. shall be deemed to be included in the item.	1.20 (For each side)
3.	Fully glazed or gauzed joinery	Measured flat (not girthed) including chowkhat or frame. Edges, Chocks, cleats, etc. shall be deemed to be included in the item.	0.80 (For each side)
4.	Partly paneled and partly glazed or gauzed joinery	Measured flat (not girthed) including chowkhat or frame. Edges, Chocks, cleats, etc. shall be deemed to be included in the item.	1.00 (For each side)
5.	Fully venetioned or louvered joinery.	Measured flat (not girthed) including chowkhat or frame. Edges, Chocks, cleats, etc. shall be deemed to be included in the item.	1.80 (For each side)
6.	Weather boarding	Measured flat (not girthed) supporting frame work shall not be measured separately.	1.20.(For each side)
7.	Wood single roofing	Measured flat (not girthed)	1.10(For each side)
8.	Boarding with cover fillets at match boarding	Measured flat (not girthed)	1.05 (For each side)
9.	Tile and Slate battening	Measured flat, overall, no deduction shall be made for open space over	0.80 (For painting all over)
10.	Trellis (or Jafri) work one way or two way	Measured flat, over all, no deduction shall be made for the open spaces supporting members shall not be measured separately)	1.00 (For painting all over)

11.	Guard, bars, balustrades, gates, graying, grills, expanded metal and railings.	Measured flat over all, No deduction shall be made for the open spaces, over) supporting members shall not be measured separately.	1.00 (For painting all over)
12.	Gates and open palisade fencing including standards	Measured flat over all No. deduction shall be made of open spaces : supporting members shall not be measured separately, (see note).	1.00 painting all over
13.	Curved or enriched work	Measured flat	2.0 (For each side)
14.	Steel roller shutter	Measured flat (size of opening) over all jamb, guides bottom rails and locking arrangement etc., shall be included in the item (top cover shall be measured separately).	1.10 (For each side)
15.	Plain sheet door and windows	Measured flat (not including) frame	1.10 (For each side)
16.	Full glazed or gauze steel door and windows	Measured flat (not girthed) including Frame edges etc.	0.50 (For each side)
17.	Partly paneled and partly glazed or gauzed steel doors	Measured flat (not girthed) including frame edges etc.	0.08 (For each side)
18.	Collapsible gate	Measured flat (size of opening) no separate measurements shall be taken for the top and bottom guide rails, rollers, fittings, etc.	1.50 (For painting all over)

Note : The height shall be taken from the bottom of the lowest of rail if the palisades do not go below it (or from the lower end of palisades, if they protect below the lower rail) up to the top of palisades, but not upto the top of standards if they are higher then the palisades.

CODE OF PRACTICE C-13 (B)
SCHEDULE OF FIXTURES AND
FASTENINGS FOR DOORS,
WINDOWS, VENTILATORS,
WARDROBES AND CUPBOARDS

NOTATIONS

Da.....	Teakwood doors fully paneled or fully glazed or partly paneled : and glazed
Db.....	Bathroom and W.C. door with single shutter
Dc.....	Doors plying planked
Dd.....	Doors battened framed and braced
Wa.....	Teakwood windows fully paneled or fully glazed or partly paneled and glazed
Va-Ind.....	Teakwood ventilator (independent)
S.W.....	Steel Windows
SV-Ind.....	Steel ventilators (independent)
CB.....	Cupboard
S.1.....	Single shutter
S.2.....	Double shutter
S.4.....	Four shutter
B.....	Breadth of door shutter
T.....	Thickness of door shutter
H.....	Height of window shutter.
900.....	900 mm & below
900.....	above 900 mm
1200.....	1200 mm & below
1200.....	above

NOTE : PLEASE READ CAREFULLY :

- (1) Where detailed specification of an item provides for specific size of any fixture or fastening that shall prevail over the provisions in this schedule.
- (2) Fixtures and fastenings (except hold fasts which shall be of M.S. plate only) shall be of Brass, copper, oxidised brass, chromium plated brass, Iron, copper oxidised iron, or chromium plated iron as specified in the item of the work or detailed specifications.
- (3) External door and door failing in staircase excepting the door in balcony shall have sliding door bolt of size 300 mm. x 18 mm. in place of 250 mm. x 16 mm- as shown in this schedule.
- (4) The length of tower bolt shown is for a door having shutter height up to 2100 mm. only. For door having shutter height more than 2100 mm. the length of tower bolts to be increased to the extent of increase of door shutter height beyond 2100 mm.
- (5) 150 mm. x 150 mm. size glass vision panel shall be provided in the doors of Officers chamber in addition to the scheduled provision if so directed by the Engineering in charge.
- (6) Diamond shape chromium plated brass peeping plate of approved quality shall be provided in one entrance door in residential building in addition to the scheduled provisions.
- (7) Drawer up a wardrobe shall be provided with one furniture handle and one drawer lock (4 levers) in addition to its scheduled provision.
- (8) For door and window with steel frame, 75 mm. size screws, shall be provided both in top bottom frame for fixity as shown below:
 - (a) For width up to 1200 mm.....2 Nos.
 - (b) For width above 1200 mm. and up to 1800 mm.....3 Nos.
 - (c) For every additional width of 500 mm. over and above 1800 mm.....1 No.
- (9) When the mortise lock (6 levers) and latch is specified to be provided to a door either in the item of work itself or by a separate item, the requirement of providing sliding door bolt, door latch and handles as per this schedule shall be dispensed with.
- (10) For door/window with ventilator at top, fixtures and fastenings of door/window plus those of ventilator (excluding hold fasts) shall be used.
- (11) Where the item of the work, or its specification provides for anodised aluminum fixtures, all the fixtures except hinges and screws will be of anodised aluminum and chromium plated iron hinges and screws shall be used.
- (12) For door, window, or cupboard frame abutting concrete section, instead of hold fasts as shown in the schedule-, coach screws of size mentioned below shall be used:
 - (a) Teak wood frame..... 125 mm.
 - (b) Steel frame.....75 mm.
- (13) The locking etc. in the door latch shall be so positioned that the can be properly rocked even if part of the latch, when fully slid, remains in the frame or masonry.
- (14) Showcase cupboards having single shutter shall be provided with all catcher instead of tower bolt (barrel type) as per schedule.
- (15) The size of the handle shown in the schedule indicates grip length.
- (16) Door stopper shall be shown in the schedule indicates grip length.
- (17) Piano hinges shall be for the full height of the shutter.
- (18) Shutter with pivot arrangements shall be pivot arrangement shall be provided with two pivots of approved size instead of hinges as per the schedule.
- (19) For butt hinges, only lengths are indicated in the schedule. The width of each flap being 5 mm. less than the thickness of the shutter to which they are to be fixed and the thickness of the flap shall be as specified in the relevant I.S. for heavy, medium or light as specified in the detailed specifications of the item of work.

Schedule for Testing of Materials

For ensuring quality control and workmanship, various test prescribe below corresponding to the material concerned shall be taken as periodic intervals as stipulated below be taken.

The Material shall be got tested Govt. recognized Laboratory (R & B) or field Laboratory of GERI (R & 6) for which 1 % of the estimated amount to tender shall be recovered from the contractor from the R.A. Bill and Final Bills as the testing charges shall be paid by the Govt. to the GERI. However if the charges increase over 1 % no excess recovery shall be made from the contractor as per resolution of B&C department dated 10th May 1985, vide TNC/1085 (4) S.

Item No. as per Sch. B	Brief Description of Materials to be tested	Qty. of Material	Prescription of test which shall be carried out	Frequency @ which test shall be carried out	Total No. of Test to be taken
1.	Kapchi		- Gradation test - Impact Value - Flakiness Index of aggregate	CMT 1 to 100 – 1 test 100 to 500 – 3 tests 500 to 1500 – 5 tests 1500 to 5000 – 7 tests	
2.	Grit		- Stripping Value		
3.	Sand		- Special gravity - Water absorption - Fineness Modulus - Silt – Content - Soundness		
4.	Tiles		- Dimension Test - Transverse strength - Water Absorption - Abrasion Test		
5.	Teakwood		- Anatomy Test - Density Test - Moisture Content Test		
6.	Bricks		- Water absorption - Effluence - Size - Comprehensive Strength	1 Test @ 50,000 Bricks	
7.	Cement		- Consistency - Setting Time - Compressive Strength	1 Test @ 10.0 M.T. As per manual of Quality Control	
8.	Steel		- Tensile Strength - Yield Stress - Elongation - Size		
9.	C.C. Cube test 1:2:4		- Compressive Strength	1 to 5 Cum. 1 No. 6 to 15 Cum. 2 Nos. 16 to 20 Cum. 3 Nos. 21 to 50 Cum. 4 Nos. 51 & Above Cum. 4 + 1 for each Cum or part thereof	

The contractor shall have to pay 1% of the estimate cost put to tender towards all testing of materials & same shall be deducted from their bills for the works. The testing of various materials shall be carried out in GERI and result received shall be binding to all. i.e. contractor and Govt.

Testing Charges of GERI shall be born by Govt. No refund be made or extra charge over 1 % shall be recoverable form the contractor.

SIGN OF CONTRACTOR

SPECIAL CONDITIONS OF CONTRACT FOR ELECTRICAL WORK

1. EXTENT OF WORK

1.1. The scope includes design, manufacture, inspection & testing at manufacturer's works, delivery to site, unloading & storage at site, installation, testing at site, commissioning, final painting and handing over to client the complete electrical work to be carried out at the site.

1.2. The scope of work includes the following:-

- 1.2.1. 11 kV VCB H.T. Panel/ DP STRUCTURE
- 1.2.2. 250/125/63 KVA Oil Type Distribution Transformer – 11 kV / 0.433 kV
- 1.2.3. 125/250 kVA DG sets, UPS, Inverters etc.
- 1.2.4. H.V. XLPE cables and end termination
- 1.2.5. Main Power Control Centre, D.G. Control cum synch Panel
- 1.2.6. Utility system
- 1.2.7. Mail Lighting Distribution Board (MLDB) & Main Power Distribution Board (MPDB).
- 1.2.8. L.V. capacitor bank with APFCR panel
- 1.2.9. L.V. XLPE cable and end termination
- 1.2.10. Earthing and lightning protection system
- 1.2.11. Internal Wiring with conduits, wires, junction boxes, switches, sockets, Lighting distribution boards.
- 1.2.12. Light fixtures for General Area and Parking area
- 1.2.13. Auxiliaries items viz. Cable tray/ Cable Trench with necessary mounting / fixing supports, Route ON / OFF Push button sets
- 1.2.14. Conduiting wiring and necessary electrical work for Fire Alarm & Detection System, Computer network system, Telephone network, Security & Access Control System etc.
- 1.2.15. External Lighting and Cable laying, lighting poles/mast installation
- 1.2.16. Façade lights, area lighting, street lights, landscape lighting, pathway lighting, High masts, functional lightings etc
- 1.2.17. Under water and water body lighting system
- 1.2.18. Civil work viz. Foundation, trenches, excavation, back filling, cutting and drilling holes through walls or floors, chiseling in wall if required or any civil work required to complete the job
- 1.2.19. Safety accessories, tools, tackles, spares, consumables
- 1.2.20. Extra low voltage system installations like Voice and Data, Cable TV systems
- 1.2.21. Security and surveillance systems like CCTV / Public address / Evacuation / Access control etc.

2. SCOPE OF WORK :

2.1. The work to be carried out under this contract comprises of the Electrical Installation work for the proposed project called for in the documents. The work covered under this contract comprises of supply (wherever called for), installation, connection, testing and commissioning the Electrical installation commencing from point of electric power supply within the project site as per specifications, relevant Indian standards, Code of practice

2.2. The contractor shall carry out and complete the said work under this contract in every respect in conformity with the current rules and regulations of the local Electricity Authority, the Indian Standards and with the directions of and to the satisfaction of the Consultant and owner. The Contractor shall furnish all labor and install all materials, appliances, equipment (except those items which will be supplied by the Owner to the contractor at site), necessary for complete provision and testing of the whole electrical installation as specified herein and shown on the drawings. This also includes any material, appliances, equipment not specifically mentioned herein or noted on the drawing as being furnished or installed but which are necessary and customary to make complete installation with all outlets for power, light, telephone conduits, all other conduits and other electrical systems shown in the schedule or described herein, properly connected and in working order.

2.3. The work shall include all incidental jobs connected with electrical installation such as excavation for trenches and back filling, cutting/drilling holes through walls/floors and grouting for fixing of fixtures, equipment etc. Chiseling in the wall or principal structure is not permitted. In general, the work to be performed under this contract shall comprise of the following :-

2.4. Substation comprising of :

2.4.1.H.T. Switchgear & H.T Cable

2.4.2.Transformer

2.4.3.D. G. set

2.4.4.Substation accessories

2.4.5.Earthing

2.4.6.Power Control Centre

2.4.7.Main L.T panel

2.5. Lighting distribution board (LDB)

2.5.1. Earthing and lightning protection system installation

2.5.2.Plate / Pipe electrode type earth station

2.6. Earth continuity conductor

2.7. Internal and external lighting with fixtures

2.8. UPS/Stabilizer

2.9. All qualities mentioned in the Bill of quantity are approximate and the contractor shall not be eligible for any claim due to any variation in / or omission of any item.

2.10. Any extra item shall be calculated on the rate analysis basis approved by OWNER.

2.11. It is the responsibility of the contractor to co-ordinate with Torrent Power Ltd. / Electrical Inspector and fulfil all the requirements of Torrent Power Ltd. at no extra cost and arrange for the power connection.

3. ABBREVIATIONS :

The following, abbreviations have been used in the accompanying specifications, drawings and Bill of quantity :

ISS :Indian Standard Specifications.

HRC :High Rupturing Capacity.

GI :Galvanized Iron.

MS :Mild Steel.

MV :Medium Voltage.

LV :Low Voltage.

PVC :Polyvinyl Chloride.

AMP :Amperes.

V :Volts.

KV :Kilo Volts.

HV :High Voltage

KW :Kilo Watt

KVA :Kilo Volt Ampere

PF :Power Factor

Hz :Frequency

KWH :Kilo Watt Hour

XLPE :Cross Linked Polyethelene

ACB :Air Circuit Breaker

LED :Light Emitting diode

PLC :Programmable Logic Controller

UPS :Uninterrupted Power Supply

DP :Double Phase

IEE : Institute of Electrical Engineers, London.

MCB	: Miniature Circuit Breaker.
TPN	: Triple pole and Neutral.
SP	: Single Pole.
MCCB	: Moulded case Circuit breaker.
VCB	: Vacuum circuit breaker.
CT	: Current transformer.
DB	: Distribution board.
DG	: Diesel generator.
BOQ	: Bill of quantity.
SITC	: Supply, installation, testing and commissioning.
L.O.I	: Letter of intent/Acceptance letter.

4. REGULATIONS AND STANDARDS :

4.1. The installation shall conform in all respects to Indian standard code of Practice for Electrical Wiring installation IS : 732-1963 and IS : 2214-1963 (Silver Nitrate Pure and analytical reagent). It shall also be in conformity with the current Indian Electricity, Rules, Indian Electricity Act, National Electrical Code and Regulations of the Local Electrical supply Authority in so far as these become applicable to the installation. Wherever this specification calls for a higher standard of material and/or workmanship than those required by any of the above regulations then this specification shall take precedence over the said regulations and standard. In general, the materials equipment and workmanship not covered by the above shall conform to the relevant Indian Standards.

4.2. The electrical installation work shall follow Codes, Indian standard specifications and rules (Within the best meaning of the same) under this contract.

4.3. The following list is given for general guidance only in addition to list given in each individual section, however all other latest editions of Codes, Indian standard specifications and Rules shall also be followed when it is required.

I.S: 8623	Low voltage switchgear & control gear assemblies.
I.S: 10118	Code of practice for selection, installation and maintenance of switchgear and control gear.
I.S: 4237	General requirement for switch gear and control gear for voltage not exceeding 1000 Volt a.c. or 1200 volts d.c.
I.S: 13947	Low voltage switchgear and control gear.
I.S: 9224	Low voltage fuses.
I.S: 8828	Circuit breakers for out protection for household and similar installations.
I.S: 12640	Earth leakage circuit breaker
I.S: 1248	Direct acting indicating analog electrical measuring instruments
I.S: 2705	Current transformers.
I.S: 4201	Application guide for voltage transformers.
I.S: 6875	Control switches for voltage upto and indicating 1000V a.c. 1200 V d.c.
I.S: 5578	Guide for marking of insulated conductors..
I.S: 11353	Guide for uniform system of marking and identification of conductors and apparatus transmission.
I.S: 8197	Terminal markings for electrical measuring instruments and their accessories.
I.S: 694	Specifications for PVC insulated cables for working voltages up to and including 1100 volts.
I.S: 2551	Danger notice plates.
I.S: 3043	Code of practice for earthing.
I.S: 5216	Guide for safety procedures and practices in electrical work.

I.S: 1646 Code of practice for fire safety of building : Electrical installation.
Indian Electricity Act as amended up to date.
Indian Electricity Rules as amended up to date.
Rules and Regulations of Bombay Regional Council of Fire Insurance & Association of India for Electrical wiring.

5. FEES, PERMITS AND TESTS :

5.1. The Contractor shall pay for any and all fees and obtain permits required for the installation work. On completion of the work the contractor shall obtain and deliver to the OWNER, certificates of final inspection and approval by the local electric supply authority and the electrical inspector.

6. 10.0 UTILITY SUPPLY :

6.1. The location of receipt of incoming utilities supply (Hook up Points) like HT supply shall be verified with various concerned authorities. It is the responsibility of the contractor to co-ordinate with various utility agencies, the exact location of such Hook Up Point and mode of connection. Further the contractor shall co-ordinate with such utility agencies to provide necessary drawings, documents, get their approval, make the necessary arrangement for the payments and arrange the utilities supply at no extra cost.

7. 11.0 ACTUAL ROUTE OF CABLE :

7.1. The location of the cables, panel boards etc. is only indicative, therefore, the actual route of cables and the location of panel boards may differ from the plans according to the details of the building construction and the conditions of executions of the installations.

7.2. The contractor shall supply and install at his expense all secondary materials and special fittings found necessary to overcome the interference and to supply the modifications on the route of cables and conduits that are found necessary during the work, to the complete satisfaction of the owner's representative.

8. 12.0 MATERIAL AND EQUIPMENT :

8.1. All material and equipment shall conform to the relevant standards and shall be of the approved make and design. The materials and equipment shall conform to relevant Indian Standards. The Contractor shall be responsible for the safe custody of all the materials and shall insure them against theft, damage by fire, earthquake etc. A list of items of materials and equipment, together with sample of each shall be submitted to the OWNER within 10 days of the award of the contract. Any item which is proposed as a substitute, shall be accompanied by all technical detail giving sizes, particulars of materials and the manufacturer's name and shall be submitted along with the tender or bid offer. At the time of the submission of proposed substitute the Contractor shall state the credit, if any due to the owner. In the event the substitution is approved, all changes and substitutions shall be requested in writing and approvals obtained in writing from OWNER. OWNER's decision in the matter shall be final.

8.2. All materials of the same kind of service shall be identical and made by the same manufacturers. Any deviation to this rule shall be approved by the Consultant. Top priority shall be given to the products that have a permanent agent providing spare parts and maintenance facilities in the same city where the project is situated.

8.3. The make of electrical equipments, components, accessories, etc. has been mentioned in order of priorities. The tenderer has to quote for the first priority as mentioned above after ascertaining that the first preference materials are available. If at a later stage during executing the work, material of the first preference make are not available, the contractor has to get approval from the OWNER to use other make of material prior to procurement. Any rate difference for the first preference make and the one approved will be passed on to the owner.

9. MANUFACTURERS :

9.1. Where manufacturers have furnished specific instructions relating to the materials used in this job, covering points not specifically mentioned in these documents, these instructions shall be followed in all cases.

9.2. Where manufacturer's names and/or catalogue numbers are given, this is an indication of the quality, standards and performance required.

9.3. When interfacing occurs, equipment shall be mutually compatible in all respects.

10. RATING :

10.1. Rating of all items shall be appropriate for the conditions on the particular site on which the items will be used. All the equipment shall be fit for continuous work under the worst conditions of site and shall be rated for the following ambient condition.

10.2. Outdoor temperature 50 deg. cel.

10.3. Temperature under shed 45 deg. cel.

10.4. Salty, dusty and humid

10.5. Coastal area

11. 15.0 INSPECTION AND TESTING :

11.1. OWNER'S representative reserves the right to request inspection and testing at manufacturer's works at all reasonable times during manufacture of items for this contract. Tests on site of completed works shall demonstrate, among other things :

12. That the equipment installed complies with specification in all particulars and is of the correct rating for the duty and site conditions.

13. That all items operate efficiently and quietly to meet the specified requirements.

14. That all circuits are correctly fused and protected and that protective devices are properly coordinated.

15. That all non current carrying metal work is properly and safely grounded in accordance with the specifications.

15.1. The contractor shall provide all necessary instruments and labor for testing, shall make adequate records of test procedures and readings, shall repeat any tests requested by the OWNER and shall provide test certificates signed by a properly authorized person. Such test certificates shall cover all works.

15.2. If tests fail to demonstrate the satisfactory nature of the installation or any part thereof then no claims for the extra cost of modifications, replacements or re testing will be considered. OWNER's decision as to what constitutes a satisfactory test shall be final.

15.3. The above general requirements as to testing shall be read in conjunction with any particular requirements specified elsewhere.

16. PRICE DETAILS :

16.1. At anytime and at the request of OWNER, the contract shall provide details or breakdown of costs and prices of any part or parts of the works.

17. TEST CERTIFICATES :

17.1. The contractor shall submit test certificates for all the electrical material/system installed. These shall be issued by a government recognized inspection office certifying that all equipment, materials, construction and functions are in agreement with the requirements of these specifications, ISI and when ISI is not applicable other approved certifying agencies.

18. INSTRUCTION MANUAL :

18.1. The contractor shall prepare and produce instruction, operation and maintenance manuals in English for the use, operation and maintenance of the supplied equipment and installations, and submit 3 sets to OWNER, at the time of handing over.

19. SAMPLES AND CATALOGUES :

19.1. Before ordering the material necessary for these installations, the contractor shall submit to OWNER for approval, a sample of every kind of material such as cables, conductors, conduits, switches, socket outlets, circuit breakers, lighting fixtures, boxes etc., along with the catalogues.

19.2. For big items such as switchboards, the submission of catalogues shall be enough. Prior to ordering any electrical equipment/material/system, the contractor shall submit to OWNER, the catalogues, along with the samples, at least from three different manufacturers. After the selection of manufacturer by OWNER, the contractor shall arrange inspection and testing at the manufacturer's factory or assembly shop for final approval. No material shall be procured prior to the approval of the OWNER.

20. VENDOR AND SHOP DRAWINGS :

20.1. The contractor shall prepare and submit to OWNER, for his approval, two sets of vendor detailed drawings of all distribution boards, switch boards, outlet boxes, special pull boxes, and other likewise material, equipment to be fabricated by the contractor, or other vendor within 15 days of signing of the contract.

20.2. Before starting the work, the contractor shall submit to OWNER for his approval in the prescribed manner, the shop/execution drawings for the entire installation, specially the main connections and junctions, the route of conduits and cables, no. and size of wires drawn through the conduits, location of all the outlet points, and switch boards and distribution boards and any other information required by OWNER. OWNER reserves the right to alter or modify these drawings if they are found to be insufficient or not complying with the established technical standards or if they do not offer the most satisfactory performance or accessibility for maintenance.

21. AS BUILT DRAWINGS :

21.1. At the completion of work and before issuance of certificate of virtual completion the contractor shall submit to OWNER, three sets of layout drawing drawn at appropriate scale indicating the complete wiring system "as installed". These drawings must provide (in plan, folded elevation and section)

21.2. Location and details of distribution boards, main switches, switchgear and other particulars.

21.3. Location of all earthing stations, route and size of all earthing conductors, manholes etc.

21.4. Route and particulars of all cables.

21.5. Lighting layout plan for all the floors alongwith circuit distribution details.

21.6. External Area Lighting Plan.

22. GUARANTEE :

22.1. At the close of the work and before issuance of final certificate of virtual completion by OWNER, the contractor shall furnish written guarantee indemnifying OWNER against defective materials and workmanship for a period of one year after completion. The contractor shall hold himself fully responsible for reinstallation or replacement, free of cost to OWNER, the following :

22.2. Any defective work or material supplied by the contractor.

22.3. Any material or equipment supplied by OWNER which is damaged or destroyed as a result of defective workmanship by the contractor.

22.4. Any material or equipment damaged or destroyed as a result of defective workmanship by the contractor

GENERAL MATERIAL SPECIFICATIONS FOR ELECTRICAL EQUIPMENTS

1. Printed instruction chart

1.1. Material specification

1.1.1. Providing printed instruction charts both in English & Gujarati and duly framed with front glassed for shock treatment chart.

1.2. Workmanship

1.2.1. The printed instruction chart should be provided in panel room, substation space, feeder pillar etc.

2. Rubber matting:

2.1. Material specification

2.1.1. Rubber matting should be given for the main panels for the below mention voltage grade.

2.1.2. Voltage grade: 440 volts, minimum thickness 6 mm

2.1.3. Voltage grade: 11000 volts, minimum thickness 9 mm

2.1.4. It should be FRP material sheet, provided for panel (make: sintex or equivalent)

2.2. Workmanship

2.2.1. The rubber matting should be provided at floor for every floor mounting HT/LT panels.

3. First aid kit (standard)

3.1. Material specification

3.1.1. Minimum quantities for low risk establishments and activities may be considered as a general guidance leaflet on first aid.

3.1.2. 20 individually wrapped sterile adhesive dressings (assorted sizes) appropriate for the activity (detectable dressings (colored blue) should be available (if catering is to be undertaken).

3.1.3. 2 sterile eye pads.

3.1.4. 4 individually wrapped triangular bandages (preferably sterile)

3.1.5. 6 safety pins (optional)

3.1.6. 6 medium size individually wrapped sterile unmedicated wound dressings (approx. 12cm × 12cm)

3.1.7. 2 large sterile individually wrapped unmediated wound dressings (approx. 18cm × 18cm)

3.1.8. 1 pair of disposable glove

3.2. Workmanship

3.2.1. The first aid box should be provided in substation area, panel room, etc.

3.2.2. It should be placed in location which is easy in access & visibility.

4. Rubber Hand Gloves

4.1. Material Specification & Workmanship

4.1.1. Applicable standards: Unless otherwise modified in this specification the rubber hand gloves shall comply with IS: 4770-1968 or its latest version

4.1.2. Voltage Rating : 3.3 kV

4.1.3. Test Potential: 1.5 kV

4.1.4. Max. leakage Current & test potential : 12mA

4.1.5. The leakage current at the normal working voltage of the gloves shall not exceed 300 micro Amps

4.1.6. The minimum breakdown voltage of the gloves shall be 25 kV

4.1.7. The minimum and maximum dimension of the gloves shall be in accordance with Indian Standards.

4.1.8. The allowable value of Tensile Strength, Elongation at Break, Tensile Set and ageing properties shall be as stipulated in Indian standards

4.1.9. The Gloves shall be marked with Type of Gloves & its Size

5. The LT Switch Gear & Panel

5.1. Material specification

5.1.1. The It shall be manufactured as per the relevant Indian and international standards.

5.1.2. All the components in the panel shall be of the panels shall be as per approved make.

The panels shall be manufactured with sheet steel prepared using cnc machines for accurate cutting, bending and drilling etc. The sheet metal shall be pre-treated before painting. The assembly of the panels shall be with new techniques for easy removal and refitting of the components. The panel shall have a high degree of reliability and safety of the operating personnel. The components of identical feeders should be fully compatible to each other. The panel manufactured shall be fully conforming to the following standards.

IS 1248 & 3107	: direct acting electrical indicating instruments
IS 2959	: ac contactors up to 1000v
IS 13947	: ac circuit breakers
IS 2705	: current transformers
IS 3156 & 4146	: potential transformers
IS 4047	: specification for air break switches and combination fuse switch units for voltage not exceeding 1000v
IS 6875	: control switches for voltages up to and including 1000v ac and 1200v dc.
IS 1822	: motor duty switches
IS 12021	: specification for control transformer
IS 8623	: factory built assembly of switchgear & control gear for voltage not exceeding 1000v
IS 13947 (part i)	: degree of protection for enclosure
IS 3842	: specification for electrical relays for ac system
IS 2208 & 9224	: specification for hrc fuses
IS 5082	: wrought al. And aluminium alloys, bars, rods, tube and sections for electrical purposes.
IS 4237	: general requirement for switchgear & control gear for voltage not exceeding 1000v
IS 3231	: electrical relays for power system protection 151
IS 375	: marking and arrangement for switchgear bus bars, main connection and control Wiring
IS 5578	: guide for marking of insulated conductors.
IS 3618	: pre-treatment of ms sheets for phosphatising

5.2. Miniature Circuit Breaker

5.2.1. Miniature circuit breakers shall be quick make and break and break type non-welding self-wiping silver alloy contacts for 10 ka short circuit both on the manual and automatic operation, confirm with british standard bs : 3871 (part-i) 1965 and is :8825 (1996) with facility for locking in off position.

5.2.2. The housing of MCBs shall be heat resistant and having high impact strength. The fault current of MCBs shall not be less than 10ka, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "on" and "off" indications. 'C' characteristic current limiting type, 10 ka and having quick break with trip free operating mechanism. Each pole of the breaker shall be provided with inverse time thermal over load and instantaneous over current tripping elements, with trip-free mechanism. In case of multi-pole breakers, the tripping must be on all the poles and operating handle shall be common. Pressure clamp terminals for stranded/solid conductor insertion are acceptable up to 4 sqmm aluminum or 2.5 sqmm copper and for higher ratings; the terminals shall be suitably shrouded. Wherever MCB isolators are specified they are without the tripping elements.

5.2.3. The MCB contact shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger relay for over current and short circuit protection

5.3. Switch Fuse Unit

5.3.1. This unit shall be approved make triple pole metal clad switch fuse unit 415 volt, 200 amp, cat iii with link type h.r.c. fuses and natural link confirming to i.s.s. erected on angle iron frame, double break type suitable for load break duty (ac 23), quick make and break action. Separate neutral link shall be provided. The door of panel shall be duly interlocked with operating mechanism so as to prevent closing of the switch when the door is not properly secured. It shall be provided with at least 2 auxiliary contacts. All contacts shall be silver plated and all live parts shall be shrouded. The incoming and outgoing terminals of switches shall be adequately sized to receive 3.5 core x 120 sq mm xlpe aluminum cables. High rupturing capacity of not less than 35mva at 415 volts hrc fuse links shall be provided with visible indicators to show that they have operated. The switch fuse unit shall be manufactured in accordance with is: 4047-1967 as amended to date.

5.4. Fuse

5.4.1. Fuses shall be of high rupturing capacity (hrc) fuse links and shall be in accordance with is: 2000-1962 and having rupturing capacity of not less than 35 mva at 415 volts. The backup fuse rating as per site requirements / equipment.

5.5. Porcelain Fuse

5.5.1. Features

5.5.1.1. It should be made from top quality porcelain.

5.5.1.2. Best quality Brass, Phosphorus Bronze components and ETP copper contacts should be heavily silver plated to improve the high conductivity.

5.5.1.3. WEATHER CONDITION: The material used in construction of the fuse unit shall be suitable for use under following weather condition:-

Temp. Range : 0 to 50 C

Relative humidity : 2% to 100%

Altitude-upto : 1000 Meters

Use : Outdoor, in dist. box or indoor in consumer's premises.

5.5.1.4. The fuses shall be suitable for continuous operation at AC 415 V and frequency 50 Hz

5.5.1.5. IS: 2086/1993 with latest amendment for fuses up to 100 Amp

5.5.1.6. The fuses base shall be provided with two fixing holes for fixing the fuse base by means of screwier bolts.

5.5.1.7. The fuse base shall have contacts for suitably engaging with the contacts of the fuse carrier rigidly under any condition. The contacts shall be made out of such a metal which will not lose its electricity due to heating of the contacts on full load with 20% overload current or heat generated and required pressure is maintained even after repeated engagements and disengagement. The contact for rating 63 A and above will also have extended strips for fixing cable lugs by means of bolt.

5.5.1.8. FUSE CARRIER: The fuse carried shall have contacts suitable for engaging with fuse base contacts. They shall be provided with suitable terminals for the connection of the fuse elements. The fuse carrier shall be so constructed that it is capable of being reversible for introduction into the fuse base. The contacts shall be made out of the metal which will not lose its elasticity on account of heating of the contacts on full load with 20% overload conditions or heating due to blowing of the fuse element due to short circuit and required pressure is maintained and even after repeated engagement and disengagement.

5.5.1.9. Every fuse carrier shall be clearly and indelibly embossed with the following information.

5.5.1.9.1. Rated Current

5.5.1.9.2. Rated voltage

5.5.1.9.3. Size of fuse wire

5.5.1.9.4. Manufacturer's name/Trade mark.

5.5.2. Workmanship

- 5.5.2.1. The carrier and fuse base when installed in the intended manner shall have all live parts so protected as to prevent inadvertent contact with such live parts.
- 5.5.2.2. The fuse carrier shall be provided with a handle or grip and shall be shaped in acceptable manner so that it will be easy to withdraw the carrier without use of any tools and without danger to any L.M. or operator.
- 5.5.2.3. All metal parts shall be protected against corrosion by suitable methods.
- 5.5.2.4. Live parts of the fuse carrier shall be covered either by a shield or barrier of insulating materials or be counter sunk not less than 3 mm below surface of the base and covered with water proof insulating sealing compound which will not deteriorated or flow at temp lower than 100 C.
- 5.5.2.5. Live parts on the underside of the fuse base for surface mounting shall be either covered by a shield or barrier of insulating materials or be counter sunk not less than 3mm below the surface of the base and covered with water proof insulating sealing compound which will not deteriorate or flow at a temp. lower than 100 degree C or on full load current with 20% overload or blowing of fuse under short circuit condition or shall have clearance of not less than 6.0 mm for 16A and 32A and 9mm for 63A, 100A and 200A size from the mounting surface and reliably prevented from loosening.
- 5.5.2.6. Screws upon which the general assembly of the fuse base and carriers terminals and contacts depend shall be prevented from loosening or backing out by lock, washers, stacking or other reliable means.
- 5.5.2.7. If screws used in the assembly of a fuse are loosened or removed in order to install the fuse elements or to connect the fuse into a circuit they should be thread into metal and shall be provided with washers

5.6. Moulded Case Circuit Breaker

- 5.6.1. The MCCB shall be air break type and having quick break with trip free operating mechanism confirmed to is : 8825 and iec-60947-1/2 standard.
- 5.6.2. It should have thermal magnetic trip unit, adjustable thermal protection from 0.8 -1 in for 400 amp. And short circuit protection from 5 -10 in for rating more than 4000amp.it should be of rated operational voltage of 690 v ac (50 hz) and insulation voltage of 750v ac. It should have electrical life of 4000 (2500) operations and mechanical life of 10000 (8000) operations for rating 400 amp. (>400 amp.) All the MCCB above 400 shall be have breaking capacity of 50ka. And 25 ka for MCCB < 400 amp rating
- 5.6.3. Housing of the MCCB shall be of heat resistant and flame retardant insulating material. Operating handle of the MCCB shall be in front and clearly indicate on / off / trip positions. The electrical contact of the circuit breaker shall be of high conducting non deteriorating silver alloy contacts. The MCCB shall be provided with thermal / magnetic type bi-metal over load release and electro-magnetic short circuit protection device. All the releases shall operate on common trip bus bar so that in case of operation of any one of the releases in any of the three phases, it will cut off all the three phases and thereby single phasing of the system is avoided. The MCCB whenever called for in the appendix drawings shall provide an earth fault relay. The MCCB shall provide two sets of extra auxiliary contacts with connections for additional controls at future date. The electrical parameters of the MCCB shall be as per the descriptions given in the attached drawings.

5.7. Contactor:

- 5.7.1. Contactor shall be air break type, having 3 power contact and 4 nos. Of auxiliary contact conforming to is: 2959, contactor provided shall be ac4 duty type for capacitor and ac3 duty type for motor loads. It shall be suitable for minimum class ii intermittent duty. It shall be capable of making and breaking starting current of motors and require capacity of capacitor load of corresponding rating. Auxiliary contacts shall be rated for at least 6a and shall be capable of carrying the maximum estimated current, also shall be break before

make type. No volt coil working voltage shall be 360 V to 440 V. It should be complete with over current relay with single phasing protection.

5.8. Thyristorised / Solid State Fast Response Pfc / Solid-State Ssr Switching (Apfc Relay)
:-

- 5.8.1. The automatic power factor controller should be of 12 step microprocessor base and having following features. It shall form thyristorised / solid state fast response pfc / solid-state ssr switching.
- 5.8.2. Automatic step section depending upon the system power factor and targeted power factor, relay should sense the capacity of each bank automatically and accordingly only required nos of capacitor should be switched on in any case
- 5.8.3. This controller should take sensing current and voltage from incomer of l.t. sides.
- 5.8.4. Required epoxy cast resin c.t.'s for sensing incomer should be supplied by the contractor. Summation c.t. (if required) should be supplied by the contractor. Apfc controller shall have rs 485 communication port
- 5.8.5. Automatic selection of c/k ratio (min. Capacitor step size/c.t. ratio)
- 5.8.6. Indication of real time p.f. with lagging or leading
- 5.8.7. Prevent leading p.f. during low load condition
- 5.8.8. Audio (hooter) and visual alarm with reset push button for low p.f. below targeted.
- 5.8.9. Max. Acquisition time: - 2 sec.
- 5.8.10. Smallest group to sense :- 5 kvar
- 5.8.11. Type of switching: - thyristorised / solid state relay.
- 5.8.12. Microprocessor based displaying system p.f., kvar, average power factor since reset, kvar per stage, system 3 phase voltage, current , power factor, kw, kvar, stage on off indication shall be included
- 5.8.13. PFC should sense 3 phase kvar correctly even in unbalanced load 3 phase 4 wire systems.
- 5.8.14. PFC should be provided with adequate harmonic filter in case of higher harmonic level of 3/5/7/9/11th harmonic more than 5 % or total thd more than 7%.
- 5.8.15. It shall be capable of selecting and connecting right value of capacitors. To effect complete correction within 2 seconds by var sensing relay.
- 5.8.16. The apfc relay should have rs-485 communication port to communicate with computer.
- 5.8.17. The 12 step p.f. controller should operate capacitor in 12 steps depending upon system power factor.
- 5.8.18. The capacitor must be disconnected in the event of power supply failure and should be protected against high inrush current, when power supply restored or at the time of automatic and time delayed switching of capacitor.

5.9. Capacitors:

- 5.9.1. Supplying, installation, testing and commissioning of double layer app / extra low losses mdxl type, rated $450 \pm 10\%$ volt, 50 hz., three phase, delta connected, capacitor in required bank/bunch size and having following features.
- 5.9.2. Watt losses total $< 0.5w / kvar$,
- 5.9.3. Degree of protection ip 31, with safety feature like pressure sensitive disconnect or (over pressure tear off fuse), with discharge resistor,
- 5.9.4. Complete with minimum two earthing terminal, name plate rating etc.
- 5.9.5. Confirming to is-2834/1986 and latest relevant is.
- 5.9.6. It shall be capable of coping with over voltage condition.
- 5.9.7. Above-mentioned capacitor banks should be connected with the outgoing feeders of the apfc panel. Capacitor should be supplied as per above-mentioned table.
- 5.9.8. All the capacitor should be tested in tpsel / recognized laboratory and two copies of the test reports/certificates of the capacitors shall be submitted to the client. Catalogues/technical details of the capacitor shall be furnished along with technical bid of the tender.
- 5.9.9. After commissioning of whole automation system, contractor shall have to analyze the harmonic level of the whole system i.e. Harmonic level of thd of whole system if found more than 5.0%, then necessary instruments/systems like harmonic filter, output filter etc. Shall be supplied and fitted to control harmonic level of thd of whole system to achieve less than 5.0%, without any extra cost.

5.10. Main bus bar:

5.10.1. Three phase and neutral bus bar shall be designed for minimum specified rated current. Bus bar shall be high quality, air insulated, high conductivity, high strength, tinned copper with non hygroscopic colored sleeve. Bus bar copper shall be electrolytic grade. Minimum bus bar size used must be derived by considering current density of bus bar and shall be mounted with standard bus bar SMC (seat molded compound)/dmc support at sufficient interval to avoid sag and effectively **withstand** electromagnetic stress in the event of short circuit capacity of 50 ka rms symmetrical for 1 sec. And pick short circuit current of 105 ka. The bus bar shall be housed in separate compartment and shall be isolated with at least 3mm thick Bakelite sheet or higher grade material. Bus bar and panel board design shall be as per Indian electricity rule and CPRI norms and standards. Bus bar shall be extendible type for future expansion. Necessary cut out arrangement shall be provided for the same. The size of neutral bus bar shall be same as that of phase bus bar for main panel and lighting panel. The bus bar shall be arranged such that minimum distance between them does not remain lower than below.

Between phase	: 25 mm
Between phase and neutral	: 25 mm
Between phase and earth	: 25 mm
Between neutral and earth	: 20 mm.

5.10.2. The bus bar and interconnections shall be insulated with heat shrinkable PVC sleeve with standard color identification codes. The bus bar shall be connected by chromium plated or tinned plated brass bolts and nuts and washers shall be used for tightening. All connection between bus bar strips and circuit breaker/ switch and terminals shall be thoroughly insulated aluminum strips of proper size to carry rated current.

5.11. Time Switch

5.11.1. Approved make time switch with single pole air break contacts suitable for 230 v / 16a, complete with self starting motor driven clock on & off automatic arrangement at any predetermined time during each 24 hours, with nickel cadmium rechargeable battery backup erected as directed

5.11.2. Technical specification

Operating voltage	240 v ac
Supply frequency	50-60 hz
Power consumption	Less than 4 w
Ambient temperature	-10 0c to 55 0c
Clock accuracy	+/- 1 sec./day at 20 0c
Switching contact	2 c/o contact
Manual over ride	Provided
Mounting	Din rail

5.12. Contactors:

5.12.1. 32/70 amp. 500 v 50 hz tp high rupturing capacity contactors for incoming 3 phase, 4 wire, 440 v, 50 hz electric supply having following technical data.

- 5.12.1.1. Main poles - 3
- 5.12.1.2. Current rating – minimum 32/70 amp.
- 5.12.1.3. Duty - ac – 3
- 5.12.1.4. Terminal capacity - suitable for connecting 4 x 50 sq mm aluminium conductor cable with or without cable end socket.

5.13. Panel Feeder Meter:

- 5.13.1. It shall be provided for generator feeder. It shall be dial flush mounted digital power meter. It shall have metering capacity of all three phase voltage, current, kw, kva, kvar, pf, frequency phase angle. It should show three phase parameter at a same time on display. Instrument shall have measuring capacity of accuracy class-1.

5.14. Indication Lamp

- 5.14.1. Indication lamp shall be led type panel mounted, low power consumption, long life, o/l and s/c protected with its holders etc. Suitable for specified voltage shall be used.

On indication	: red
Off indication	: green
Trip indication	: amber

5.15. Current Transformers

- 5.15.1. The current transformers shall have synthetic cast resin insulation and be of the single phase type, with number of cores as per the specific requirements.
- 5.15.2. The primary & secondary connections shall be clearly labeled.
- 5.15.3. All current transformers shall have insulation level and short time rating as per main switchgear. All current transformers shall be dimensioned to carry continuously a current of 120% of the rated current. The ratios shall be as per the specific requirements.

5.16. Voltage/Potential Transformer (PT):

- 5.16.1. The voltage transformers shall be insulated for full voltage rating.
- 5.16.2. The pt shall have synthetic resin insulation and be of single phase type. Rated secondary voltage shall be $110 \text{ V}/\sqrt{3}$ unless otherwise specified.
- 5.16.3. Pt shall be capable of withstanding thermal and mechanical stresses resulting from short circuit and momentary current rating of breaker/switches.

5.17. Control Switches/Selector Switches:

- 5.17.1. Control and meter selection switches shall have integral name plate and for all other devices, the same shall be located below the respective devices. Instrument and devices mounted on the face of the panels shall also be identified on the rear with the same number.
- 5.17.2. All control switches shall be rotary, back connected type having cam operation contact mechanism. Phosphor bronze contacts shall be used on switches
- 5.17.3. The handle of control switches used for circuit breaker operation shall turn clockwise for closing and anti-clockwise for tripping and shall be spring return to neutral from close/trip with lost motion device.
- 5.17.4. Control switch for dg and incomer panels shall have one set of lost motion spare contacts.
- 5.17.5. Ammeter selector switches shall be with off position and with make before break feature and shall have 3 positions to read the three phase currents. Voltmeter selector switches shall also be of 3 positions and off position, suitable to read phase to phase voltages.
- 5.17.6. The control switches, operating handles, meters, relays etc shall be mounted at the front of the switchgear panels. The instruments shall not be mounted less than one meter or more than two meters from the floor level. Ammeters and voltmeters are to be provided with selector switches. Operating handles shall not be mounted at a height more than 1.75 meters. Breaker control switches wherever provided shall be so designed that when released by the operator it shall automatically return to a neutral position. They shall be fitted in sequence with lock to avoid inadvertent operation and shall be arranged such that after passing the "closed" position the control switch cannot be moved into the "closed" position again without passing the

"open" position. Each panel shall have indicating lamps for "on", "off", "trip" "trip circuit healthy" and "spring charged".

- 5.18. Auxiliary Supply
 - 5.18.1. Auxiliary dc and ac supply shall be derived from the incoming source of the panel with suitable control arrangements for indication circuits, closing circuits, space heaters etc.
 - 5.18.2. Separate dc insulated wire buses shall be provided. Dc supply required for protection/ indication/ tripping shall be taken from the above wire bus bars through protective fuses.
 - 5.18.3. Suitable fuses and links shall be provided for individual circuits for protection and also for isolation from bus wire without disturbing the other circuits. Bus wires from panel to panel shall be wired through necessary control terminals.
 - 5.18.4. Panel heaters and thermostats shall be provided in all the panels.
- 5.19. Wiring And Controls:
 - 5.19.1. Control supply of the each individual feeder shall be taken from the auxiliary contact of the MCB, so by switching the MCB, control supply of the concern feeder will be controlled. The main object of doing this is to cut-off power as well as control supply from the feeder at the time of maintenance / repairing. The wiring inside the modules for power and control protection and instrumentation shall be done using 1.1 kV grade, PVC insulated FRP copper conductor cables conforming to is 694 and is 8130. Power wiring inside the starter module shall be rated for full current rating of contactor but not less than 4.0 sqmm size. For c.t. 2.5 sq.mm. Cu. Wire shall be used whereas other control wiring shall be done using 1.5 sq. Mm wire. Control wiring and indicating lamps shall have protective fuses (hrc type) .the necessary ferrules shall be filled to all wire terminals for ease of identification. Only one conductor shall be permitted to one termination.
- 5.20. Cable Compartment:
 - 5.20.1. Cable compartment should have adequate space to accommodate required number xlpe insulated copper or aluminum conductor both in incoming & outgoing. There should be ample space for the termination of this cable.
- 5.21. Construction:
 - 5.21.1. The panel shall comprise fully compartmentalized bottom entry, extensible type cubicle pattern, and front operated, suitable for floor / stand mounting as per site requirement. The panel board shall be divided into distinct vertical sections comprising of completely metal enclosed bus compartment running horizontally
 - 5.21.2. The schematic diagrams are interned as a guide and manufacturer shall develop his own general arrangement and schematic drawing adding necessary auxiliary devices , accessories , components peculiar to supplied equipments , ferrules number , terminal number etc. Which are required for safe, convenient, efficient a proper operation of the 415 volts switchboard / m.c.c.
- 5.22. Following shall be taken care.
 - 5.22.1. Main bus bar should be electrolytic tin copper type with heat shrinkable PVC sleeves with colour code.
 - 5.22.2. All internal wiring and all connection shall be with copper wires and strips as required. Copper flexible wire shall be used below 100 amps.
 - 5.22.3. All component, frame etc shall be earthed. A common internal earth bar with two separate earthing leads shall be provided.
 - 5.22.4. Powder coating to be done on all sheet metal works as required.
 - 5.22.5. Panel should have ms base frame for floor mounting unless otherwise specified.
 - 5.22.6. The board should be front operated and extendible type.
 - 5.22.7. Compression type brass glands and crimping lugs for incomer and outgoing ends.
 - 5.22.8. All ammeters to be provided with CTs and selector switch and control fuses.

- 5.22.9. Panel components shall be specified.
 - 5.22.10. The design and location of damp panel to be approved by the engineer incharge before fabrication and installation
 - 5.22.11. All panels should be dust and vermin proof.
 - 5.22.12. All panels should be fabricated out of 14 gauges CRCA sheet. The door should be made from 14 gauge CRCA sheet.
 - 5.22.13. All meters should be digital type only unless and otherwise specified.
 - 5.22.14. Panel builder shall be CPRI approved.
 - 5.22.15. The board should meet with requirement of IS 2147/1962.
 - 5.22.16. All the switches used should be capable of withstanding the ac23 duty for motor operation. The switches should have quick break. The contacts should be silverplated double break type. The switch should confirm to IEC 947-iii.
 - 5.22.17. If it is possible panel component as well as accessories should be one make.
 - 5.22.18. The board should with stand the system prospective fault current.
 - 5.22.19. The switches shall confirm to IS: 4047 the fuses shall conform to IS: 220 the fuses shall be of hrc type.
 - 5.22.20. Engraved plastic labels shall be provided indicating the feeder details, capacity, cable size, and load in kW and danger signs.
 - 5.22.21. The entire panel board should be with adequate height width & depth as per relevant prevailing standard
 - 5.22.22. Include foundation bolts of suitable size as per requirement.
 - 5.22.23. All compartment doors should be concealed hinged type & handles of feeders to be interlocked mechanically with the doors such that door cannot be opened when the switch position "on" & switch cannot be "on" when the doors is on open position.
 - 5.22.24. Detailed drawing shall be got approved prior to manufacture.
 - 5.22.25. If required only front opened and operated panel for ldb and ahu panels will be accepted.
 - 5.22.26. If capacitors of apfcr panels are not mounted in the panel itself than separate closed/covered rack with sufficient ventilation shall be included.
 - 5.22.27. Engraved PVC labels shall be provided on incoming and outgoing feeders.
 - 5.22.28. Sld showing circuit inside the d. B. Shall be posted inside of door and covered with transparent laminated plastic sheet.
 - 5.22.29. The name plate with panel designation shall be fixed at the top of central panel. And name plate showing feeder details shall be provided on each feeder module as well as termination door.
- 5.23. General requirement of the panel
- 5.23.1. The tenderer must have CPRI approval for manufacturing panel for the tenderer, who has not CPRI approval, has to make panel from CPRI approved panel manufacturer only.
 - 5.23.2. Each switch fuse unit must be complete with the operating handle interlock; suitable h.r.c. fuses etc as per site requirement.
 - 5.23.3. The entire l.t. switch gear unit should confirm to IS-13947.
 - 5.23.4. All the CTs shall have cast resin type only with class i accuracy and each ct should have short link.
 - 5.23.5. Indication lamp shall be led type panel mounted, low power consumption, min.100000 hours of life, o/l and s/c protected with its holders etc. Suitable for specified voltage shall be used.
 - 5.23.6. All the measuring instruments should be of accuracy class 1.0.
 - 5.23.7. Each door of the panel should be earthed separately by flexible link.
 - 5.23.8. The above cubicle pattern l.t. switch board comprising of incoming and outgoing described above must be complete with necessary floor stands, foundations bolts, copper inter connections between bus bars and incoming / outgoing / ats / variable frequency drive, inter wiring with PVC copper cables, labels marked for incoming /outgoing / ats / variable frequency drive, earthing terminal etc. And other required major / minor items.
 - 5.23.9. All internal wiring work should be permanently marked / labelled at terminations with numbers or letters corresponding to diagram.

- 5.23.10. A copper earth with bus must also run throughout the panel.
- 5.23.11. Ample space in each compartment shall be provided for easy maintenance and repairing.
- 5.23.12. Extra fans should be provided for cooling the panel if required and as per directed by engineer-in-charge
- 5.23.13. The complete board should be scraped, cleaned and painted with powdercoated paint after application of 7 tank process and primer using siemens grey shade coat at manufacturer's works as per relevant is.. An easy access to bus bar should be kept for testing, maintenance and checking. The board should be prepared and erected in accordance with the prevailing Indian electricity rules and regulations. The appearance of the panel board should be neat, clean and pleasant. The panel should be fabricated from suitable size angles and 14 swg CRCA sheet steel and angle / channel iron sections. Sufficient space should be available for cable jointing. All live parts must be covered with non- hygroscopic insulated sheet. The lifting lugs / hooks should also be provided for handling the board. The necessary sufficient louvers should be provided for heat dissipation and air cooling.
- 5.23.14. The space requirement for board must be specified. The board is to be installed on the r.c.c. platform having cable trench 1.0 metre. Size. Cable entry to panel board should be at bottom long. A floor stand and operating platform having minimum width of 1 metre. Should also be incorporated.

5.24. Safety Shutter Devices:

- 5.24.1. Shutters shall be provided at bus bar chamber cut out for closing the same when the drawable chassis of the modules are drawn out.
- 5.24.2. The bus bar shutters shall be automatically operated by the movement of the carriage.

5.25. Insulators:

- 5.25.1. Insulators of moulded or resin bonded material shall have a durable, non-hygroscopic surface finish having a high anti-tracking index. Insulators, barriers made out of hylam, synthetic resin bonded paper, treated wood will not to be accepted.
- 5.25.2. Insulators shall be mounted on the switchgear structure such that there is no likelihood of their being mechanically over-stressed, during normal tightening of the mounting and bus bars, connections etc.

5.26. Earthing:

- 5.26.1. Copper earth bar of minimum 25mm x 3mm (or specified size) size shall be run through whole length of panel. The frame work of panels shall be connected to this earth bar and it shall be provided to facilitate connection with main earth coming from earth pit on both sides of panels. The earth continuity conductor of each in/out feeder shall be connected to this earth bar. The armor shall be properly connected to earthing clamp, and clamp shall be ultimately bonded with earth bar.

5.27. Danger board:

- 5.27.1. 440 volt danger board as per IS: 2551-1982 in English and Gujarati shall be fixed on all sides of panel.
- 5.27.2. The board shall be glass enameled with red background and white letterings.
- 5.27.3. The danger notice plate shall be made out of 1.6mm thick mild steel sheet. Approximate size should be 200mm x 150 mm.
- 5.27.4. The letters, figures, the conventional skull and bones etc shall be positioned on the plate as per IS 2551-1982. The said figures & pictures shall be painted in single red color as per is5-1978

5.28. Painting:

- 5.28.1. The panel shall undergo chemical de-rusting and blasting and shall be effectively prophesied as per is-6005. The panel shall be thoroughly rinsed with clean water

after phosphate followed by final rinse with dilute dichromate solution and even drying. The phosphate coating shall be sealed by the application of two coats of ready mixed staving type zinc chromate primer.

- 5.28.2. Two coats of finishing powder coated paint shall be applied. The final finished thickness of paint film on steel shall not be less than 100 microns and shall not be more than 150 microns. The color for the finishing paint shall be approved by the engineer. The finished appearance of panels shall present an aesthetically pleasing appearance free from dust and uneven surfaces.
- 5.29. Brief description of the atomization:
 - 5.29.1. The atomization is meant to control the acbs, MCCBs, contactors and other switchgears fully automatically as directed in drawing or elsewhere. The main features to be take care are.
 - 5.29.1.1. The bus coupler acb must be off when any generator is on load or outgoing from dg or incoming from dg to lt main panel acb is on
 - 5.29.1.2. The apfcr and fixed capacitors feeders must be electromechanically interlocked in such a way that, any of the capacitor does not come in line when any dg is on load.
 - 5.29.1.3. The transformer outgoing acb (incomer-1 of main LT panel) and outgoing acb of dg as well as incomer of main LT panel can never be "on" together.
 - 5.29.1.4. All the switchgears should be mechanically interlocked in such a way that, all above conditions must be fulfilled even on manual mode of operation of dg / acbs.
 - 5.29.1.5. If client needs to provide additional back-up protection of reverse current / reverse powers relay it must be included.
- 5.30. Tests and inspection:
 - 5.30.1. All site tests as per Indian standards and high voltage test of bus bars in presence of engineer-in-charge.
- 5.31. Drawings:
- 5.32. Manufacturers shall submit for approval the single line, general arrangement drawing including material list, accessories, components peculiar to supplied equipments, ferrules numbers, terminal numbers, foundation drawings and control wiring drawings. Approval of schematic drawings, single line and control wiring drawings shall be obtained before starting the manufacturing of panel board. Manufacturer shall submit the 04 copies of final prints with laminations and 01 reproducible tracing of each and every drawing. Out of these 04 copies, 01 copy should be affixed in the panel as directed by engineer-in-charge.
- 5.33. Test certificates
 - 5.33.1. Type test certificates of all standard component parts, e.g. Contactors, breakers, switches, fuses, relays, ct's, vt's, and for the standard factory built assembly shall be submitted by the supplier.
- 5.34. instruction manuals
 - 5.34.1. The supplier shall furnish specified number of copies of the instruction manual which would contain detailed instructions for all operational & maintenance requirement. The manual shall be furnished at the time of dispatch of the equipment and shall include the following aspects:
 - 5.34.2. Outline dimension drawings showing relevant cross-sectional views, earthing details and constructional features.
 - 5.34.3. Rated voltages, current, duty-cycle and all other technical information, which may be necessary for correct operation of the switchgear.
 - 5.34.4. Catalogue numbers of all components liable to be replaced during the life of the switchgear.
 - 5.34.5. Storage for prolonged duration.

- 5.34.6. Unpacking.
- 5.34.7. Handling at site.
- 5.34.8. Erection.
- 5.34.9. Pre commissioning tests.
- 5.34.10. Operating procedures
- 5.34.11. Maintenance procedures.
- 5.34.12. Precautions to be taken during operation and maintenance work.

5.35. Workmanship

- 5.35.1. The panel should be fabricated from CPRI approved panel manufacturer, each switch fuse unit must be complete with the operating handle interlock, suitable h.r.c. fuses etc as per site requirement. All the l.t. switch gear unit should be should be of the same company.
- 5.35.2. All the CTs shall have cast resin type only and each ct should have short link. Indication lamp shall be led type panel mounted, low power consumption, min.100000 hours of life, o/l and s/c protected with its holders etc. Suitable for specified voltage shall be used.
- 5.35.3. All the measuring instruments should be of accuracy class 1.0 each door of the panel should be earthed separately by flexible link. The above cubicle pattern l.t. switch board comprising of incoming and outgoing described above must be complete with necessary floor stands, foundations bolts, copper inter connections between bus bars and incoming / outgoing / ats / variable frequency drive, inter wiring with PVC copper cables, labels marked for incoming /outgoing / ats / variable frequency drive, earthing terminal etc. And other required major / minor items.
- 5.35.4. All internal wiring work should be permanently marked / labelled at terminations with numbers or letters corresponding to diagram. A copper earth with bus must also run throughout the panel.
- 5.35.5. Ample space in each compartment shall be provided for easy maintenance and repairing.
- 5.35.6. The required size capacitor bank with thyristorised base apfc relay should be in corporate inside all pcc, lighting, hvacs panel, where ever required.
- 5.35.7. Extra fans should be provided for cooling the panel if required and as per directed by consultant / engineer-in-charge

6. DOL starter

6.1. Material specification

- 6.1.1. Applicable standards: IS: 13947 (part 4/sec1) 1993:low voltage switchgear and control gear: part 4 contractors and motor starters, sec 1 electromechanical contactors and motor starters [superseding is 2959 & is 8544(all parts)] (amendment 1)
- 6.1.2. Operation range should be -20% to + 15% of rated coil voltage
- 6.1.3.Suitable for intermittent duty class 30
- 6.1.4. Under-voltage protection below 40% of rated voltage.
- 6.1.5. Adequate space and terminal sizes for terminations of recommended cables of either copper or aluminum, easy to install and maintain.
- 6.1.6. Starter enclosure should be minimum ip-53.

6.2. Workmanship

- 6.2.1. Direct on line should be made from 16 g CRCA sheet duly epoxy powder painted
- 6.2.2.Inside and outside with hinge door and locking arrangement consisting of suitable size of on-off isolated (AC-3/23 duty) main fuses, single phasing prevented. Indicating lamp for r-y-b phases overload relay, automatic water level controller, a meter, volt meter each with selected switch incoming wire duly socket crimped, main contactor start-stop push button to be erected on angle iron frame grouted on wall as directed.

7. Indoor & Outdoor Lighting Equipments

7.1. General material specification

- 7.1.1. This section relates to technical specification for indoor & outdoor lighting equipments of the project.

- 7.1.2. All fixtures shall be complete with accessories necessary for installation whether so detailed under fixture description or not.
- 7.1.3. Fixture housing, frame or canopy shall provide a suitable cover for the fixture outlet box or fixture opening.
- 7.1.4. Fixtures shall be installed at mounting heights as detailed on the drawings or instructed on site by the engineer in charge.
- 7.1.5. Fixtures and/or fixture outlet boxes shall be provided with hangers to adequately support the complete weight of the fixture. Design of hangers and method of fastening other than shown on the drawings or herein specified shall be submitted to the engineer in charge for approval.
- 7.1.6. Pendant fixtures within the same room or area shall be installed plumb and at a uniform height from the finished floor. Adjustment of height shall be made during installation as per engineer in charge instructions.
- 7.1.7. Flush mounted and recessed fixtures shall be installed so as to completely eliminate light leakage within the fixture and between the fixture and adjacent finished surface.
- 7.1.8. Fixture mounted on outlet boxes shall be tightly secured to a fixture stud in the outlet box. Extension pieces shall be installed where required to facilitate proper installation.
- 7.1.9. Fixture shall be completely wired and constructed to comply with the regulations and standards for electric lighting fixtures, unless otherwise specified. Fixtures shall bear manufacturer's name and the factory inspection label unless otherwise approved.
- 7.1.10. Wiring within the fixture and for connection to the branch circuit wiring shall not be less than 2.5 sqmm copper for 250 volt applications. Wire insulation shall suit the temperature conditions inside the fixture and wires bypassing the choke/ballast shall be heat protected with a heat resistant sleeve.
- 7.1.11. Metal used in lighting fixtures shall be not less than 22 swg or heavier if so required to comply with the specification or standards. Sheet steel reflectors shall have a thickness of not less than 20 SWG. The metal parts of the fixtures shall be completely free from burrs and tool marks. Solder shall not be used as mechanical fastening device on any part of the fixture.
- 7.1.12. Ferrous metal shall be bowdlerized and given a corrosion resistant phosphate treatment or other approved rust inhibiting prime coat to provide a rust-proof base before application of finish.
- 7.1.13. Non-reflecting surfaces such as fixture frames and trim shall be finished in baked enamel paint.
- 7.1.14. Light reflecting surface shall be finished in baked white enamel having a reflection factor of not less than 80%. All parts of reflector shall be completely covered by finish and free from irregularities. After finish has been applied and cured, it shall be capable of withstanding a 6 mm radius bend without showing sign of cracking, peeling or loosening from the base metal. Finish shall be capable of withstanding 72 hours exposure to an ultraviolet sun lamp placed 10 cm from the surface without discoloration, hardening or warping and retain the same reflection factor after exposure. Test results shall be furnished for each lot of fixtures.
- 7.1.15. Fixture with visible frames shall have concealed hinged and catches. Pendant fixtures and lamp holders shall be provided with ball type Algiers or similar approved means. Recessed fixtures shall be constructed so as to fit into an acoustic tile ceiling or plaster ceiling without distorting either the fixture or the ceiling plaster rings/flanges shall be provided for plaster ceiling. Fixtures with hinged diffuser doors shall be provided with spring clips or other retaining device prevent the diffuser from moving.
- 7.1.16. Detailed catalogue cuts for all fixtures, or, if so required by the engineer in charge sample fixtures shall be submitted for approval to the architect/consultant before orders for the fixtures are placed. Shop drawings for non-standard fixture types shall be submitted for approval to the architect/consultant.
- 7.1.17. Recessed fixtures shall be constructed so that all components are replaceable without removing housing from the ceiling.

7.2. Lamps:

- 7.2.1. Lamps shall be supplied and installed in all lighting fixtures furnished under this contract. All lamps shall be rated for 250 volts.
- 7.2.2. Lamps used for temporary lighting service shall not be used in the final lighting of fixtures units.

- 7.2.3. Lamps shall be of wattage and type as shown on the drawings and schedule. Where not shown, the details shall be ascertained from the architect / engineer in charge before procurement.
- 7.2.4. Lamps for permanent installation shall not be placed in the fixtures until so directed by the architect / engineer in charge, and this shall be accomplished directly before the building portions are ready for occupation.
- 7.2.5. Lamp should be of the same make as of control gear/ballast.

7.3. Fluorescent fittings with hi - frequency ballast:

- 7.3.1. Only single and/or two lamp ballast shall be used in any one fixture. Ballast shall be completely enclosed inside sheet steel casing and shall have corrosion - resistant finish. Ballast shall contain a thermosetting type compound not subject to softening or liquefying under any operating conditions or upon ballast failure. Compound shall not support combustion. All ballast shall be of high power factor compensated to above 0.9pf. Ballast temperature and sound rating shall be specified by the manufacturer and guaranteed. Ballast shall be for operation at the voltages and frequencies indicated and under temperature conditions prevailing in the various locations of the premises. Tapped ballast is preferred.
- 7.3.2. Ballast general/technical specification must be within the specified limit as mentioned in is 13021 part-i&ii with latest amendments. The e.m.i & r.f.i values must be as per is 6842 with latest amendments, if any. The ballast should have over voltage protection circuit and transient/spike suppression circuit. Total harmonic distortion should be less than or equal to 33%, current crest factor (peak/rms current value) should be ≤ 2 .
- 7.3.3. All fluorescent fixtures shall be provided with separate wiring channel with cover plate and an earth terminal. All screws shall be chromium brass screws. Lamp and starter holders shall be out of tough molded plastic with spring loaded rotor type contactors rendered shock and vibration proof. Condensers shall be low loss paper impregnated hermetically sealed complying with is 1969-196. Internal wiring shall be neatly clipped and where by passing the ballast, a suitable heat resistant barrier or sleeve shall be provided.
- 7.3.4. Minimum working (burning) life of fluorescent lamp should be more than or equal to 15000 hours. (Necessary confirmation must be sought from the manufacturer). Lamp lumen output should be ≥ 91 lumen/watt. Depreciation of lumen output over life span of lamp should not exceed 10%.
- 7.3.5. The combined power factor should be more than or equal to 0.92 at 230 volt.
- 7.3.6. Surface mounted fixtures longer than two feet shall have one additional point of support besides the outlet box fixture stud when installed individually. Pendant individually mounted fixtures four feet long and smaller shall be provided with twin stem/conduit hangers. Stems shall have ball aligners or similar devices and provided for a minimum of 25 mm vertical adjustment. Stem shall be of appropriate length to suspend fixtures at required mounting height.
- 7.3.7. Lamps shall have bi-pin bases and a minimum approximate rating.

7.4. Emergency lighting

7.4.1. Code & standards:

7.4.1.1.	National building code of india	: SP: 7 2005
	Specification for emergency lighting unit	IS: 9583-1981
	Code of practice for safety colors and safety signs	IS: 9457-1980
	Fire protection safety sign	IS: 12349-1988
	Fire safety in hotels-code of practice	IS: 13716
7.4.1.2.	Code of practice for fire safety of building(general)	
	Exit requirement and personal hazards	IS: 1644-1988
	Code of practice for fire safety of building (electrical Installation)	IS: 1646
	Graphic symbols for fire protection plans	IS: 12407-1988

7.4.2. Technical specifications:

- 7.4.2.1.** Ac supply for charging of battery: 240V AC, 50/60 Hz.

- 7.4.2.2. Recharging period should be 10-12 hours and regulated battery charging with constant voltage tapering current characteristics and goes into trickle charge when the battery attains full charge
- 7.4.2.3. Emergency light switches on instantly on ac mains failure. Switches off automatically and reverts back to battery charging mode after supply resumption.
- 7.4.2.4. Automatic low battery cut-off.
- 7.4.2.5. Over voltage protection
- 7.4.2.6. Manual switch for switching of emergency light when not required.
- 7.4.2.7. Rugged metal body with powder coated finish.
- 7.4.2.8. Provision of wall mounting of the light fixture should be provided.
- 7.4.2.9. It should be with ni-mh/ni-cd rechargeable battery of constant current charge type.
- 7.4.2.10. All emergency lighting should be tested in accordance with en60598-2-22.
- 7.4.2.11. Inbuilt push test switch should be provided.
- 7.4.2.12. Battery backup: 3 hour for emergency signages & 1 hour for the emergency light

7.5. Decorative post top lantern / flood light fixtures

- 7.5.1. The light fixture construction shall be of die cast aluminum or otherwise as specified with a separate compartment for integral ballast equipment. The reflector shall be anodized polished aluminum. The glass reflector shall be heat-resistant.
- 7.5.2. Lamp holder shall be of porcelain and shall comprise of a terminal block of non-hygroscopic material. The luminaries shall have integral ballast housed in water tight and dust tight metal cases. Ballast shall be pre-wired to the lamp socket and terminal block, requiring only power supply leads to the ballast primary terminals.
- 7.5.3. The light fixtures shall be minimum IP66 unless until mentioned in the schedule.

7.6. Earthing

- 7.6.1. All the light fixtures, indoor & outdoor, shall be properly earthed by means of copper conductor as mentioned elsewhere in this document.

7.7. Special notes

- 7.7.1. The successful tenderer will have to supply the makes from above in consultation with the client/architect/consultant without any extra cost.
- 7.7.2. Tenderer should have to specify the list of makes considered in the tender while quoting the rates in the tender, in covering letter of separate letter enclosure. However, the final decision for accepting make specified by tenderer would be of engineer in charge / architect.
- 7.7.3. As far as possible, the successful tenderer will have to place order directly to the manufacturer or its authorized dealer. The engineer in charge have right to check the challans of supplier.
- 7.7.4. Make of components required to be used by contractor to complete the installation, if not mentioned anywhere, shall be required to get it approved by engineer in charge before installation in writing.
- 7.7.5. Within a week of work order, the contractor shall submit the sample and/or catalogue of each item / component of above mentioned approved make for the approval of the engineer in charge / architect.
- 7.7.6. The contractor should have to prepare full fledged lighting demo of each kind of light fixtures as per instruction of engineer in charge / architect for approval at no extra cost.

7.8. Workmanship

- 7.8.1. The fixture shall be installed as per manufacturer's instruction, with all necessary accessories. The job also includes connection of fixture with respective outlet point with heat resistant wires through heat resistance sleeve and PVC connector. Proper earthing shall be provided to the fixtures.
- 7.8.2. The contractor has to work in co-ordination with existing contract. The conduits are already laid in the slab by existing contractor. The contractor has to solve any dispute mutually and practically regarding existing work done by existing contractor.

8. Decorative Lighting poles

- 8.1. GI Lighting pole should conforming to I.S. 2713-1980 with latest amendment

- 8.2. The pole shall be provided with 12mm diameter tapped hole with bolt nut welded for earthing at suitable height as directed by Engineer-in-charge.
- 8.3. The Pole shall be painted with one coat of red oxide and two coats of aluminium paint after erection prior to commissioning.
- 8.4. Please refer section 24 of material specification for details of B class GI Pipe
- 8.5. Decorative Pole, with Base Plate made out of G.I tubular pole, primed and painted.
- 8.6. The column shall also be provided with flush door at the bottom with proper strengthening to the cutout of the door opening.
- 8.7. A junction/ looping box with Heavy duty 3 phase connector shall be built into the pole.
- 8.8. The Pole shall be painted two coats of polyurithyne based Paint.
- 8.9. MCB of required rating to be provided with pole.
- 8.10. Workmanship
 - 8.10.1. The lighting poles shall be fabricated from heavy duty cold-rolled ms pips and painted as specified. The pole shall have a base plate, a large access panel, and necessary fixture mounting bracket at top. The access panel shall provide easy access to a multi-way porcelain connector and fuse/MCB board, to be mounted inside the pole. The access shall be specially fabricated with adequate reinforcement and weather gasket to prevent ingress of moisture and vandal proof. Poles shall have large diameter entries for incoming and outgoing cable and two earth studs. The pole fabrication shall conform to the drawings and where such drawing is not available; the contractor shall make such drawing and have it approved before fabrication.
 - 8.10.2. The pole shall house a multi-way terminal block and MCB as shown on the drawings.
 - 8.10.3. Foundation bolts & nuts shall be provided with the pole

9. Poles Foundation

- 9.1. Material specification
 - 9.1.1.1:2:4 cement concrete foundation (along with base plate and cable guard pipe and earthing wire etc. Which are included in other item) of 450mm x 450mm x 900 mm length for 4 meter poles, 600mm x 600mm x 1200mm for pole up to 8.5 mtr height, 600mm x 600mm x 1500mm for pole up to 8.5 mtr height, with necessary plastering and colour washing for pole. The item includes excavation and supply of cement, sand, kapachi, grit etc. By the contractor. The contractor should make necessary arrangement for water required for the works at his own cost. The site should be cleaned off excess material after the work is completed.
- 9.2. Workmanship
 - 9.2.1. The foundation with necessary plastering and colour washing shall be arranged for pole for good finishing of the foundation

10. Pole Box:

- 10.1. Material specification
 - 10.1.1. Sintex or approved make SMC press moulded composite frp (plastic) loop-in, loop-out box approx. 207mm thick complete with Bakelite connector strip 4 way & hinged doors having locking arrangements with mounting clamp with nuts, bolts & washers suitable for erection on pole with cable clamp & earth bolt of following size of box. (a) 300mm x 200mm x 100mm
 - 10.1.2. Press moulded composite FRP (plastic) loop- in, loop-out, dust & water proof, junction box, minimum 2 mm thick (Sintex or equivalent), with doors hinged on top side (open able from bottom to top) having locking arrangements ,with above mentioned size.
 - 10.1.3. Should be provided with 6 amp sp MCB 10ka.
- 10.2. Workmanship
 - 10.2.1. GI mounting clamp with nuts, bolts & washers suitable for erection on pole with cable clamps & earth bolt.
 - 10.2.2. The box should have provision for 2 nos. (or 3 nos. If required) cable entries suitable for size of the cable. The box should be so designed to prevent ingress of foreign material including rainwater.
 - 10.2.3. The box should accommodate the following:

- 10.2.4. For the poles of 4 m height the junction box sintex or equivalent make SMC press moulded composite frp (plastic) to be fixed on streetlight pole with suitable g.i. clamp and bolts, nuts.
- 10.2.5. A danger notice caution sticker should be fixed on junction box.
- 10.2.6. Each box should be complete with earthing strip for cable (armoured) termination and earthing bolts for the same.

11. Ceiling Fan, Regulators And Clamps :

- 11.1. Material specification
 - 11.1.1. Ceiling fan should follow the below mentioned standards
 - 11.1.1.1. IS 374(part 0/sec 0):1979 : electric ceiling type fans and regulators
(third Revision)
 - 11.1.1.2. IS 2997(part 0/sec 0):1964 : air circulator type electric fans and regulators
 - 11.1.1.3. IS 302 (part 2/sec 80):2003 : safety of household and similar electrical Appliances
 - 11.1.1.4. Part 2 particular requirements, sec 80 fans (superseding is 12155:1987)
 - 11.1.2. Ceiling fans including their suspension shall conform to relevant iss with secondary safety device incorporated against free fall of fans from their hooks.
 - 11.1.3. Fan hooks made of M.S. rods of 15 mm diameter shaped in 'u' form with their legs projecting horizontally on the top at least 19 cm on either side and tied over the top reinforcement of the roof shall be laid in the concrete slabs.
 - 11.1.4. The body of the ceiling fan, exhaust fan and fan regulator shall be connected to the earthing system by proper earth leads.
- 11.2. Workmanship
 - 11.2.1. The all ceiling fans shall be wired to ceiling roses or to special connector boxes and suspended from hooks or shackles. There shall be no joints in the suspension rod.
 - 11.2.2. In case of "i" beams, the suspension arrangements fabricated out of m.s. plates shall be shaped suitably to catch the flanges and shall be held together by means of laying bolts, nuts, check nut and split pin.
 - 11.2.3. For concrete roofs, ceiling fans hooks shall be got buried in the concrete during construction.
 - 11.2.4. The suspension arrangement for the fans shall be so designed that the fans canopies shall completely hide suspension element.
 - 11.2.5. Unless otherwise specified all ceiling fans shall be hung 2.75m above the floor.
 - 11.2.6. In the case of measurement of extra down rod for ceiling fans including wiring, the same shall be measured in units of 10 cms & length less than 5 cm shall be ignored. The cost of wiring for extra down rod shall be paid as per supplying and drawing cable in existing conduits

12. Exhaust Fans

- 12.1. Material specification
 - 12.1.1. Exhaust fans shall conform to is 302(part 2/sec 80):2003 : safety of household and similar electrical appliances: part 2 particular requirements, sec 80 fans (superseding is 12155:1987) and other relevant iss.
 - 12.1.2. It should be reversible fresh air cum exhaust fan
- 12.2. Workmanship
 - 12.2.1. The exhaust fans shall be erected at the places indicated by the engineer-in-charge. For fixing exhaust fans a circular opening shall be provided in the wall to suit the size of the frame, which would be fixed by means of rag bolts, embedded in the walls, opening shall be neatly plastered to the original finish of the wall. The exhaust fan shall be wired as near to the opening as possible by means of flexible cord. Care being taken that the blades rotate in the proper direction.
 - 12.2.2. The exhaust fan for installation in corrosive atmosphere shall be painted with special PVC paint or chlorinated rubber paint. Installation of exhaust fan in kitchen, dark room and such other special locations shall be carried out giving due consideration for the specific requirements.
 - 12.2.3. The body of the ceiling fan, exhaust fan and fan regulator shall be connected to the earthing system by proper earth leads.

13. MS Fabricated Items.

- 13.1. Material specification
 - 13.1.1. Materials: all structural steel shall conform to i.s. 226-1975. The steel shall be free from the defects mentioned in i.s. 226-1975 and shall have a smooth finish. The material shall be free from loose mill scale, rust pits or other defects affecting the strength and durability. Rivet bars shall conform to i.s. 1148-1992.
 - 13.1.2. When the steel is supplied by the contractor test certificates of the manufacturer shall be obtained according to i.s. 226-1975 and other relevant Indian standards
- 13.2. Workmanship
 - 13.2.1. The steel section as specified or required shall be cut square and to correct length as per drawing and design. The cut ends exposed to view shall be finished smooth. No two pieces shall be welded or otherwise jointed to make of the required length of member, except as indicated in the drawings or as directed. All straightening and shaping to form shall be done by application of pressure and not by hammering. Any bending or cutting shall be carried out in such a manner as not to impair the strength of the metal. All operations shall be done in cold state unless otherwise directed / permitted.
 - 13.2.2. Steel riveted or bolted in built up sections, framework.
 - 13.2.3. The steel structure as shown in the drawings or as per directions of the engineer-in-charge shall be laid out on a level platform to full scale and to full size or in parts. A steel tape shall be used for measurements to ensure maximum accuracy.
 - 13.2.4. Wooden templates 12 mm to 19 mm thick or metal steel templates shall be made to correspond to each connecting gusset plate and rivet holes shall be accurately marked on them and drilled. The templates shall be laid on the steel members and holes of the steel members shall also be marked for cutting. The base of steel columns and the position of anchor bolts shall be carefully set out.
 - 13.2.5. All stiffeners shall be formed by pressure and where practicable, the metal shall not be cut and welded in making these. In major works or where so specified, shop drawings giving complete details and information for the fabrication of the component parts of the structure, including location, type size, length and details of rivets, bolts, or weld shall be prepared in advance of the actual fabrication and as approved. The drawings shall indicate the shop and field rivets and bolts. The steel members shall be distinctly marked or stencilled with paint with the identification marks as given in the shop drawings.
 - 13.2.6. The bars shall be thickened at the ends, so as to provide for screwed threads and gradually tapered off to meet their normal sections.
 - 13.2.7. Great accuracy shall be observed in fabrication of various members so that this can be assembled without being unduly packed, strained, or forced into position and when built up, shall be true and free from twists, blinks, buckles or open joints. Before making holes in individual members for fabrication the steel work intended to be riveted or bolted together shall be as embedded or clamped properly and tightly so as to ensure close abutting or lapping of the surfaces of the different members. All stiffeners shall bear tightly both at top and bottom without being drawn or caulked. The abutting joints shall be cut or dressed true and straight and fitted close together.
 - 13.2.8. Web splice plates and fillers under stiffeners shall be cut to fit within 3 mm or flange angles, web plates of girders shall have to no cover plates shall have their ends flush with the top of angles forming the flanges unless otherwise required. The web plates when spiced shall have clearance of not more than 6 mm.
 - 13.2.9. The erection, clearance for cleared ends of members connecting steel to steel shall preferably be not greater than 1.5 mm. The erection clearance at the ends of beams without web cleats shall not be more than 3 mm at each end but where for a practical reason greater clearance is necessary, suitably designed neating shall be provided.
 - 13.2.10. Pins and rollers shall be accurately turned to gauge. These shall be straight and smooth and free from flaws. The roller bearing shall be provided with adequate arrangements for holding the girders of truss resting on it. In columns caps and bases, the ends of shafts together with the attached gusset angles, channels etc. After riveting together shall be accurately mechanized so that the paths connected but against each other over the entire surfaces of contact connecting angles or channels shall be fabricated and placed in position with greater accuracy so that they are not unduly reduced in thickness by machining.

- 13.2.11. The ends of bearing stiffeners shall be mechanized or ground to fit tightly both at the top and bottom. All holes shall generally be drilled to the required size and at required position. Sub punching shall be permitted, provided it is done 3 mm or less in diameter and reamed thereafter to the required size. The holes for rivets and bolts shall be larger by 0.4 to 6 mm than the nominal diameter of rivets or black bolts depending upon the diameter of rivets.
- 13.2.12. Holes shall have their axis perpendicular to the surface bored through. The drilling or reaming shall be free from burrs, and the holes should be clean and accurate holes for countersunk bolts shall be made in such a manner that their heads fit flush with the surface after fixing.
- 13.2.13. The fabrication work shall be completed in workshop as far as it is practicable to do so. Site joints shall be done with rivets and fitted bolts or black bolts, as shown in the drawing or as directed. Generally the following principles shall govern the use of rivets turned and fitted bolts and black bolts.
- 13.2.14. Rivets and turned and fitted bolts shall be used where the connection is such that slip under load has to be avoided.
- 13.2.15. Black bolts may be used very sparingly where a force is carried through a connection without impact, vibration or reversal of stresses.
- 13.2.16. Riveting :
- 13.2.16.1.** The parts assembled for riveting shall be in close contact with each other and the bearing stiffeners shall bear tightly both top and bottom without being drawn or caulked. Members to be riveted shall be properly pinned or bolted and rigidly held together while riveting. Drifting of holes shall not be permitted except to draw the parts together and the drifting tools so used shall have maximum diameter not exceeding the nominal diameter of rivets or bolts. Drifting done during assembling shall not distort the metal or enlarge the holes.
- 13.2.16.2.** The shanks of rivets shall project beyond the plate surface sufficiently so as to fill the hole thoroughly and form the required head after riveting.
- 13.2.16.3.** The riveting shall be done by hydraulic or pneumatic process. However where such facilities are not available hand riveting may be permitted. The rivet shall be heated red hot, care being taken to control the temperature of heating so as not to burn the steel. Rivets of diameter less than 10 mm may be fitted cold. Rivets shall be of heat finish with heads full and of equal size. All loose burnt or badly formed rivets with concentric or deficient heads shall be cut out and replaced. The heads of rivets shall be central to shanks and shall grip the assembled members firmly. In cutting out rivets, care shall be taken so as not to injure the assembled members caulking or reoccupying shall not be permitted.
- 13.2.16.4.** For testing rivets, a hammer weighing approximately 0.25 kg shall be used. Both heads of the rivets shall be tapped slack rivets will give a hollow sound and a jar.
- 13.2.16.5.** All rivets heads shall be painted with red lead paint within a week of their fixing.
- 13.2.17. Bolting
- 13.2.17.1.** All bolts and nuts shall be hexagonal and of equal size unless specified otherwise. The screwed heads shall conform to i.s. 1363-1960 and the threaded surface shall not be tapered. The bolts shall be of such length so as to project two clear threads beyond the nuts when fixed in position and these shall fit in the holes without any shakes. The nut shall be fit in the threaded ends of bolts properly.
- 13.2.17.2.** Where turned and fitted bolts are required to be used in place of rivets there shall be provided with washers not less than 6 mm thick so that the nut when tightened shall not bear on the unthreaded body of the bolt. Tapered washers shall be provided for all heads and nuts bearing on levelled surfaces. The threaded portion of the bolt shall not be within the thickness of the parts bolted together. The faces of the bolt heads and nuts abutting against steel members shall be machine finished. Where there is a risk of the nut being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of lock nuts, spring washers, cross cutting or hammering down of threads as directed.

- 13.2.17.3.** Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. The whole steel work shall be painted with a coat of priming, coat of red lead, as per relevant specification of painting there is a risk of the nut being removed or becoming loose due to vibrations or reversal of stresses, these shall be secured from slackening by the use of lock nuts, spring washers, cross cutting or hammering down of threads as directed.
- 13.2.17.4.** Bolts, nuts and washers shall be thoroughly cleaned and dipped in double boiled linseed oil before use. The whole steel work shall be painted with a coat of priming, coat of red lead, as per relevant specification of painting

14. 1.1 kV Grade LT Cables

14.1. Material specification

14.1.1. Applicable Standards

- IS-694 : PVC insulated cables for working voltages up to and including 1100V.
- IS-1554 : (Part-I) PVC insulated (heavy duty) electric cables for working voltages up to and including 1100V.
- IS-1554 : (Part-II) PVC insulated (heavy duty) electric cables for working voltages from 3.3kV up to and including 11kV.
- IS-3961 : Recommended current ratings for cables
- IS-8130 : Conductors for insulated electric cables and flexible cords.
- IS-5831 : PVC insulation and sheath of electric cables
- IS-6380 : Specification of Elastomeric Insulation & Sheath of Electric Cables
- IS-7098 : (Part-I & II) Cross linked polyethylene insulated PVC sheathed cables for working voltages up to 33kV.
- IS-3975 : Mild steel wires, strips and tapes for armoring cables.
- IS-1753 : Aluminium conductors for insulated cables
- IS-1255 : Code of practice for installation and maintenance of power cables up to and including 33kV rating.
- IS-12943 : Brass glands for PVC cables
- IS-10418 : Drums for electric cables
- IS-10810 : (Part 0 to 63) Method of test for cables
- IS-6474 : Polyethylene insulation and sheath of electric cables
- IS-5819 : Recommended short circuit ratings of high voltage PVC cables
- IEC-60502 : Power cables with extruded insulation & their accessories for rated voltages 1kV to 30kV
- IEC-540 & 540A : Test methods for insulation and sheaths of electric cables and cord
- IEC-60332 : Test on electric cables under fire conditions.
- IEC-60754 : Test on gases evolved during combustion of electric cables.
- IEC-10333 : Cable joints and terminations
- IEC Hand Book for Temperature Index Cable in fire regarding temperature Index Chapter-6.
- Any other applicable standards

14.2. Testing:

- 14.2.1. The contractor shall take full responsibility of testing pre-commissioning and commissioning of cabling system being installed by him. It shall be overall responsibility of the contractor to arrange and complete all activities in complete co-ordination with equipment commissioning agency keeping in view the overall commissioning programmed. The contractor shall submit a check list for testing and commissioning and the activities shall be carried out in accordance with the check list.
- 14.2.2. Testing and electric measurement of cable installations shall conform to IS: 1255.
- 14.2.3. Prior to installation, cables shall be tested for
- 14.2.3.1.** Continuity of conductors
- 14.2.3.2.** Insulation resistance between conductor and earth
- 14.2.3.3.** Insulation resistance between the conductors
- 14.2.4. After installation each cable shall be tested for
- 14.2.4.1.** Insulation resistance between conductors

- 14.2.4.2.** Insulation resistance between the conductors and earth
 - 14.2.4.3.** Absence of cross phasing
 - 14.2.4.4.** Firmness of terminations
- 14.2.5. The check and commissioning tests shall be carried out as part of the installation work and the contractor shall not be paid any extra amount for the same.
- 14.2.6. The contractor shall have to bring all testing equipment/instruments in sufficient numbers. All instruments shall be calibrated to the satisfaction of the purchaser before actual testing and tests to be conducted by qualified experienced personnel.
- 14.2.7. All documents/records regarding test data and all other measured values shall be submitted for approval and subsequent record and reference. All cables shall be energized only after certification from certification personnel that cable is ready for energizing. The results of all tests shall conform to the specification requirement as well as guaranteed data.
- 14.2.8. General:
- 14.2.8.1.** The medium voltage cables shall be supplied, laid, connected, tested and commissioned in accordance with the drawings, specifications, relevant Indian standards specifications, manufacturer's instruction, all cables run in parallel between LT. side of the existing transformer, LT incomer ACB's of LT switch board panel / outgoing of panel to motor terminal etc as required and as directed by the engineer-in-charge. Excavation and refilling using Stones, road crossing using RCC pipe, sand etc. Will be in the scope of contractor and shall be done as per relevant is standard.
 - 14.2.8.2.** The cable shall confirm to relevant is which should be specified and shall bear ISI mark. The quantities mentioned above are approximate only. The cables should be supplied after taking actual measurement jointly. No straight joint in any cables shall be permitted. Any piece or cut length shall have to be taken back by contractor. The contractor should plan and purchase the cable to avoid wastage / cut length / excess length as the corporation will not accept the same under any circumstances. The cable shall be genuine and of approved make only.
 - 14.2.8.3.** Root marker shall be provided for every 10 meter length of underground cable and cable identifier for every 20 meter length of cable not covered in underground.
 - 14.2.8.4.** RCC half round muff of standard make shall be provided for protection of underground cable.
 - 14.2.8.5.** All above item should be got approved from engineer-in-charge before execution.
 - 14.2.8.6.** The cables shall be delivered at site in the original drums with manufacturer's name, size and type clearly written on the drums.
 - 14.2.8.7.** All cables shall be adequately protected against any risk of mechanical damage to which they may be liable in normal conditions of handling during transportation, loading, unloading etc.
 - 14.2.8.8.** The cable shall be supplied in single length i.e. Without any intermediate joint or cut unless specifically approved by the client. The cable ends shall be suitably sealed against entry of moisture, dust, water etc. With cable compound as per standard practice.
- 14.2.9. Conductor:
- 14.2.9.1.** Uncoated, annealed copper / aluminium, of high conductivity, up to 4 mm² size the conductor shall be solid and above 4 sq. Mm, the conductor shall be concentrically stranded as per iec: 228.
- 14.2.10. Insulation:
- 14.2.10.1.** Cross link polyethylene (xlpe) extruded insulation rated at 70oc.
- 14.2.11. Core identification:
- | | |
|-------------|-------------------------------|
| Two cores | : red and black |
| Three cores | : red, yellow and blue |
| Four core | : red, yellow, blue and black |
| Single core | : green, yellow for earthing. |

Black shall always be used for neutral.

- 14.2.12. Assembly:
14.2.12.1. Two, three or four insulated conductors shall be laid up, filled with non-hygroscopic material and covered with an additional layer of thermoplastic material.
- 14.2.13. Armour:
14.2.13.1. Galvanized steel flat strip / round strips applied helically in single layers complete with covering the assembly of cores
14.2.13.2. For cable size up to 10 sq mm : armor of 1.4 mm dia g.i. round wire
14.2.13.3. For cable size above 10 sq mm : armor of 4 mm wide 0.8 mm thick gi strip
- 14.2.14. Sheath:
14.2.14.1. St -2 PVC along with polypropylene fillers to be provided. Inner sheath shall be extruded type and shall be compatible with the insulation provided for the cables. Outer sheath shall be of an extruded type layer of suitable PVC material compatible with the specified ambient temp. Of 50oc and operating temperature of cables. The sheath shall be resistant to water, ultra violet radiation, fungus, termite and rodent attacks. The colour of outer sheath shall be black. Sequential length marking along with size and other standard parameters shall be required at every 1.0 meter on the outer sheath.
- 14.2.15. Testing:
14.2.15.1. The finished cables shall be tested at manufacturer's works for all the routine tests for all the length and size of cables to be delivered at site and the certificate for the same shall be furnished to client. If required, the cables shall be tested in presence of the client's representative.
14.2.15.2. Voltage test: each core of cable shall be tested at room temperature at 3 kV AC RMS for duration of 5 minutes.
- 14.2.16. Conductor resistance test:
14.2.16.1. The DC resistance of each conductor shall be measured at room temperature and the results shall be corrected to 20 degree centigrade to check the compliance with the values specified in the is 8130 – 1976.
14.2.16.2. Cable tests before and after laying cables at site:
14.2.16.2.1. Insulation resistance test between phases, phase to neutral and phase to earth.
14.2.16.2.2. Continuity test of all the phases, neutral and earth continuity conductor.
14.2.16.2.3. Earth resistance test of all the phases and neutral.
14.2.16.2.4. All the tests shall be carried out in accordance with the relevant is code of practice and Indian electricity rules. The vendor/contractor shall provide necessary instruments, equipments and labour for conducting the above tests and shall bear all the expenses in connection with such tests. All tests shall be carried out in the presence of client and the results shall be prescribed in forms and submitted.
- 14.2.17. Cable marking:
14.2.17.1. The outer sheath shall be legibly embossed at every meter with following legend: electric cable: 1100 v, size: ___c x ___mm² with manufacturers name, year of manufacturing and isi symbol. The Surat Municipal Corporation shall be also is written with embossed writing on the cable.
- 14.2.18. Sealing drumming and packing:
14.2.18.1. After tests at manufacturer's works, both ends of the cables shall be sealed to prevent the ingress of moisture during transportation and storage. Cable shall be supplied in length of 500 metres or as required in non-returnable drums of sufficiently sturdy construction. Cables of more than 250 meters shall also be

supplied in non-returnable drums. The spindle hole shall be minimum 110 mm in diameter.

- 14.2.18.2.** Each drum shall bear on the outside flange, legibly and indelibly in the english literature, a distinguishing number, the manufacturer's name and particulars of the cable i.e. Voltage grade, length, conductor size, cable type, insulation type, and gross weight. The direction for rolling shall be indicated by an arrow. The drum flange shall also be marked with manufacturer's name and year of manufacturing etc.

14.3. Workmanship

- 14.3.1. Cables shall be laid in the routes marked in the drawings. Where the route is not marked, the Contractor shall mark it out on the drawings and also on the site and obtain the approval of the CLIENT AND/OR ITS ARCHITECT before laying the cable. Procurement of cables shall be on the basis of actual site measurements and the quantities shown in the schedule of work shall be regarded as a guide only.
- 14.3.2. Cables shall be laid on walls, cable trays, inside shafts or trenches. Saddling or support for the cable shall not be more than 500 mm apart. Plastic identification tags shall be provided at every 30 m. Cables shall be bent to a radius not less than 12 (twelve) times the overall diameter of the cable or in accordance with the manufacturer's recommendations whichever is higher. In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc unless marked on drawing by architect / consultant. Cables shall be laid on an excavated, graded trench, over a sand or soft earth cushion to provide protection against abrasion. Cables shall be protected with Stone or cement tiles on all the three sides as shown on drawings. Width of excavated trenches shall be as per drawings. Back fill over buried cables shall be with a minimum earth cover of 750 mm to 1000 mm. The cables shall be provided with cables markers at every 10 meters and at all loop points. All cables shall be full runs from panel to panel without any joints or splices. Cables shall be identified at end termination indicating the feeder number and the Panel/Distribution board from where it is being laid.
- 14.3.3. In case of cables entering the buildings
 - 14.3.3.1.** It would be done duly only through pipes. The pipes shall be laid in slant position, so that no rainwater may enter the building. After the cables are tested the pipes shall be sealed with M. seal & then tarpaulin shall be wrapped around the cable for making the entry watertight.
- 14.3.4. Testing: LT cables shall be tested upon installation with a 500 V Meggar and the Following readings established:
 - 14.3.4.1.** Continuity on all phase Insulation Resistance, between conductors, all conductors and ground
 - 14.3.4.2.** All test readings shall be recorded and shall form part of the completion documentation.
- 14.3.5. Format for cable testing certificate:
 - 14.3.5.1.** Drum no. from which cable is taken :
 - 14.3.5.2.** Cable from _____ to _____
 - 14.3.5.3.** Length of run of this cable _____ meter
 - 14.3.5.4.** Insulation resistance test
 - 14.3.5.4.1.** Between core 1 to earth _____ mega-ohm
 - 14.3.5.4.2.** Between core 2 to earth _____ mega-ohm
 - 14.3.5.4.3.** Between core 3 to earth _____ mega-ohm
 - 14.3.5.4.4.** Between core 1 to core 2 _____ mega-ohm
 - 14.3.5.4.5.** Between core 2 to core 3 _____ mega-ohm
 - 14.3.5.4.6.** Between core 1 to core 3 _____ mega-ohm
 - 14.3.5.4.7.** Duration used:
 - 14.3.5.4.8.** High voltage test: Voltage Duration
 - 14.3.5.4.9.** Between core and earth
 - 14.3.5.4.10.** Between individual cores

15. Cable Laying

15.1. Route

- 15.1.1. Before the cable laying work is undertaken, the route layout of the cable shall be submitted to the Engineer -in-Charge and the work shall be undertaken only after approval of the route layout.
- 15.1.2. Whenever cables of different voltages are laid following points shall be noted while laying along well demarcated or established roads, the LV / MV cables shall be laid further from the kerbed line than HV cables.
- 15.1.3. Cables of different voltages and also power and control cables shall be kept in different trenches with adequate separation. Where available space is restricted such that this requirement cannot be met, LV / MV cables shall be laid above HV cables.
- 15.1.4. Where cables cross one another, the cable of higher voltage shall be laid at a lower level than the cable of lower voltage.
- 15.1.5. Proximity to communication cables.
 - 15.1.5.1. Power and communication cables shall be as far as possible cross each other at right angles. The horizontal and vertical clearance between them shall not be less than 60 cm.

15.2. Methods of Laying

- 15.2.1. The cables shall be laid direct in ground, pipe, closed or open ducts, and cable trays or on surface of wall etc. The method(s) of laying required shall be specified in the tender / schedule of work.

15.3. Laying direct in ground

- 15.3.1. This method shall be adopted where specified in the schedule of works. Normally this method shall be adopted when the cable route is through open ground, along roads, lanes, etc. and where no frequent excavations are likely to be encountered and where re-excavation is easily possible without affecting other services.

15.3.2. Trenching

- 15.3.2.1. Width and depth of the trench shall be as shown in the drawing. When more than one tier of cables is unavoidable and vertical formation of laying is adopted, the depth of the trench shall be increased by 30 cm for each additional tier to be formed
- 15.3.2.2. The trenches shall be excavated in reasonably straight lines. Wherever there is a change in the direction, a suitable curvature shall be adopted complying with the minimum bending radius specified in Table – 11. Where gradients and changes in depth are unavoidable, these shall be gradual. The bottom of the trench shall be level and free from stones, Stone bats etc.

15.3.2.3. TABLE – 2

System voltage	Minimum bending radius		
	Single Core	Multi-Core	
		Armored	Unarmored
11KV	20D	12D	15D
22KV	25D	15D	20D
33KV	30D	20D	25D

Note: Where "D" is the overall diameter of the cable

- 15.3.2.4. Excavation should be done by suitable means – manual or mechanical. The excavated soil shall be stacked firmly by the side of the trench such that it may not fall back into the trench.
- 15.3.2.5. Adequate precautions should be taken not to damage any existing cable(s), pipes or any other such installations in the route during excavation. Wherever Stones, tiles or protective covers or bare cables are encountered, further

excavation shall not be carried out without the approval of the Engineer-in-Charge.

- 15.3.2.6.** Existing property, if any, exposed during trenching shall be temporarily supported adequately as directed by the Engineer -in-Charge. The trenching in such cases shall be done in short lengths, necessary pipes laid for passing cables there in, if required. If there is any danger of a trench collapsing or endangering adjacent structures, the sides should be well shored up with sheeting as the excavation proceeds. Where necessary, these may even be left in place when backfilling the trench.
- 15.3.2.7.** Excavation through lawns shall be done in consultation with the department concerned.

15.3.3. Laying of Cable in Trench

- 15.3.3.1.** Sand cushioning: The excavated trench shall be provided with a layer of clean, dry sand cushion of not less than 8 cm in depth, before laying the cables therein. However, sand cushioning may not be provided for MV cables, where there is no possibility of any mechanical damage to the cables due to heavy or shock loading on the soil above if so specified in the tender document and as per approval of the Engineer-in-Charge. Sand cushioning shall however be invariably provided in the case of HV cables.
- 15.3.3.2.** The cable drum shall be properly mounted on jacks, or on a cable wheel at a suitable location, making sure that the spindle, jack etc. are strong enough to carry the weight of the drum without failure and that the spindle is horizontal in the bearings so as to prevent the drum creeping to one side while rotating.
- 15.3.3.3.** The cable shall be pulled over in rollers in the trench steadily and uniformly without jerks and strain. The entire cable length shall be far as possible laid off in one stretch. PVC / XLPE cables less than 120 sq.mm size may be removed by "Flaking" i.e. by making one long loop in the reverse direction. For short runs and sizes up to 50 sq.mm of MV cables, any other suitable method of direct handling and lying can be adopted without strain or excess bending of the cables.
- 15.3.3.4.** After the cable has been so uncoiled, it shall be lifted slightly over the rollers beginning from one end by helpers standing about 10 m apart and drawn straight. The cable shall then be lifted off the rollers and laid in a reasonably straight line.
- 15.3.3.5.** Testing before covering. The cables shall be tested in presence of the Engineer -in-Charge for continuity of cores and insulation resistance and the cable length shall be measured, before closing the trench.
- 15.3.3.6.** Sand covering: Cables laid in trenches in a single tier formation shall have a covering of dry sand of not less than 17 cm above the base cushion of sand before the protective covers laid. In the case of vertical multi -tier formation, after the first cable has been laid, a sand cushion of 30 cm shall be provided over the base cushion before the second tier is laid. If additional tiers are formed, each of the subsequent tiers also shall have a sand cushion of 30 cm as stated above. Cables in the top most tiers shall have final sand covering not less than 17 cm before the protective cover is laid. Sand covering as stated above need not be provided for MV cables where a decision is taken by the Engineer -in-Charge as per sub clause (iii-a) above, but theater tier spacing should be maintained with soft soil instead of sand between tiers and for covering. Sand cushioning shall however be invariably provided in the case of HV cables.
- 15.3.3.7.** Extra loop cable
 - 15.3.3.7.1.** At the time of original installation, approximately 3 m of surplus cable shall be left on each terminal end of the cable and on each side of the underground joints. The surplus cable shall be left in the form of a loop. Where there are long runs of cables such loose cable may be left at suitable intervals as specified by the Engineer-in-Charge.

- 15.3.3.7.2.** Where it may not be practically possible to provide separation between cables when forming loops of a number of cables as in the case of cable emanating from a substation, measurement shall be made only to the extent of actual volume of excavation, sand filling etc and paid for accordingly.
- 15.3.3.8.** Mechanical protection over the covering: Mechanical protection to cables shall be laid over the covering to provide warning to future excavators of the present of the cable and also to protect the cable against accidental mechanical damage by pick-axe blows etc. as follows:
- 15.3.3.8.1.** Unless otherwise specified, the cables shall be protected by second class Stone of nominal size 22 cm x 11.4 cm x 7 cm or locally available size, placed on top of the sand (or, soil as the case may be). The Stones shall be placed breadth wise for the full length of the cable. Where more than one cable is to be laid in the same trench, this protective covering shall cover all the cables and projects at least 5 cm over the sides of the end cables.
- 15.3.3.8.2.** Where Stones are not easily available, or are comparatively costly, there is no objection to use locally available material such as tiles or slates or stone / cement concrete slabs. Where such an alternative is acceptable, the same shall be clearly specified in the tender specifications.
- 15.3.3.9.** Backfilling
- 15.3.3.9.1.** The trenches shall be then backfilled with excavated earth, free from stones or other sharp edged debris and shall be rammed and watered, if necessary in successive layers not exceeding 30 cm depth.
- 15.3.3.9.2.** Unless otherwise specified, a crown of earth not less than 50 mm and not exceeding 100 mm in the centre and tapering towards the sides of the trench shall be left to allow for subsidence. The crown of the earth, however, should not exceed 10 cms so as not to be a hazard to vehicular traffic.
- 15.3.3.9.3.** The temporary restatements of roadways should be inspected at regular intervals, particularly during wet weather and settlements should be made good by further filling as may be required.
- 15.3.3.9.4.** After the subsidence has ceased, trenches cut through roadways or other paved areas shall be restored to the same density and materials as the surrounding area and repaved in accordance with the relevant building Specifications to the satisfaction of the Engineer -in-Charge.
- 15.3.3.9.5.** Where lawns have been cut out of necessity, or kerb stones displaced, the same shall be repaired and made good, except for asphaltting, to the satisfaction of the Engineer -in-Charge and all the surplus earth or rock shall be removed to places as specified.
- 15.3.3.10.** Laying of single core cables
- 15.3.3.10.1.** Three single core cables forming one three phase circuit shall normally be held in close trefoil formation and shall be bound together at intervals of approximately 1m. The relative position of the three cables shall be changed at each joint at the time of original installation, complete transposition being effected in every three consecutive cable lengths.
- 15.3.3.11.** Route markers
- 15.3.3.11.1.** Location: Route markers shall be provided along with the runs of cable allocations approved by the Engineer -in-Charge and generally at intervals not exceeding 100m. Markers shall also be provided to identify change in the direction of the cable route and locations of underground joints.

- 15.3.3.11.2.** Plate type marker: Route markers shall be made out of 23 cms.X 12 cms G.I. /aluminium plate welded / bolted on 35 mm x 35 mm x 6 mm angel iron, 60 cms long. Such plate markers shall be mounted parallel to and at about 0.5 m away from the edge of the trench.
- 15.3.3.11.3.** CC marker: Alternatively, cement concrete 1:2:4 (1 cement: 2 coarse sand: 4 graded stone aggregate of 20 mm in size) shall be laid flat and centered over the cable. The concrete markers, unless otherwise instructed by the Engineer -in-Charge, shall project over the surrounding surface so as to make the cable route easily identifiable.
- 15.3.3.11.4.** Inscription: The words IITG-MV / HV CABLE as the case may be shall be inscribed on the marker.

15.4. Laying in Pipes / Closed Ducts

- 15.4.1. In locations such as road crossing, entry in to buildings, paved areas etc., and cable shall be laid in pipes or closed ducts. Stone ware pipes, GI, CI or spun reinforced concrete pipes shall be used for cables as specified in the schedule of works.
- 15.4.2. Where cables pass through foundation walls or other underground structures, the necessary ducts or openings will be provided in advance for the same. However, should it become necessary to cut holes in existing foundations or structures, the electrical contractor shall determine their location and obtain approval of the Engineer in Charge before cutting is done.
- 15.4.3. At road crossing and other places where cables enter pipe sleeves adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends.
- 15.4.4. At road crossings, the top surface of pipes shall be at a minimum depth of 1 m from the pavement level. When pipes are laid cutting existing road, care shall be taken so that the soil filled up after laying the pipes is rammed well in layers with watering as required to ensure proper compaction. A crown of earth not exceeding 10 cm should be left at the top. After the subsidence has ceased, the top of the filled up trenches in road ways or other paved areas shall be restored to the same density and material as the surrounding area in accordance with the direction of the Engineer -in-Charge (Civil) up to his satisfaction.
- 15.4.5. All G.I. pipes shall be laid as per layout drawings and site requirements. Before fabrication of various profiles of pipe by hydraulically operated bending machine (which is to be arranged by the Contractor), all the burrs from the pipes shall be removed. G.I. pipes with bends shall be buried in soil / concrete in such a way that the bends shall be totally concealed. For G.I. pipes buried in soil, bitumen coating shall be applied on the buried lengths. Installation of G.I. pipes shall be undertaken well before paving is completed and necessary coordination with paving agency shall be the responsibility of Electrical Contractor. The open ends of pipes shall be suitably plugged with G.I. plugs after they are laid in final position. G.I. plugs shall be supplied by the Contractor at no extra cost.

15.5. Laying in Open Ducts.

- 15.5.1. Open ducts with suitable removable covers (RCC slabs or checkered plates) are generally provided in substations, switch rooms, plant rooms, and workshops etc. for taking the cables. The cable ducts should be of suitable dimensions for the number of cables involved.
- 15.5.2. For laying of cables with different voltage ratings in the same duct shall be avoided. Where it is inescapable to take HV & MV cables same trench, they shall be laid with a barrier between them or alternatively, one of the two (HV / MV) cables may be taken through pipe(s). Splices or joints of any type shall not be permitted inside the ducts.
- 15.5.3. The cables shall be laid directly in the duct such that unnecessary crossing of cables is avoided.
- 15.5.4. Where specified, cables may be fixed with clamps on the walls of the duct or taken in hooks / brackets / cable trays through in ducts.
- 15.5.5. Where specified, ducts may be filled with dry sand after the cables
- 15.5.6. Are laid and covered as above, or finished with cement plaster, especially in high voltage applications.

- 15.6. Laying on Surface
 - 15.6.1. The method may be adopted in places like switch rooms, workshops, tunnels, rising (distribution) mains in buildings etc. This may be necessitated in the works of additions and / or alternations to the existing installation, where other methods of laying may not be feasible. Cables may be laid in surface by any of the following methods as specified:
 - 15.6.1.1.** Directly clamped by saddles or clamps
 - 15.6.1.2.** Supported on cradle
 - 15.6.1.3.** Laid on troughs / trays duly clamped.
- 15.7. Laying on Cable Tray
 - 15.7.1. This method may be adopted in places like indoor substations, air - conditioning plant rooms; generator rooms etc. or where long horizontal runs of cables are required within the building and where it is not convenient to carry the cable in open ducts. This method is preferred where heavy sized cables or a number of cables are required to be laid. The cable trays may be either of perforated sheets Type or ladder type as specified.

16. LT Cable Terminations:

- 16.1. Material Specification
 - 16.1.1. Cable termination:
 - 16.1.1.1.** Cable terminations shall be made with aluminium crimped type solder less lugs for all aluminium cables and stud type terminals. For copper cables copper crimped solder less lugs shall be used. Crimping shall be done with the help of hydraulically operated crimping tool. For joints where cable is with aluminium conductor and bus bars are aluminium, bimetallic lugs shall be used with compound. Cupal type of washers, crimping tool shall be used for crimping any size of cable.
 - 16.1.2. Cable glands:
 - 16.1.2.1.** Cable glands shall be of brass single compression type. Generally single compression type cable glands shall be used for indoor protected locations and double compression type shall be used for outdoor locations. Glands should be of nickel-plated brass, with PVC shrouds over it. Before applying PVC shrouds, all bare metal shall be wrapped with pressure sensitive adhesive tape.
 - 16.1.3. Ferrules:
 - 16.1.3.1.** Ferrules shall be of self-sticking type and shall be employed to designate the various cores of the control cable by the terminal numbers to which the cores are connected, for ease in identification and maintenance.
 - 16.1.4. Cable joints:
 - 16.1.4.1.** Kit type joint shall be done and filled with insulating compound. The joint should be for this 1.1 kV grade insulation, cable termination for conductors up to 4 sqmm may be insertion type and all higher sizes shall have compression type lugs. Cable termination shall have necessary brass glands. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armouring shall be earthed at both ends. Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages. Insulation cutting shall be done properly taking care that no area of the conductor remains exposed. Crimping shall be done with the help of hydraulic tool. Proper insulation tape shall be applied at the cable and lug joint.
 - 16.1.5. Saddles and clips:
 - 16.1.5.1.** Saddles and clips shall be PVC covered or of g.i. fixing screws shall be round head brass, where screws are used. Nuts shall be or brass, square pressed type.
 - 16.1.6. Jointing sleeves:

- 16.1.6.1.** Jointing sleeves shall be of brass with standard termination. Solder type cable connectors / cable sleeves shall be used to join the cable / conductors. The solder used shall comply with BS 219 type no corrosive flux only shall be used.

16.2. Workmanship

- 16.2.1. Suitable Size of crimped type solder less lugs should be used for all copper/aluminium cables and stud type terminals. Crimping shall be done with the help of hydraulically operated crimping tool. Crimping tool shall be used for crimping any size of cable.
- 16.2.2. Suitable Size of Cable gland should be used where cable is entering in DB or Panel. For indoor type single compression type cable glands shall be used and for outdoor type double compression type shall be used. Before applying a PVC shrouds, all bare metal shall be wrapped with pressure sensitive adhesive tape.
- 16.2.3. Proper Size of Cable Jointing Kit shall be used to joint two cables and shall be filled with insulating compound. The end termination shall be insulated with a minimum of six half-lapped layers of PVC tape. Cable armoring shall be earthed at both ends. Cable joints shall be done as per regular practice and check shall be carried out for loose connections and leakages.

17. DWC Pipe For Cable Protection Excavation And Covering The Cable:

17.1. Material Specification

- 17.1.1. Double walled corrugated pipes (dwc) of polyethylene (conforming to is 14930 ii) with necessary connecting accessory of same material at required date for laying of cable below ground / road surface for enclosing the cable and back filling the same to make ground as per original.
- 17.1.2. Diameter of pipe 90mm.
- 17.1.3. Excavation and covering the cable:
- 17.1.4. The dwc duct shall be prominently marked with indelible ink, with the following information at interval of every meter to enable identification of the pipe. The size of the ink markings shall be distinct, clear and easily visible.
- 17.1.5. Ink marking would have following written:
 - 17.1.5.1.** Manufacturer's name (can be in abbreviated form)
 - 17.1.5.2.** Name of the duct with size
 - 17.1.5.3.** Lot no. Of the product
 - 17.1.5.4.** Date of manufacture
 - 17.1.5.5.** Product length
 - 17.1.5.6.** Surat municipal corporation

17.2. Workmanship

- 17.2.1. This item includes excavation/ breaking of roads, refilling/restating land/road and covering of cable with RCC half rounds/sand etc. The covering of cable should be with RCC half round muff with cushioning of sand both on top and below of the cable. The RCC half rounds shall be of good quality. Necessary cable covering material should be supplied by the contractor. Where there are more than one cable are to be laid, minimum spacing of 225 mm should be kept, and both cables should be covered with RCC half rounds individually.
- 17.2.2. The item includes excavation of cable trench having depth of 50 to 90 MM (As instructed by engineer in charge) and refilling the same after cable laying and covering. All labour and material required for excavation, covering of cable and refilling shall be supplied by the contractor and the rate should include all such labour, material etc. Any damage to any of the services during excavation, covering, refilling shall be to the contractor's account. The work shall be carried out to the satisfaction of Engineer- in-charge. Refilling work of the trench should be carried out after final supervision of the representative of the corporation. After completion of covering work and testing, trench should be refilled and ground should be levelled including watering etc. If road of pavers-block is broken, the same shall be restated as original

18. RCC Hume Pipe

18.1. The Concrete Pipes shall be conforming to IS: 458/2003 (Fourth Revision) with Amendment 1 with regards to Design /Dimensions / Tolerances / Workmanship & Finish / Materials used for making the Pipes.

18.2. The Pipes shall be manufactured by spinning process. The ends of the concrete pipes shall be suitable for flush joints or collar joints or suitable for Socket & Spigot, roll on joints or confined gasket joints as per the requirements

19. Cable Tray

19.1. Material Specification

- 19.1.1. Ladder type cable tray. The cable tray shall be fabricated out of 2 mm thick slotted/perforated ms sheets as channel sections, single or double bended. The channel sections shall be supplied in convenient lengths and assembled at site to the desired lengths. These may be galvanized or painted as specified.
- 19.1.2. The jointing between the sections shall be made with coupler plates of the same material and thickness as the channel section. Two coupler plates, each of minimum 200mm length, shall be bolted on each of the two sides of the channel section with 8mm dia round headed bolts, nuts and washers. In order to maintain proper earth continuity bond, the paint on the contact surfaces between the coupler and cable tray shall be scraped and removed before the installation.
- 19.1.3. The permissible uniformly distributed load for various type of cables trays and for different supported span shall be as per is.
- 19.1.4. The width of the cables tray shall be chosen so as to accommodate all the cables in one tier, plus 30 to 50% additional width for future expansion. This additional width shall be minimum 100mm. The overall width of one cable tray shall be limited to 1000mm.
- 19.1.5. Factory fabricated bends, reducers, tee / cross junction. Etc shall be provided as per good engineering practice. The radius of bends, junctions etc. Shall be less than the minimum permissible radius of bending of the largest size of cable to be carried by the cable tray.
- 19.1.6. The cable tray shall be suspended from the ceiling slab with the help of 10 mm dia ms round or 25 mm x 5 mm flats at specified spacing. Flat type suspenders may be used for channels up to 450 mm width bolted to cable trays. Round suspenders shall be threaded and bolted to the cable trays or to independent support angle 50 mm x 50 mm x 5mm at the bottom and as specified these shall be grouted to the ceiling slab at the other end through an effective means, as approved by the engineer – in – charge, to take the weight of the cable tray with the cables.
- 19.1.7. The entire tray (except in the case of galvanized type) and the suspenders shall be painted with two coats of red oxide primer paint after removing the dirt and rust, and finished with two coats of spray paint of approved make synthetic enamel paint.
- 19.1.8. The cable tray shall be bonded to the earth terminal of the switch bonds at ends.
- 19.1.9. The cable tray shall be measured on unit length basis, along the centre line of the cable tray, including bends, reducers, tees, cross joints, etc.
- 19.1.10. The ladder type of cable tray shall be fabricated of double bended channel section longitudinal members with single bended channel section rungs of cross members welded to the base of the longitudinal members at a centre to centre spacing of 250 cm as per is.

19.2. Workmanship

- 19.2.1. The free vertical distance between parallel perforated trays/racks/ladder shall be at least 250mm and the perforated trays shall be 50mm away from the walls.
- 19.2.2. The trays shall be fixed to the brackets with proper nuts and bolts system.
- 19.2.3. The perforated trays shall be free from sharp edges and burns etc. so that joint between two trays shall be without any clearance and matched in proper shape.
- 19.2.4. At the bends the curvature in all axes of perforated trays/racks shall be 20R or maximum size of cable.
- 19.2.5. The supporting brackets/fixing bolts size shall be so calculated that the design load as specified under sub clause of clause 2.17 does not exceed.

- 19.2.6. The perforated trays shall be installed in such a way that as far as possible the cables can be laid directly in place rather than be pulled through.
- 19.2.7. The cables shall be fixed in the perforated trays by means of plastic ties or plastic coated wires etc.
- 19.2.8. The perforated cable trays along with their supporting arrangements shall be properly earthed by the supplier with nut and bolts from the earthing risers provided by purchaser, generally in the vicinity of the tray routing. The earthing shall be as per latest I.E. rules and IS/IEC recommendation, the size of earth connection shall be such that its conductance should be more than the conductance of the 14 sq.mm. Copper conductor cross section

20. Main Line Wiring, Internal Wiring And Point Wiring

20.1. Material Specification

20.1.1. Standards

Code of practice for electrical wiring installation system voltage not exceeding 650	: IS: 732
Code of practice for fire safety of buildings general) electrical installation	: IS: 1646
Rigid steel conduits for electrical wiring	: IS: 1653
Fittings for rigid steel conduits for electrical	: IS: 2667
Flexible steel conduit for electrical wiring	: IS: 3480
Accessories for rigid steel conduits for	: IS: 3837
PVC insulated cables (wires)	: IS: 694
Rigid non-metallic conduits for electrical wiring	: IS: 2509
Flexible (playable) non-metallic conduits for	: IS: 6946
Three pin plugs and sockets	: IS: 1293
Conductors for insulated electrical cables and	: IS: 8180
Specification for conduit for electrical installation	: IS: 9537--
1980	
Accessories for non-metallic conduits for electrical wiring	: IS: 3419
Switches	: IS: 3854
Plugs	: IS: 6538
Shunt capacitors for power systems	: IS: 2834-
1954	
Hrc cartridge fuses and links up to 660 volts	: IS: 2208
General and safety requirement for lighting fittings	: IS: 1913-1969
Code of practice for lighting public thorough fares	: IS: 2944-
1981	
3 pin plug sockets	: IS
-1293	
Specification of conduits for electrical installation	: IS -8130
Guide for electrical layout in residential building Indian electricity act and rules	: IS-
4648	

20.1.2. Rigid and flexible conduits:

- 20.1.2.1.** All conduits shall be rigid PVC pipe having minimum wall thickness of medium gauge 1.5 to 1.8 approved by FIA. & ISI and shall confirm to IS 9537.
 - 20.1.2.1.1.** Up to 38 mm. Diameter - minimum 1.8 mm. Wall thickness.
 - 20.1.2.1.2.** Above 40 mm. Diameter - minimum 2.2 mm. Wall thickness.
 - 20.1.2.1.3.** 20, 25, and 32 mm diameter- minium1.5 mm wall thickness
- 20.1.2.2.** Flexible conduits shall be formed from a continuous length of spirally wound interlocked steel strip with a fused zinc coating on both sides. The conduit shall be terminated in brass adapters.

20.1.2.3. Accessories:

20.1.2.3.1. PVC conduit fittings such as bends, elbows, reducers, chase nipples, split couplings, plugs etc. Shall be specifically designed and manufactured for their particular application. All conduit fittings shall conform to IS: 2667-1964 and IS: 3857-1966. All fitting associated with galvanized conduit shall also be galvanized.

20.1.3. Casing and Capping

20.1.3.1. Casing and capping shall be of good quality PVC, free from defects like deformations, unevenness, blisters, cavities, etc.

20.1.3.2. The casing shall be of square or rectangular body with top of the side walls suitable for tightly fitting slide-in type capping with double grooving. All surfaces shall have smooth finish inside and outside.

20.1.4. Wires:

20.1.4.1. All wires shall be single core multi-strand/ flexible copper frls type PVC insulated as per IS: 694 and shall be 660 v\1100 v grade.

20.1.4.2. All wires shall be colour coded as follows :

Phase	Colour of Wire
R	red
Y	yellow
B	blue
N	black
Earth	green (insulated)
Control (if any)	grey

20.1.4.3. All off wires shall be same as phase wire

20.1.5. Switches & Sockets:

20.1.5.1. Switches shall be moulded plate type flush piano type with silver-coated contacts. Sockets shall be 3 pin with switch and plate type cover. Combination of multiple switch units and sockets should be used to minimize the switch boxes. All screws shall be brass-chromium plated and shall be counter sunk type with half round head or flat headed. For heavy duty, metal clad sockets m.c.b/ isolator mounted in a galvanized steel box shall be provided.

20.2. Workmanship

20.2.1. Point wiring

20.2.1.1. The size of conduit shall be selected in accordance with the number of wires permitted under table given below. The minimum size of the conduit shall be 25 mm. diameters unless otherwise indicated or approved. Size of wires shall not be less than 1.5 sqmm copper or 2.5 sqmm aluminium

Nominal Dia of wires (mm)	Nominal Cross sec. Area (mm ²)	20 mm		25 mm		32 mm		38 mm	
			B	S	B	S	B	S	B
1/2.40	1.50			8	6	1 5	9	-	--
1/1.80	2.50			6	4	1 0	8	-	--
1/2.24	4.00			4	3	8	6	-	--
1/2.80	6.00			4	3	6	6	-	--
1/3.55	10.00		-	3	2	5	4	6	5

Note: S: Runs of conduits which have distance not exceeding 4.25 m. between draw boxes & which do not deflect from the straight by an angle more than 15 degree.

B: Runs of conduits which deflect from the straight by more than 15°

20.2.1.2. Conduits shall be kept at a minimum distance of 100 mm. from the pipes of other non-electrical services. And maintain minimum 300 mm distance between telephone, TV & Computer piping (if possible)

20.2.1.3. Separate conduits/raceways shall be used for :

20.2.1.3.1. Normal lights and 5 A 3 pin sockets on lighting circuit.

20.2.1.3.2. Separate conduit shall be laid from D.B. to switch board or point.

20.2.1.3.3. Power outlets - 15 A 3 pin 20 A/30 A, 2 pin scraping earth metal clad sockets.

20.2.1.3.4. Emergency lighting.

20.2.1.3.5. Telephones.

20.2.1.3.6. Fire alarm system.

20.2.1.3.7. Public address system & Music system.

20.2.1.3.8. For all other voltages higher or lower than 230 V.

20.2.1.3.9. T.V. Antenna.

20.2.1.3.10. Water level guard.

20.2.1.3.11. Computer Wiring

20.2.1.3.12. Call bell wiring layout of conduits shall be generally as indicated on drawings and the layout shall be supplemented and complemented by contractor on site with the approval of the Engineer.

20.2.1.3.13. Wiring for short extensions to outlets in hung ceiling or to vibrating equipments, motors etc., shall be installed in flexible conduits. Otherwise rigid conduits shall be used. No flexible extension shall exceed 1.25 m.

20.2.1.3.14. Conduits run on surfaces shall be supported on GI 12 mm. thick pressure saddles which in turn are properly screwed to the wall or ceiling. Saddles shall be at intervals of not more than 500 mm. Fixing screws shall be with round or cheese head and of rust-proof materials. Exposed conduits shall be neatly run parallel or at right angles to the walls of the building. Unseemly conduit bends and offsets shall be avoided by using fabricated mild steel junction/pull through boxes for better appearances. No cross-over of conduits shall be allowed unless it is necessary and entire conduit installation shall be clean and neat in appearance.

20.2.1.3.15. Conduits embedded into the walls shall be fixed by means of staples at not more than 500 mm. intervals. Chases in the walls shall be

neatly made and refilled after laying the conduit and brought to the finish of the wall but final finish will be done by the building contractor.

- 20.2.1.3.16.** Conduits buried in concrete structure shall be put in position and securely fastened to the reinforcement and got approved by the Engineer, before the concrete is poured. Proper care shall be taken to ensure that the conduits are neither dislocated nor choked at the time of pouring the concrete. Suitable fish wires shall be drawn in all conduits before they are embedded.
- 20.2.1.3.17.** Where conduit passes through expansion joints in the building, adequate expansion fittings shall be used to take care of any relative movement.
- 20.2.1.3.18.** Inspection boxes shall be provided for periodical inspection to facilitate withdrawal and removal of wires. Such inspection boxes shall be flush with the wall or ceiling in the case of concealed conduits. Inspection boxes shall be spaced at not more than 12 meters apart or two 90° solid bends or equal. All junction and switch boxes shall be covered by 6 mm. clear per plate truly cut and fixed with cadmium plated brass screws. These junction boxes shall form part of point wiring or conduit wiring as the case may be including the cost of removing the Perspex cover for painting and re-fixing. No separate charges shall be allowed except where specially mentioned.
- 20.2.1.3.19.** Conduits shall be free from sharp edges and burrs and the threading free from grease or oil. The entire system of conduits must be completely installed and rendered electrically continuous before the conductors are pulled in. Conduits should terminate in junction boxes of not less than 32 mm. deep.
- 20.2.1.3.20.** An insulated earth wire of copper rated capacity shall be run in each conduit. The earth continuity conductor shall be as follows.
- 20.2.1.3.21.** Load balancing: Balancing of circuit in three-phase installation shall be planned before the commencement of wiring and shall be strictly adhered to.

20.2.2. Minimum size of earth conductor not forming part of same cable as associate circuit conductor

20.2.3. Nominal cross section area of Largest associated copper circuit Conductor in Sq. MM	Nominal cross section area of Earth continuity conductor in Sq. MM
6.0	2.5
10.0	6.0
16.0	6.0
25.0	16.0
35.0	16.0
50.0	16.0

20.2.4. Lighting & Power Wiring:

- 20.2.4.1.** All final branch circuits for lighting and appliances shall be flexible copper wire of appropriate size run inside conduits. The conduit shall be properly connected or jointed into sockets, bends, and junction boxes.
- 20.2.4.2.** Branch circuit conductor sizes shall be as shown in the schedule of quantities and or drawings.
- 20.2.4.3.** All circuits shall preferably be kept in a separate conduit up to the Distribution Board. No other wiring shall be bunched in the same conduit except those belonging to the same phase. Each lighting branch circuit shall not have more than ten outlets or 800 watts whichever is lower. Each conduit shall not hold more than three branch circuits, of the same phase.
- 20.2.4.4.** Flexible cords for connection to appliances, fans and pendants shall be 650/1100 V grade (three or four cores i.e. with insulated neutral wire of same size) with tinned stranded copper wires, insulated, twisted and sheathed with

strengthening cord. Colour of sheath shall be subject to the Engineer's approval.

- 20.2.4.5.** Looping system of wiring shall be used. Wires shall not be jointed. Where joints are unavoidable, they shall be made through approved mechanical connectors. No such joints shall be made unless the length of the sub-circuit, sub-main or main is more than the length of the standard coil.
- 20.2.4.6.** Control switches shall be connected in the phase conductors only and shall be 'ON' when knob is down. Switches shall be fixed in 3 mm. thick painted or galvanized steel boxes with cover plates as specified. Cadmium plated brass screws shall be used.
- 20.2.4.7.** Power wiring shall be distinctly separate from lighting wiring. Conduits not less than 25 mm. and wires not less than 2.5 sq.mm. Copper shall be used.
- 20.2.4.8.** Every conductor shall be provided with identification ferrules at both ends matching the drawings.

20.2.5. Testing

- 20.2.5.1.** The entire installation shall be tested for:
- 20.2.5.2.** Insulation resistance.
- 20.2.5.3.** Earth continuity.
- 20.2.5.4.** Polarity of single pole switches

21. MCB, ELCB & LT Distribution Boards

21.1. Material Specification

21.1.1. Distribution board

- 21.1.1.1.** Distribution board using tpn/ dp/ sp MCB/MCCB isolator, earthing terminal, connector strip for phase neutral and earth for each circuit, CRCA sheet steel housing and complete.
- 21.1.1.2.** Common banking of neutral & earth conductor is not allowed. It shall be suitable to operate on 415/220 volt, 50 Hz. A. C. Supply and withstand short circuit current of 10ka.

21.1.1.3. Construction

- 21.1.1.3.1.** Distribution boards shall be fabricated from 2mm. Gauge CRCA sheet or shall be factory readymade as specified in the material list. It shall be of double door type with hinged (lockable if required) door suitable for recessed mounting in wall and dead front operated. Distribution boards shall be powder coated with 7-tank process application. The distribution boards shall be provided with phase barriers, wiring channels to accommodate wires and individual per phase neutral links.
- 21.1.1.3.2.** There shall be separate or individual earth link as per requirement. Proper arrangement shall be made for mounting of MCB's and other accessories. Distribution boards shall meet with the requirements of IS 2675 and marking arrangement of bus bars shall be in accordance with I.S. standards.
- 21.1.1.3.3.** It should be totally enclosed and made dust, vermin and weatherproof such that, it meets to the IP-51 and IP-54 protection for indoor and outdoor application respectively.
- 21.1.1.3.4.** A detachable cover plate of 2mm. CRCA sheet shall be on front of board such that, all live parts of the electrical accessories mounted on board shall be accessible only on removal of said cover plate. The cover plate shall be fixed to the board with adequate size zinc passivity metal screws. Above the detachable cover plate, one additional hinged door of 2 mm thick CRCA sheet should be provided with necessary locking arrangement and suitable gasket capable of withstanding corrosive and humid atmosphere.
- 21.1.1.3.5.** Inter connection of wiring shall be done with 660/1100 v. Grade, PVC insulated, flexible copper conductor of one size higher current carrying capacity than that of switch rating.

- 21.1.1.3.6.** Bus bars shall be suitable for the incoming switch rating and sized for a temperature rise of 35° c over the ambient. Each board shall have two separate earthing terminals.
- 21.1.1.3.7.** Circuit diagram indicating the load distribution shall be pasted on the inside of the db as instructed. One earthing terminal for single phase and two terminals for 3 phases DB shall be provided with an earth strip connecting the studs and the outgoing ecu earth bar.
- 21.1.1.3.8.** The top and the bottom faces of the DB shall be provided for conduit entry of minimum 1.5" dia if required and shown in drawing, copper cable entry provision shall be made. The circuit connection from MCB's shall be brought to elemex type connector provided on top/bottom of the db. The connector shall be suitable to receive phase, neutral and earth wire/cable coming from each individual circuit. The connectors shall have identification tag. The faces if asked shall be kept detachable. All outgoing feeders shall terminate on a terminal strip which in turn is interconnected to the MCB/fuse base by means of insulated single conductor copper wires as follows

Up to 15 Amp	2.5 sqmm
25 Amp	4.0 sqmm
32 Amp	6.0 sqmm
40 Amp	10 sqmm
63 Amp	16 sqmm
- 21.1.1.3.9.** Each db shall have indicating lamp, preferably neon type denoting power availability in the board. Indicating lamps shall be complete with fuse.

21.1.2. MCCB / Miniature Circuit Breakers (MCB):

- 21.1.2.1.** Miniature circuit breakers shall be quick make and break and break type non-welding self-wiping silver alloy contacts for 10 ka short circuit both on the manual and automatic operation, conforms with British standard BS : 3871 (part-i) 1965 and is :8825 (1996) with facility for locking in off position.
- 21.1.2.2.** The housing of MCBs shall be heat resistant and having high impact strength. The fault current of MCBs shall not be less than 10ka, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "on" and "off" indications. 'c' characteristic current limiting type, 10 ka and having quick break with trip free operating mechanism. Each pole of the breaker shall be provided with inverse time thermal over load and instantaneous over current tripping elements, with trip-free mechanism. In case of multi-pole breakers, the tripping must be on all the poles and operating handle shall be common. Pressure clamp terminals for stranded/solid conductor insertion are acceptable up to 4 sqmm aluminium or 2.5 sqmm copper and for higher ratings; the terminals shall be suitably shrouded. Wherever MCB isolators are specified they are without the tripping elements.
- 21.1.2.3.** The MCB contact shall be silver nickel and silver graphite alloy and tip coated with silver. Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger relay for over current and short circuit protection

21.1.3. RCCB / ELCB

- 21.1.3.1.** The RCCB should suffice all the requirements of is as per code is - 12640 - 1988. The RCA should be current operated and not on line voltage.
- 21.1.3.2.** The RCCB should ensure mainly the following functions:
 - 21.1.3.2.1.** Measurement of the fault current value.
 - 21.1.3.2.2.** Comparison of the fault current with a reference value.
 - 21.1.3.2.3.** The RCCB should have a torrid transformer which has the main conductors of primary (p - n) which check the sum of the current close to zero

- 21.1.3.2.4.** All metal parts should be inherently resistant to corrosion and treated to make them corrosion resistant
- 21.1.3.2.5.** It should be truly current operated
- 21.1.3.2.6.** It should operate on core balance torrid transformer
- 21.1.3.2.7.** Its accuracy should be $\pm 5\%$.
- 21.1.3.2.8.** It should operate even in case of neutral failure.
- 21.1.3.2.9.** It should trip at a present leakage current within 100 ma
- 21.1.3.2.10.** Its enclosure should be as per ip 30.
- 21.1.3.2.11.** Its mechanical operation life should be more than 20,000 operations.
- 21.1.3.2.12.** It should provide full protection as envisaged by IE rules-61-a, 71-EE, 73-EE, and 1985 and also rule 50 of ie rule 1956.
- 21.1.3.2.13.** It should conform to all national and international standards like IS: 8828-1993, IS: 12640-1988, BS 4293 - 1983, CEE 27 (international commission rules for the approved of electrical equipment)

21.2. Workmanship

- 21.2.1. The D.B. shall be properly grouted in the wall in concealed manner taking care that the powder coating is not scratched and dents are not formed on the D.B. The MCBs and ELCBs in the distribution boards shall be fixed as per the circuit details provided. All the wires terminating in the MCBs and the ELCBs shall be lugged for proper contact and ferrules depicting the circuit no's shall be provided. D.B.s mounted in concealed manner shall have a groove around it so as to save the finish of the plaster and colour during future opening of the door. The distribution boards shall have circuit chart tagged on the door for future maintenance. Danger notice plates shall be fitted to the distribution boards with screws and not stuck so as to assure its presence for a longer duration.

22. Earthing System

22.1. Material Specification

- 22.1.1. The earthing system complete in all respect with all equipments, fittings and accessories for efficient and trouble-free operation. The material to be supplied by the contractor and work to be carried out by the contractor shall be in general, but not limited to, conforming to the specification laid down for each item.

22.1.2. Codes & standards

- 22.1.2.1.** The design, material, assembling, inspection and testing shall comply with all currently applicable statutes, regulations and safety codes in the locality where the system will be installed. The equipment shall also confirm to the latest applicable standards and codes of practice as mentioned below

S r.	Item	Relevant is
1	Code of practice for earthing	IS 3043
2	Insulation co-ordination application guide	IS 3716
3	Code of practice for protection of buildings and allied structures against lightning	IS 2309
4	Indian electricity rules, 1956	
5	Indian electricity act, 1910	
6	National electrical code	

22.1.3. Materials required

- 22.1.3.1.** All required hardware such as bolts, nuts, washers (round and spring type), anchor fasteners, screws, etc. Of sizes and type as required shall be conforming to relevant is. All hardware shall be hot-dip galvanized or zinc passivated /cadmium plated as per requirement of work either mechanical fabrication or electrical jointing
- 22.1.3.2.** All other items required for installation shall be as approved by engineer in-charge.

22.2. Workmanship

- 22.2.1. Following activities shall be carried out for the earthing station
- 22.2.2. Excavation in hard murrum.
- 22.2.3. Laying Watering pipe.
- 22.2.4. Stone masonry with cast iron frame and hinged covers.
- 22.2.5. Charcoal and Salt fill.
- 22.2.6. Earth station should be 1 meter away from building.
- 22.2.7. Keep minimum 3 meter distance between two earth pits.
- 22.2.8. The pit should be minimum 4 meter deep.
- 22.2.9. The earth resistance should not exceed 1 ohm.
- 22.2.10. All earth pits of same category shall be interlinked with strip.
- 22.2.11. Separate earthing for the Audio-Video device to be provided as required

22.2.12. INSTALLATION OF SYSTEM

- 22.2.12.1. The plate/pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case less than 3 M below finished ground level
- 22.2.12.2. The plate/pipe electrode shall be kept clear of the building foundation and in no case, it shall be nearer by less than 2 M from outer face of the respective building wall / column
- 22.2.12.3. The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture
- 22.2.12.4. 20 mm. dia. G.I. pipe for watering, shall run from top edge of the plate / pipe electrode to the mid level of block masonry chamber
- 22.2.12.5. Top of the pipe shall be provided with G.I. funnel and screen for watering the earth / ground through the pipe
- 22.2.12.6. The funnel with screen over the G.I. pipe for watering to the earth shall be housed in a block masonry chamber as shown in the drawing
- 22.2.12.7. The masonry chamber shall be provided with a Cast Iron hinged cover resting over the Cast Iron frame which shall be embedded in the block masonry
- 22.2.12.8. Construction of the earthing station shall in general be as shown in the drawing and shall conform to the requirement on earth electrodes mentioned in the latest edition of Indian Standard IS: 3043, Code of Practice for Earthing Installation
- 22.2.12.9. The earth conductors (Strips / Wires, Hot dip G.I. / copper) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Hot Dip GI screws / bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level
- 22.2.12.10. The earth conductors shall either terminate on earthing socket provided on the equipment or shall be fastened to the foundation bolt and / or on frames of the equipment. The earthing connection to equipment body shall be done after removing paint and other oily substances from the body and then properly be finished
- 22.2.12.11. Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long and bitumen coated
- 22.2.12.12. The earth conductors shall be in one length between the earthing grid and the equipment to be earthed
- 22.2.12.13. Minimum distance of 2 meter shall be maintained between other electric conductor, earthing conductor and the conductor laid for the lightning protection system. Earthing and lightning protection system conductors shall be bonded to each other to prevent side flashover in case of non-availability of adequate clearance
- 22.2.12.14. The earthing met conductors, risers, earthing cables, etc. passing through walls shall be covered with galvanized iron sleeves for the passage through wall. Water stop sleeves shall also be provided wherever the earthing conductor enters the building from outside

22.2.13. INSPECTION AND TESTING

- 22.2.13.1. The following earth resistance values shall be measured with an approved earth megger and recorded.
- 22.2.13.2. Each earthing station

- 22.2.13.3.** Earthing system as a whole
- 22.2.13.4.** Earth continuity conductors
- 22.2.13.5.** Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 1 ohm in each case. In case of more earth resistance, the Contractor shall have to carry out necessary modification in the system without any cost implication to the Client
- 22.2.13.6.** Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed
- 22.2.13.7.** All tests shall be carried out in presence of the consultant / client and report should be submitted in two sets

22.2.14. Size of GI Earth-strip for earthing shall be generally under:

- 22.2.14.1.** HT Switch-yard/Earthing station: 50 x 6 mm GI strip
- 22.2.14.2.** Switch-boards up to 800 Amps: 40 x 6 mm GI strip
- 22.2.14.3.** Other switch-boards and motors including 50HP and above: 32 x 6 mm GI strip
- 22.2.14.4.** Motors less than 50HP up to and including 20HP: 32 x 3 mm GI strip
- 22.2.14.5.** Motors less than 20HP: 25 x 3 mm GI strip
- 22.2.14.6.** P.S.D.B.'s L.S.D.B's: 10 SWG GI Wire
- 22.2.14.7.** Transformer Neutral: Copper strip Size as per transformer rating
- 22.2.14.8.** Metering C.T's / P.T's, L.A's & TVM Box: (double earthing): 25mmx5 mm copper
- 22.2.14.9.** Lighting Conductor System: 32 x 6 mm GI strip

23. Portable Fire Extinguishers

- 23.1. Portable Dry Chemical Powder Type Extinguisher
 - 23.1.1. Portable dry chemical powder type fire extinguishers shall be provided as ready means for dealing effectively and immediately with fire in the substation and pump house area. Following types of fire extinguishing equipment as per the "Schedule of Requirements" shall be provided.
 - 23.1.1.1.** Hand portable dry chemical powder type extinguisher of 2.5 kgs complete with initial charge and hanging brackets.
 - 23.1.1.2.** Hand portable type fire extinguishers shall fulfill the requirements of Indian Standard Specification IS: 2171 in respect of material, shape and construction etc. Each fire extinguisher shall be subjected to the performance as laid down in the above Indian Standards Specification.
 - 23.1.2. The portable fire extinguishers as stated above shall be located at suitable places. All the fire extinguishers shall be subjected to anti corrosive treatment and shall be painted and marked as per requirement of relevant standards.

24. B class GI pipe

- 24.1. Materials.
 - 24.1.1. Galvanized iron pipes shall be of the medium type and of required diameter and shall comply with I.S. 1239-1990. The specified diameter of the pipes shall refer to the inside diameter of the bore. Clamps, screw and all galvanized iron fittings shall be of the standard "R" or equivalent make.
- 24.2. Workmanship.
 - 24.2.1. Cutting, laying & jointing.
 - 24.2.1.1.** When the tubes are to be cut or rethreaded, the ends shall be carefully filed out so that no obstruction to bore is offered. The ends of the tubes shall then be threaded confirming to the requirements of I.S. 554-1955 with pipe dies and tape carefully in such a manner as will not result in slackness of joints when two pieces are screwed together.
 - 24.2.1.2.** The taps and dies shall be used only for straightening screw threads which have become bent or damaged and shall not be used for turning of the threads so as to make them slack as the latter procedure may not result in a water tight joint. The screw threads for the tube and fitting shall be protected from edge until they are fitted.
 - 24.2.1.3.** In jointing the tubes, the inside of the socket screwed end of the tubes shall be oiled and smeared with white or red lead and wrapped around with a few turns of fine spun yarn around the screwed end of the tube. The end shall

then be tightly screwed in the socket, tees etc. with a pipe wrench. Care shall be taken that all pipes and fittings are properly jointed so as to make the joints completely water tight and pipes are kept at all times free from dust and dirt during fixing. Burr from the joints shall be removed after screwing. After laying the open ends of the pipes shall be temporarily plugged to prevent access of water, soil or any other foreign matter.

24.2.1.4. The threads exposed after 3 jointing shall be painted or in the case of underground piping thickly coated with approved anti-corrosive paint to prevent corrosion.

24.2.2. Laying in trenches.

24.2.2.1. The width and depth of trenches for different diameters of tube shall be as for 15 to 80 mm dia tube width of trenches shall be 30 cm and depth of trenches 60 cm.

24.2.2.2. At joints the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications of earth work in trenches.

24.2.2.3. The pipes shall be painted with two coats of anti-corrosive bitumastic paint of approved quality. The pipe shall be laid on a layer of 75 mm sand filled upto 150 mm above the pipe if so specified. The remaining portion of trench shall be then filled with excavated earth. The surplus earth shall be disposed of as directed.

24.2.2.4. When the excavation is done in rock the bottom shall cut deep enough to permit the pipe to be laid and cushion of sand 75 mm. In case of bigger diameter of tube where pressure is very high, thrust block of cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground and spreading it over a sufficient area if so specified.

24.2.3. Fixing of tube fittings to wall ceiling and floors.

24.2.3.1. In case of fixing of tubes and fittings to the walls or ceilings, these shall run on the surface of the wall or ceiling (not in chase) unless otherwise specified. The fixing shall be done about 15 mm clear off the wall. When it is found necessary to conceal the pipes and when specified so, chasing may be adopted or pipe fixed in ducts or recesses etc., provided that there is sufficient space to work on the pipe with usual tools. The pipe shall not ordinarily be buried in walls or solid floors, where unavoidable pipes may be buried for short distances provided that adequate protection is given against damage and where so required joints are not buried. Where required M.S. tube sleeves shall be fixed at a place a pipe is passing through a wall or floor for expansion and contraction and other movements. In case the pipe is embedded in walls or floors, it should be painted with anti-corrosive bitumastic paint of approved quality. The pipe should not come in contact with lime mortar or lime concrete as the pipe is affected by lime. Under the floors the pipe shall be laid in layer of sand filling.

24.2.3.2. All pipes and fittings shall be fixed truly vertical and horizontal unless unavoidable. The pipes shall be fixed to walls with standard pattern clamps of required size and shape, one end of which shall be properly plugged or cemented into walls with cement mortar 1:3 (cement : 3 coarse sand) and the other tightened round the pipes to hold it securely. These clamps shall be spaced at regular intervals in straight lengths at 2.0 metre c/c interval in horizontal run and 2.5 metre intervals in vertical run. For pipe of 15 mm dia upto 25 mm dia the holes in the walls and floors shall be made by drilling with chisel or jumper and not by dismantling the Stone or concrete. However, for bigger diameter pipes the holes shall be carefully made of the smallest required size. After fixing the pipe holes shall be made good with cement mortar 1:3 (1 cement: 3 coarse sand) and properly finished to match the adjacent surface.

24.2.4. Testing of joints.

24.2.4.1. After laying and jointing, the pipe and fittings shall be inspected under working conditions of pressure and flow. Any joint found leaking will be re done and all leaking pipes removed and replaced without extra cost.

- 24.2.4.2.** The pipes and fitting after they are laid shall be tested to hydraulic pressure of 6 kg / Sq cm the pipe shall be slowly and carefully charged with water allowing all air to escape and avoiding all stock and water hammer. The draw off takes and stock shall then be closed and specified hydraulic pressure shall be applied gradually. The pressure gauge must be accurate. The pipes and fittings shall be tested in sections as the work of laying proceeds, keeping the joints exposed for inspection during the testing.
- 24.2.5. The width and depth of the trenches for different diameters of tube shall be as under.
- 24.2.6. For 15 to 80 mm dia tube width of trenches shall be 30 cm and depth 60 cm.
- 24.2.7. At joints, the trench width shall be widened where necessary. The work of excavation and refilling shall be done true to line and gradient in accordance with general specifications of earth work in trenches.
- 24.2.8. The pipe shall be painted with two coats of anti-corrosive bitumastic paint of approved quality. The pipe shall be laid on a layer of 75 mm sand filled upto 150 mm above the pipe if so specified. The remaining portion of trench shall be then filled with excavated earth. The surplus earth shall be disposed off as directed.
- 24.2.9. When the excavation is done in rock the bottom shall cut deep enough to permit the pipe to be laid and cushion of sand 75 mm. In case of bigger diameter of tube where pressure is very high, thrust block of cement concrete 1:2:4 (1 cement : 2 coarse sand : 4 graded stone aggregate of 20 mm nominal size) shall be constructed on all bends to transmit the hydraulic thrust without impairing the ground and spreading it over a sufficient area if so specified.
- 24.3. Mode of measurement and payments.
- 24.3.1.1.** The description of item , shall unless otherwise stated, be held to include where necessary, conveyances and delivery, handling, unloading, storing, fabrication, hoisting, all labour for finishing to required shape and size, setting, fitting in position, straight, cutting and waste, return of packing etc.
- 24.3.1.2.** The length shall be measured on running metre basis of finished work. The length shall be taken along the centre line of the pipe and fittings. The pipes fixed to walls, ceiling, floors etc. shall be measured and paid under this item.
- 24.3.1.3.** All the work shall be measured in decimal system as fixed in its place, subject to tolerance given unless otherwise stated.
- 24.3.1.3.1.** Dimension shall be measured to the nearest 0.01 metre.
- 24.3.1.3.2.** Area shall be worked out to the nearest of 0.01 Sq. metre.
- 24.3.1.4.** In case of fittings with unequal bore, the largest bore shall be measured for the test.
- 24.3.1.5.** Testing of pipe lines, fittings and joints including providing all plant and appliances necessary for obtaining access to the work to be tested and carrying out the test.
- 24.3.1.6.** The rate includes galvanized steel tubing with screwed socket joints, together with all fittings (such as bends, sockets, springs, elbows, tees, crosses, short pieces, clamps and plug union etc.) and fixing complete with clamping wall hooks, wooden plugs etc and also cutting, screwing and waste for making forged (or handmade) bends or piping as required. The rate also includes cutting through walls, floors etc., and their making good and painting exposed threads with anti corrosive paint as above and testing. Where tubes are to be fixed to wall, ceiling and flooring, the rates shall not include painting of pipes, providing sleeves and sand filling under floor for which separate payment shall be made.
- 24.3.2. For purpose of calculating cubic content , cross section shall normally be taken at suitable intervals i.e. manhole or wall chamber intervals, except in a abnormal cases like sudden change in strata or undulating ground etc. where they may be taken at closer intervals as approved by the Engineer-in-charge whose decision shall be final, conclusive and binding.
- 24.3.3. Authorized width.
- 24.3.3.1.** Upto one meter depth, the width of the trenches for the purpose of measurements of excavation shall be arrived at by adding 40 cm to the external diameter of the tube (not the socket) where a pipe is laid on concrete bed / cushioning layer, the authorized width shall be external diameter of tube plus 40 cm or the width of concrete bed cushioning layer whichever is more.

- 24.3.3.2.** For depth exceeding one meter an allowance of 5 cm per metre of depth for each side of the trench shall be added to the authorized width (i.e. external diameter of pipe plus 40 cm) this allowance shall be applied to entire depth of trench. The authorized width in such cases shall therefore be equal to the depth of trench, plus external diameter of tube plus 40 cm.
- 24.3.3.3.** Where more than one tube is laid, the diameter shall be reckoned at the horizontal distance from outside to outside of the outermost pipes.
- 24.3.3.4.** Where sheeting etc. has been provided the authorized width of the trenches at bottom shall be increased to accommodate for sheeting etc. so the clear width available between faces of sheeting is as per provisions of (a), (b) & (c) above.
- 24.3.3.5.** If the sides of the trench are not vertical, the toes of the side slope shall at end at the top of the pipe and vertical sided trench of authorized width as per (a), (b), (c) and (d) above shall be excavated from these down to the bed of trenches.

24.3.4. Where the tubes are laid in trenches, the work of excavation and refilling shall be paid of separately. The rate also does not include painting of pipes and sand filling all round the tubes for which separate, payment shall be made. The length shall be measured in running metre basis.

24.3.5. The rate shall be for a unit of one running metre.

25. Open Well Mono Block Pump Set

25.1. Applicable Indian Standards

IS: 1520-1980: Horizontal pumps for clear, cold, fresh, water.

IS: 1520-1977: Technical requirements for roto-dynamic special purpose pumps.

IS: 6595-1993: Horizontal centrifugal pumps for clear, cold, fresh water for agricultural purposes.

IS: 8034-1989: Submersible pump sets for clear, cold, fresh water.

IS: 8418-1977: Horizontal centrifugal self priming pumps.

IS: 8472-1977: Regenerative self priming pumps for clear, cold, fresh water.

IS: 9079-1989: Mono set pumps for clear, cold, fresh water for agricultural purposes.

IS: 9137-1978: Code for acceptance tests for centrifugal mixed flow and axial pumps.

IS: 9301-1984: Deep well hand pumps.

IS: 9542-1980: Horizontal centrifugal mono set pumps for clear, cold, fresh water.

IS: 9694-1980 (Pt I, II, III & IV): Code of practice for the selection, installation, operation and maintenance of horizontal centrifugal pumps for agricultural applications: Part I selection

IS: 9694-1980: Part II Installation.

IS: 9694-1980: Part III Installation.

IS: 9694-1980: Part IV Maintenance.

IS: 10572-1983: Methods of sampling pumps.

IS: 10804-1986: Recommended pumping system for agricultural purposes.

IS: 10805-1986: Foot-valve, reflux valve or non-return valve and bore valve to be used in suction lines of agricultural pumps.

IS: 10981-1983: Code of acceptance test for centrifugal mixed flow and axial pumps.

IS: 11004-1985 Pt I & II): Code of practice for installation and maintenance of deep well hand pumps: Part I-Installation.

IS: 11004-1985: Part II-Maintenance.

IS: 11346-1985: Testing set up for agricultural pumps.

IS: 11501-1986: Engine mono set pumps for clear, cold, fresh, water for agricultural pumps.

IS: 12225-1987: Jet centrifugal pump combination.

25.2. Standard Construction

25.2.1. Pumps Portion: Graded Cast Iron pump with high class powder coated.

25.2.2. Motor should be designed, assembled and tested as per IS specifications, fully moisture proof & should run at low voltage successfully.

25.2.3. Winding & Insulation: Stator windings consist of synthetic enameled copper wire coils with slot insulations which provide rigidity to winding at all working temperatures. The vacuum impregnation gives stator a high insulation resistance to moisture that gives complete protection to the winding under all working conditions, including humid tropical climates.

- 25.2.4. Impeller: High tensile Bronze or Forged Impeller (Brass) should be Lead free & food graded.
- 25.2.5. Bearings & Shafts: Anti friction double Z Ball Bearings should be fitted along with lithium based grease in the motor at both the ends for long life. Shaft should be machined and grinded with latest technology to extremely fine limits to ensure proper fitting for bearings.
- 25.2.6. Rotor: Pressure die cast aluminum cage rotor with radial fins which should be dynamically balanced along with a stainless steel shaft.
- 25.2.7. Seal: High Alumina and graphite mechanical seal.

26. Water Level Controller

- 26.1. Standard Specification
 - 26.1.1. Water Level Controller should be completely Automatic System without any 'Pump set Protection Circuitry' feature:
 - 26.1.2. The system automatically controls pumping of water from Underground Sump / Well / Bore well to Overhead Tank.
 - 26.1.3. The system can be upgraded into "Multi-tank control system" to maintain water level in several overhead tanks.
 - 26.1.4. The system comes with Industrial Grade Electronic Components, Reliable Power Supply and Power Contactor in Powder coated Metallic Enclosure.
 - 26.1.5. The system is adoptable for any kind of starters of both Single phase and Three phase Motors.
 - 26.1.6. This system is based on AC Sensing Technology; hence the sensors are non-corrosive and maintenance free.
 - 26.1.7. This system is suitable for Residential Applications and simple Industrial requirements.
 - 26.1.8. The system has three positions Power Control Toggle Switch with "Auto" mode, "Off" mode and "Manual" mode.
 - 26.1.9. In "Manual" mode the Pump set can be controlled directly and level controller gets completely shut down and bypassed.
 - 26.1.10. Should follow IS 15840:2009 which defines Determination of volume of water & water level in lakes & ISO/TR 11330:1997 reservoirs

Signature of Contractor

**Signature of
EXECUTIVE ENGINEER
BUILDING
DEPARTMENT
BHAVNAGAR
MUNICIPAL
CORPORATION
BHAVNAGAR**



सत्यमेव जयते



CPWD HANDBOOK OF HORTICULTURE



Central Public Works Department

Ministry of Housing and Urban Affairs



Zaitoon (*Olea europaea*)



सत्यमेव जयते



CPWD HANDBOOK OF HORTICULTURE

CENTRAL PUBLIC WORKS DEPARTMENT
Ministry of Housing and Urban Affairs



Hon'ble Prime Minister planting Rudraksh Tree in the Parliament House



Hon'ble Minister and his wife visiting Bonsai stall during CPWD flower show

हरदीप एस पुरी
HARDEEP S PURI



अवधान श्री वरिष्ठ कार्यपालक (सर्वोच्च स्तर)
समा विभाग एवं शहरी (सर्वोच्च स्तर)
वर्षिक एवं उद्योग एवं शहरी
समा विभाग

Minister of State (IC), Housing & Urban Affairs
Minister of State (IC), Civil Aviation
Minister of State, Commerce & Industry,
Government of India



MESSAGE

It gives me immense pleasure to note that "CPWD Handbook of Horticulture" is being published by the Central Public Works Department on the occasion of 166th CPWD Day on 12 July 2020.

Green areas are the lungs for the planet Earth. Man survives only if the surrounding natural habitat is green and vibrant. Any grievous assault on nature puts our very survival as a human race in peril. We can all contribute in our own ways in keeping the earth green. In urban areas, tree lined avenues and parks supplement the ecosystem and add to the aesthetics.

I hope this book will be beneficial for the professionals and amateurs in the field of horticulture and ornamental gardening.

I congratulate Shri Vinit Kumar Jayaswal, Director General, CPWD and his team for publishing this handbook of Horticulture.

New Delhi
07 July 2020



(Hardeep S Puri)

दुर्गा शंकर मिश्र

सचिव

Durga Shanker Mishra

Secretary



भारत शासन
आवास और शहरी मामलों का विभाग
Ministry of Housing and Urban Affairs

Government of India
Ministry of Housing and Urban Affairs
New Delhi-110011



MESSAGE

Congratulations to Central Public Works Department for publishing "CPWD Handbook of Horticulture" on the occasion of its 166th Foundation Day. This Handbook deals with various aspects of horticulture, landscaping and ornamental gardening. Green areas are not only important for environmental conservation, micro-climate regulations, bio-aesthetics, but also for stress busting effects.

I am confident that this Handbook will increase awareness amongst horticulturists, professionals, garden amateurs, practicing engineers and architects.

I applaud the efforts of Shri Vishi Kataria Invernal, Director General, CPWD and his team in publishing this very useful Handbook.

(Durga Shanker Mishra)

New Delhi

7 July, 2020



Shri K. Kumar Jagtap
Director General



सत्यमेव जयते

भारत सरकार
Government of India



भारत की सड़कें, पुल, बाँध, सिंचन
कामों का रख-रखाव
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MESSAGE

It gives me immense pleasure to note that CPWD Handbook of Horticulture is being published by the Horticulture Wing of Central Public Works Department on the occasion of 165th CPWD Day on 12 July, 2020.

Landscaping and horticulture are essential elements for healthy living and create pleasant eco-friendly surroundings. Trees, shrubs, foliage, flowering plants and green spaces trigger happy emotions with feelings of togetherness with nature. This ultimately improves work performance.

I hope this CPWD Handbook of Horticulture which contains various aspects of Horticulture will be beneficial to professionals, garden amateurs, garden lovers and public at large to update their knowledge in the field of landscaping, horticulture and ornamental gardening.

I appreciate the sincere efforts of Dr P. K. Tripathi, Deputy Director General, Horticulture and his team of officers and staff for bringing out this book and I wish it a great success.


(Y.K. Jayaswal)

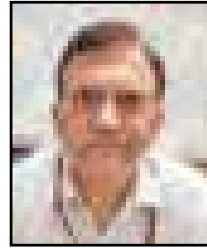
New Delhi
July, 2020



भारत सरकार
Government of India
अन्य सचिव (जी.)
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Message

I am happy to note that CPWD Handbook of Horticulture is being published by the Horticulture Wing of Central Public Works Department on the occasion of 166th CPWD Day on 12 July 2020.

Horticulture, landscaping and garden design is the foundation of any great landscape. The garden can incorporate both natural and man made materials. Plants are considered one of the most cost effective agents for remedying negative views of an area, thereby adding to its aesthetic value and significantly improving the visual amenity, economic and social conditions of the city.

Indoor air pollution is now considered by many experts to be one of the major threats to health. During pollution alerts, people are generally advised to stay indoors. Now a days Indoor plants are advised for air purification and absorption of obnoxious gases emitted through household gadgets.

I appreciate the sincere efforts of Dr P.K.Tripathi, Deputy Director General Horticulture and his team of officers and staff for bringing out this book and I wish it a great success.


(Anant Kumar)

New Delhi
July, 2020

डॉ. प्रसून कुमार त्रिपाठी

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FOREWORD

In CPWD, Horticulture deals with planting of ornamental plants in a such a way that it creates a picturesque effect. The concept of landscape and horticulture is being implemented by way of using different kind of garden features that must conform to the place and the purpose.

The importance of a tree can be attributed that a mature leafy tree produces as much oxygen in a season as ten people inhale in a year. A single mature tree can absorb carbon dioxide at a rate of 48 pounds per year and release enough oxygen back in to the atmosphere to support two human beings. On average, one tree produces nearly 250 pounds of oxygen each year. Two mature trees can provide enough oxygen for a family of four.

This book contains 30 chapters on different aspects of horticulture and ornamental gardening ranging over various fields of horticulture. I understand this book would be ready reference and beneficial for the professionals and garden amateurs through know how, discussions, experiences for refreshing and updating latest technology and methodology in the field of horticulture and ornamental gardening.

I express my sincere gratitude and thanks to Sh. V. K. Jaiswal, Director General, CPWD for entrusting me this work.

I also express my sincere thanks to Sh. Anant Kumar, A.I.G. (TechWorks) for guiding me during this work.

I take this opportunity to thank Sh. Yogendra Singh, Sh. Ram Singh Meena, Sh. R. Solanki, Sh. Ram Kumar Malik, Deputy Directors (Hort.), Sh. Ashwani Kumar Dindwal, Sh. Sudhakar Kumar, Dr. S. K. Singh, Dr. Deepthi Saxena, Sh. R. S. Chaudhari, Divyesh Kumar Tyagi, Sh. S. S. Sharma, Sh. V. K. Gaur, Assistant Directors (Hort.) for providing necessary data's and pictures during the writing of this book, and Sh. Anant Singh Shukla, Sh. Rajat Shukla and Sh. Dilip Karmakar for typing this manuscript neatly.

(Dr. P. K. Tripathi)
Deputy Director General (Hort.)

New Delhi
July, 2020

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INTRODUCTION

The Horticulture Unit of CPWD was established way back on 1st April, 1912 under the able guidance of Shri R.H.Loke, Horticulture Superintendent. Since then the unit has evolved into a large wing, pioneer in execution of all kinds of horticulture & Landscape works. The major functions of the wing are as follows:

- Development & Maintenance of open spaces and parks
- Development of different types of gardens
- Raising of trees
- Development and Maintenance of Landscape and Horticulture works in Residences of Hon'ble Vice President, Prime Minister, Ministers, Members of Parliament, Judges of Supreme Court & High Court etc.
- Development and Maintenance of Landscape and Horticulture works in the Samadhi complexes of National Leaders spread in about 200 acres area. The Rajghat and other Samadhi complexes



are not only visited by International dignitaries and leaders but also International and local tourists.

- Development and Maintenance of Landscape and Horticulture works in Central Government office complexes and residential areas

Besides above, Horticulture wing is also involved in enhancing and conserving the green areas, aesthetic improvement of the gardens and preparation of green manure using green waste in localized areas, thereby maintaining and conserving an eco-friendly environment. The nurseries maintained by this wing of CPWD are well known for maintaining large collection of indigenous plants, seasonal, perennial, foliage, exotic, herbal and aromatic plants. Horticulture wing is maintaining two major nurseries i.e. Government Sunder Nursery and Government Mehrauli Nursery in New Delhi.



Hon'ble Prime Minister planting Kadamba Tree

HISTORY

The Horticulture Wing of CPWD was established on 1st April, 1912 with a very small unit headed by Shri R.H. Loke (British origin), as Horticulture Superintendent. It was pioneer in the field of horticulture and famous for indigenous plants and collection of all kind of seasonal, perennial, foliage, exotic, herbal and aromatic plants. Horticulture Unit is maintaining two major nurseries viz., Govt. Sunder Nursery and Govt. Mehruali Nursery.

Govt. Sunder nursery was inaugurated in February, 1949, presently spreaded in 20

acres land (approx.) at Nizamuddin, New Delhi. The nursery is bordered by Humayun's Tomb to the South and the National Zoological Park to the North.

Govt. Mehruali Nursery is located in Shaheed Jeet Singh Marg, (in front of NCERT Gate No.2), Katwarai Sarai New Delhi. Mehruali nursery is presently spread over in 33 Acre area (approx.) and is also having a collection of foliage's plant, perennials, seasonal plants, palms, cactus, Bougnavellia, money plants, roses, etc.



CHAPTER - 1

HORTICULTURE AND THE LANDSCAPE

The CPWD , comprises of Civil, Electrical, Architecture and Horticulture wings, finds its relation with the Built Infrastructure. The people of the world are slowly realizing the damage that has been done to our environment. The success of development and maintenance of landscaping features can be judged by the quality of relationship between the building, the site ,landscaping features and its surroundings .The natural resources which are useful in the landscaping should be environmentally sustainable and function efficiently and economically in the long run. Man`s greed for quick economic gains has led to imbalance of this planet thereby threatening to the very survival of mankind in the not very distant future. In our metro cities we are already experiencing the effects of soil, water, air and noise pollution which has already crossed the threshold of human tolerance and has manifested itself in the deterioration of all life forms. In this bleak scenario there is still a ray of hope if people in general are awake and realize that the solution for correcting our mistakes lies in our understanding of nature as a holistic phenomenon and take course of action intelligently and diligently.

In CPWD, Horticulture deals with planting of ornamental plants in such a way that it creates a picturesque effect .Landscaping gardening can be defined as the decoration of a tract of land with plants and other garden materials so as to produce a picturesque and naturalistic effects in a limited space. Landscape gardening can also be defined as the beautification of a tract of land having a house or other object of interest on it. It is a done with a view to create a natural scene by

the planting of lawn, ground covers, shrubs ,hedges and trees. The arrangement and final establishment of the garden features must be done in a such a way that it gives an effect of a natural landscape soothing to the heart. It must act in such a way that it helps in improving of the total living environment for the people. The concept of landscape and horticulture by way of using different kind of garden features must conform to the place and the purpose for which it is built example. Selection of plants in a Samadhi and in a recreational park are totally different to one another. Care must be taken to define the relationship between various colours of the plants, flowers, building or other objects present at the site.

Landscape Concept and Garden Design :

Garden and garden features should be compatible to each other and meet the characteristics of the garden, because it is an extension of house and an enclosure for pleasure. It is essential to understand the site characteristic and its potential for development and conceptualize the scheme for specific purpose and design accordingly. Most of us love to be with nature and are often disappointed with the limited space available around the house, which makes us think that these little spaces do not accommodate beautiful gardens. Landscaping is making of pictures with plant materials and hence its principles are same as those of art. Followings are the points which needs to taken care during the landscape concept and garden design.

Rhythm: Repetition of same object at equidistance is called rhythm. It can be created through the shapes, progression of size or a continuous line movement, rhythm creates movement to the eye. In gardens generally trees of single species of equal height and shape are planted to create this effect. In Mogul gardens, fountains and water canals have also been extensively used to create such effects. Now-a-days other objects like lights are also used to

Whether you're planning to "borrow ideas," or coming up with your customized landscape design, you need to know the basic principles of landscape design. Understanding these landscape design principles will increase your creativity while at the same time help you generate new ideas. A great landscape design lies in the eyes of the artist, and these basic principles of landscape design will not only boost your creativity, but also ensure that the elements in your design have balance and harmony.

Basic Principles of Landscape Design:

1. Unity

Unity in landscaping is the repetition and consistency of a design. Repetition is used to bring about unity in your design by repeating like elements which include plants and decor in the landscape. Consistency is used to create unity by fitting different elements of a landscape together to create a common unit or theme.

2. Balance

Balance is simply a sense of equality. There are two types of balance in design symmetrical and asymmetrical balance. In symmetrical balance, two sides of the landscape are identical while in asymmetrical balance, the landscape composition is balanced using different elements and objects which have almost similar imaginary weight.

3. Contrast and harmony

Contrast helps highlight certain elements in your design, while harmony helps elements in a landscape composition look unified. Contrasting elements draw the viewer's attention when they're placed next to each other. Contrast and harmony are achieved by the comparison of any elements of art or using complementary colors side by side.

4. Color

Color gives your landscape design the dimension of real life. Warm colors (e.g. red and orange) seem to advance towards you, making an object seem closer. While cool colors like blues and greens seem to move away from you. Blues and greens are used to create perspective.

5. Transition

Transition is simply a gradual change. Transition in a landscape design is illustrated by gradually varying the plant size or the color intensity. Transition can also be applied to texture, foliage shape and size of different elements.

6. Line

Line is the mother of all elements in landscape design. Lines are used almost everywhere including creating beds, entryways, walkways, texture and perspective. Lines are also used to give an illusion of depth and distance.

7. Proportion

Proportion refers to the size of an element in relation to the other. Among the principles of landscape design, this is the most obvious one but still needs a little planning and thought. One must ensure that all the elements in a landscape design have proper proportions.

8. Repetition

Repetition is directly related to unity. It's good to have several elements and forms in

a garden, but repeating the same elements gives your design various expressions. Too many objects that are not related can make your design look unplanned and cluttered. Also, don't overuse an element since over using an element can make your design feel boring, uninteresting, and monotonous.

In Conclusion

With these basic principles of landscape design designing a landscape can be a nice way of unleashing your creativity. Utilizing, colors, contrast, and lines all can help influence the design of your landscape.

Important Things to Consider When Planning Your Landscape Design:

Whether you are interested in completely redesigning your landscape or simply making a few changes there are some important factors to consider before you start planting. While many people head straight to their local gardening supply store to browse the selections, creating a plan beforehand will help you chose plants that will best fit your needs and thrive in your landscape.

It's easy to go out and be tempted into buying plants that look beautiful at the garden store, only to get them home and realize they are wrong for your landscape. These tips will help you develop a plan and put you on the road to creating a beautiful, cohesive, and thriving landscape.

Know your Garden :

Think about your regional climate, the topography of your site, and your soil type when planning your landscape.

Keep in mind that the specific conditions of your garden are likely to create a microclimate based on the amount and length of sun and shade exposure the area receives.

Microclimates are usually broken into one of four categories: full sun, partial shade, shade, or deep shade; take note of your landscape's microclimate when selecting plants for your landscape.

The topography of your site is important to consider as well as you plan; take note of how water drains in your landscape. The best landscape design will promote water movement away from your home towards other areas of your garden.

Who will be using your Garden :

Think about who will be using your garden and how they will use it. Will children be using your garden? Do you have pets? Are you hoping to use your garden for outdoor entertaining? Remember you can create different spaces for different uses in your landscape using strategic plantings and hardscapes. Walkways can be used to move people from one area to another.

Since you will be using and maintaining your garden (or hiring someone to maintain it) consider what your maintenance style and



budget are. Be as realistic as you can. How much time will you truly have to put into your landscape? Or if you won't have the time will you have the money to pay someone else to put in the time? How much do you have to invest in your landscape? Determining the answer to these questions will help to ensure the success of your landscape for years to come.

Think about themes of your garden:

A theme can unify your landscape and help guide your plant and material selections. Themes can be as simple as using consistent shapes or forms throughout your garden or as complex as creating a relaxation garden or an Oriental garden. When deciding on a theme for your garden, a good place to start is looking at the architecture of your home. Try to complement the lines and style of your home's architecture in your garden; after all, your garden is an extension of your home.

Themes can help guide how you place and select plants, decorations, hardscapes, and structures. Are you someone who wants lots of neat, geometric shapes and structures in your landscape? Do you want softer lines and a more natural feel to your space? Do you want a landscape to include only specific colors? Questions like these will help you choose a unified theme for your garden.

Create and link spaces :

In order to get the most out of your garden, think of it as another room, or rooms, in your home. Just as a home has well defined and carefully planned rooms, so should your landscape; using your materials wisely allows you can create different "rooms" in your landscape. Don't forget to think about how you'll link your spaces. How will people move from one area of your garden to another? Create openings to encourage

exploration in your garden and keep people moving throughout the landscape.

Make your plants work for you :

Early in your planning you should determine how your plants will function in your landscape. Plants can be used in a number of ways, they can provide you with fresh and delicious fruits and vegetables, beautiful scenery, lovely aromas, and much more. Plants can be used as barriers to define areas within your landscape as well as identify where your landscape ends. You can use plants to create physical barriers in your landscape by blocking both views and access to an area. If you want to keep your views open, but maintain some barriers, low growing plants can be used to create implied barriers, blocking access but not the view.

Correctly placed plants can also be used to alter your landscape site conditions. Temperature, light levels, and wind are greatly affected by the trees and plants in a landscape. The noises in your landscape can be affected by what you put into the design, such as water features or bird houses, as well as any physical barriers that keep your garden insulated from noises beyond your landscape.

Structure your plantings :

Consider your various visual planes when selecting plants. Starting from the area above you, think about the overhead plane, this might include archways and trees.

Moving on to the vertical plane, consider how closely spaced or far apart plants will be, how plants will be layered or staggered (generally larger plants are used behind smaller plants), as well as the individual and massed heights and widths of your plants.

Don't forget about the ground plane (including how smaller plants will be grouped

and arranged as well as groundcovers and hardscapes).

Repeating similar shapes and structures in your garden will give you a unified view throughout your space.

Highlight important points :

Using unique plants, distinct structures, or garden ornaments allows you to highlight a particular area of your landscape. Contrasting shapes, textures, sizes, and colors will help to capture attention and direct it to a specific area.

Pay attention to detail :

Plants, hardscapes, and garden ornaments all have their own visual details, from various forms and shapes to an array of colors and textures. By thinking about how these visual details can be used to complement and contrast each other, you can create a cohesive and captivating landscape.

Don't just think about visuals; taking into consideration the scents of the plants you select for your landscape can enhance the experience you create for those in your garden. Think about when flowers will be blooming and fragrant, as well as what scents will complement each other in the landscape.

Think about the future :

More specifically, take into account how the passage of time will affect your landscape plants. When selecting plants, make sure you consider the plant's growth rate, maintenance needs, and its eventual mature size. Make sure you provide your plants with enough room to reach their mature size. Keep in mind though, that mature size is typically based on optimal growing conditions, your landscape's specific conditions may cause a plant to grow larger or smaller.

Protect your resources:

By choosing resource-efficient plants, consciously managing water, and choosing environmentally sound hardscapes, you can help protect and preserve your environment.

Before removing plants from your landscape, determine whether these plants truly need to be removed, or if they could be relocated to another area of your yard. When selecting new plants, look for resource-efficient plants, ones that will require less water, fertilizers, and pesticides.

When planning the changes to your landscape, consider installing a rainwater catchment system which will provide you with an environmentally sustainable source of irrigation water. With careful planning such a system can even be incorporated as an aesthetic design element.

Using environmentally friendly hardscapes, non-toxic preservatives, stains, paints, and cleaners is another way you can protect your natural resources. Also, consider reusing construction materials; before demolition starts consider what materials you might be able to reuse, repurpose, or incorporate into your new lands



GARDEN STYLES

The Orangerie in the Gardens of Versailles with the Pièce d'Eau des Suisses in the background (French formal garden)



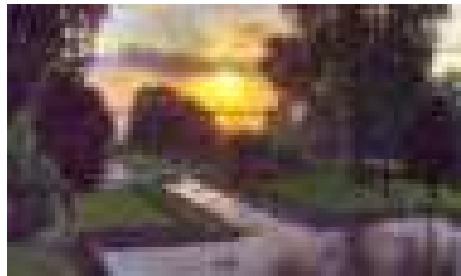
Stourhead (1741-80) (English garden)

Jardin del Generalife de Granada (Spanish garden)



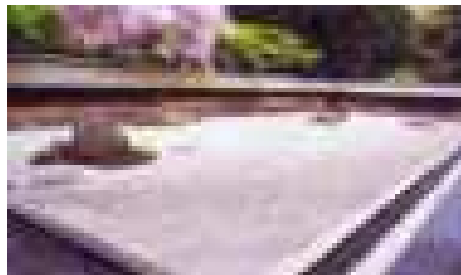
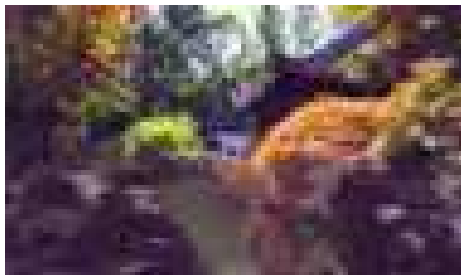
Reflection of the Bagh-e Narenjestan (orange garden) and the Khaneh Ghavam (Ghavam house) at Shiraz, Iran (Persian garden)

Mughal gardens at Taj Mahal, Agra, India



Nishat Bagh, terrace garden at Srinagar, India (Mughal Gardens)

The Yuyuan Garden in Shanghai, China (created in 1559) shows all the elements of a classical Chinese garden



Ryoan-ji (late 15th century) in Kyoto, Japan, the most famous example of a Zen rock garden

Royal Botanic Gardens, Kew, London



Labyrinth maze of Bravaux, Durbuy, Belgium

Parc de Bagatelle, a rose garden in Paris



Roof garden on the top deck of a multi-storey car park at Hyderabad

GARDEN FEATURES

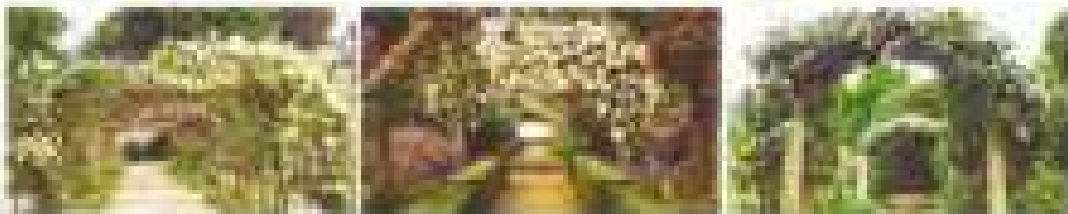
GARDEN
PAVING



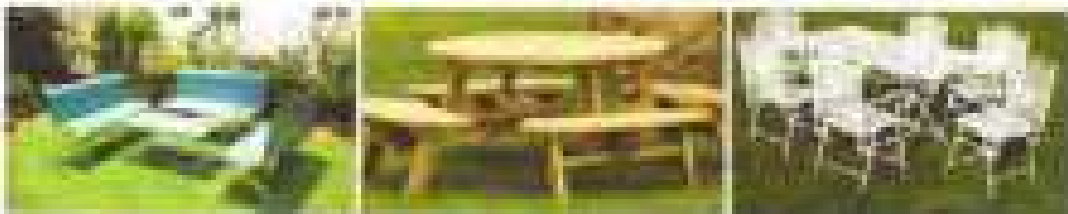
GARDEN
GATES



GARDEN
ARCHES



GARDEN
FURNITURES



GARDEN
SCULPTURES



GARDEN
GAZEBOS



GARDEN
BRIDGES

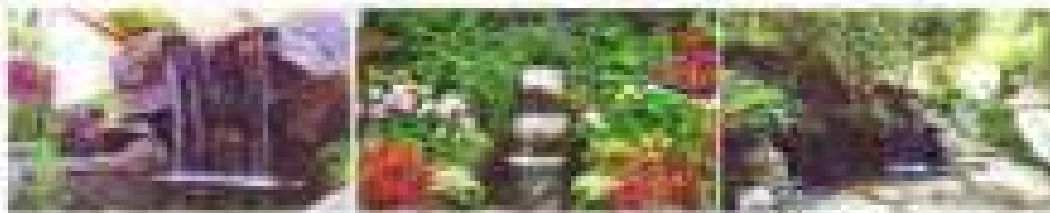


GARDEN FEATURES

GARDEN
FOUNTAIN



GARDEN
WATER FALLS



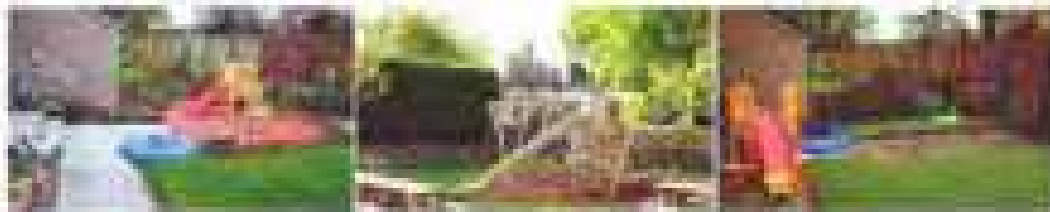
GARDEN
WATER BODY



GARDEN
ILLUMINATION



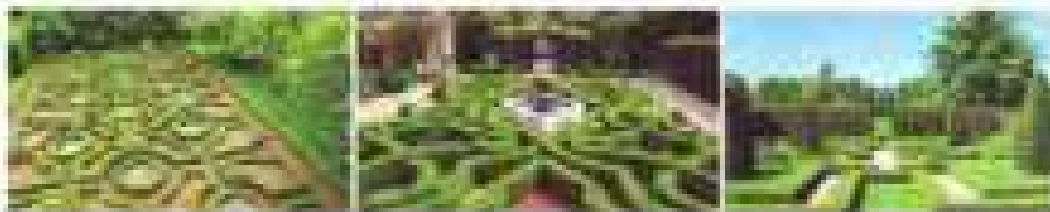
GARDEN
CHILDREN
PLAY AREA

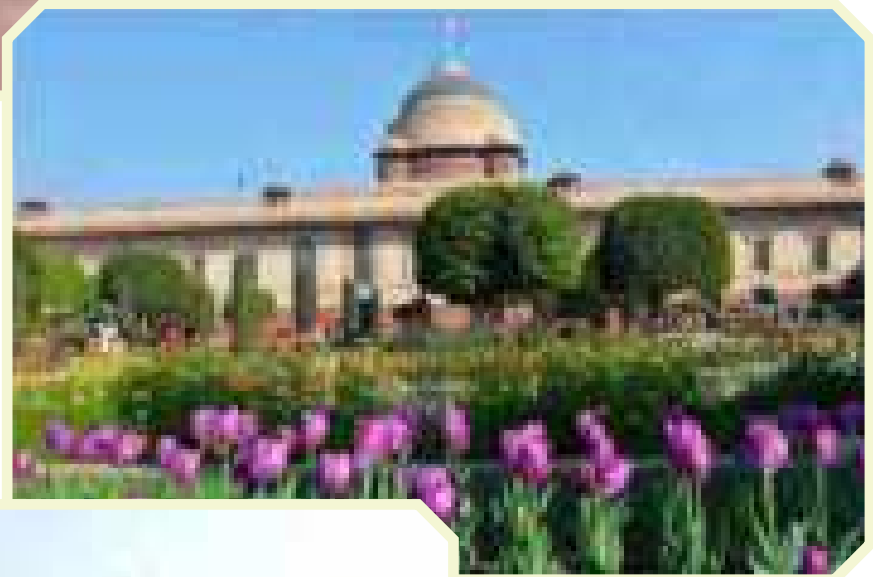


GARDEN
FOR-LIPS
SPRINKERS

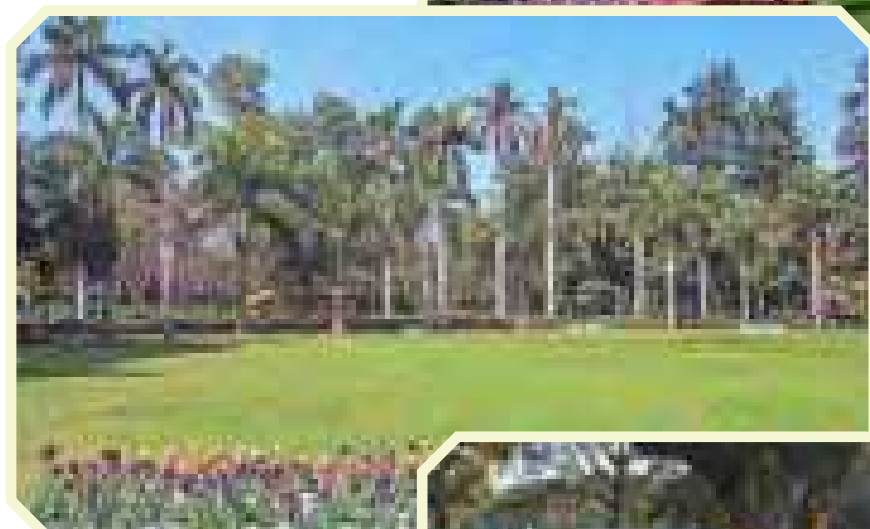


GARDEN
KNOTS





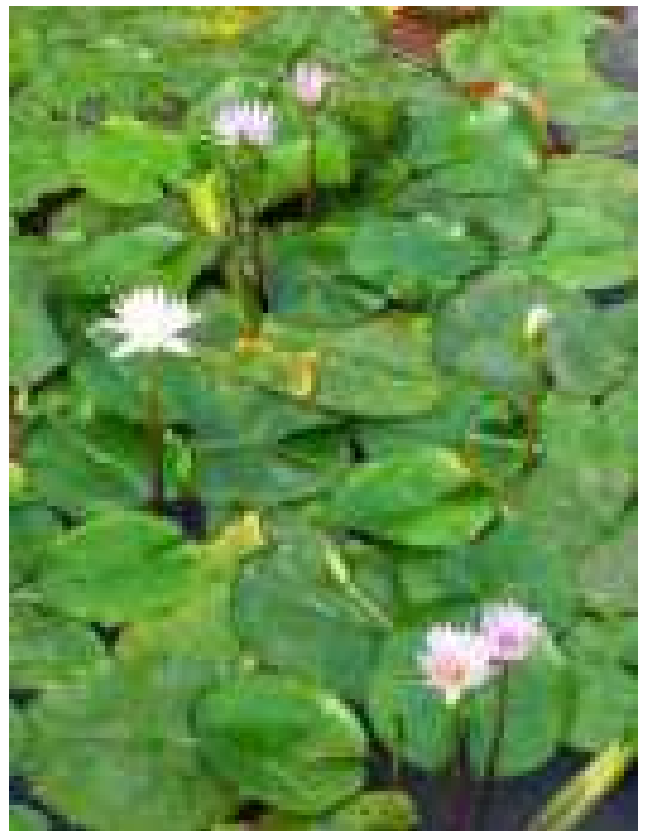
President Estate Garden



Landscaping Ideas



Landscaping Ideas





Landscaping Ideas

CHAPTER - 2

GREEN WALL / VERTICAL GARDEN

Green wall/Vertical Garden is the new concept of gardening particularly suitable for cities, as they allow good use of available vertical surface areas. With nationwide emphasis on being environment friendly and conserving resources beautiful creations like a Green Wall are bound to become common place in most commercial and residential buildings. A Green Wall, also known as living wall, bio wall or a vertical garden, is a living plant based exterior or interior wall to buildings or homes which may be free standing structures or part of the building. They are more frequently composed of climbing plants, but there are other options that some designers have incorporated in which the plants are grown in specially made support structure and growth media such as soil. The benefits of a Green Wall go far beyond aesthetics. A Green Wall is a natural insulation that helps to maintain and regulate the temperature within a building. It has been observed that the exterior of a wall with a Green Wall is 10 degrees cooler than an exposed wall. With the rising costs and shortage of energy, this feature reduces consumption of energy for heating or cooling in a multiple occupancy building. Living walls used on the interior of a building can also help to maintain humidity levels as well as assist in the air filtration, which can be a problem for some commercial buildings because they are located in crowded parts of the city. According to the EPA (Environmental Protection Agency), USA, poor indoor air quality is ranked fourth on a list of 31 of the worst environmental threats that the average worker faces each day. Another benefit of Green Wall is that they can be a means of water reuse. The Plants may purify slightly polluted water by

breaking down the nutrients and filtering into the water system. They also have the ability to absorb noise and reduce noise pollution inside the building while increasing the property value of a building. The living wall could also function for urban gardening or for its beauty. In vertical gardens, various types of modular panels can be used along with geotextiles fabrics, growing media, irrigation systems, and plants.

Commonly seen types of vertical gardens

Ideally the selected plants are planted into the modules or pots and are allowed to settle and grow over a period, before installation on site. Watering can be done manually or through irrigation systems which can be installed along with living wall structure. These living wall structures can be fixed directly to existing walls or can be fixed on to a MS framework in case of free standing living walls.

Green wall: This type consists of plastic modules which have a geotextile fabric bag which is filled with growing media and rooted plants are inserted into slits made into the bag placed inside the module. The modules can be fixed to walls directly or on a framework.

Bio wall: This type consists of plastic frames and plastic pots. Plants can be planted directly into the pots. The pots can be easily inserted into the frames, which are fixed to walls directly or on a framework.

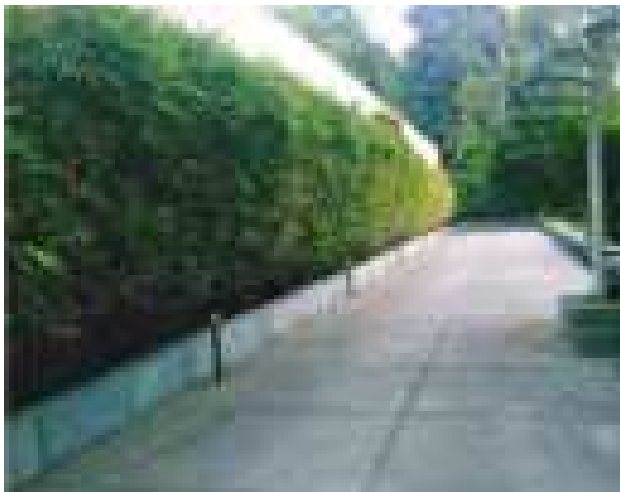
Living wall: This type consists of felt fabric fixed on a support, which in turn is fixed to

the wall. Plants can be planted directly into slits made to this fabric.

Benefits:

1. Aesthetics.

Green walls combine the works of art by nature in different ways as there are numerous varieties of plants that can be used in different combinations.

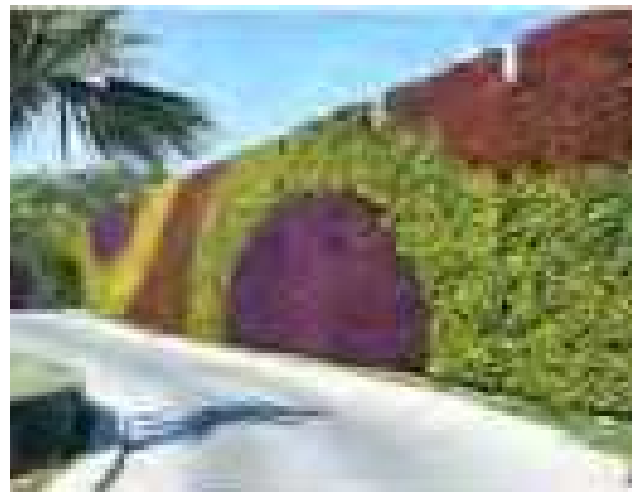


2. Indoor Air Quality

It is well established that plants can purify air. Along with indoor potted plants, green walls go a long way in improving indoor air quality.

3. Health and Wellness.

Living in urban environments, we are surrounded by concrete, traffic, noise and pollution. It has a profound impact on our physical and mental wellness. Greenery softens this hard environment, acting as a tonic to ease stress and fatigue.



CHAPTER - 3

MODULAR LANDSCAPING SOLUTIONS

Landscape Horticulture around the country has been evolving with new trends and we need to keep in pace with the developments of the International world of green practices in order to keep up with the influx of Landscape developments in this country.

People have practiced landscaping for centuries. As far back as the ancient civilizations, humans were manipulating the land for both aesthetic and practical reasons. The addition of plants, changes to the existing terrain and the construction of structures are all part of landscaping. Today landscaping refers to the planning, laying out and construction of gardens that enhance the appearance and create useable space for outdoor activities around a home.

A high proportion of the population and economic activities are at risk from climate change in urban areas, and a high proportion of global greenhouse gas emissions are generated by urban-based activities and residents. Suspended Particulate Matter (SPM) is the main problem of urban air pollution in India, caused mainly due to fast growing population of automobiles and poor traffic control, congested roads as well as factories in the peri urban areas. The most watched pollutants include particulate matter (PM), Nitrogen dioxide (NO₂), Sulphur dioxide (SO₂) and Carbon dioxide (CO₂), that are continuously degrading the ambient air quality in major cities in India.

With the growth of urbanization the cities are converted in to concrete jungles day by day and consequently reducing the greenery, rise to global warming, here the need is to bring about greenery in the every little available area along with its beautification.

Landscaping products which can bring about greenery vertically as well as horizontally as per your need and available spaces as all of them are modular system. Followings are the some key Features & General Informations about Various Landscaping Products.



DRAIN MAT

Sheet Drains for single side drainage applications are prefabricated products that consist of a solid, formed, three dimensional core covered with a geotextile Sheet Drains for single side drainage applications are prefabricated products that consist of a solid, formed, three dimensional core covered with a geotextile filter fabric bonded to the dimple side of the core. The filter fabric is securely bonded to prevent soil intrusion into the core flow channel while allowing water to freely enter the drainage core. Sheet drains solid cores allow water entry from one side and are typically used to collect and re-direct water from a structure or site. Sheet drains are designed for use in both vertical and horizontal drainage applications.

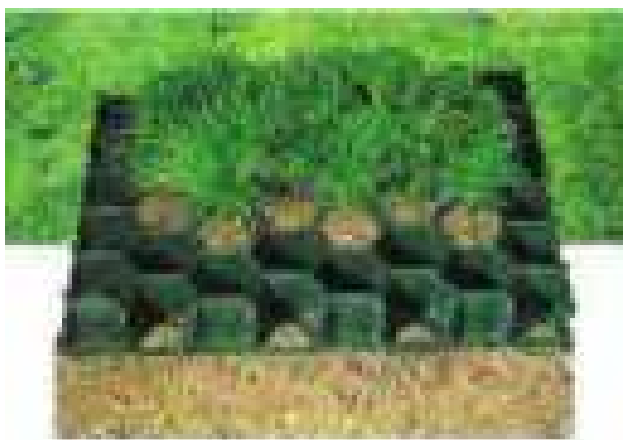
HONEYCOMB GRASS PAVER

Each Honeycomb Grass paver Unit made with a High-density recycled and UV rays-stable polythene (PE-HD), Weighing 1 kg.

and available in green or black colour. The Load bearing capacity is 200 tons/m² & Dimensions of the unit is 500mm x 430mm x 45mm.



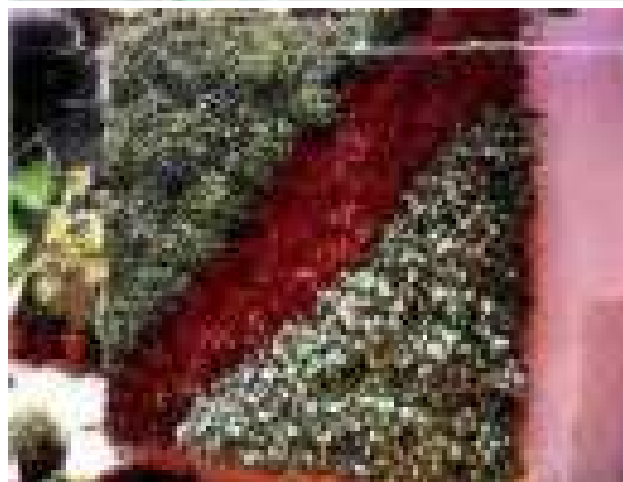
- Instant lawn effect with minimal labour.
- Makes maintenance operations, including lawn moving very easy.
- Mobility to your lawn patch. Takes ample foot traffic.
- Eliminates heavy ground and soil preparation.
- Water logging is eliminated with the special studs provided below the trays.
- The unique interlocking trays allow replacement of damaged lawn instantly with matured turf.



GREEN WALL

Each Green wall Unit made with a UV rays-stable RC Polypropylene (PP), Weighing <3.5kg. and available in green or black colour. The load bearing capacity is 150 kgs /module & Dimensions of the unit is 500mmx125mm.

- Modular Planting System
- Very Little framework Required
- Self Supporting & Strong Structure
- Easy for Creative Planting Design & Easy Maintenance
- Quick Construction & Plant Installation
- Both Vertical & Horizontal Expansion possible
- Each Plant can be Accessed & Maintained Individually.

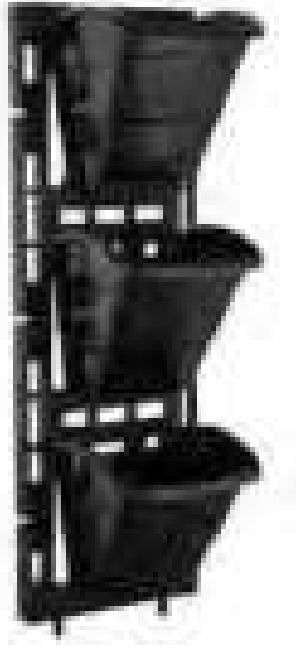


BIO WALL

“BIOWALL” it’s a kind of Green wall made from the shown product. Where we can create most beautiful Green wall using our choice of plants, herbs etc.

As Highlighted above one of the main feature of BIOWALL is its flexibility in the sense of giving it a shape.

It gives freedom of having green wall in the required shape like Round, Half Circle, Square, Angular and Curve in addition to normal horizontal and vertical. Each Bio wall Unit is made with a UV rays-stable RC Polypropylene (PP), made in black colour, Dimesions of the unit is 450mm x 150mm x 125mm.

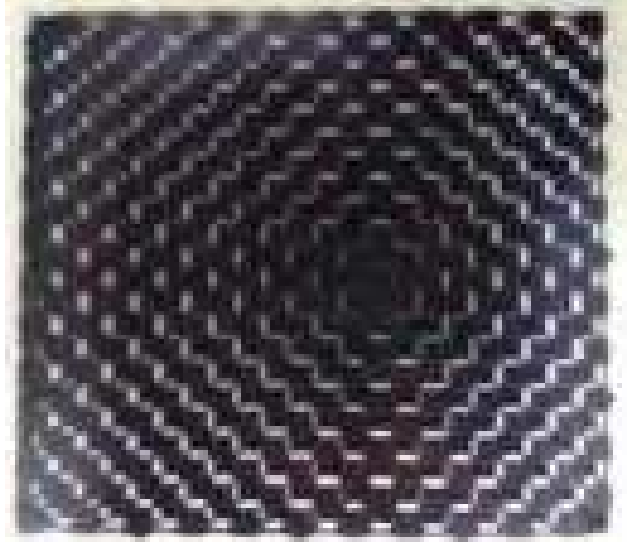


Available in box containing 4 frames + 12 pots and it covers area of 3 Sq.Ft.



DRAIN CELLS

Drain cell Unit is made with 100% recycled Polypropylene available in black colour. Can take compressive load of $> 100t/m^2$ Above 1200 KN having Discharge Capacity of 350 lit./min @1% Gradient Available in Dimension of: 610mm x 410mm x 30mm, 450mm x 450mm x 30mm & 450mm x 450mm x 20mm.



GEO TEXTILES

Geotextiles are permeable fabrics which, when used in association with soil, have the ability to separate, filter, reinforce, protects or drains. Typically made from polypropylene. Geotextile forms an integral part of drain cell system.

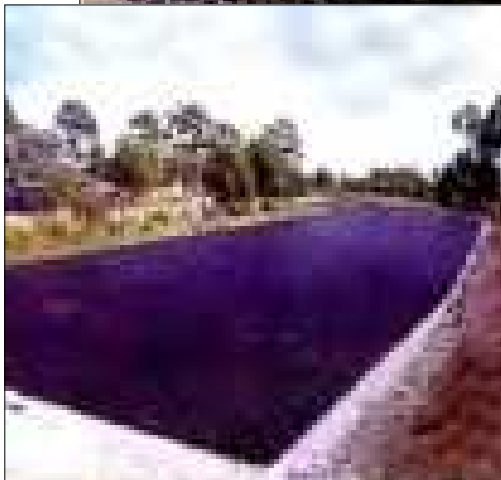
Available mainly in Gray, Black and White Colours in diff. GSM.



ROAD SURFACE CELL

Basic Structure and Specifications are same as Multi Grow wall.

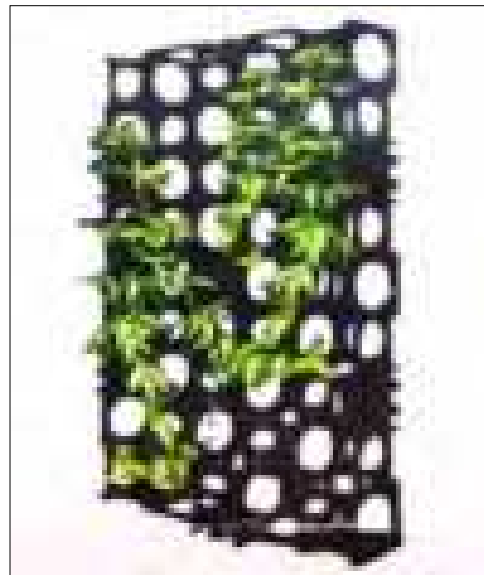
The Cells can be used in any situation where low to medium & heavy use parking surfaces, access roads for mining sites and driveways are required.



MULTI GROW WALL

Each Multi Grow wall Unit is made with a High-density recycled and UV rays-stable polythene (PE-HD), Weighing <math>< 1\text{kg}</math>. and available in black colour, The Load bearing capacity is 200 tons/m^2 & Dimensions of the unit is $480\text{mm} \times 260\text{mm} \times 51\text{mm}$.

- Modular Planting System & Easy Maintenance
- Easy for Creative planting Design
- Quick Construction & Plant Installation
- Both Vertical & Horizontal Expansion possible



ARTIFICIAL SPORTS SURFACE

With the modular landscaping solutions, it has been successfully completed sports grounds related projects for various surfaces for sports centres and gymnasiums.

- Sports surfaces for sports centres and gymnasiums.
- Artificial grass for both elite football and lower divisions/training pitches
- Sports and gymnastics mats
- Surfaces for Cricket, Volley Ball, Badminton
- Synthetic surfaces for tennis and multisport (outdoor) Skating etc.



EASSY WALL

A New Concept in Greenwall

Easy Hook Module system is one of the latest in many Green wall/ bio wall products introduced by the Modular Landscaping Solutions.

Just like other products, we can incorporate drip irrigation system in the Green wall made with help of Hook Easy module. With this facility we required less external irrigation elements and thus gives us enhanced irrigation efficiency and reduced cost, water flows smoothly throughout the system and maintains the green wall evenly.



TECHNICAL SPECIFICATION OF THE MODULE:

Height: 130 mm Base : 90 x55 mm Top : 115 x 125 mm

New Modular Design: Better design gives elegant look to the green wall

- Simple Method: Easy to build method.

Eco Friendly: Made with UV stabilized recycled polypropylene material

- Instant Wall: We can create an instant wall by placing pre grown plants in the pots.
- Drainage Holes: Holes at the bottom allows excess water to flow next level.



BIOWALL ULTRA

USED AS KITCHEN GARDEN SYSTEM

How it works: it consists of two trays kept one over the other, with lower one providing the water to the upper tray where the plantations are done, the lower tray comes with a water level meter which helps to adjust the water level required in the lower tray.

Where it can be placed:

- A corner of Kitchen
- Balcony or Verandah
- On the Terrace Area
- Backyard
- Window Cut outs.



CHAPTER - 4

HYDROPONICS

Hydroponics has, popularly, been defined as methods of growing plants without soil. The soilless culture defined as biotechnology technique that makes use of natural plant growth phenomena in obtaining better results from plants using inorganic or organic nutrients and standard agronomic practices. The fact is that soilless culture technology is a form of eco-technology that realizes the efficiency and profit from crop plants while maintaining harmony between human activities and the environment.

Thus, hydroponics and organic hydroponics are environment friendly technologies suitable for growing all kind of plants using balanced nutrients in a scientific way. This soilless culture technology not only supplements but also compliments the normal soil condition. It is a clean and scientific eco technology – a smart way to grow the plants.

Hydroponics is highly productive and yield superior quality crop produce round the year, irrespective of the soil and climatic conditions. Organic farming is as good as hydroponic farming albeit low and slow productivity.

Soilless Culture Techniques:

A soilless culture technique refers to the methods of applying nutrient solution to the roots in an efficient way. There are ten techniques in soilless culture.

1. Static Aerated Technique (SAT):

Plants are grown in a depth of static nutrient solution which is aerated either by providing air space in the root zone or by pumping air in

to nutrient solution in the tank. In organics, a simple pot or bag of organic medium is used. This is sometimes referred to as a “Passive Technique”. Ideally suited for learning the basics of hydroponics or organics and for doing R&D work. Never use this technique for regular growing of plants hydroponically (especially in the tropics) as mosquitoes might breed.

2. Ebb and Flow Technique (EFT):

Plants are grown as a SAT, but the nutrient solution is drained off 3-4 times a day to permit the roots to breathe. This technique is sometimes called “Flood & Drain Technique”(in aggregate culture). In organics plants are grown in organic medium and only plain water is used for flooding. Good for home gardens and commercial nurseries. Almost any type of plants can be grown.

3. Deep Flow Technique (DFT):

A depth of nutrient solution (4-6 cm) is circulated around the roots either by gravity or by using a pump. As the nutrient solution circulates, it absorbs oxygen from the atmosphere. This technique is also referred to as “Dynamic Root” Flootation Technique” and as “Raceways Hydroponics”. Ideal for leafy vegetables and all shallow rooted plants. In organics, fish tank water or any liquid organic nutrient source is used.

4. Aerated Flow Technique (AFT):

This is modified version of DFT. Here, the nutrient solution is profusely aerated by special mechanism. Oxygen level of 10-12 ppm is maintained in the nutrient solution.

The Japanese “Kyowa Hyponica System” and “Styrofoam Float System” adopt AFT, Excellent for growing both leafy and fruit vegetables and certain ornamentals. In organics, fish tank water or any liquid organic source is used.

5. Nutrient Film Technique (NFT):

A thin film of nutrient solution is always in contact with the roots. While the nutrient solution is circulated, the root surface is exposed to the air. This helps the roots to breathe. Numerous modified versions featuring slant /plane feeding, hypertonic feeding, etc. are available. Very good for producing fruit and leafy vegetables. This technique works well both in temperate and tropical regions of the world. In organics, fish tank water or any liquid organic nutrient source is used.

6. Gravel Flow Technique (GFT):

Plants are grown in inert inorganic or organic substrates and the nutrient solution is fed to the roots from beneath the roots. A film of nutrient solution is circulated beneath the substrate. This technique is usually practiced with sand, granite or perlite or other porous substrates which permit free flow of nutrient solution beneath. Commonly practiced in the USA, South Africa, Australia and India for growing lettuces and other kinds of plants. The Bengal System Adopts this technique. In organics, fish tank water or any liquid organic nutrient source is used.

7. Sub-Irrigation Technique (SIT):

Plants are grown in inert inorganic or organic substances and nutrient solution is fed to the roots from beneath the roots through seepage tubes. Though this method of feeding has been practiced in soil cultivation, it has been refined in hydroponics. Nutrients are fed through capillary action of the

growing medium or wicks or any similar water absorbing material that links a pipe or tray containing the nutrient solution to the media surrounding the roots.

8. Drip Irrigation Technique (DIT) :

Like SIT, plants are grown in inert inorganic or organic substrates, and the nutrient solution is fed close to the roots 6-7 times a day in drops or trickles. This technique is called a” Drip Fertigation Technique”. This technique is also referred to as “Surface Watering Technique” if hand watering or flooding is practiced instead of drippers. Deserts in the Middle - East are exporting crop produce because of this technique. Also suitable for the plantation, orchard and landscaping industries.

9. Root Mist Technique (RMT):

A mist of nutrient solution is sprayed every 4-5 minutes on to the roots of the plants that hang from a frame in a rooting chamber. Hydroponic system that are designed using the technique is popularly known as “aeroponics. Good for initiating rooting of cuttings and also for extracting (“milking”) phytochemicals from the roots for medicinal purposes. Also good for growing any type of plants. Selection of nozzles to adjust the droplet size might promote more fine root hairs which in turn might influence nutrient absorption. In organics, fish tank water or any liquid organic nutrient source is used.

10. Fog Feed Technique (FFT):

This is similar to RMT but the droplet size is so very minute (like a cloud) that the nutrient solution can hardly moisten our hand. This technique has yet to be perfected. Good for plants having aerial roots with spongy water absorbing tissues like “valamen”. e.g orchids, anthuriums, etc. In organics, fish tank water or any liquid organic nutrient source is used.



CHAPTER - 5

HOME GARDEN FEATURES

Gardens have been established next to homes since time immemorial. The most important characteristics of home gardens are their location adjacent to homes, close association with family activities and a wide diversity of plant species to meet family needs.

Home gardens are divided based on their features, broadly into:

1. **Front garden or aesthetic garden:** This is the visual area between the gate of the campus and entry point to the main building. Focus is laid on aesthetic components such as lawns, flower beds, shrubs, trees, edges, hedges, creepers on arches, pergolas, walls, fountains, waterfalls etc. This part of the garden enhances the value of the building, refreshes the mind after hard work outside and makes life more enjoyable both for owners and visitors.
2. **Indoor Garden:** This is mostly a container garden in any part of the house like verandah, balconies, living room, kitchen, bedrooms and bathrooms etc. There is scope to showcase the entire house as a garden and allow one to be close to nature. It is easy to maintain and enjoy an indoor garden especially foliage plants. Potted plants can be placed on pot stands, window-sills, on the floor in pot trays or in corners or can be hanged on specially made hooks.
3. **Back yard or Kitchen Garden:** This is mainly used for growing fruits and vegetables for personal use and also to have some lawn area for a family sit out. Functional value is of prime concern.
4. **Roof Garden:** A rooftop garden is when you build a garden on the roof of a building which is usually done in urban areas. It is an easy way to have a garden experience without needing the land to create the garden. The plants are usually grown in pots or planters especially constructed for the purpose. Flowers & vegetables grown in pots on the roof top provide coolness to the building and also help in creating a habitat for birds. Light pots and pot media are preferred. Water proofing the roof floor is very important. Lawns can also be raised with light soil media and by providing proper drainage.

HOME GARDEN COMPONENTS

This can be broadly divided into soft and hard landscape components. Soft landscape components consist of various types of plants and hard landscape components comprise of civil works including metallic structures such as arches pergolas etc.

(A) Softscape Garden Components:

- i. **Trees:** Trees are grown for shade, cooling effect, screening, reducing dust, sound and air pollution. Based on available space, medium or small canopy trees can be grown. Trees can be evergreen and deciduous, based on their leaf shedding character or they can be flowering and non flowering foliage trees.
- ii. **Palms:** Palms require very small ground space for growth. They can either have clear, round, upright trunk with a majestic ever green crown or clustering habit. Their root system does not require large surface area or depth in the ground. They are elegant to look at and well known for

- their symmetrical growth which makes an avenue look beautiful. They remain evergreen and do not litter the ground with leaves. Therefore, palms are more suitable and ideal for narrow passages and narrow strips of land, boundaries and near the building.
- iii. **Shrubs:** Shrubs can be classified as flowering and non flowering. Flowering shrubs need full sun light, and foliage shrubs can grow well under partial sunlight and shade. Location has to be decided based on the height and canopy of the shrubs. Pruning of shrubs helps to get bushy growth.
 - iv. **Climbers:** Climbers are plants which require support to grow. They can be trained on arches, pergolas, walls, trees and on pandals. Climbers can be used for screening even in narrow spaces, over grills and wire meshes.
 - v. **Flower beds :** Seasonal and perennial flower beds can be laid in various shapes and sizes. Flowers in all colours of the rainbow are available. Some species are specific to winter; summer or rainy season and some can be grown throughout the year.
 - vi. **Ground Covers:** These are used to cover the soil surface as an alternative to lawns for avoiding dust and to add colour through flowers or foliage. They also check soil erosion.
 - vii. **Hedges and edges:** Hedges are used for providing privacy, concealing unwanted and ugly locations or as a back ground to lawns, flower beds etc... Edges are used as demarcating lines to lawns, flower beds, pathways etc. and low height is maintained with regular pruning with shears.
 - viii. **Roses :** Many people consider a garden incomplete without rose plants. These are grown for attractive and scented blooms, in beds or as standards and climbers.
 - ix. **Potted plants:** Potted plants are displayed both indoors and outdoors, as groups or in singles, on plane areas or steps, on ground or pot stands. Hanging pots are also used extensively. Pots in a group give a very good effect.
 - x. **Lawns:** Lawns are areas planted with various types of grasses. They are a major component in any garden. They can be planted in turf form and also as grass slips. The following varieties are available either in carpet or loose form- Korean, Mexican, Fescue, Calcutta doob, Bermuda, Paspalum and St. Augustine.
 - xi. **Rockery:** A rockery is a retaining or protection structure that consists of stacked rocks without mortar, concrete or steel reinforcement. The rocks are stacked in an “interlocking” pattern, and rely on the weight, size, shape, and interface friction of the rock elements to provide overall stability. Selected plants are grown to give an effect of a rocky terrain. Plants best suited to rockeries are those which grow slow and low and are happy in dry areas. These plants usually prefer well-drained soil and less water.
 - xii. **Special garden features:** Special features include Bonsai, Topiary, tray gardens, bottle gardens and specimen plants etc. that are used especially to create an aesthetic effect in a garden.

(B) Hardscape Garden Components :

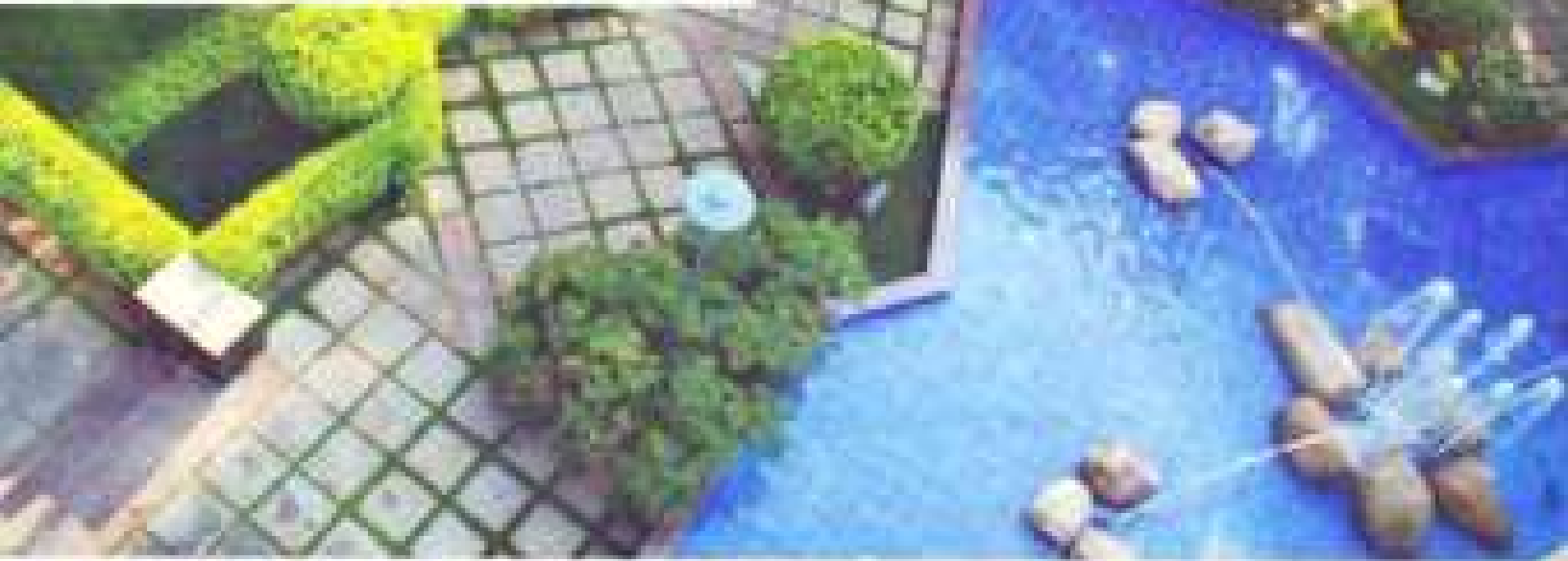
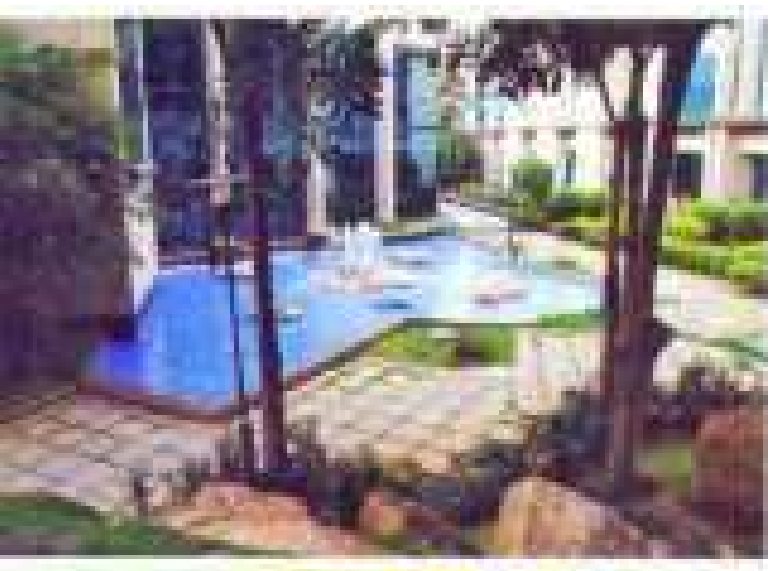
- i. **Arches:** These are used at entry points to the house or a lawn and are covered with creepers. Arches are of different shapes and sizes and can be made of iron pipes/ flat rods, wood, cement bars etc.
- ii. **Pergolas:** Pergolas are umbrella shaped iron or wooden structures covered with

creepers to provide shade over sit-outs and also for elegance.

- iii. **Statuses:** These can be art statues or memorials.
- iv. **Pathways, steps, curbs, benches etc:** Functional elements introduced in a garden which are very much essential and practical.
- v. **Water features:** Ponds, flow channels, waterfalls, fountains, sprinklers and swimming pools are essential water

features which can be used in a garden to provide a feeling of peace, calmness and beauty.

- vi. **Tools and Implements for Watering, Drainage and Lighting Systems:** These are the basic needs for any garden. Tools and implements like a pruning Shear, Rake, watering can, drip systems etc. can be used. Nowadays, to showcase a garden, a variety of lighting systems can be designed.





Hydrangea Flowers



Kalanchoe



CHAPTER - 6

ROOF GARDENS

Tips for Roof Garden:

1. Suitable for people living in apartments or buildings without much open area around the house.
2. Ensure the structural strength of the building, before embarking on the project.
3. Provide water proofing to roof top before under taking any construction of planter boxes with the required water proofing material. Use drain cells and geo textile fabric for improving the drainage for lawns, flower beds and planters, before filling with red soil and manure.
4. Try and use materials which are light weight like plastic pots and trays, aluminum pots, fiber glass planters and earthen pots. This helps in reduction of dead load on the terrace.
5. Use of light weight material like peat or sphagnum moss, coco peat, vermicompost etc. in the soil mixture will help in reduction of weight.
6. For plant propping, provide light supporting structure.
7. Keep the plant growth under check by regular pruning.
8. For shade loving plants provide shade net.
9. Use limited quantity of water daily. Care should be taken to avoid water stagnation.
10. With proper planning, care and precaution, a full-fledged roof garden can be developed and maintained with many Garden features.



CHAPTER - 7

PLANT PHYSIOLOGY

Fundamentals of Plant Physiology and Soil Moisture:

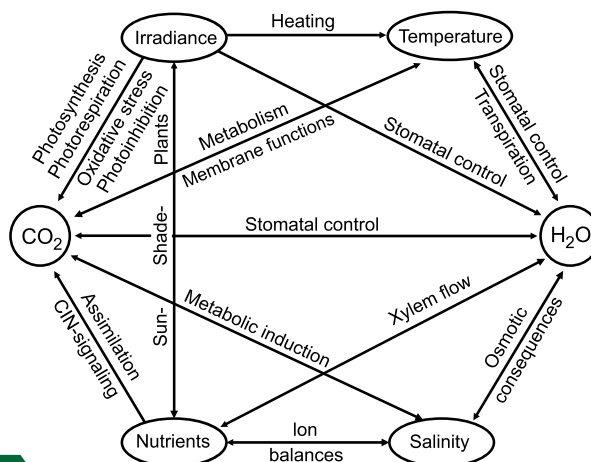
- i. **Photosynthesis:** Photosynthesis is the process of converting light energy to chemical energy and storing it in the bonds of sugar. Plants need only light energy, Carbon-di-oxide and water to make sugar while releasing oxygen. The process of photosynthesis takes place in the chloroplasts using the green pigment chlorophyll. This is essential for survival of life on earth.
- ii. **Osmosis:** The process of absorption of dilute plant nutrients through the roots is osmosis. If the nutrient solution around the absorbing roots is more concentrated than that of plant sap, then such solutions suck plant sap and the plant dies, this process is called as reverse Osmosis.
- iii. **Transpiration:** The process of evaporation of moisture from the plant through leaves is transpiration. This depends on the surface area of the leaf, atmospheric temperature, humidity and wind speeds. If the rate of evaporation is more than absorption of moisture from the soil through roots, the plant wilts and dies.
- iv. **Respiration:** Plants respire through leaves and roots. Periodical loosening of soil near the root zone helps in better aeration and respiration of the plant and it helps in maintaining plant vigour.

Factors Responsible For Better Plant Growth:

1. **Light:** Plants need light for photosynthesis and growth. Intensity and duration of light needed by a plant differs from species to species. Poor light results in pale leaves or loss of colour. If proper distribution of light is not available on all sides of the

plant, pots need to be rotated regularly. Bright artificial light can substitute natural light.

2. **Humidity:** 40-60% RH is ideal for plant growth. It is very low during summer months. Low humidity leads to tip burn in leaves. Protect the plants from dry winds during summer. To increase humidity, spray fine mist on foliage, sponge the leaves with water or place pots on moist sand, cover the soil around the plant with sphagnum moss/wet paper.
3. **Temperature:** Ideal temperature for indoor plants varies from 15-30 C for different species. Plants prefer uniform temperatures, which can be achieved with good aeration by keeping the doors or at least windows open.
4. **Soil moisture:** Indoor plants need lesser water than outdoor plants. Succulent and thorny plants need water less frequently. Soil in small pots dries quickly than in larger pots. Clay pots need water more frequently than plastic or ceramic pots. For retention of water in the pots loosen top soil, apply mulches, and add charcoal, brick crumbs, and coco peat and water absorbents. Do not over water the plants as this may create anaerobic conditions for the root system.



CHAPTER - 8

TREES

For us a tree means flowers, fruits and shade. For a person in a village it means fuel wood, timber, fodder and lots more. For children it is a wonderful place to climb on to and watch animals in action. For elders it is a religious symbol and a pharmacy at home. For some people it is a leaf shedding machine that fills the yard with leaf litter. In urban areas, they are of immense value as they are the only source of greenery amidst the concrete jungle, adding beauty to the city surroundings with their lush foliage, colorful flowers and beautiful shapes. Beside the aesthetic value, they help in controlling pollution, regulating temperature and as wind breakers. Trees are dominant elements of a garden and contribute substantially to the garden atmosphere. They are available in many shapes, sizes, foliage and blooms. The selection of trees depend on the architecture of the building, the purpose for which they are planted whether a single plant as a focus of attention, or a cluster of plants for mass effect, the position available, whether in shade, semi-shade or open sunshine, waterside, rock areas etc.,

Tree are grown for shade, cooling effect, screening, reducing dust, sound and air pollution. Based on available space, large or small canopy trees can be grown. Trees can be classified as evergreen (which do not shed leaves) and deciduous (which shed leaves during a particular season of the year) or as flowering and foliage trees.

Trees are an important component of a garden.

- They Provide shade during summer and shelter during rainy season.

- Help in preventing soil erosion.
- Provide good nesting places for birds.
- Check air and sound pollution.
- Obstruct entry of dust and smoke into the house.
- Create required privacy.
- Generate fragrance in and around the house with scented flowers.
- Make the campus colourful with multicoloured flowers and foliage.
- Improve environment by creating humidity and coolness.
- Act as a background to the lawns and other garden features.
- Act as natural protection system for shade loving potted plants.

Tips for Planting & Maintaining Trees:

- Plant the trees and water them properly. Next day press at the base and stake the plants. Pressing is done to remove the air pockets created during planting. If air pockets are not removed, they will act as precursors to infections.
- Pruning and training by removal of lower branches results in a balanced plant growth.
- Regular weeding, mulching and watering in the plant basins during first three years of planting are essential.
- Periodic pruning of dried branches carefully with a pruning saw is desirable.

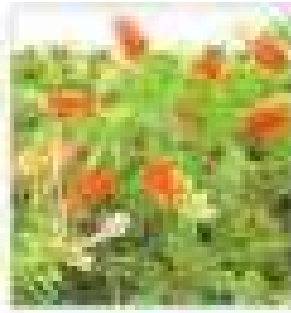
Apply copper oxi-chloride paste to the cut ends.

- Trees help us in many ways. Plant & protect them.
- Trees hold the soil with their roots and prevent it from getting eroded by heavy rains and winds.
- Trees in upland areas trap rainwater and prevent flooding of lowlands during heavy rains.
- Trees help to reclaim wastelands by improving soil texture and fertility.
- Tree roots create paths into the soil, through which water percolates down for use as ground water.
- Tree roots and leaf litter act as barriers to runoff water, and when stored for a period of time, it decomposes to form leaf mold manure which is excellent for the growth of plants.
- By releasing water in the atmosphere from tiny pores in their leaves, trees cool and refresh the air; this process also reduces dust pollution as the dust particles in the air stick to the water vapor thus released.
- Trees produce oxygen through the process of photosynthesis

S. No.	Name	Colour	Height	Flowering Season
1.	Bauhinia Var	White, pink, purple	Small to medium	Nov-Mar
2.	Cassia fistula	Yellow	Small	Feb-Apr
3.	Cassia javanica	Pink, white	Medium	Jly-Sep
4.	Cassia nodosa	Orange -Scarlet	Medium	Jly-Sep
5.	Colvillia racemosa	Pink	Tall	Jly-Sep
6.	Erythriana indica	Scarlet	Medium	Mar-Apr
7.	Erythrina crista-galli	Scarlet	Small	Year round
8.	Jacaranda	Blue	Medium	Oct-Feb
9.	Lagerstroemia florisregene	Purple, pink	Medium	Jul-Aug
10.	Delonix regia	Orange	Big	Mar-July
11.	Peltophorum	Yellow	Big	Year Round
12.	Plumeria sp.	White	Medium	Oct-Mar
13.	Spathodea companulata	Orange	Tall	Oct-Mar
14.	Tecoma argentia	Yellow	Small	Feb-Mar
15.	Tecoma gaudi chaudi	Yellow	Small	Year Round
16.	Tabebuia rosea	Pink	Small	Feb-Mar
17.	Saraca indica	Orange	Small	Apr-Jun
18.	Cordia sebestena	Orange	Small	Year Round



Magnolia Grandiflora



Callistemon Pollandi



Aegle Marmelos



Pithecelobium SP



Saraca Indica



Cordia (Yellow)



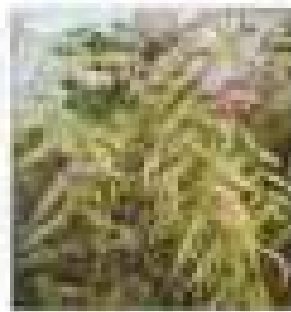
Cordia Sebestena



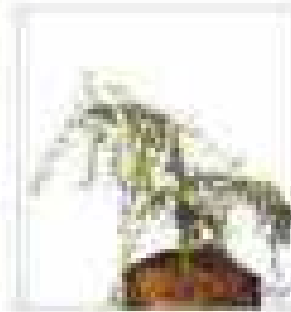
Golden Melaleuca



Artabotrys



Azadirachta Indica Vergated



Opercularia Decary



Delonix Regia



Spathodea Campanulata



Melaleuca Linearlifolia



Cassia Spectabilis



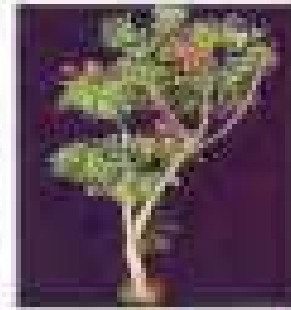
Millettia Reticulata



Terminalia Mentaly



Cochlospermum Religiosum (Double)



Erythrina Cristagalli



Lagerstroemia



Bamboo (Black)



Simarouba Glauca



Brassaia Actinophylla



Alstonia Scholaris



Plumeria Obtusa



Leucophyllum Fruitsens



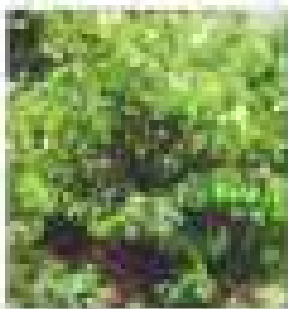
Dillenia Indica



Gauva



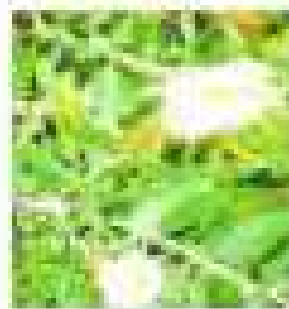
Ficus Carica



Bauhinia Alba



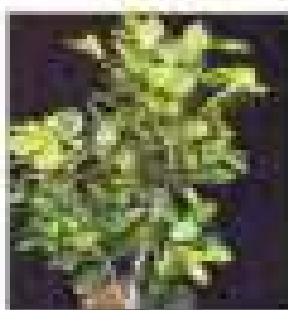
Citharexylum Spinosum



Melaleuca Armillaris (White)



Couroupita Guianensis



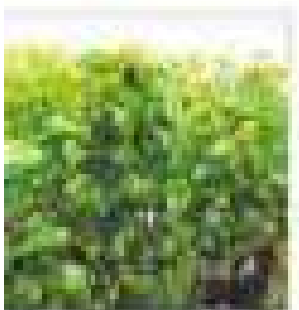
Artocarpus Hetrophyllus



Erythrina Blackiena



Chorisia Speciosa



Sterculia Alata



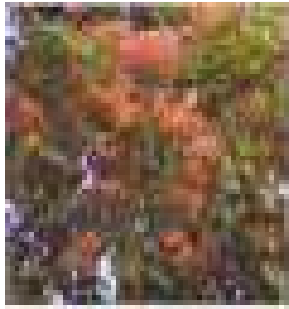
Colvillea Racemosa



Solanum Vergated



Mango



Cassia Marginata



Giant Bamboo



Ficus Createrisperma



Tabebuia Pallida



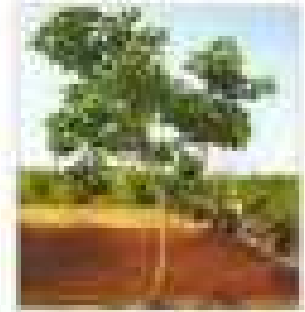
Sterculia Foetida



Millingtonia Hortensis



Anthocephalus Cadamba



Thespesia Populnea



Mesua Ferrea



Jacaranda



Ficus Bengalensis



Crataeva Religiosa



Agathis Robusta



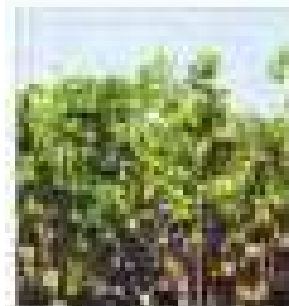
Cassia Fistula



Bauhinia Purpurea



Tabebuia Rosea



Markhamia Lutea



Pachieia Aquactica



Ficus Roxburghii



Cassia Alata



Cananga Odorata



Kigelia Pinnata



Callistemon Pollandi



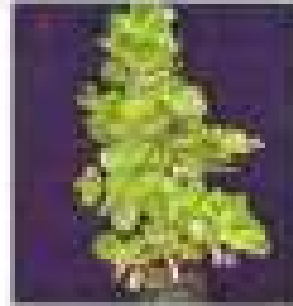
Swietenia Mahagoni



Plumeria Singapore Dwarf



Crescentia Cujete



Clusia Rosia Variegata



Clusia Rosea



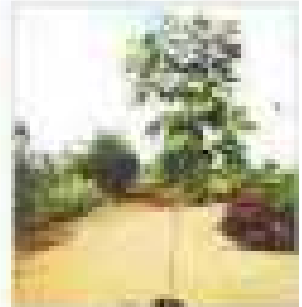
Solanum Macranthum



Bombax Ellipticum



Nyctanthes Arbortristis



Pterospermum Acerifolium



Cochlospermum Regligosum



Bixa Orellana



Madhuca Latifolia



Schizostachyum Brachycladum



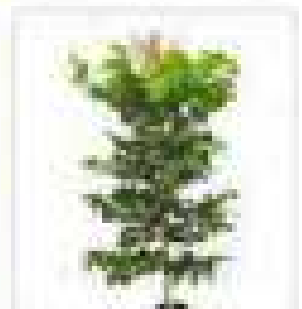
Thevetia



Plumeria Pudica



Guaiacum Officinale



Aphanomixus Polysytachya



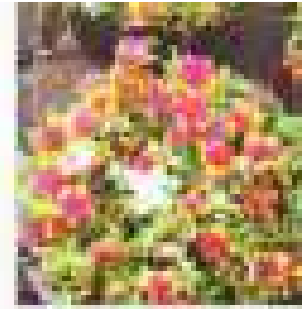
Milletia Ovalifolia



Cattleya Orchid



Quisqualis Indica



Portulaca Oleracea



Kadamba Dwarf



Monstera Deliciosa Variegated



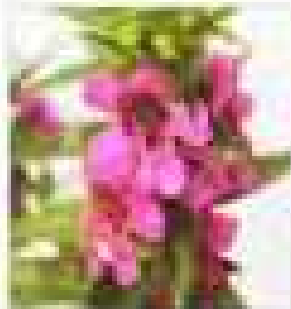
Hanging



Hanging



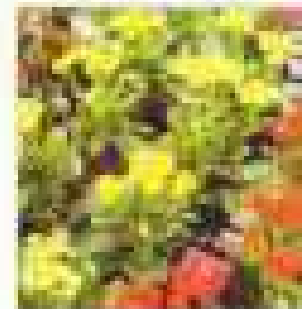
Angelonia Serena Pink



Angilonium Red



Kalanchoe Variegated



Kalanchoe



Aquatic Plant



Philodendron Magestic



Canna Dwarf



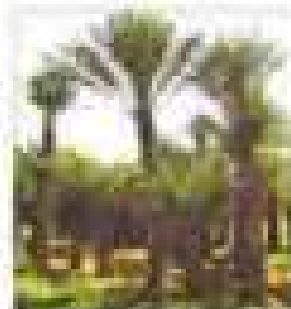
Episcia Cupreata



Bamboo Variegated



Neodypsis Decaryi



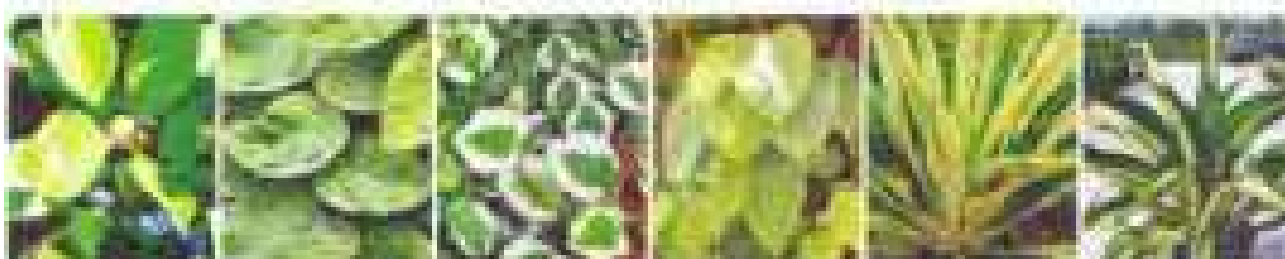
Phoenix Sylvistris



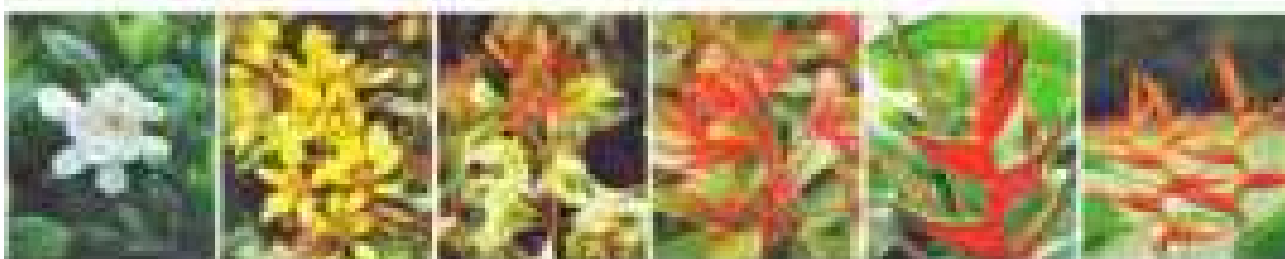
Podocarpus



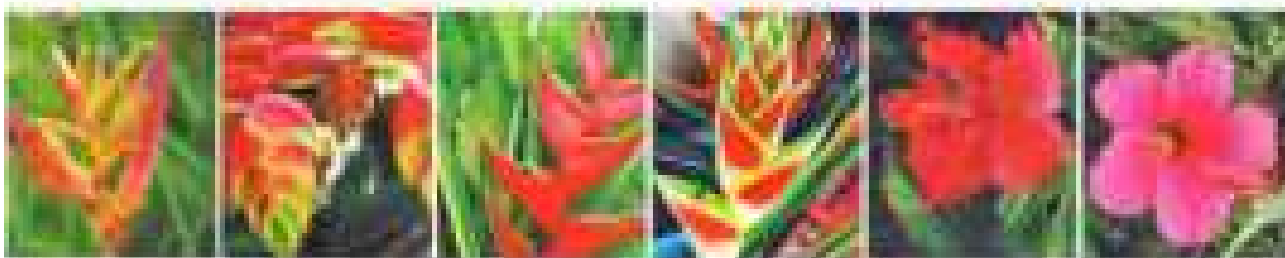
Ficus elastica *Ficus elastica* *Ficus lyrata* *Ficus macrophylla hillii* *Ficus macrophylla* *Ficus mysorensis*



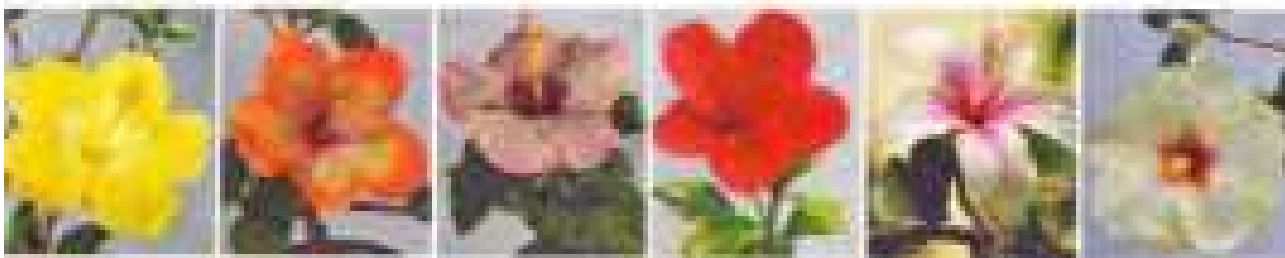
Ficus nitida *Ficus pumila wall creeper* *Ficus pumila variegata* *Ficus religiosa* *Furcraea foetida variegated* *Furcraea foetida variegated*



Gardenia jasminoides *Galphimia glauca* *Hamelia patens variegata* *Hamelia patens* *Heliconia caribaea* *Heliconia latispatha Starwiz*



Heliconia psittacorum *Heliconia rostrata* *Heliconia stricta huber* *Heliconia wagneriana* *Hibiscus rosa sinensis* *Hibiscus rosa sinensis pink*



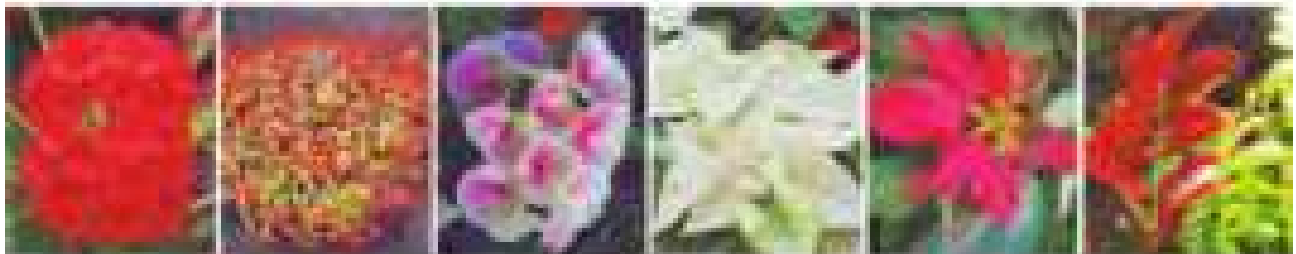
Hibiscus rosa-sinensis hawaiian variety *Hibiscus rosa-sinensis hawaiian variety* *Hibiscus rosa-sinensis hawaiian variety* *Hibiscus rosa-sinensis viceroy variety* *Hibiscus rosa-sinensis hawaiian variety* *Hibiscus rosa-sinensis hawaiian variety*



Cordea lutea Crossandra infundibuliformis Crossandra regular Crossandra yellow Datura metel Cycus revoulta



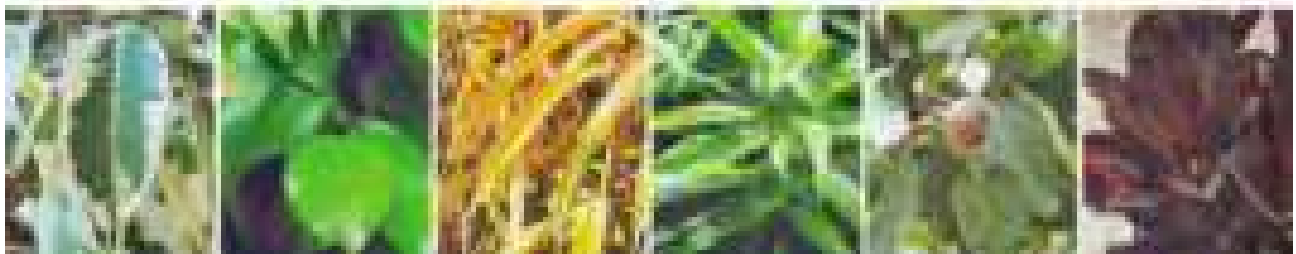
Cycus circinalis Duranta variegated Duranta golden speciosa Eranthemum laxiflorum Euphorbia Cotinifolia Euphorbia leucocephala



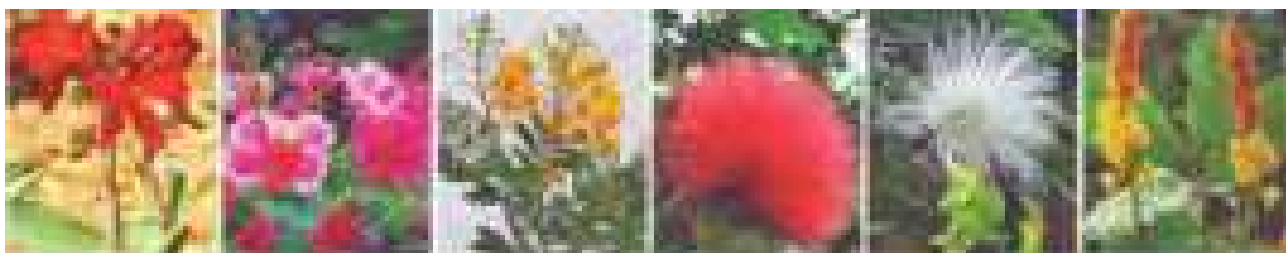
Euphorbia milii visoffora Euphorbia milii Desert rose Euphorbia milii Hybrid Euphorbia-pulcherrima White Euphorbia-pulcherrima red Excoecaria bicolour



Ficus benjamina (black) Ficus benjamina bushy king Ficus benjamina Panda Ficus benjamina rigenold Ficus benjamina variegata Ficus bnjamina variegata



Ficus benjamina variegata Ficus benjamina Ficus binnendijkii yellow (long island) Ficus binnendijkii Ficus carica (Angeer) Ficus elastica burgundy



Cannas dwarf red

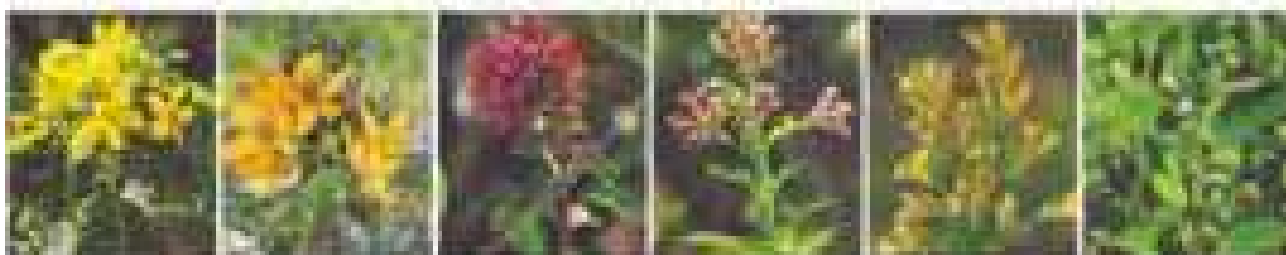
Caesalpinia pulcherrima Pink

Caesalpinia pulcherrima (Yellow)

Calliandra deep red

Calliandra protoricensis (Milk way)

Cassia alata



Cassia gluca

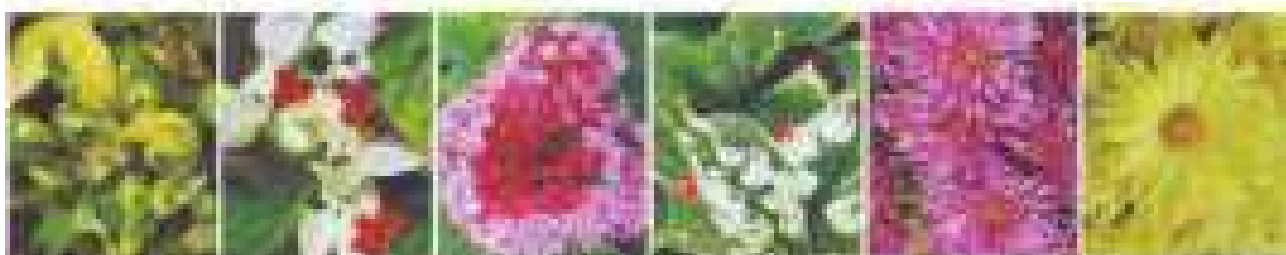
Cassia biflora (Bicapsularis)

Cestrum elegans (Night queen red)

Cestrum (Night queen pink)

Cestrum aurantiacum (Night queen yellow)

Clerodendron inerme



Clerodendron inerme variegated

Clerodendron thomsonae

Clerodendron bungei

Clerodendron variegata

Chrysanthemums Kanchil

Chrysanthemums Kargil



Chrysanthemums Karnal Pink

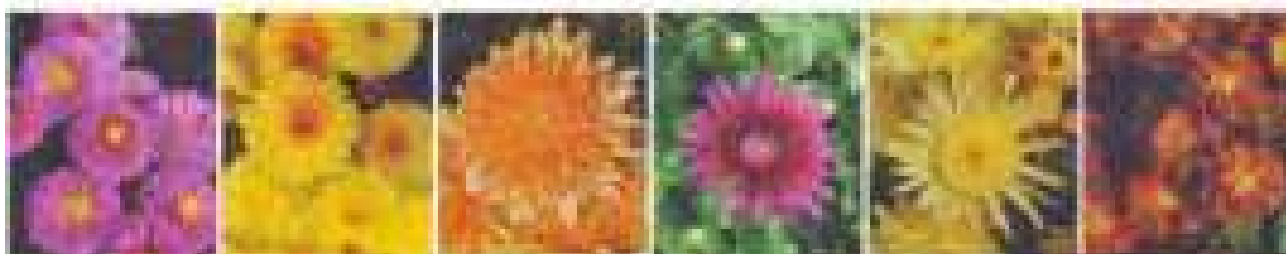
Chrysanthemums Kundan

Chrysanthemums Lalit

Chrysanthemums Lalpani

Chrysanthemums Little Darling

Chrysanthemums Little Orange



Chrysanthemums Little Pink

Chrysanthemums Haldighati

Chrysanthemums Thaichin Queen

Chrysanthemums Queen

Chrysanthemums Ranbil

Chrysanthemums Red Stone



Abutilon hybridum

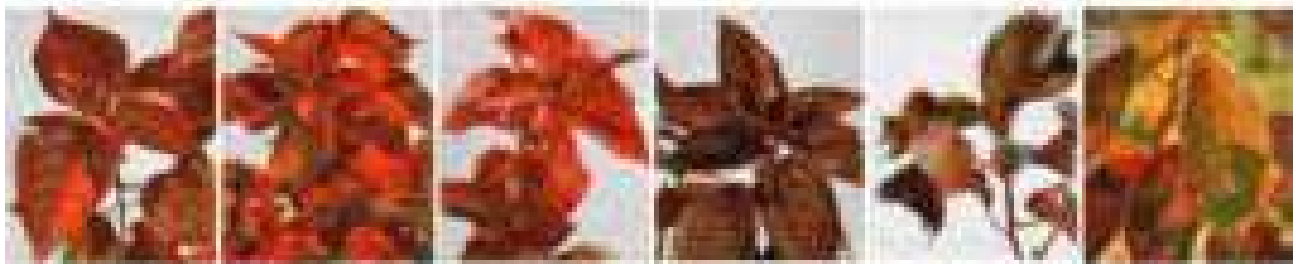
Acalypha wilkesiana philippine

Acalypha wilkesiana inferno

Acalypha wilkesiana ceylon lime

Acalypha wilkesiana tahiti plain

Acalypha wilkesiana hoffmanni



Acalypha wilkesiana lousiana red

Acalypha wilkesiana dwarf

Acalypha wilkesiana brazen

Acalypha wilkesiana moorea chocolate

Acalypha wilkesiana moorea twisted

Acalypha wilkesiana bourbonstreet



Acalypha godseffiana heteropylla bronze

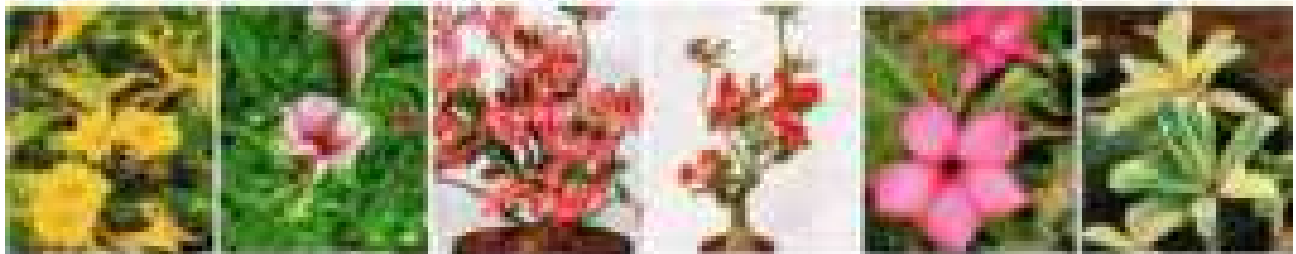
Acalypha godseffiana heteropylla variegata

Acalypha godseffiana heteropylla / kilauea

Acalypha hispida indica

Acalypha hispida rubra

Acalypha wilkesiana microphylla



Allamanda nerifolia

Allamanda violacea

Adenium arabicum

Adenium obessum grafts

Adenium obessum grafts

Adenium obessum variatged



Angelonia angustifolia

Angelonia angel mistwhite

Artemisia arborescens lavender

Bambusa balcooa (giant bamboo)

Bamboo salsa maquonia

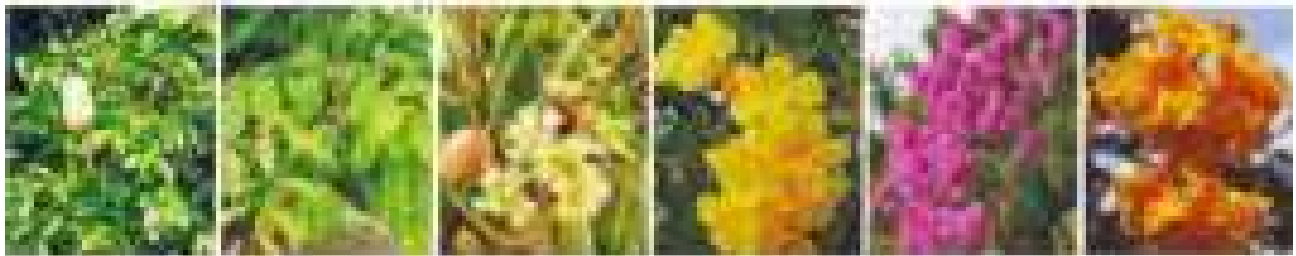
Bambusa variegated new



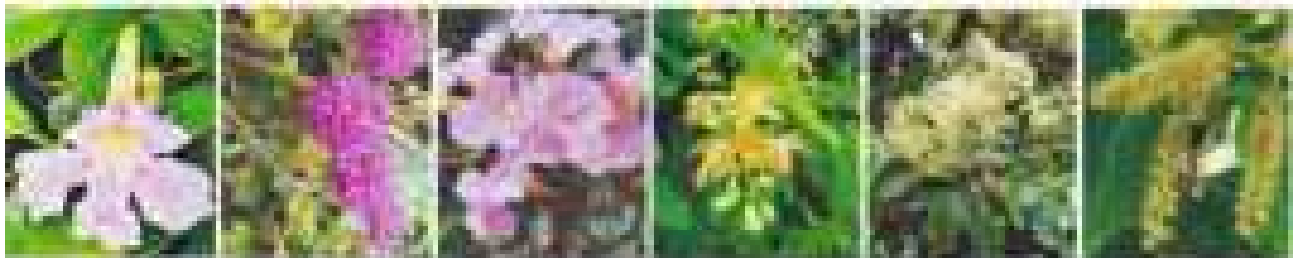
Prosopis juliflora Sterospermum suberifolium Putranjiva roxburghii Samanea saman rain tree Santalum album sandal wood Saraca asoca ashoka tree



Saraca cauliflora Sesbania grandiflora avisa Simarouba glauca Spathodea campanulata tulip tree-yellow Spathodea campanulata tulip tree-orange Sterculia foetida china badam



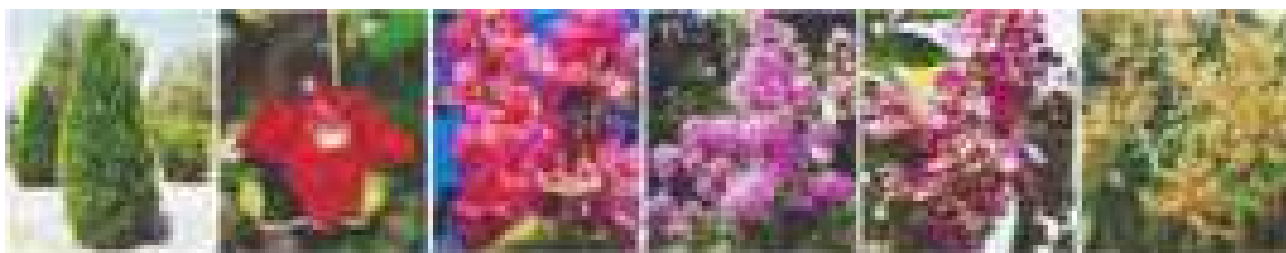
Swietenia macrophylla Swietenia mahagoni Syzygium cumini kala jamun Tabebuia argentea Tabebuia palmeri Tabebuia chrysantha



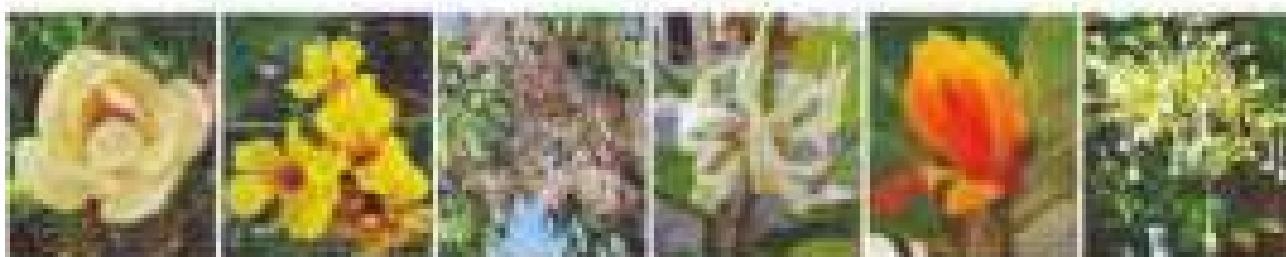
Tabebuia pallida Tabebuia avellanedae Tabebuia rosea Tamarindus indica tamarind Tectona grandis teak wood Terminali arjuna



Terminalia catappa Thespesia populnea Thevetia peruviana (Orange) Thevetia peruviana (white) Thuja orientalis Tipuana tipu



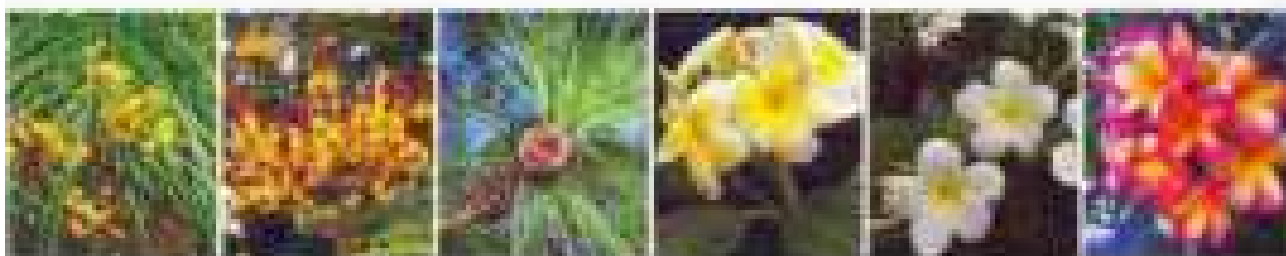
Juniperus chinensis Kigelia pinnata Lagerstroemia speciosa rosea Lagerstroemia speciosa Lagerstroemia thorelli Mangifera indica



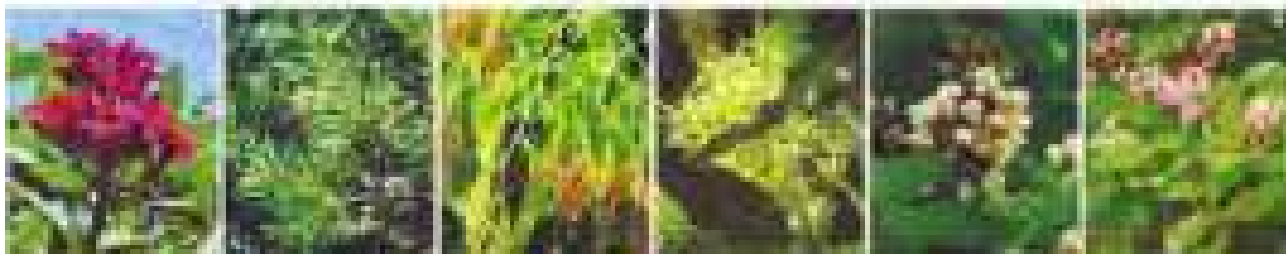
Magnolia grandiflora Markhamia platycalyx Melia azedarach Michelia champaca alba Michelia champaca Milligtonia hortensis



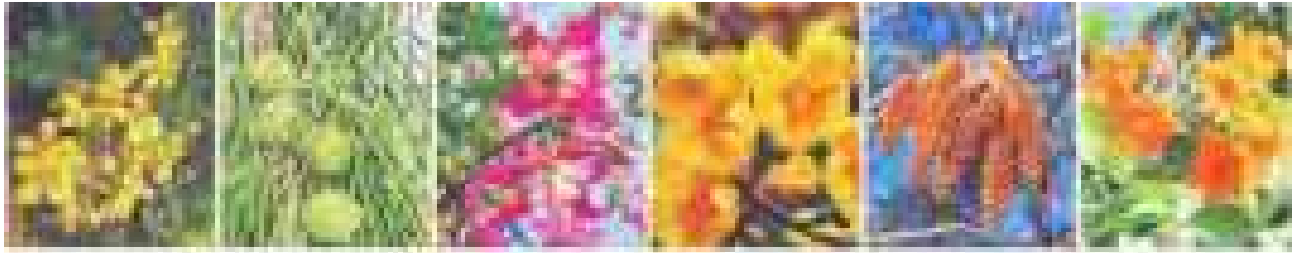
Mimusops elengi variegata Mimusops elengi Muntingia calabura singapore cherry Murraya koenigii curry leaf Nyctanthes arbor-tristis parijatham (coral jasmine) Parkia biglandulosa



Parkinsonia aculeata Peltophorum pterocarpum Pinus longifolia Plumeria lutea Frangipani Plumeria obtusa Frangipani Plumeria rubra forma tricolour Frangipani



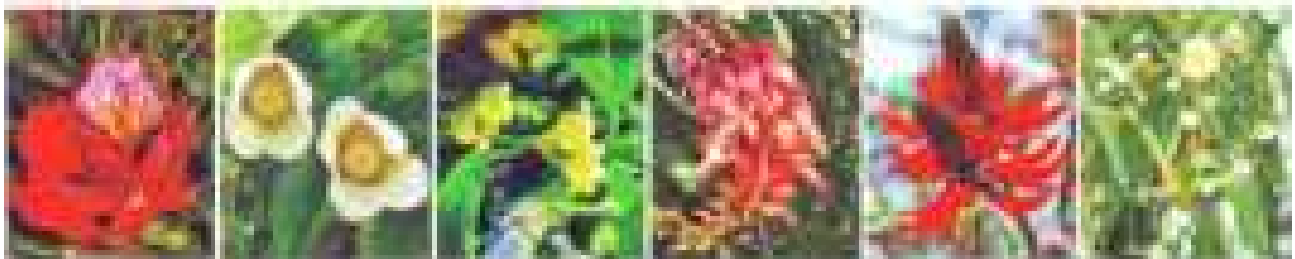
Plumeria rubra Frangipani Podocarpus macrophyllus Polyalthia longifolia pendula variety Polyalthia longifolia Pongamia pinnata white flowers Pongamia pinnata light pink flowers



Cassia siamea Casuarina equisetifolia Chorisia speciosa Cochlospermum religiosum Colvillea racemosa Cordia sebestena



Couroupita guianensis Crataeva religiosa Crescentia cujete beggers bowl Cycas circinalis Cupressus sempervirens Dalbergia sissoo



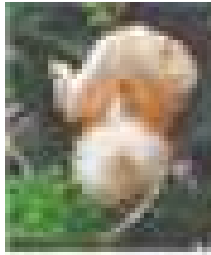
Delonix regia Dillenia indica Diospyros peregrina Erithrina crastagalli Erythrina indica Eucalyptus citriodora



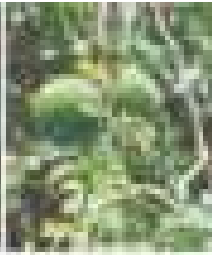
Ficus benghalensis krishne Ficus benghalensis Ficus craterostoma Ficus hispida Ficus infectoria Ficus religiosa



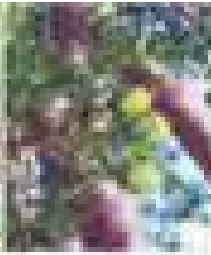
Filicium decipiens Gardenia latifolia Gliricidia sepium Grevillea robusta Jacaranda filicifolia Jacaranda mimosifolia



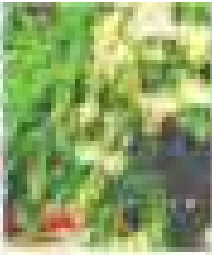
Adansonia digitata



Aegle marmelos



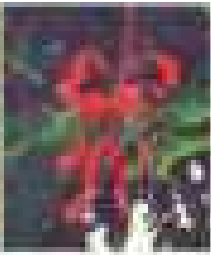
Agethis robusta



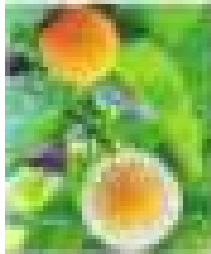
Albizzia lebbek



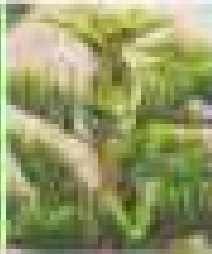
Alstonia scholaris



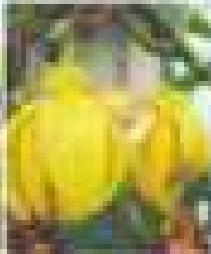
Amherstia nobilis



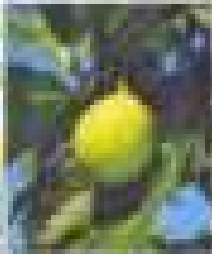
Anthocephalus indicus Kadamba



Araucaria cookii



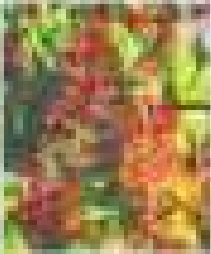
Artabotrys



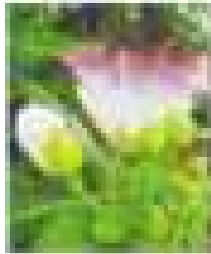
Artocarpus altilis



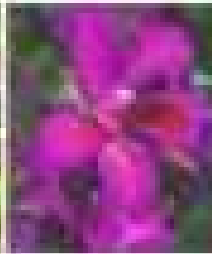
Azadirachta indica



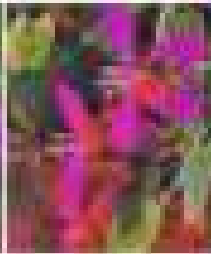
Barringtonia acutangula



Barringtonia asiatica



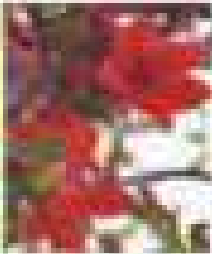
Bauhinia blakeana



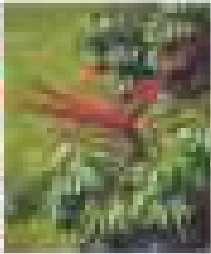
Bauhinia purpurea



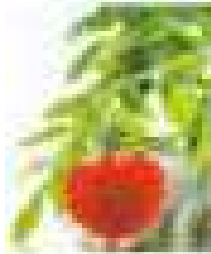
Bixa orellana



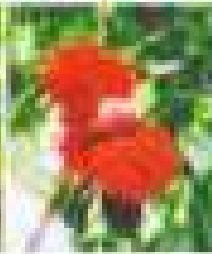
Bombax ceiba



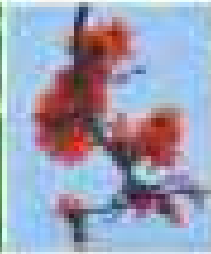
Brassaia actinophylla



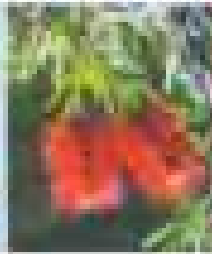
Brownea ariza



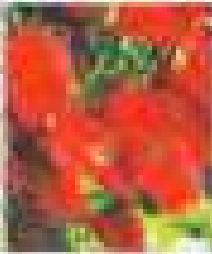
Brownea coccinea



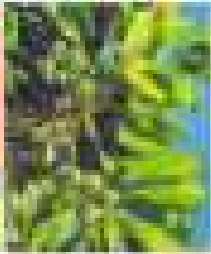
Butea monosperma



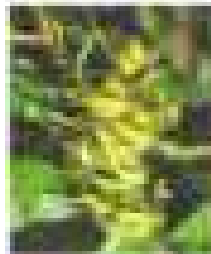
Callistemon citrinus



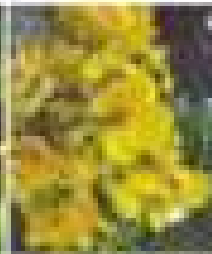
Callistemon pollandi



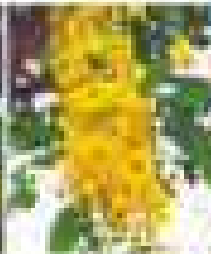
Calophyllum inophyllum



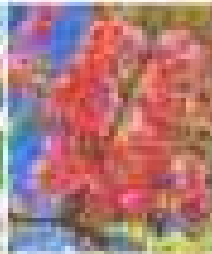
Cananga odorata



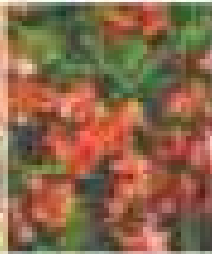
Cassia excelsa



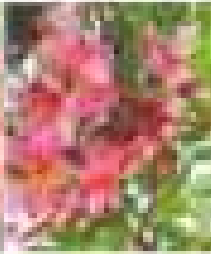
Cassia fistula



Cassia javanica



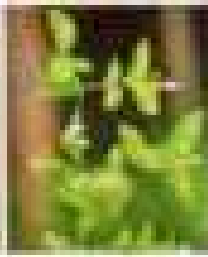
Cassia marginata



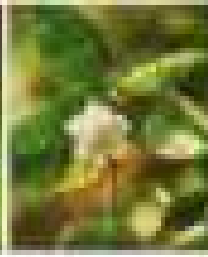
Cassia nodosa



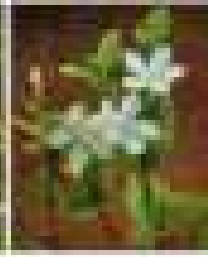
Jasminum
Compact disc



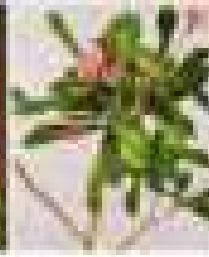
Jasminum



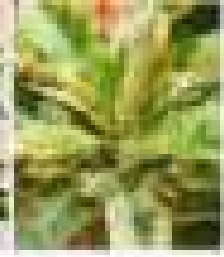
Jasmine



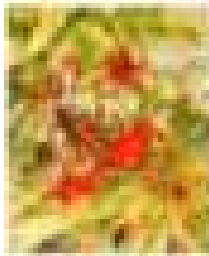
Jasmine



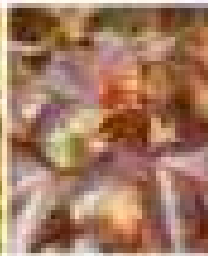
Jatropha
panduraefolia



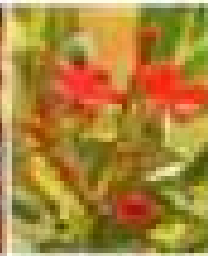
Jatropha
panduraefolia
variegata



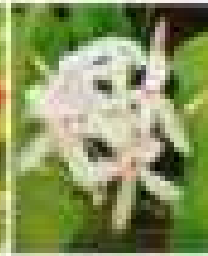
Jatropha
panduraefolia
variegata



Jatropha
panduraefolia



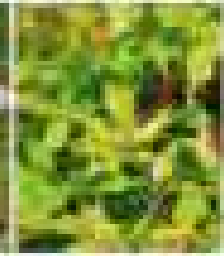
Jatropha
panduraefolia
variegata



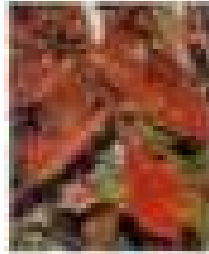
Kopsia
singapurensis



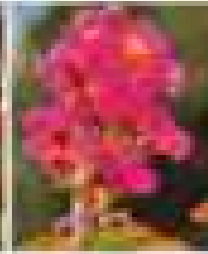
Kopsia



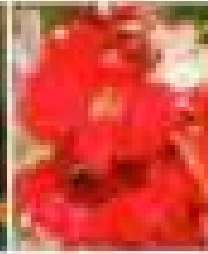
Leea coccinea
green



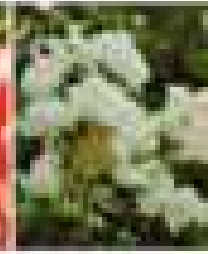
Leea coccinea
rubra



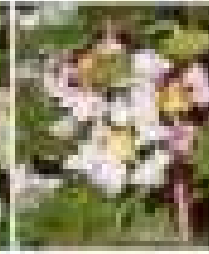
Lagerstroemia
indic Pink



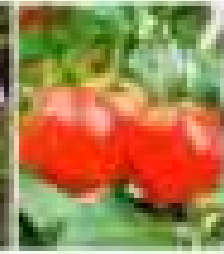
Lagerstroemia
indica Red



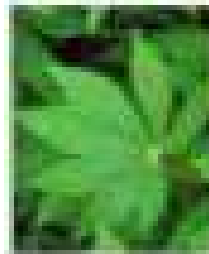
Lagerstroemia
indica White



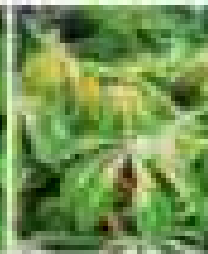
Malpighia
coccigera



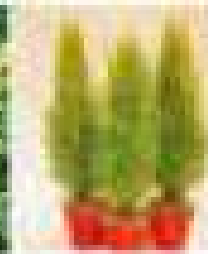
Malpighia glabra
West indian cherry



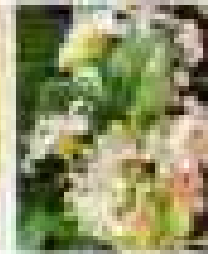
Manihot Esculenta
Green



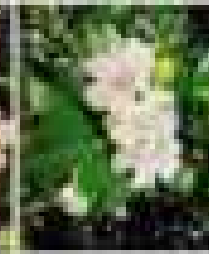
Manihot Eseulenta
varigeta



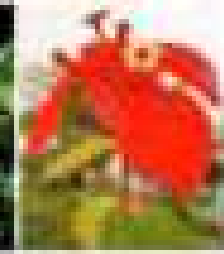
Melaleuca golden
crest



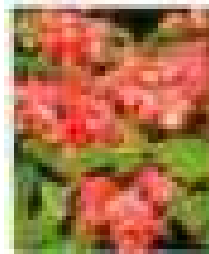
Murraya exotica



Murraya paniculata



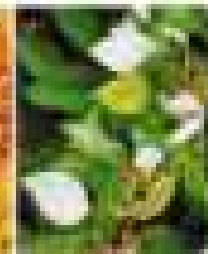
Mussaenda
erythrophylla
Scarlet



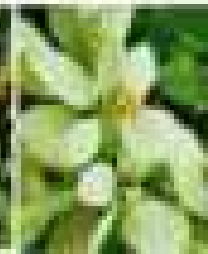
Mussaenda
erythrophylla rosea



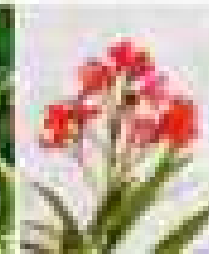
Mussaenda
Frondosa mustard



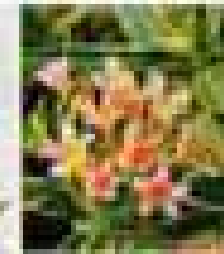
Mussaenda
Frondosa



Mussaenda
Philippica aurorae



Nerium olender



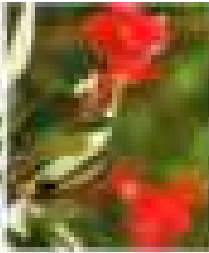
Nerium olender
variegata



Nerium olender
Dwarf soft pink



Nerium olender
Tall-Roseum



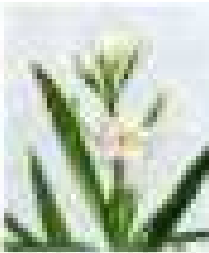
Nerium olender
Tall-Carncum flore-
eleno



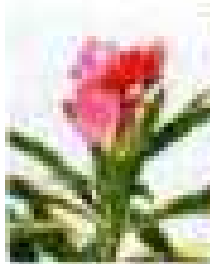
Nerium olender
Tall Yellow



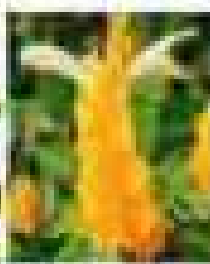
Nerium olender
Tall-Carnea



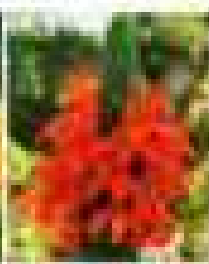
Nerium olender
Tall-Album



Nerium olender
Tall-variegatum
plenum



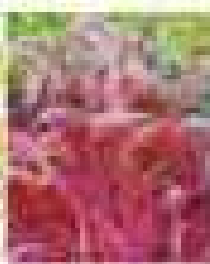
Pachystachys lutea



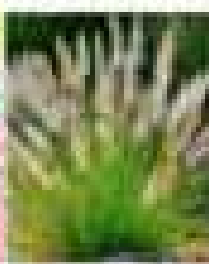
Pachystachys
Coccinea



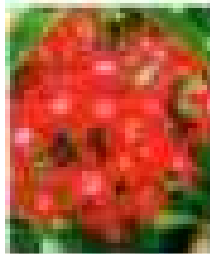
Pandans mini



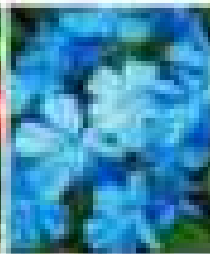
Pennisetum
setaceum Fountain
grass red (Rubra)



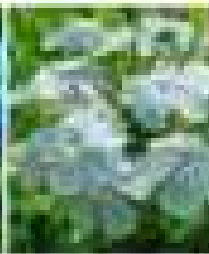
Pennisetum
setaceum Fountain
grass white



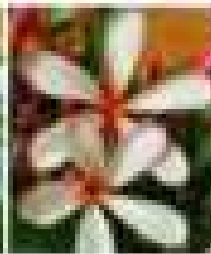
Pentas flower



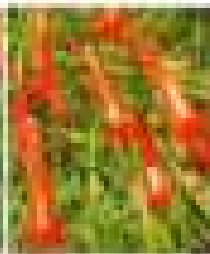
Plumbago
auriculata Blue
flower



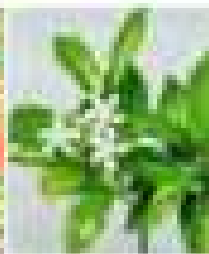
Plumbago
auriculata White
(alba)



Plumeria Singapore
dwarf



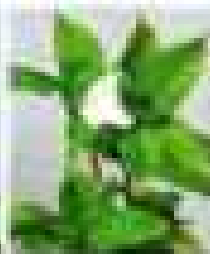
Russelia juncea



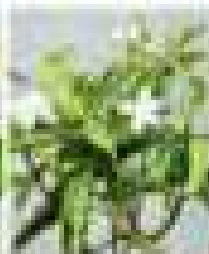
Tabernaemontana
coronaria



Tabernaemontana
coronaria White
wing



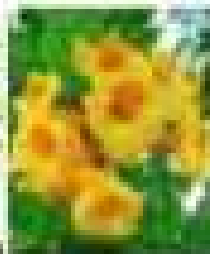
Tabernaemontana
coronaria Flore-
pleno (multi petel)



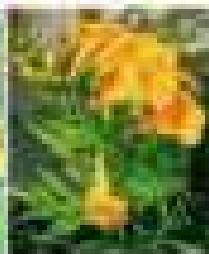
Tabernaemontana
coronaria Variegata



Tabernaemontana
coronaria Dwarf
compact



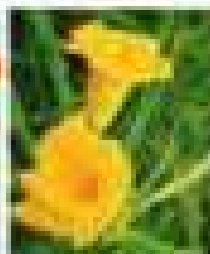
Tecoma
gaudichaudi



Tecoma stans



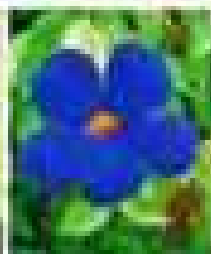
Tecomaria capensis



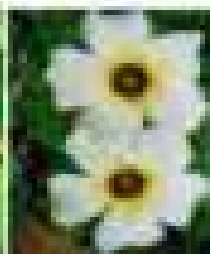
Thevetia peruviana
Yellow



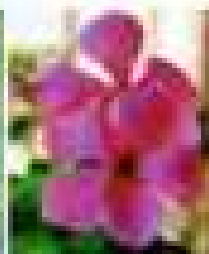
Thuja orientalis



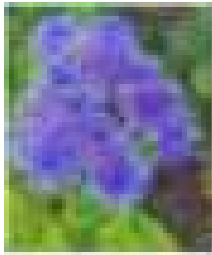
Thunbergia erecta
Yellow



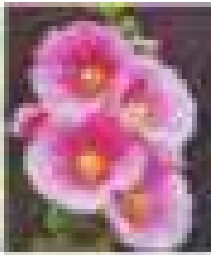
Thunbergia alata
white



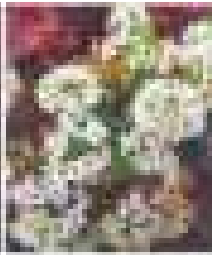
Vinca rosea



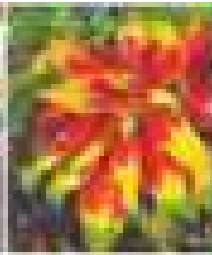
Ageratum houstonianum floss flower



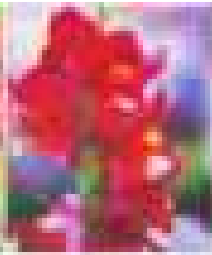
Althaea rosea Holly hock



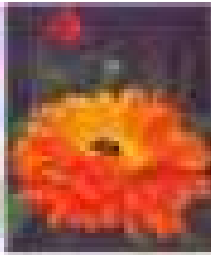
Alyssum Madwo



Amaranthus tricolor Joseph's cost



Antirrhenum majus Snap dragon



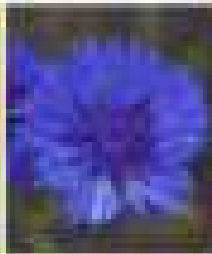
Calendula Calendula flower



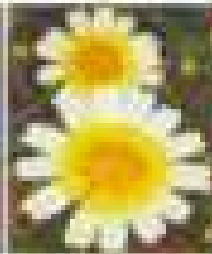
Calliposis Corepis



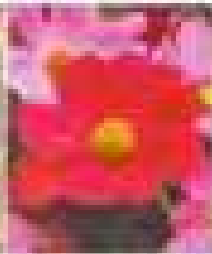
Celosia Cocks comb



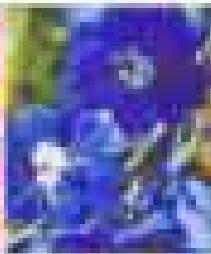
Centaurea cyanus Cornflower



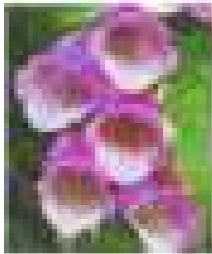
Chrysanthemum coronarium Annual Chrysanthemum



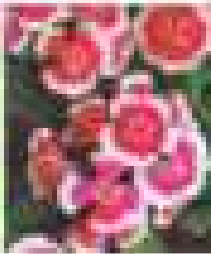
Cosmos Mexican aster



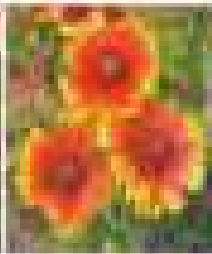
Delphinium spp Larkspur



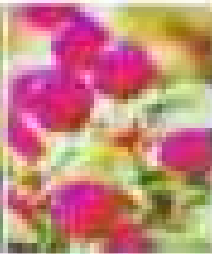
Digitalis purpurea Fox glove



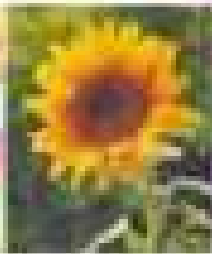
Dianthus caryophyllus Fairy queen



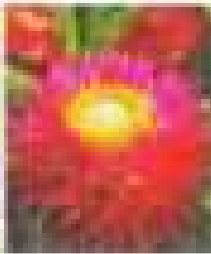
Gaillardia pulchella Blanket flower



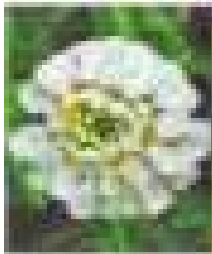
Gomphrena globosa Bachelor button



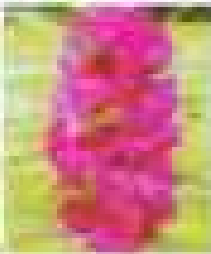
Helianthus annuus Sunflower ornamental



Helianthus annuus Straw/paper flower



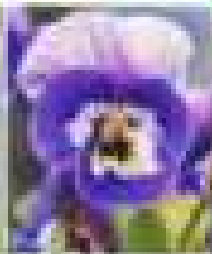
Iberis sempervirens Candytuft



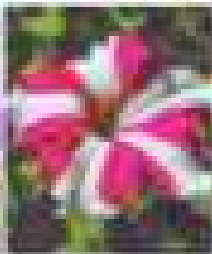
Impatiens balsam



Flax



Pansy



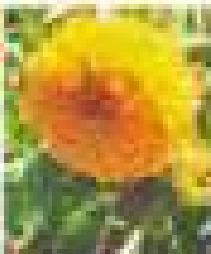
Petunia grandiflora Picoti variety



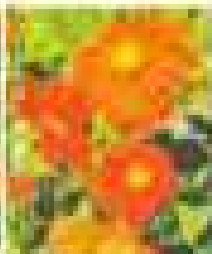
Phlox drummondii Phlox



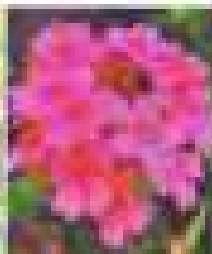
Salvia splendens Salvia red



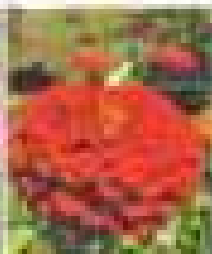
Tagetes sp marigold



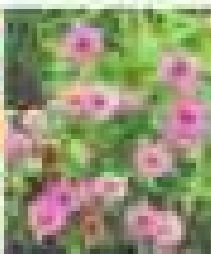
Torenia sp Torenia



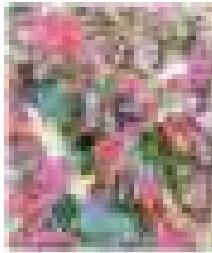
Verbena Flower Verbena



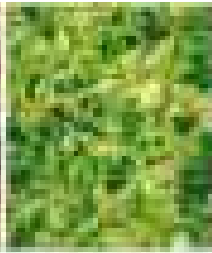
Zinnia elegans red Youth and old



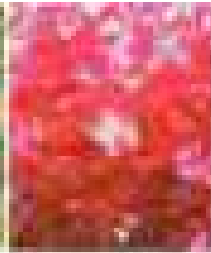
Zinnia liners Perennial zennia



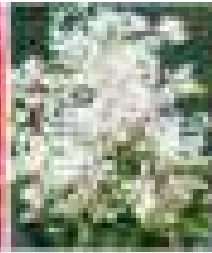
Alternanthera amoena



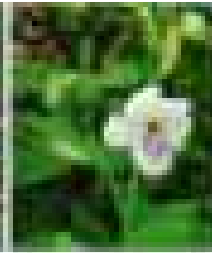
Alternanthera betzickiana variegata



Alternanthera betzickiana



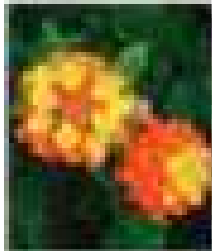
Alternanthera snowball



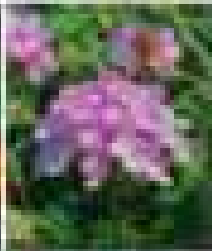
Asystasia gangetica



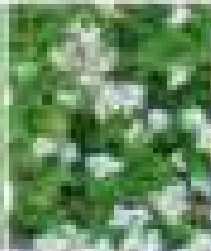
Lantana camara red



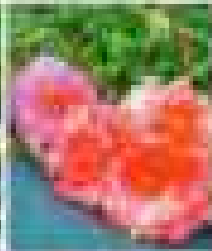
Lantana camara red



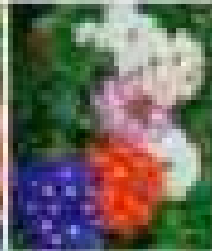
Lantana sellowiana purple



Lantana sellowiana white



Porchulaca



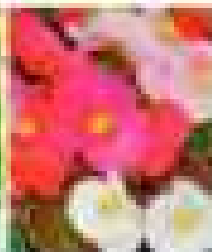
Verbina



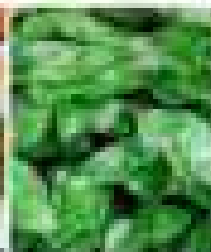
Wedelia trilobata



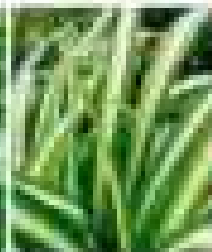
Aspidistra elatior



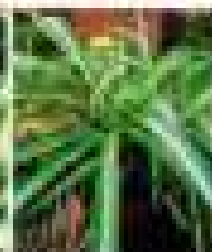
Begonia semperflorens



Callisia Repens



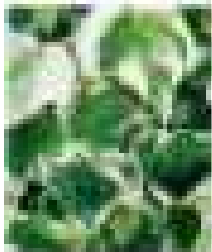
Chlorophytum comosum milky way



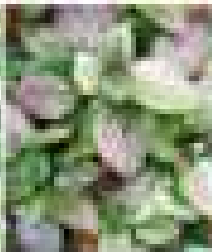
Chlorophytum comosum vittatum



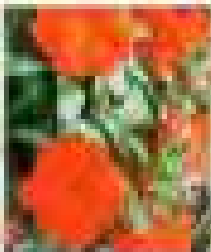
Euonymus japonicus albomarginatus



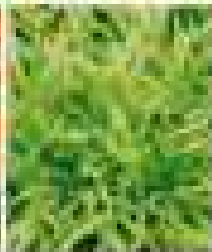
Hedera canariensis



Hemigraphis colorata



Impatiens linearifolia



Liriope muscari variegata



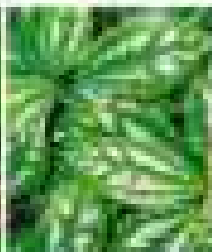
Liriope platyphylla



Liriope platyphylla



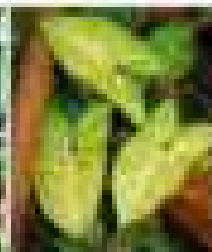
Pelargonium hortorum



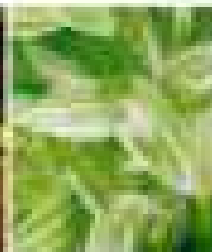
Pilea cadierei



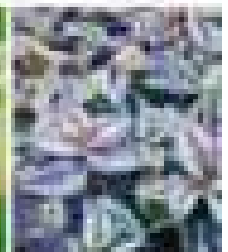
Rhoco spathacea vittata



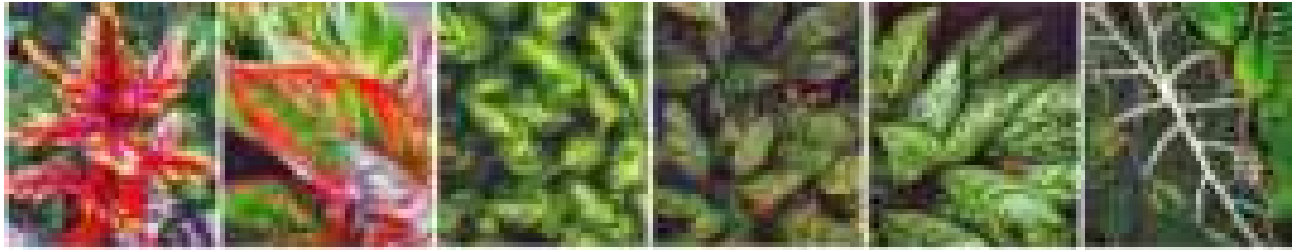
Syngonium podophyllum white butterfly



Tradescantia albiflora albovittata



Zebrina pendula



Aechmea chantinii

Aglaonema colour

Aglaonema commutatum elegans

Aglaonema commutatum maculatum

Aglaonema commutatum

Alocasia amazonica



Alocasia korthalsii

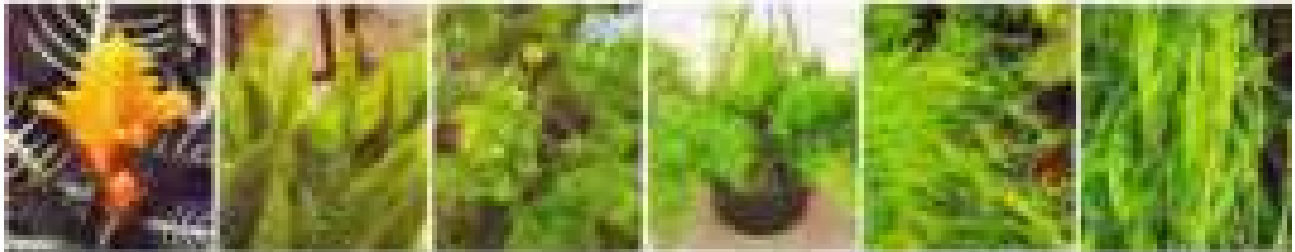
Alocasia macrorrhiza variegata

Alocasia macrorrhiza

Alpinia sanderae

Alpinia zerumbet

Anthurium andraeanum



Aphelandra squarrosa

Asparagus densiflorus myers

Asparagus densiflorus myriocladus

Asparagus densiflorus sprengeri

Asparagus plumosus

Asparagus setaceus pyramidalis



Aspidistra elatior 'variegata'

Begonia rex

Begonia semperflorens red pearl

Bromelia balansae

Caladium hortulanum canbidum

Caladium hortulanum attala



Calathea insignis

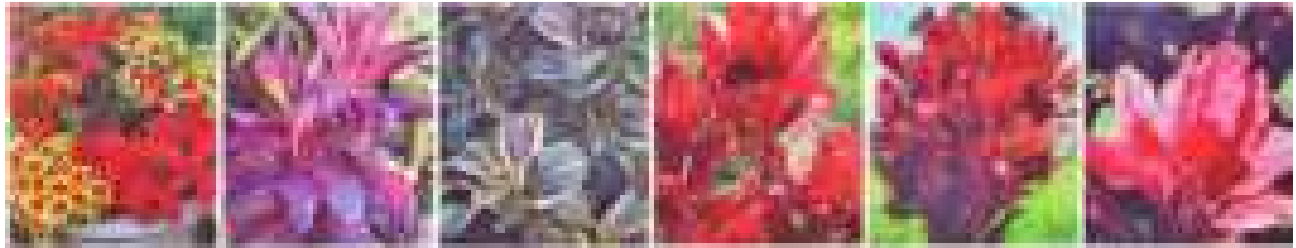
Calathea rufibarba

Codiaeum variegatum gold dust

Codiaeum variegatum mammy

Codiaeum variegatum petra

Codiaeum variegatum



Coleus

Cordyline terminalis

Cordyline terminalis 'miss andrea'

Cordyline terminalis red ti

Cordyline terminalis rubra

Cordyline terminalis va baby doll



Cordyline terminalis vs fruticosa

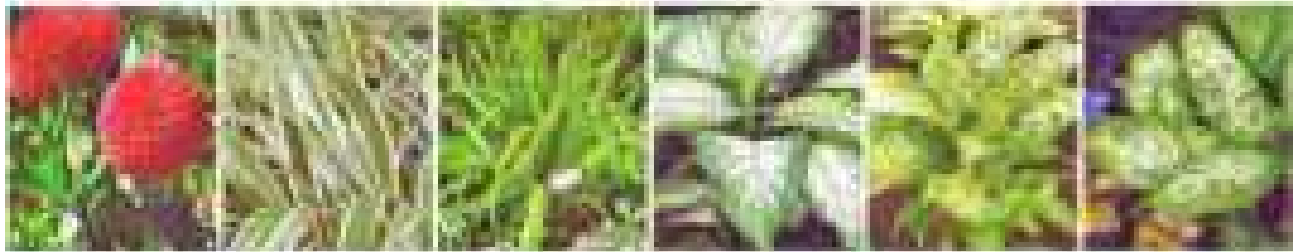
Cryptanthus bivittatus

Cryptanthus bromeliades

Cryptanthus zonatus

Cyclame persicum

Cyclamen persicum



Dahlia

Dianella tasmanica variegata

Dianella tasmanica

Dieffenbachia amoena

Dieffenbachia bausei

Dieffenbachia maculata



Dizygotheca elegantissima

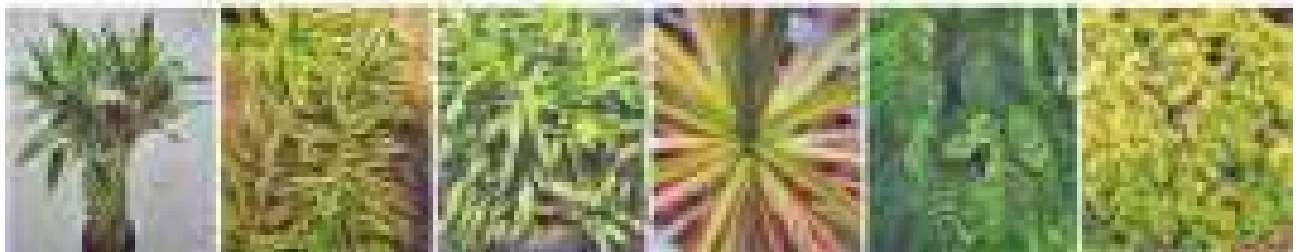
Dracaena fragrans massangeana

Dracaena marginata

Dracaena sanderiana gold

Dracaena sanderiana green

Dracaena sanderiana white



Dracaena sanderiana

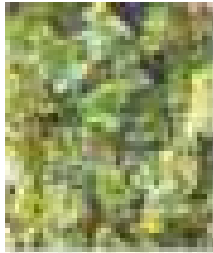
Dracaena song of india

Dracaena song of jamaica

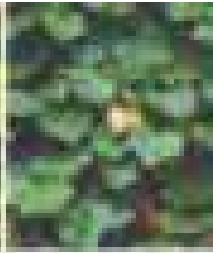
Dracaena tricolour

Epipremnum pinnatum

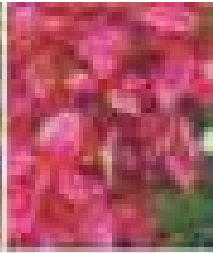
Euonymus japonicus yellow queen



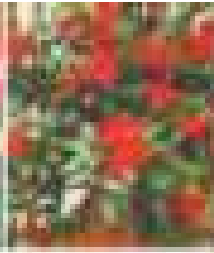
Hedera canariensis variegata



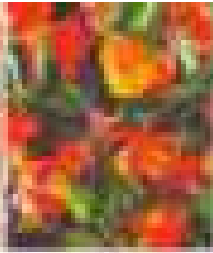
Hedera canariensis



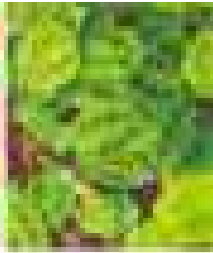
Hypoestes sanguinolenta



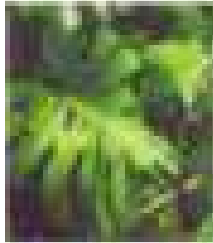
Impatiens linearifolia



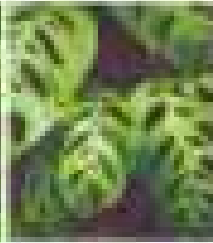
Impatiens walleriana



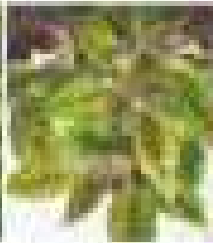
Maranta leuconeura



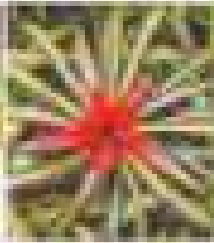
Monstera deliciosa



Monstera obliqua



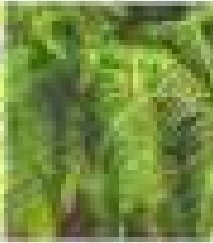
Nautilocalyx frogetii



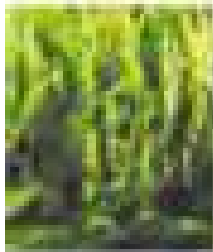
Neoregelia carolinae



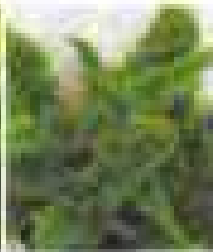
Nephrolepis biserrata furcans



Nephrolepis biserrata 'macho'



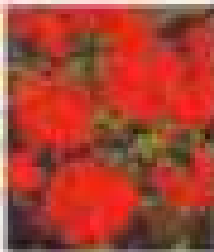
Nephrolepis cordifolia



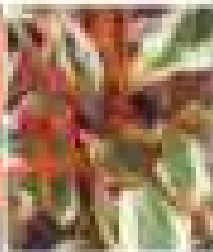
Nephrolepis exaltata



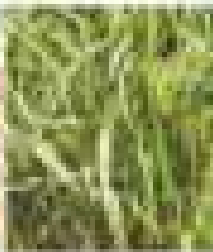
Nephrolepis green lady



Pelargonium hortorum



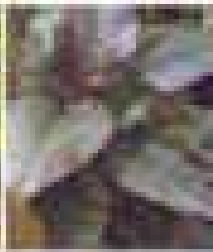
Peperomia clusiifolia variegata



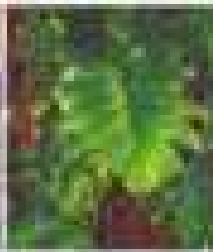
Phalaris arundinacea variegata



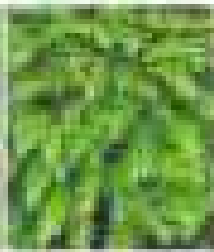
Philodendron bipinnatifidum



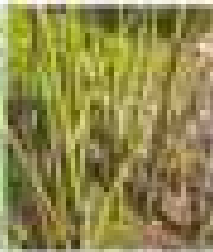
Philodendron congo



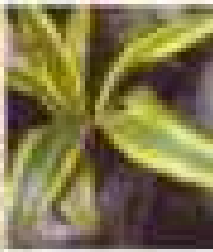
Philodendron lacerum



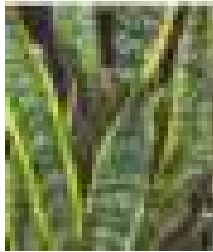
Philodendron xanadu



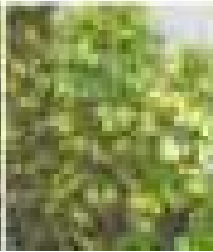
Sansevieria cylindrica



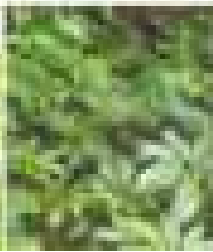
Sansevieria guineensis



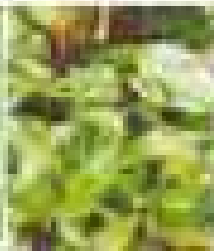
Sansevieria trifasciata



Schefflera arboricola variegata



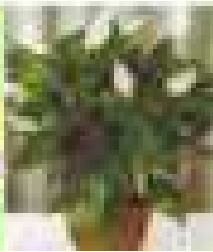
Schefflera arboricola



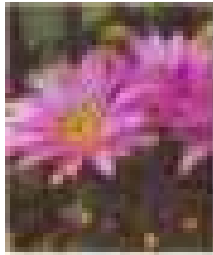
Scindapsus aureus marble queen



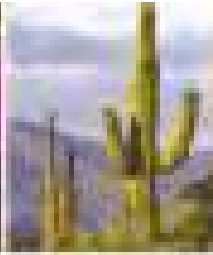
Scindapsus aureus



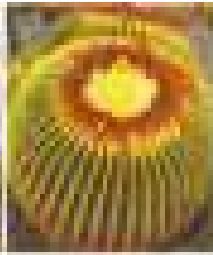
Spathiphyllum wallisii



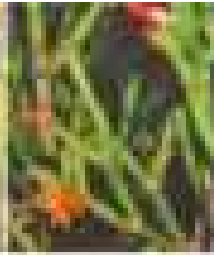
Acanthocalycium violaceum



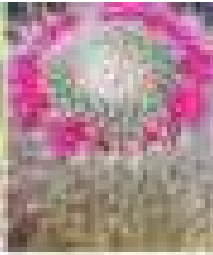
Carnegiea gigantea



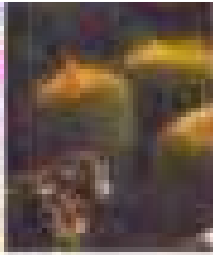
Echinocactus grusonii



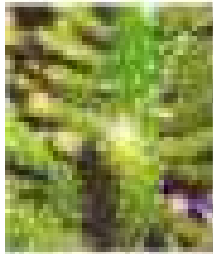
Hatiora salicornioides



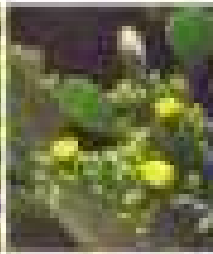
Mammillaria hahniana



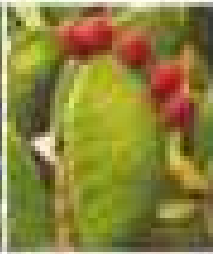
Notocactus leninghausii



Opuntia cylindrica



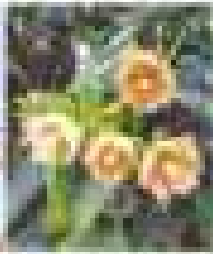
Opuntia falcata



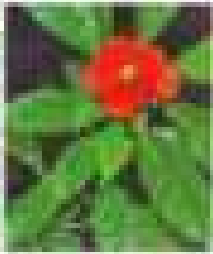
Opuntia ficus indica



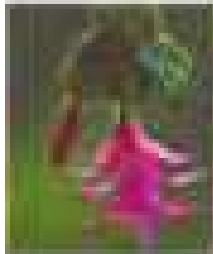
Pachycereus pringlei



Pereskia aculeata



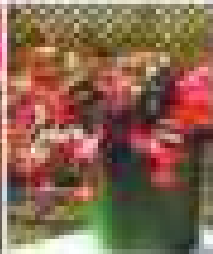
Pereskia bleo



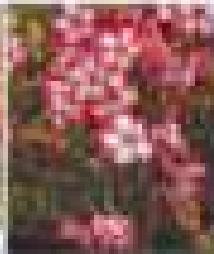
Schlumbergera bridgesii



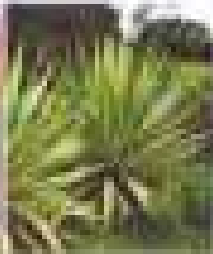
Schlumbergera russelliana



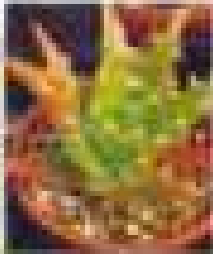
Zygocactus truncatus



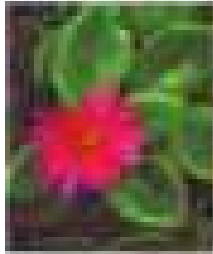
Adenium obesum



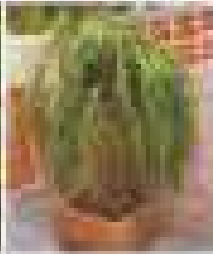
Agave angustifolia



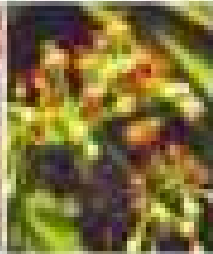
Aloe abyssinica



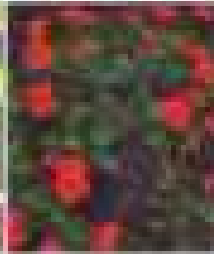
Aptenia cordifolia



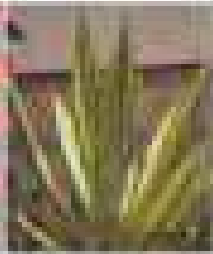
Beaucarnea recurvata



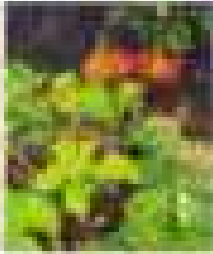
Butea monosperma



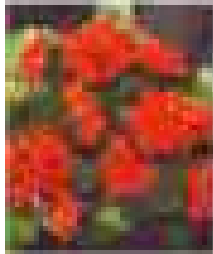
Cissus quadrangularis



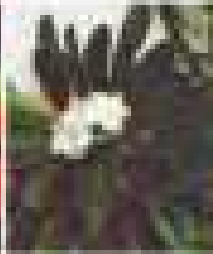
Euphorbia milii



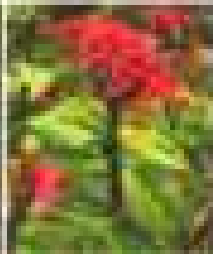
Furcraea gigantea



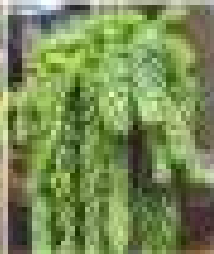
Kalanchoe blossfeldiana



Pachypodium lamerei



Pedilanthus tithymaloides



Sedum morganianum



Senecio radicans



Yucca aloifolianodosa



KLN Yadav Park Erragadda



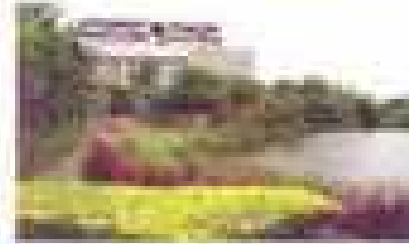
Chacha Nehru Park, Masab Tank



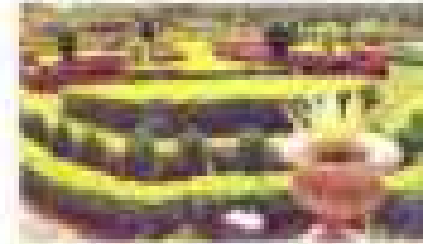
Japanese Garden, Jubilee Hills



Clock Tower Park, Secunderabad



Lotus Pond, Jubilee Hills



Krishna Kant Park, Yousufguda



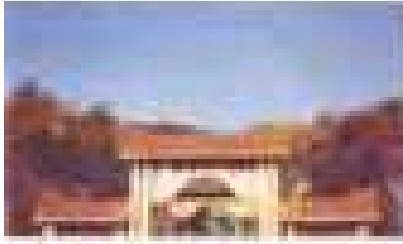
Krishna Kant Park, Yousufguda



Krishna Kant Park, Yousufguda



Krishna Kant Park, Yousufguda



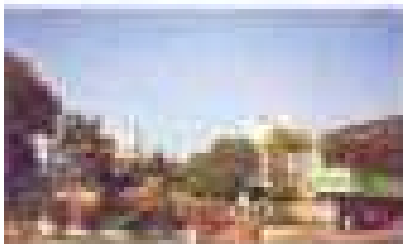
Indira Park, Tankbund



Indira Park, Tankbund



Dr. Marri Channareddy Memorial Rock Garden, Indira Park



Road Island near G.H.M.C. Head Office



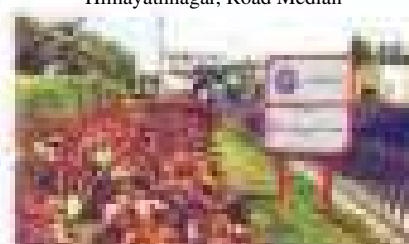
Tirumala Tirupathi Devasthanam Temple, Himayathnagar, Road Median



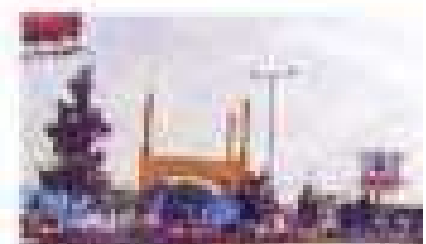
Herbal Garden, Ashwini Layout, Jubilee Hills



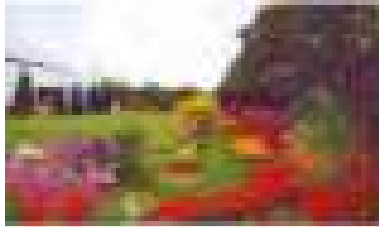
Colony Parks



Road Median at Gachibowli



Hitex Road Median, Hi-tech City



Golconda Textiles, Manneguda, Vikarabad



Green Valley Farm, Yenkapally Village, Vikarabad



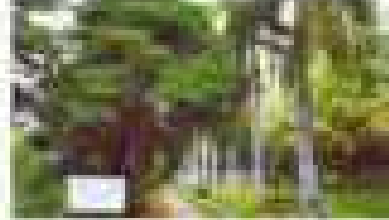
Dr. V. Venkat, Villa No. 446, Pragati Green Villas, Proddutoor, Shankerpally



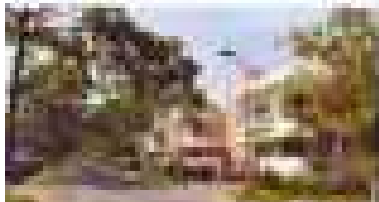
Pragati Green Meadows and Resorts Ltd.



Pragati Green Meadows and Resorts Ltd.



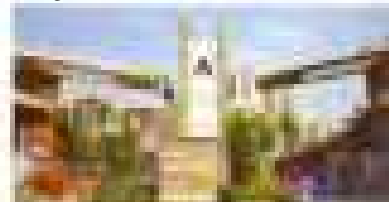
Pragati Green Meadows and Resorts Ltd.



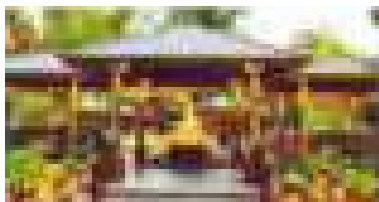
Aparna Kanapy Tulip Apts, Owners Association



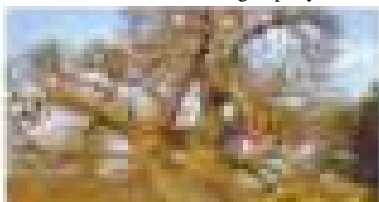
Trendset Winz Owners Welfare, Association Serlingampally



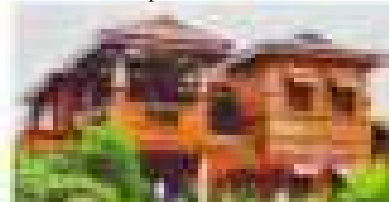
Aparna Sarovar



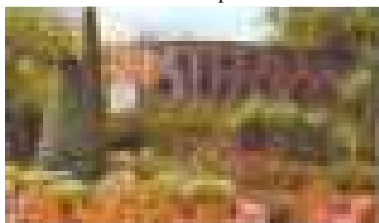
Aalankrita Resorts & SPA, Thumkunta, Shameerpet



Adansonia Digitata (Boabab Tree) 500 Years Old Tree near Golconda Fort



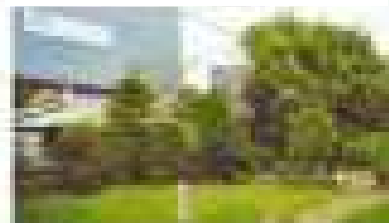
Aalankrita Resorts & SPA, Thumkunta, Shameerpet



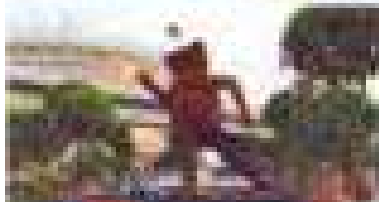
Rock Garden, Sanjeevayya Park



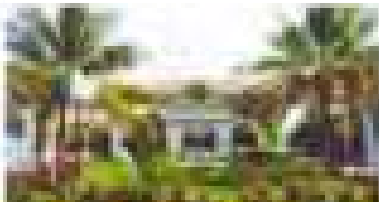
Basava Tarakam Indo-American Cancer Hospital Research Institute Banjara Hills



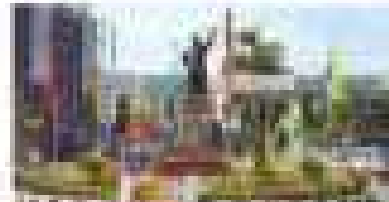
AFTON Chemicals Hyderabad Pvt. Ltd.



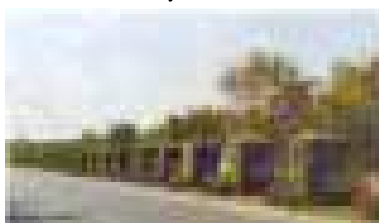
Potted Plants on Road Island near Cyber City Towers



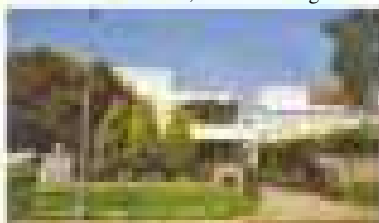
Lahari Resorts, Bhanur Village



Road Island at Minister Road Junction



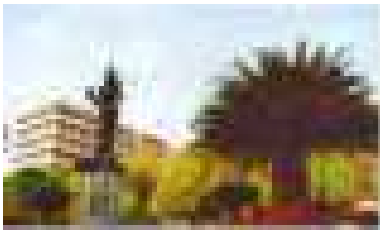
Nagpur National Highway Road Median



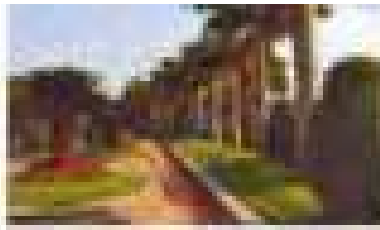
Mr. K Bhoopal Reddy, Villa No.-15, Micasa Sterling Kompally



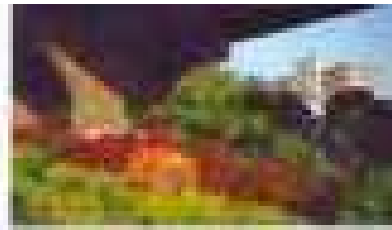
Raheja Mindspace Hi-tech City



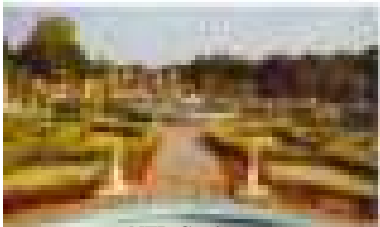
Telugu Thalli Island



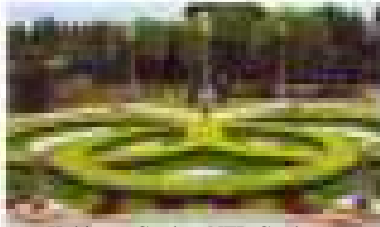
Telugu Thalli Island



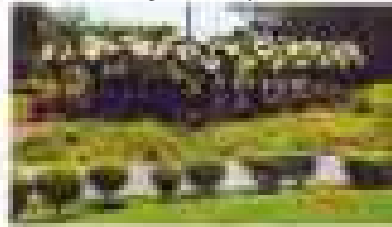
Telugu Thalli Flyover



NTR Gardens



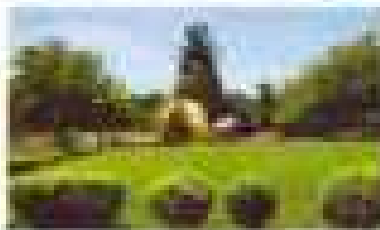
Kohinoor Garden, NTR Gardens



NTR Gardens



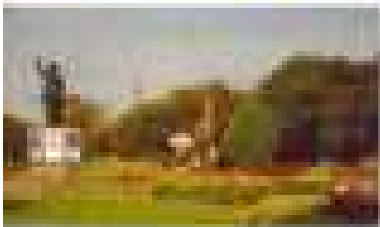
Japanese Garden, NTR Gardens



NTR Gardens



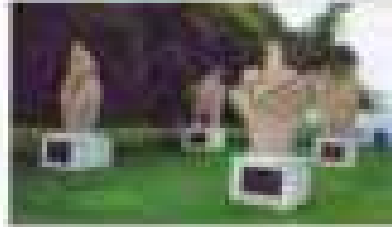
NTR Memorial Garden



Indira Gandhi Island, Necklace Road



Road Median at Kothaguda Junction



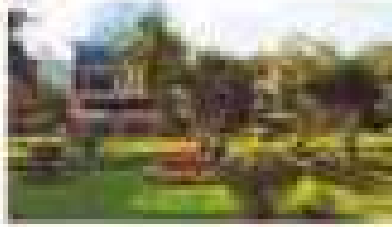
P.V. Gyana Bhoomi, Necklace Road



P.V. Gyana Bhoomi, Necklace Road



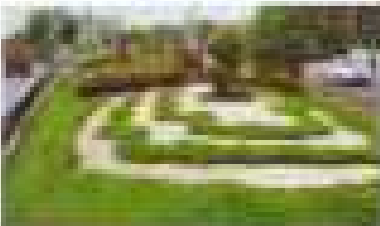
Lumbini Park



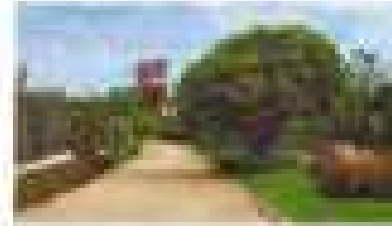
Buddha Purnima, Project Office



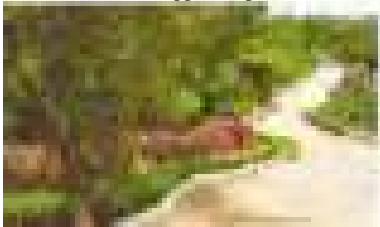
Road Island Opp., Shilparamum



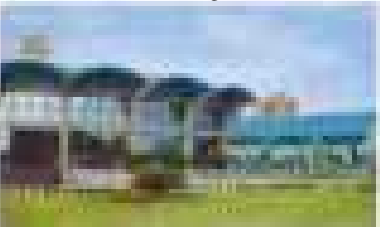
Zen Garden, Kothaguda Junction



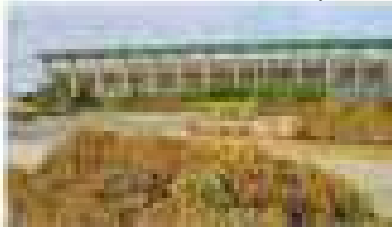
KBR National Park Walkway



KBR National Park Walkway



Railway Station, Necklace Road



Garchibowli Stadium

CHAPTER - 9

PALMS

Palms require very small ground space for growth. They can either have clear, round, upright trunk with a majestic ever green crown or clustering habit. Their root system does not require large surface area or depth in the ground. They are elegant to look at and well known for their symmetrical growth which makes an avenue look beautiful.

They remain evergreen and do not litter the ground with leaves. Therefore, palms are more suitable and ideal for narrow passages and narrow strips of land, boundaries and near the building.

Note: Tips for planting can be adopted as in trees.

PALMS : 1

S. No.	Plant Name	S. No.	Plant Name
1.	Adonidia merrillii green	16.	Borassus aethiopum (African palmyra palm)
2.	Adonidia merrillii golden (Christmas palm)	17.	Borassus flabellifer (Palmyra palm)
3.	Archontophoenix alexandrae (King palm)	18.	Brahea armata (Blue hesper palm)
4.	A. cunninghamiana (Piccabean palm)	19.	Butia capitata (Wine palm)
5.	Archontophoenix myolensis (Myola palm)	20.	Butia paraguiaensis
6.	Areca catechu cv.alba	21.	Caryota mitis (Clustering fish tail palm)
7.	Areca catechu dwarf (Dwarf betel nut palm)	22.	Caryota urens (Fish tail palm)
8.	Areca catechu (Betel nut palm)	23.	Chameadorea costaricana (Pacaya palm)
9.	Areca macrocalyx (Kawiwi palm)	24.	Chamaedorea elegans (Parlour palm)
10.	Areca triandra (Triandra palm)	25.	Chamaerops humilis (European fan palm)
11.	Areca vestiaria (Langlois palm)	26.	Coccothrinax argenata (Silver thatch palm)
12.	Arenga obtusifolia (Langkap palm)	27.	Cocos nucifera (East coast tall)
13.	Arenga pinnata (Black sugar palm)	28.	Cocos nucifera (Ceylon orange)
14.	Arenga tremula (Dwarf sugar palm)	29.	Cocos nucifera dwarf (Dwarf coconut)
15.	Bismarckia nobilis (Bismarck palm)	30.	Cocos nucifera (Malayan golden yellow)

PALMS : 2

31.	<i>Copernicia hospita</i> (Cuban wax palm)	46.	<i>Livistona chinensis</i> (Chinese fan palm)
32.	<i>Cyrtosrtachys renda</i> (Sealing wax palm/ lipstick)	47.	<i>Livistona rotundifolia</i> (Foot stool palm)
33.	<i>Dypsis decaryi</i> (Triangle palm)	48.	<i>Nypa fruticans</i> (Mangrove palm)
34.	<i>Dypsis leptocheilos</i> (Red neck palm)	49.	<i>Phoenix dactylifera</i> (Date palm)
35.	<i>Dypsis lutescens</i> (Golden cane palm)	50.	<i>Phoenix roebelenii</i> (Pygmy date palm)
36.	<i>Elaeis guineensis</i> (African oil palm)	51.	<i>Phoenix sylvestris</i> (Indian date palm)
37.	<i>Euterpe oleracea</i> (Assai palm)	52.	<i>Pritchardia pacifica</i> (Fiji fan palm)
38.	<i>Howea forsteriana</i>	53.	<i>Pritchardia thurstonii</i> (Thurston palm)
39.	<i>Hyophorbe lagenicaulis</i> (Champagne palm)	54.	<i>Pseudophoenix ekmanii</i> (Cacheo palm)
40.	<i>Hyophorbe verschaffeltii</i> (Spindle palm)	55.	<i>Ravenea rivularis</i> (Majestic palm)
41.	<i>Latania loddigesii</i> (Blue latan palm)	56.	<i>Rhapis excelsa</i> (Lady palm)
42.	<i>Latania lontaroides</i> (Red latan palm)	57.	<i>Rhapis humilis</i> (Slender lady palm)
43.	<i>Latania verschaffeltii</i> (Yellow latan palm)	58.	<i>Roystonea regia</i> (Cuban royal palm)
44.	<i>Licuala grandis</i> (<i>Licuala</i> palm)	59.	<i>Washingtonia filifera</i> (Petticoat palm/ desert fan palm)
45.	<i>Licuala peltata</i> (Giant fan palm)	60.	<i>Wodyetia bifurcata</i> (Foxtailpalm)





Ravenala madagascariensis



Musa palm



Carpentaria palm



Arenga Engleri



Trinex palm



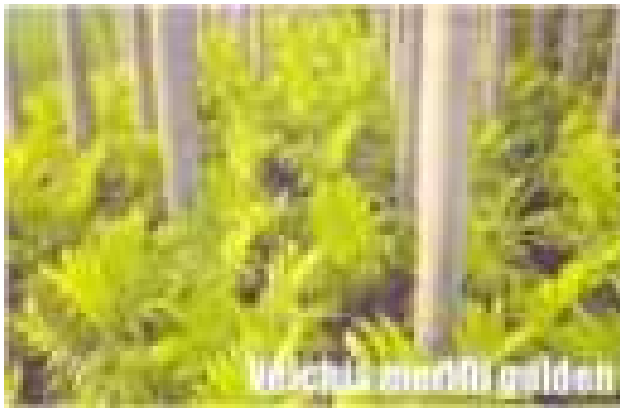
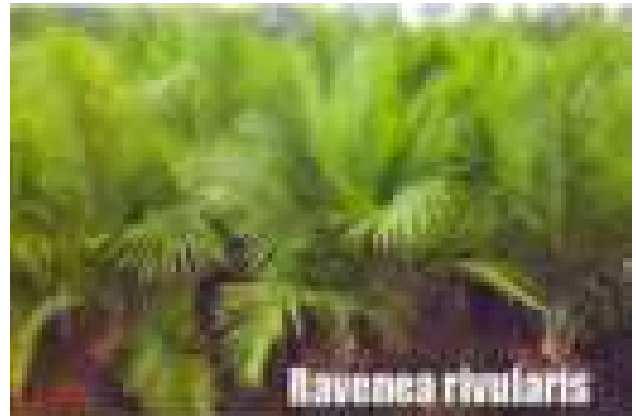
Wajgela bifurcata



Lotania lotarioides

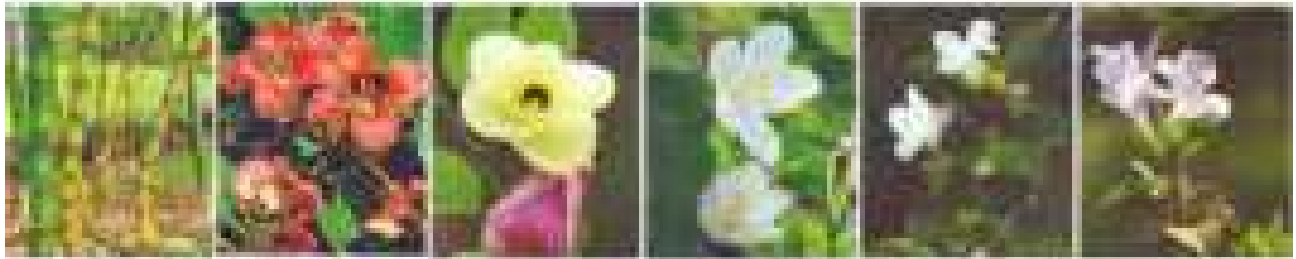


Livistona rotundifolia





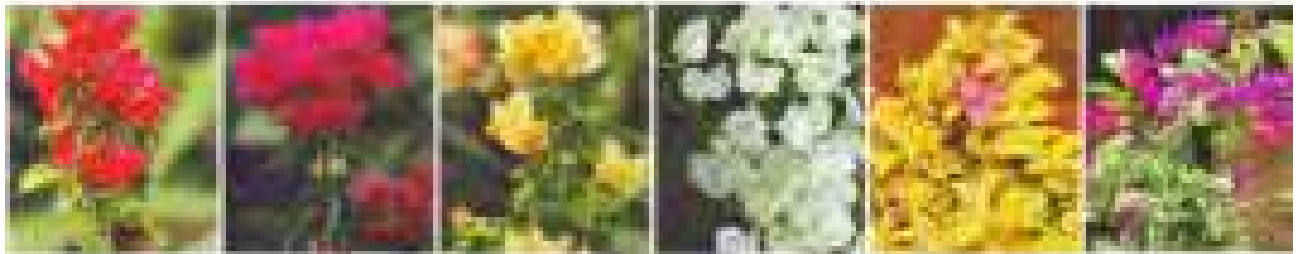
Bambusa vulgaris vittata (Golden bamboo) *Bambusa multiplex* (Hedge bamboo) Bamboo golden *Bambusa vulgaris wamin Strita* (Buddha belly variegated) *Bambusa vulgaris* Back bamboo *Bambusa* Bamboo grass



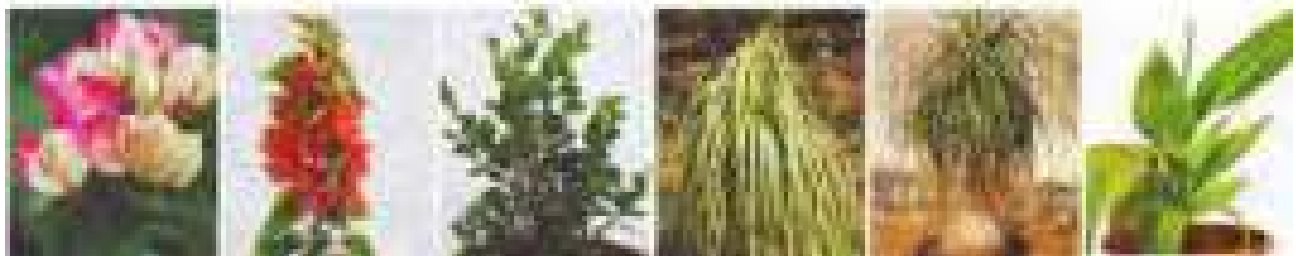
Bambusa ventricosa (Buddha Belly) *Bauhinia galpini* *Bauhinia tomentosa* *Bauhinia acuminata* *Barleria cristata* Candida (White) *Barleria cristata* Candida (Pink)



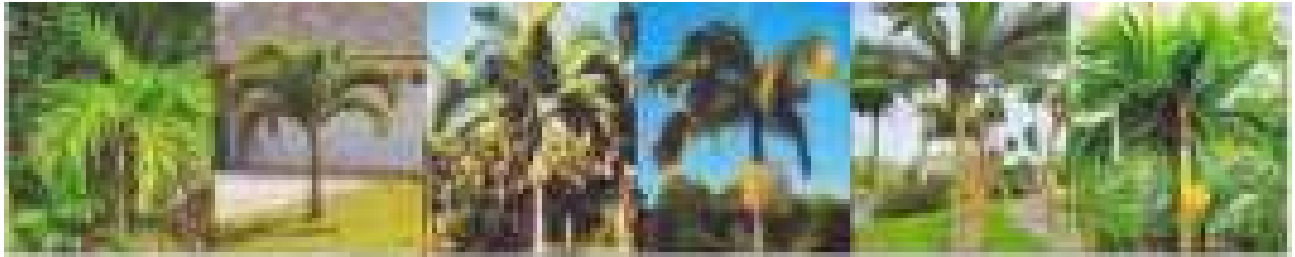
Beloperona guttata (Yellow) *Beloperona guttata* (Red) *Brunfelsia americana* *Bougainvillea glabra* *Bougainvillea thimma* *Bougainvillea* Dr. Rao



Bougainvillea *Bougainvillea rosevelt delight* *Bougainvillea lady mary baring* *Bougainvillea subra white* *Bougainvillea gold capalio* *Bougainvillea glabra* variegated



Bougainvillea Chitra *Bougainvillea mahara Coopacta red* *Buxus* *Beaucarnea recurvata Nolina* variegated *Beaucarnea recurvata Nolina* *Cannas* variegated



Adonidia merrillii
Golden vitegia
palm

Adonidia merrillii
Green vitchia palm

Archontophoenix
Alexandrac (king
palm)

Archonotophoenix
Cunninghamiana
piccabeen palm

Archontophoenix
Myolensis (myola
palm)

Areca catechu
cv.alba Betel nut
palm



Areca catechu
Dwarf betel nut
palm

Areca catechu
Betel nut palm

Areca macrocalyx
Kawiwi palm

Areca triandra
Triandra palm

Areca vestiaria
Langlois palm

Arenga obtusifolia
Lang kap palm



Arenga pinnata
Black sugar palm

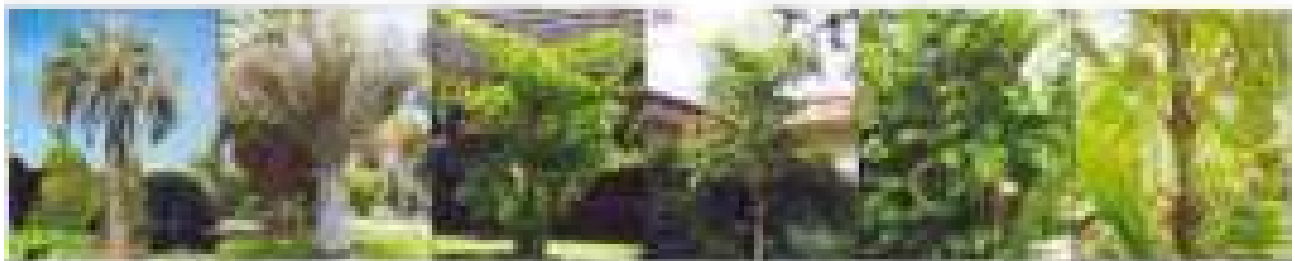
Arenga tremula
Dwarf sugar palm

Bismarckia nobilis
Bismarck palm

Borassus
aethiopum African
palmyra palm

Borassus flabellifer
Palmyra palm

Brahea armata
Blue hesper palm



Butia capitata
Wine palm

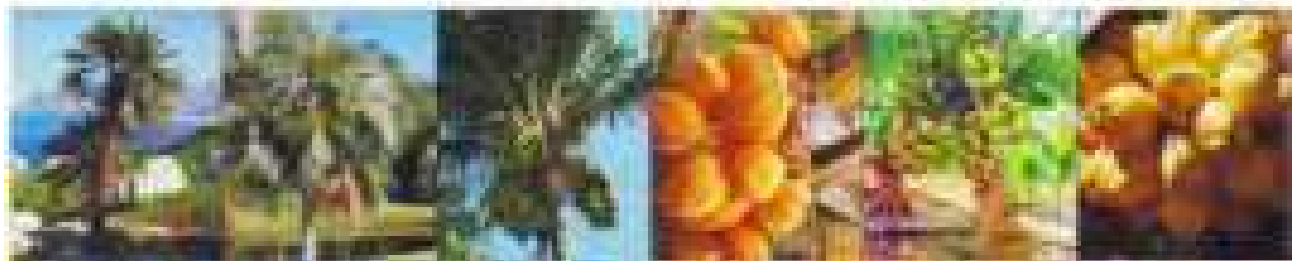
Butia
paraguayensis

Caryota mitis
Clustering fish tail
palm

Caryota urens
Giant fish tail palm

Chamaedorea
costaricana Pacaya
palm

Chamaedorea elegans
Parlour palm



Chamaerops
humilis European
fan palm

Coccothrinax
argentata Silver
thatch palm

Cocos nucifera
Coconut (east coast
tall)

Cocos nucifera
Coconut (ceylon
orange)

Cocos nucifera
dwarf Coconut

Cocos nucifera
Coconut malayan
golden yellow





Eriocarya bicolor



Galphimia glauca



Golden Juniperus



Anas Tricolor Med



Ecalypta wilkesiana



Rakhi creeper



Ficus blackiana



Ficus antiochi



Ficus longiliana



Ficus nerolinia

CHAPTER - 10

SHRUBS

Shrubs are usually woody or semi-woody perennial plants with branches arising from the base of the plants and growing up to heights of 1-4 meters. Most of the shrubs are hardy and grow in all types of soil.

Shrubs can be classified into three groups according to the requirement of sunlight for growth and flowering.

- Plants that show normal growth and flowering in full sun,
- Grow only in partial shade,
- Can grow well both in sunny and semi-shady conditions.

Shrubs are usually grown for their showy flowers or beautiful foliage. Pruning of plants helps to get bushy growth. The practice of clipping shrubs into ornamental shapes, known as topiary, has been in vogue for centuries. Flowering shrubs need sun light and foliage shrubs grow well under partial sunlight and shade. Location can be decided based on the height and canopy of the plant.

Tips for Planting & Maintaining of Shrubs:

- Dig pits of 8 cft (cubic feet) and loosening bottom of the pit, expose to sun for at least 2 weeks or burn the pit with leaf trash.
- Maintain 2' to 6' distance between pits, depending on the growth potential of the plant.
- Fill the pits with dug out soil; 10 kg well decomposed cattle compost or 5 Kg vermi-compost, 1Kg neem cake and ½ Kg super phosphate and 100 gms of folidol dust.
- Plant the selected shrubs or creepers, water well, stake the plant next day. Regular watering is required thereafter.
- Run and train the shrubs and creepers for controlling plant size, shape and giving a bushy growth.
- Take up weeding and mulching in the basin on a regular basis.
- Regular care is required to protect the plants against pests and diseases.

Common Shrubs:

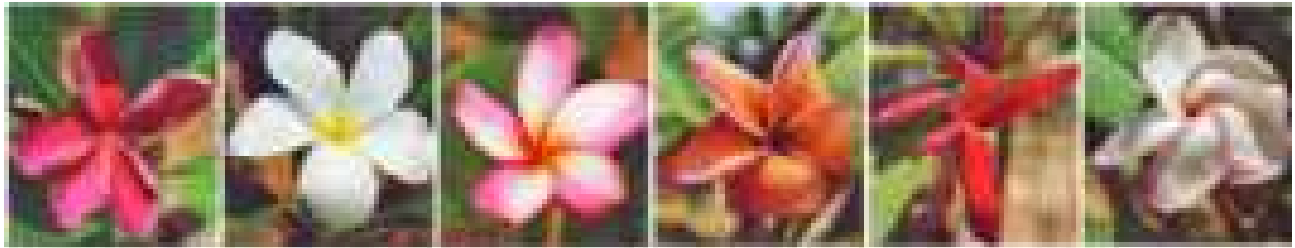
Drought Resistant				Water Loving			
1.	Allamanda	11.	Jasmine	1.	Dambeya	1.	Crotons
2.	Bougainvillea	12.	Justicea	2.	Gardenia	2.	Coleus
3.	Caesalpinea	13.	Lantana	3.	Murraya exotica	3.	Phyllanthus
4.	Cassias	14.	Lagerstromia	4.	Mussaenda	4.	Eranthemums
5.	Cestrum	15.	Plumeria	5.	Plumbago	5.	Acalyphas
6.	Euphorbia	16.	Tecomas	6.	Ixora	6.	Aralias
7.	Hamelia	17.	Thevetia	7.	Lemonia		
8.	Hibiscus			8.	Pentas		
9.	Holmskoildea			9.	Bottle Brush		
10.	Roses			10.	Calliandra		

FLOWERING AND FOLIAGE SHRUBS

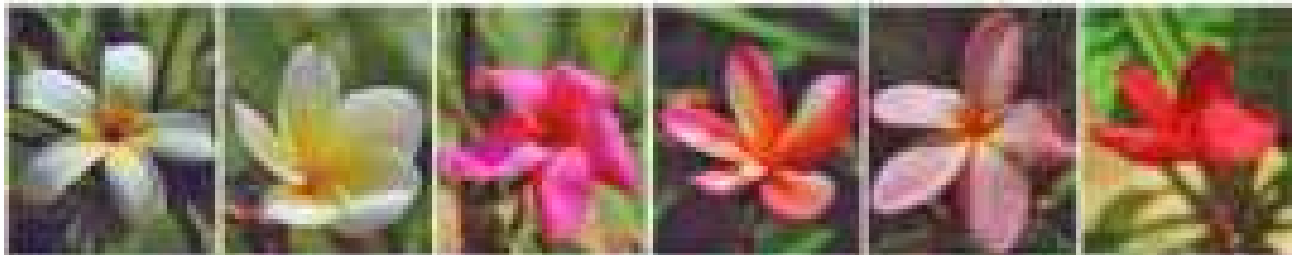
S. No.	Scientific and Common Name	Natural order	Method of propagation	Description
1	Achania malvaviscus	Malvaceae	Cutting	A quick growing medium-sized shrub. Produces red mauve colour half opened hibiscus-like flowers throughout the year.
2	Acalypha sandariana	Euphorbiaceae	„	A small shrub with dark broad green leaves. Produces drooping catkins of crimson flowers. Flowers throughout the year. Prefers shady places. A wilkesiana have copper coloured leaves.
3	Artabotrys odoratis-simus (Hara Champa)	Annoniaceae	Seed	A small evergreen hardy shrub. Produces strongly fragrant flowers of green colour turning yellow on ripening.
4	Barleria cristata	Acanthaceae	Cutting	A bushy small shrub growing up to a height of 1.5 –1.8 m. produces blue flowers almost all the year round.
5	Caesalpinin pulcher-rima (Poniciana puleherima) (Peacock flower)	Leguminoseae	Seed or layers	A medium-sized shrub growing up to a height of 2.4-3 m. Produces red and yellow flowers almost all round the year with profuse flowering during rains and summer.
6	Caryopteris masta-canthus	Verbenaceae	Cutting	A medium-sized shrub reaching up to a height of 2.4-3 m. with. dark green leaves. Produces handsome blue flowers.
7	Codiaem variegatum	Euphorbiaceae	Cutting and goote	Handsome, medium sized shrub with numerous shades of leaves. Loaves may be twisted, thin or very broad.
8	Cestrum norturnum (Rat ki Rani)	Solanaceae	Cutting	A soft wooded shrub growing 1.5 m. in height. Produces small pale green flowers. Flowers open at night and are highly fragrant. Flowers during March-April and in July-August. C. drurnem, produces white scented flowers throughout the year.
9	Euphorbia pulcher- rims (Poinsettia)	Euphorbiaceae	Cutting	A tall shrub reaching up to a height of 2.4-3.0 m. Produces light yellow or yellow flowers on the terminals. Flowers throughout the year.
10	Duranta repens	Verbanaceae	Seed or Cutting	A small thorny shrub with light yellow leaves. Bears blue or white flowers in clusters during rains. The berries are also very attractive, makes an effec-tive hedge variety with varie-gated leaves look more pretty.

S. No.	Scientific and Common Name	Natural order	Method of propagation	Description
11	Gardenia florida	Rubiaceae	Air-layering Cutting	A tall evergreen shrub with shining green leaves. Produces white highly fragrant flowers during summers and rains.
12	Gossypium spp.	Malvaceae	Cutting	Produces white flowers during rains.
13	Hamiltonia-suaveo-lens	Rubiaceae	„	A medium-sized shrub with coarse leaves. Produces sweet scented white or blue tinged flowers during winter months. Responds well to pruning.
14	Hamelia patens	„	„	A strong bushy shrub attaining a height of 3.0-4.5 m with attractive foliage of small green and greenish bronze leaves. Produces orange yellow tubular flowers during winters. Good as an ornamental hedge.
15	Hibiscus mutabilis	Malvaceae	„	A large deciduous shrub of 3-4.5m height with large leaves. Produces large handsome double flowers of white, pink and yellow shades during September—October.
16	Hibiscus rosa-sinensis	Malvaceae	Cutting	Flowers are single or double and appear throughout the year. Colour ranges from deep red, bright red, white red with white strips.
17	Hibiscus syriacus	Malvaceae	Cutting	White or purple blue flowers white single or double forms.
18	Ixora rosea (Rukmini)	Rubiaceae	Layering	A medium-sized shrub with handsome foliage. Produces pink fragrant flowers during March-April. I. lutea produces yellow flowers of large size.
19	Ixora coccinea	Rubiaceae	Layering	A medium shrub with handsome foliage. Produces abundant bright red flowers during rains.
20	Jasminum humile (Yellow Jasmine)	Oleaceae	Cutting	A dwarf shrub reaching up to a height of 1.5-1.8 m. Produces bright yellow flowers in April--June.
21	Jasminum sambac (Mogra Bela)	„	„	A dwarf spreading shrub growing up to 0.9-1.2 m height. Bears creamy white flowers during May to August which are sweet scented.
22	Jasminum sambac (var. Motia Bela)	„	„	A dwarf spreading shrub reaching to a height 0.6-0.9 m. Bears pure white highly fragrant flowers in May to August. The flowers open loosely and look like a star in shape.

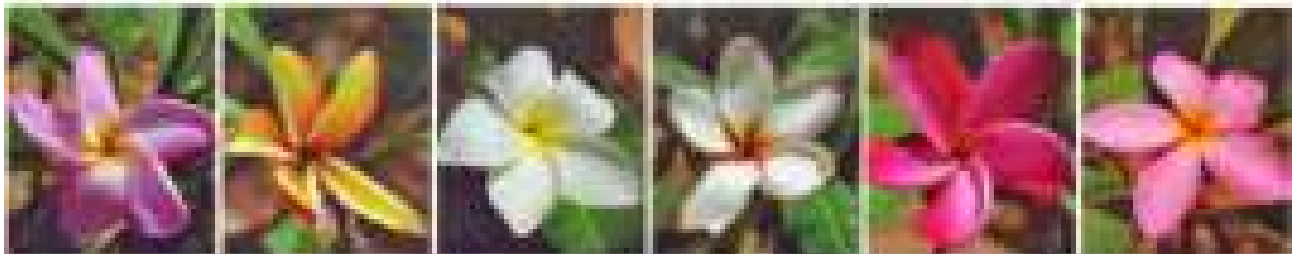
S. No.	Scientific and Common Name	Natural order	Method of propagation	Description
23	Lagerstroetnia app (Sanwani)	Lytharaceac	„	A medium-sized deciduous shrub. Bears flowers of pink, mauve and white colour during May to August. Responds well to pruning.
24	Murraya exotica (Kamni)	Rutaceae	Seed	A medium-sized, evergreen shrub with glossy green pinnate leaves. Produces sweet scented white flowers during May – August. Makes an excellent shrub and hedge.
25	Nerium indicum	Apocynaceae	Cutting	A tall, evergreen shrub reaching a height of 3.0-4.5 m. Bears white pink flowers in single double during May– November. Well suited for dry localities. Scented flowers appear on top of branches.
26	Russelia equisetifolia	Scrophulariaeeae	„	A dwarf, spreading, evergreen and graceful shrub. Produces bright red flowers. Well suited for rockeries and for hanging baskets R. coccinea produces red or scarlet flower. Plant is erect and leaves are small.
27	Stachytrpheta rosea	Verbenaceae	Cutting	A medium-sized, soft wooded shrub. Produces spikes of rose red colour flowers almost throughout the year.
28	Tecoma stans (Yellow elder)	Bignoniaceae	Seed	A tall, erect, globrous shrub growing up to a height of 3– 4 5 m. Produces flowers of yellow colour in panicles during rains and summers. Well suited for dry localities, can be used as a hedge
29	Tabernaemontana divaricata (Chandni)	Apocynaceae	Cutting	An evergreen, hardy shrub with glossy foliage. Produces pure white scented single cr double flow ers during summers and rains.
30	Thevetia neriifolia	„	Cutting or Seed	A tall, evergreen shrub attaining a height of 3-3 6 m. Produces yellow white and bronze funnel-shaped flowers all the year round.
31	Thanbergia ereeta	Acanthaceae	Cutting	Dwarf, hard shrub produces blue funnel shaped flower all the year round.



Plumeria acuminata Grove farm Plumeria acuminata Hon kong Plumeria acuminata Incarnation Plumeria acuminata India Plumeria acuminata India Plumeria acuminata Kane sun burst



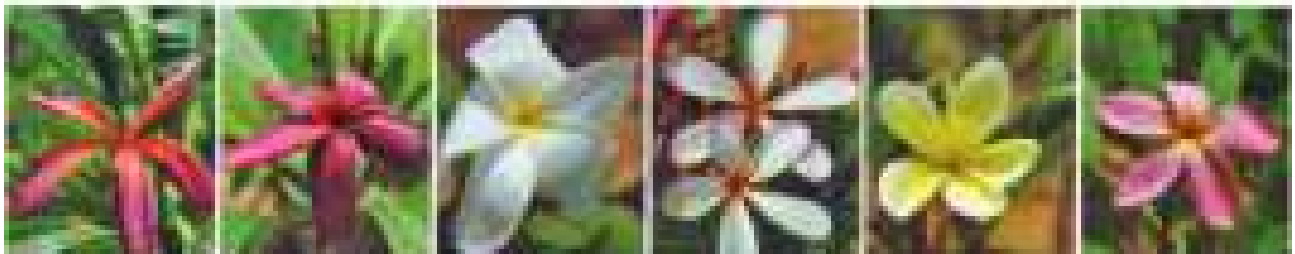
Plumeria acuminata Kaiulaia Plumeria acuminata Kaneohe Plumeria acuminata Kaneo ho sunrise Plumeria acuminata Keywest-elizabeth Plumeria acuminata Kona hybrid Plumeria acuminata Keywest red



Plumeria acuminata Lisa marie Plumeria acuminata Madam pon Plumeria acuminata Madison white Plumeria acuminata Mary susan Plumeria acuminata Miami rose Plumeria acuminata Mori



Plumeria acuminata Nebel gold Plumeria acuminata Petersons gold Plumeria acuminata Plastic pink Plumeria acuminata Pink pansy Plumeria acuminata Powder pink Plumeria acuminata Puu kahea



Plumeria acuminata Rin wheel Plumeria acuminata Ruby le Plumeria acuminata Samoan fluff Plumeria acuminata Singapore plumeria Plumeria acuminata Tangerine Plumeria acuminata Temple tree/Frangi pani



Heliconia Mathiasae



Heliconia Caribaea Bihai



Heliconia Carubaea Purpurea



Heliconia Pedro Ortez



Eltingera Elatior



Heliconia Bihai Lobster Claw



Heliconia Indica Spectabilis
Var Rubra



Alpinia Pink



Heliconia Strkta Firebird



Heliconia Orthotricua



Heliconia Orthotricua Tricolor



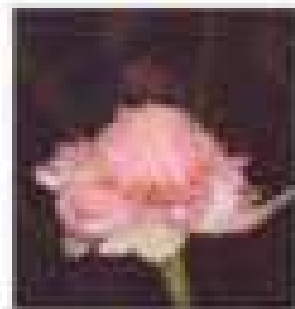
Heliconia Orthotricha



Eltingera Elatior (White)



Torch Ginger (Red)



Torch Ginger (Pink)



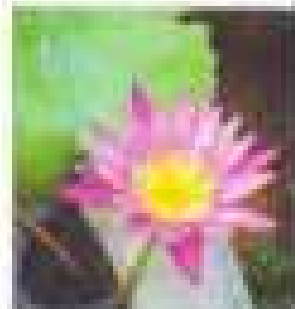
Torch Ginger Rose



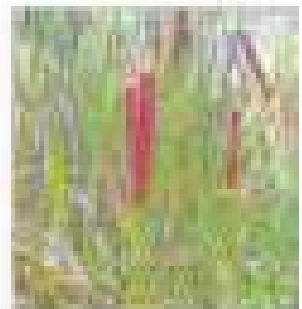
Water Lily



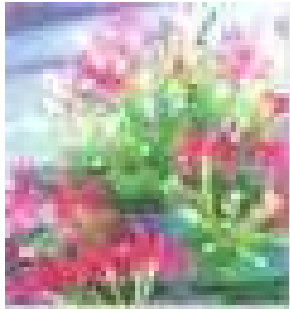
Water Lily



Water Lily



Bulrush



Quisqualis Indica Double



Passiflora Incarnata Hybrid



Passiflora Vitifolia



Pyrostegia Venusta



Stictocardia Macalusoii



Ipomoea Horsfalliae



Ipomoea Morning Glory Indica



Ipomoea Wood Rose



Thunbergia Grandiflora



Thunbergia Mysorensis



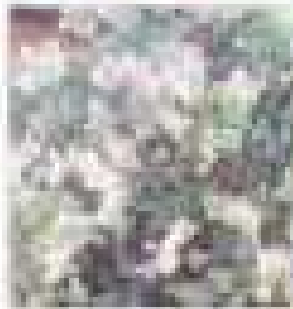
Petrea Volubilis



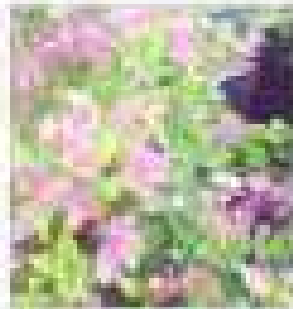
Strophanthus Gratus



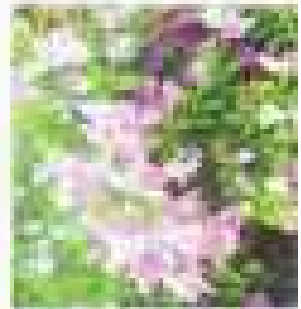
Bougainvillea



Bougainvillea



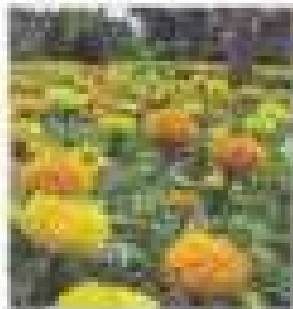
Bougainvillea



Bougainvillea



Annuals



Annuals



Annuals



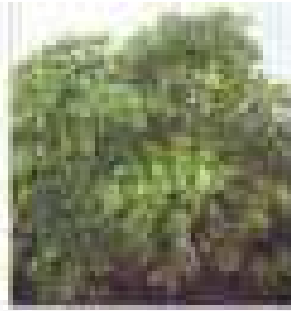
Annuals



Duranta



Duranta



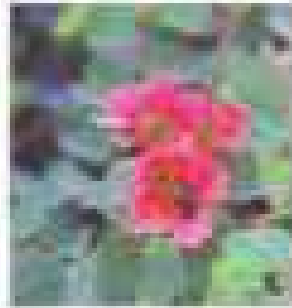
Erythrina Variegata



Nerium Oleander



Mussaenda



Bauhinea Galpini



Buxus



Crinum Black



Agave



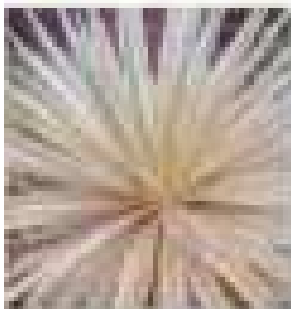
Agave



Cryptanthus



Cryptanthus



Agave



Agave



Agave



Agave



Sansevieria



Sansevieria



Sansevieria



Echinocactus Gursonii



Juniperus (New Variety)



Juniperus



Juniperus



Juniperus



Phalaris Arundinaria Variegata



Pennisetum



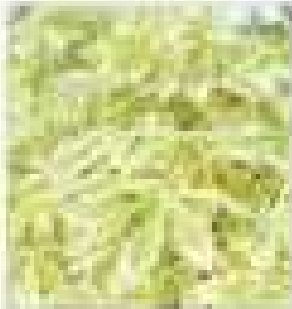
Hypoestes



Chlorophytum



Ananas



Manihot Esculenta



Jatropha Variegated Inteferrima



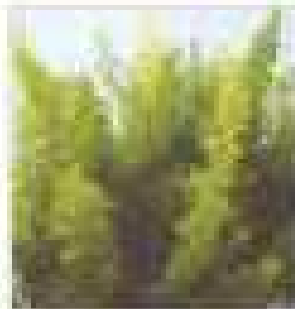
Jatropha Hybrid Inteferrima



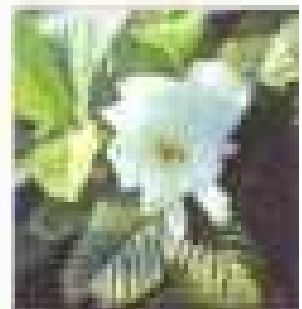
Clivia Miniata



Pandanus Baptistii



Asparagus Meyrii



Gardenia Jasminoides



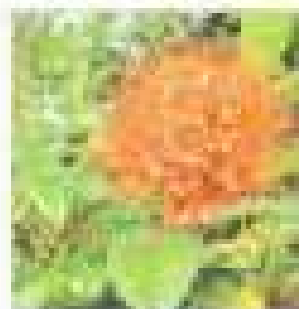
Rhododendron Azalea



Desmodium Pulchellum



Dillenia Suffruticosa



Combretum Constrictum



Codiaeum



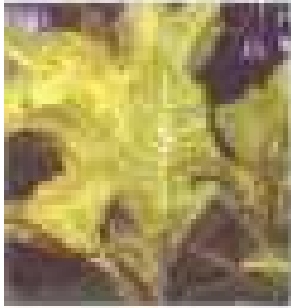
Codiaeum



Codiaeum



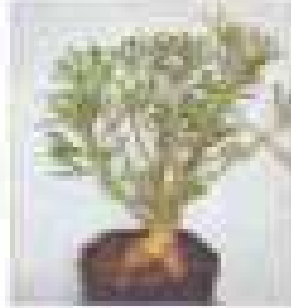
Codiaeum



Codiaeum



Codiaeum



Adenium



Dracaena Angustifolia



Arundingacea



Calathea - Majestila
Rosea - Lineata



Calathea - Majestila
Uaralbo - Lineata



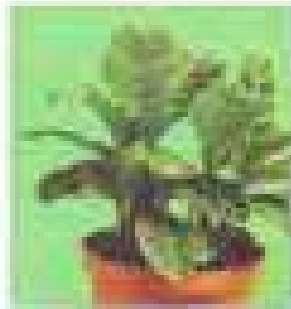
Stromanthe Sanguinea
Varigated



Zingiber Zerumbet



Alpinia Zerumbet



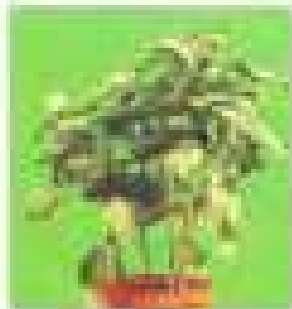
Calathea Zebrina



Calathea Makoyana



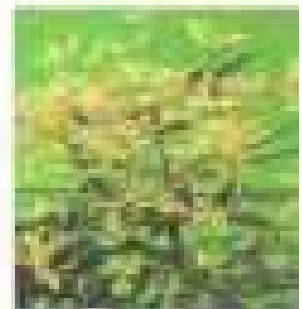
Anthurium



Aralia



Aralia



Nandina Domestica



Asplenium



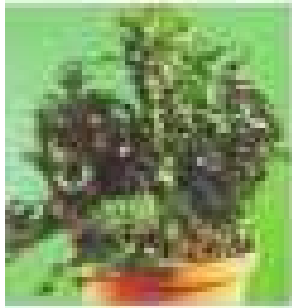
Asplenium



Pteris Cretica



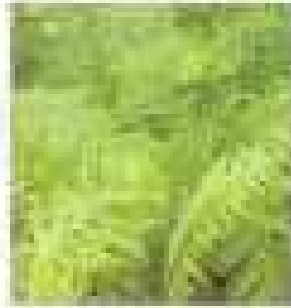
Platycerium



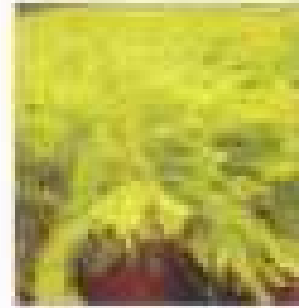
Nephrolepis



Nephrolepis



Nephrolepis



Nephrolepis



Nephrolepis



Nephrolepis



Nephrolepis



Nephrolepis



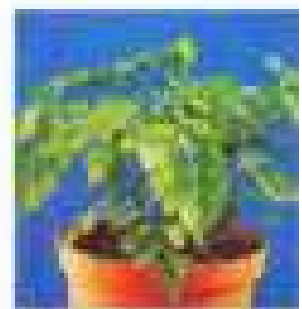
Nephrolepis



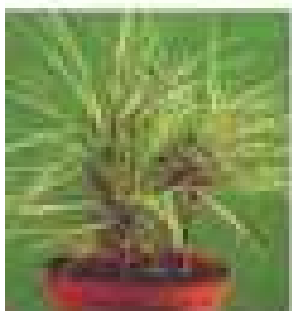
Nephrolepis



Adiantum



Adiantum



Dracaena



Dracaena



Dracaena



Dracaena



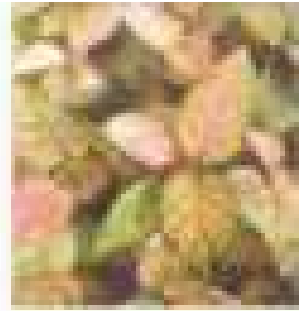
Aglaonema



Aglaonema



Aglaonema



Aglaonema



Dieffenbachia



Dieffenbachia



Dieffenbachia



Dieffenbachia



Aglaonema



Cordyline



Cordyline



Cordyline



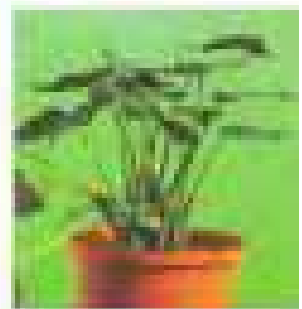
Spatiphyllum



Spatiphyllum



Aphelandra



Alocasia



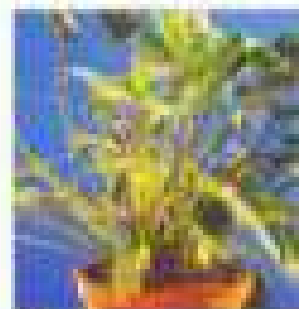
Philodendron



Philodendron



Philodendron



Philodendron



Plumeria Rubra



Plumeria Hanging



Plumeria Singapore White



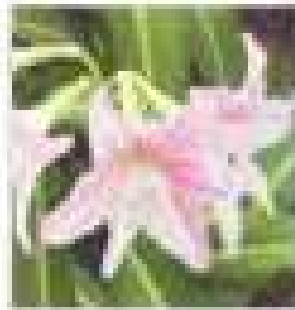
Heliconia



Veitchia Merrilli



Bauhinea Variegated



Amarylis Variegated



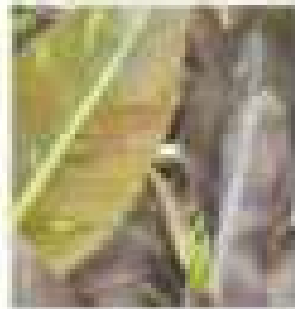
Coccoloba Uvifera



Cryptostegia Grandiflora



Alpinea (Pink Ginger)



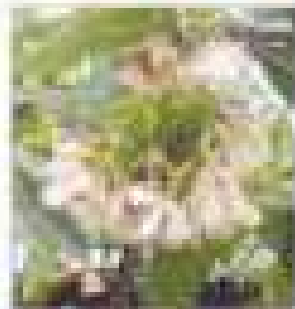
Ornamental Banana Variegated



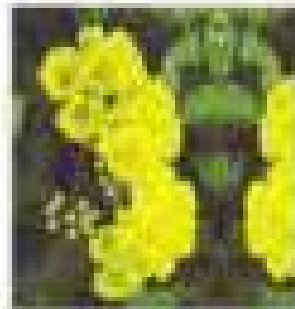
Agave Variegated



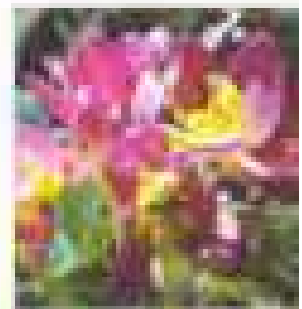
Caronda Carambola



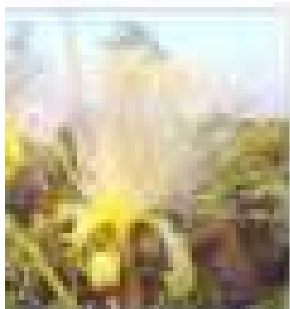
Elaeocarpus Angustifolia



Cordea Lutea



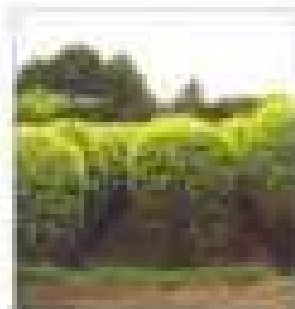
Spathoglottis Chameleon



Bombax Ellypticum



Passiflora



Ficus Topiary



Melleleuca Topiary



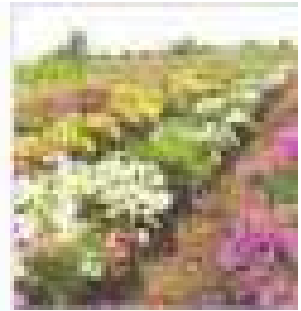
Bougainvillea



Bougainvillea



Bougainvillea



Bougainvillea



Bauhinea Blackeana



Alocasia Blackmagic



Cletozia



Spathyphylum Sensation



Allamanda Peach



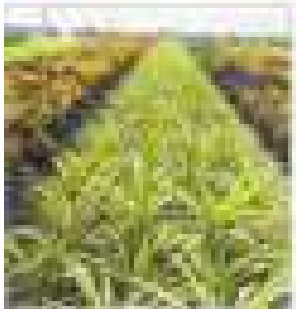
Anthurium Veitchii



Anthurium



Staghorn Fern



Pandanus



Mandevilla Bolivienensis



Collevillea Racemosa



Schefflera



Cordia Sabastena



Triplaris Surinamensis



Acocanthera Oblongifolia



Oncoba Spinosa



Haemanthus Multiflorus



Adansonia Perrieri



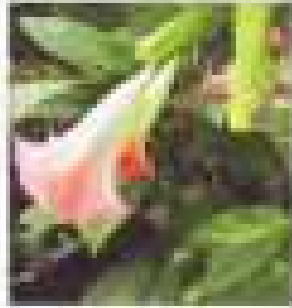
Dioon Edule



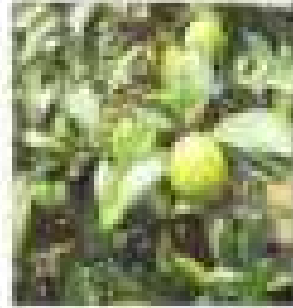
Mucuna Benetti (Jadevine Red)



Michelia Champaca



Datura Arborea



Ornamental Chinese Orange



Codiaeum



Gardenia Dwarf



Combratum



Combretum Constrictum



Filicium Decipiens



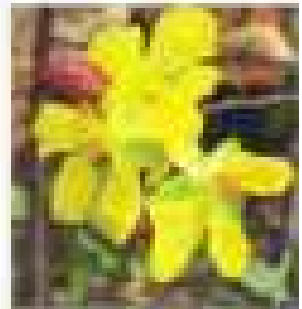
Solanum Macarantum



Barringtonia



Schefflera Haicolour



Ochna Kirkii (Tom & Jerry Plant)



Water Lily



Water Lily



Water Lily



Water Lily

CHAPTER - 11

HEDGES & EDGES

Plants grown in series in straight line or a smooth wave to serve as a barrier or screen are termed as hedges. They provide a natural background to a garden, like a frame to a picture which maybe external or internal. An external hedge is tall and may replace the compound wall. It also serves as a protection against wind. It may be 1.5 to 2.5 meters (5 to 9 feet) height. The internal hedge separates different parts of the garden and is not so tall. It may vary from 30 to 90 cm (1 to 3 feet). Hedges may be of deciduous or evergreen plants. They may be flowering or non flowering plants. Hedges are generally created with fast growing plants so as to get the effect immediately as screen, or wind-break. They have a capacity to grow tall and are evergreen.

Essentials of a good hedge:

It needs to be thick and dense; it should have evergreen foliage from bottom to top; it should withstand regular pruning and be trim and neat. If it is a flowering hedge its bloom should not clash with the colour scheme.

Hedges are used for concealing unwanted and ugly locations or as a back ground to lawns, flower beds etc and for providing privacy. Edges are used as demarcating lines to lawns, flower beds, pathways etc. and low height is maintained with regular pruning with shears.

Tips for Laying Hedges and Edges:

1. Dig trenches of 1' width and 1' depth. Loosen the bottom of trench and expose to sun for about 15 days.
2. Fill the trench with dug out soil if it is good or red soil. Mixed with 25 kg compost or 10 kg vermi-compost, 2.5 kg Neem cake and 1 kg Super Phosphate per 10' length of the trench; 25 Gms of folidol dust., and water the filled trench for settling.
3. Plant rooted cuttings of the selected plant material at 4" - 6" gap and water. During rainy season with high humidity, uprooted cuttings can also be planted, at close range of 2"-3" spacing in two rows.
4. Water well thereafter.
5. First shearing should be done at 9" - 1' height for edges and at 1' - 1.6" height for hedges to get bushy growth right from ground level. Further shearing at regular intervals to maintain desired height, shape and compactness. Shearing can be done for maintaining desired shapes.
6. Manure once in six months or whenever growth and vigour retards at the base of the trench and regular mulching also needs to be undertaken

Ornamental Hedges /Edges:

S. No.	Name	Planting Distance (cm)	Stands Pruning	S. No.	Name	Planting Distance (cm)	Stands Pruning
1.	Aclypha sp.	30-45	Poor	9.	Lantana sp.	30-45	Well
2.	Bougainvillea sp.	90-120	Well	10.	Murraya exotica	45-60	Well
3.	Cuphea	15-20	Poor	11.	Mynea erecta	15-45	Well
4.	Duranta sp.	30-45	Well	12.	Pedilanthus	15-20	Well
5.	Konocarpus	30-45	Well	13.	Ashoka pendula	90-100	Well
6.	Hemelia Patens	30-45	Well	14.	Tecoma stans	60-90	Poor
7.	Clerodendron inerme	15-20	Well	15.	Phyllanthus	30-45	Poor
8.	Justicia sp.	20-30	Well	16.	Crasulla (Jade)	20-30	Well

Protective Hedges:

1.	Carissa Carandas (Karonda)	20-60	Light
2.	Inga dulcis	90-100	Well
3.	Lawsonia inermi (Mehendi)	45-60	Well
4.	Parkinsonia aculiata	90-100	Light

A-ORNAMENTAL HEDGES

S. No.	English and Common Name	Botanical name and Natural order	Planting distance (cm)	Method of propagation	Description
1	Acalypha	Aclypha sunderiana Emphorbiaceae	30-45	Cutting	Makes a good hedge because of attractive coloured leaves ; can be trained up to a height of 0 9-1.2 m. Does not stand trimming well and is susceptible to low temperature.
2	Bougainvillea	Bougainvillea spp. Nyctaginaceae	90-120	Cutting air & ground layering	Most of the varieties make an effective beautiful and hardy hedge, produces pretty flowers almost all the year round. Stands trimming well. Can be trained up to a height of 0 9-1.2 m.

S. No.	English and Common Name	Botanical name and Natural order	Planting distance (cm)	Method of propagation	Description
3	Cupressus	Cupressus macro carpa	30-45	Seed Cutting	Makes an excellent, evergreen dense hedge. Stands trimming well. Does better in cool area.
4	Duranta	Duranta plumeri Rubiaceae	30-45	Cutting and Seed	Beautiful, effective and hardy hedge. Stands trimming well. Variety with variegated leaves is better.
5	Hamelia	Hamelia patens Rubiaceae	30-45	Cutting	Makes a good attractive hedge with coloured foliage. Stands trimming well. Can be trained up to a height of 1.2-1.8 m.
6	Hibiscus	Hibiscus rosasinensis Malvaceae	30-45	Cutting	Makes an excellent hedge, stands trimming well. Can be trained to a height of 0.9-1.2 m. Produces attractive tubular flowers almost throughout the year.
7	Justicia	Justicia grandis Acanthaceae	22.5-30	Cutting	Makes dwarf hedge. Stands trimming well. Can be trained up to a height of 0.3-0.6 m.
8	Lantana	Lantana spp. Verbenaceae	30-45	Cutting	Several varieties of Lantana make vigorous hardy and drought resistant hedge. Produces flowers of different hue. Stands trimming well. Should not be planted close to residence.
9	Dadonia	Dadonia viscosa	22-30	Cutting and Seed	A quick-growing and ornamental hedge. Stands clipping well. Requires attention during summers.
10	Murraya (Kamni)	Murraya exotica Rutaceae	45-60	Seed	Makes a pretty hedge, because of its deep green compound leaves. Produces white highly fragrant flowers during July–Aug. and Feb.–March. Stands trimming very well.
11	Mayenia	Meyenia erecta Acanthaceae	15-45	Cutting	Makes pretty dwarf hedge. Produces beautiful purple flowers. Can be trained to a height of 0.6-0.9 m.

S. No.	English and Common Name	Botanical name and Natural order	Planting distance (cm)	Method of propagation	Description
12	Ashok	Polyalthia longifolia Anonaceae	90-100	Seed	Makes an effective hedges when properly trained and trimmed. The foliage is very attractive.
13	Surinam Cherry	Eugenia uniflora Myrtaceae	60-90	„	Makes a hardy, beautiful and effective hedge. Red berries look very attractive. Fruits can be utilized for making jam and jelly. Can be trained to a height of 1.2-1.5 m. Does not require much irrigation or trimming.
14	Jaint	S sbenia sesban Leguminoceae	22.5-30	„	A quick-growing and short-lived hedge Stands trimming well. Produces yellow flowers during rains and summers.
15	Mehndi	Lawsonia inermis Lythraceae	30-45	Seed and Cutting	A slow-growing drought resistant and effective hedge. Stands trimming very well. Can be trained to a height of 1.2-1 5 m.
16	Tecoma	Tecoma stans Bignoniaceae	60-90	Seed	Makes an ornamental hedge. Produces bright yellow flowers almost throughout the year. Does not stand trimming well. Can be trained to a height of 1.2-1.5 m.
17	Chandnee (Single)	Tabernaemontana coronaria Apocynaceae	60-90	Cutting	A fairly quick growing beautiful hedge Produces white flowers in abundance. Foliage very shiny. Stands trimming nicely. Can be trained to a height of 0.9-1.2 m.
B-PROTECTIVE HEDGES					
1	Karounda	Carissa carandas Apocynaceae	120-150	Seed	It is slow growing, drought resistant plant. It makes a very effective hedge due to long thorns. Light annual pruning is needed. Fruits make excellent jam and jelly.

S. No.	English and Common Name	Botanical name and Natural order	Planting distance (cm)	Method of propagation	Description
2	Natal plum	Carissa grandiflora Apocynaceae	60-90	Seed and gootee	A low, slow growing and drought resistant plant. Follage deep green. Produces fine white flowers almost through-out the year. Closely planted, hedge is almost impenetrable. Fruit can be utilized for making jam and jelly. Can be trained up to a height of 0.6-0.9 m.
3	Jangali karounda	Carissa bispinosa Apocynaceae	120-150	Seed	A tall, vigorous, thorny and drought resistant plant. Makes a dense and compact hedge. It makes a better hedge than Karounda. Well cared plants make almost an impenetrable fence, because of big stout thorns. Fruits can be utilized for making jam, jelly and refreshing drinks.
4	Karna Khatta	Citrus karna Rutaceae	60-90	Seed	A useful plant for hedge purposes Single row planting makes a very effective hedge. Can be trained to a height of 1.2-1.5 m.
5	Turanj	C. medica Rutaceae	90-100	Seed and cutting	Same as above.
6	Madras Thorn	Inga dulcis Leguminosae	60-90	Seed	Makes a beautiful and effective hedge when planted in double row. Stands trimming well. Can be trained to a height of 0.9-1.2 m.
7	Parkensonia	Parkensonia aculata	60-90	Seed	A quick-growing effective drought resistant hedge plant. Effective up to a height of 1.2-1.5 m. Double row planting is much more effective.

CHAPTER - 12

GROUND COVERS

Plants which are used to cover the soil surface as an alternative to lawns are termed as ground covers. They help in preventing dust pollution and to add colour through flowers or foliage. They also check soil erosion.

They enhance the aesthetic appearance of any garden. They can be classified into three groups according to the requirement of sunlight for growth and flowering.

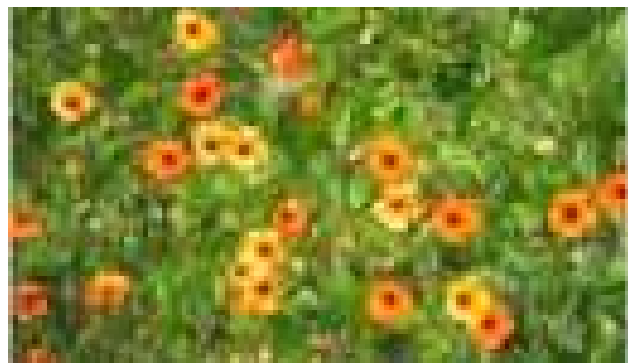
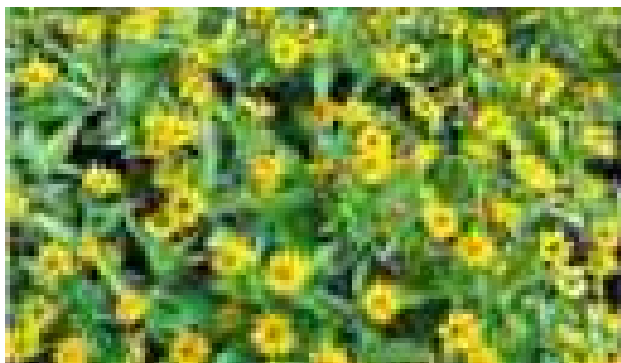
- Plants that show normal growth and flower in full sun

- Grow only in partial shade
- Grow well in full sun and semi shade conditions.

Groundcovers are useful in the garden for covering bare patches of soil beneath trees or shrubs or for covering steep banks where access is difficult. Their roots also help to stabilize soil on steep slopes and check erosion. Ground cover plants brighten up otherwise dull areas and will suppress weeds, making them ideal for a low-maintenance garden.

Groundcovers:

S. No.	Plant Name	S. No.	Plant Name	S. No.	Plant Name
1.	Alternanthera sp.	11.	Verbina	21.	Impatiens linearifolia
2.	Asystasia gangetica	12.	Wedelia trilobata	22.	Liriope muscari variegata
3.	Senecio confucius	13.	Aspidistra elatior	23.	Liriope platyphylla
4.	Zebrina pendula	14.	Begonia semperflorens	24.	Liriope platyphylla
5.	Ruellia sp.	15.	Callisia Repens	25.	Dianella tasmanica
6.	Syngonium sp.	16.	Chlorophytum sp.	26.	Aptenia caudifolia
7.	Rhoeo spathacea vittata	17.	Pelargonium hortorum	27.	Scindapsis sp.
8.	Lantana sellowiana	18.	Euonymus japonicas	28.	Sansiveras
9.	Pilea sp.	19.	Hedera canariensis	29.	Setcreasea
10.	Portulaca	20.	Hemigraphis colorata	30.	Spathyphyllum





CHAPTER - 13

CLIMBERS

Plants which have special structures to climb on supports are defined as climbers. These special structures may be tendrils, modified leaf stalks, rootlets or hook like thorns. The name rambler is usually used for climbing forms of roses which produce clusters of flowers.

Climbers can be trained on arches, pergolas, walls, trees and on pandals. Climbers can be used for screening even in narrow spaces over grills and wire meshes.

Tips for Planting & Maintaining of Climbers

1. Dig pits of 8 cft (cubic feet) and loosening bottom of the pit, expose to sun for at least 2 weeks or burn the pit with leaf trash.
2. Maintain 4' to 6' between pits.
3. Fill the pits with dug out soil, 10 kg well decomposed cattle compost or 5 Kg vermi-compost, 1Kg neem cake and ½ kg super phosphate and 100 gms of folidol dust.
4. Plant the selected climber, water well, stake the plant next day. Regularly water thereafter.
5. Prune and train the climbers for controlling plant size, shape and giving a bushy growth.
6. Take up weeding and mulching in the basin on a regular basis.
7. Regular care is required to protect the plants against the pests and diseases.

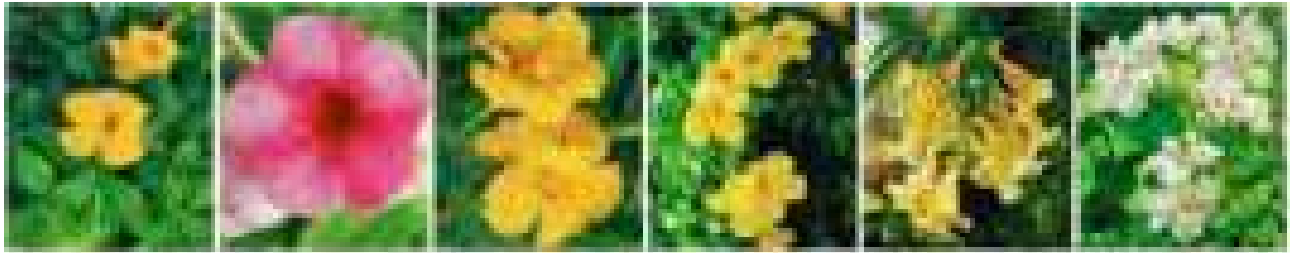
Common Climbers:

S. No.	Name	Common Name	Flower colour	Flowering season	Type	Propagation
1.	Agamosma caryophyllata	Maiati lata	White	Rainy	H	C
2.	Allamanda cathartica	.....	Yellow	AYR	L	CL
3.	Antigonan leptopus	.....	Rosy	AYR	L	S
4.	Aristolochia grandiflora	Birth wart	Purple	Summer, Rainy	L	CL
5.	Beaumonta purpuria	Nepal Trumpet	White	Winter	H	CL
6.	Bougainvilles sp.	.....	Multi	Summer	H	CL
7.	Bignonia purpuria	.....	Purple		L	L
8.	Bignonia venusta	Golden Shower	Orange		L	L
9.	Cleorodendron splendence	.....	Scarlet	Winter	L	C,S
10.	Ficus repens	Wall creeper	...	....	L	C,L
11.	Areca vestiaria (Langlois palm)	Madhavi Lily	Yellow	Winter	L	S,L
12.	Ipomea horsfolliae	.....	Crimson	Winter	H	G,L
13.	Jacquemontia	.....	Blue	AYR	L	C,L
14.	Jasminum SP.	Motia	White	Summer	L	C,L

Climber

S. No.	Scientific and Common Name	Natural order	Method of propagation	Description
1	Allamanda cathartica var. grandiflora	Apocynaceae	Ground Layering	A climbing plant with bright green leaves grandiflora Layering leaves. Produces big showy yellow flowers from June—Nov. A violacea produces violet-purple flowers.
2	Antigonon alba	Polygonaceae	Seed	A quick growing climber. Produces lovely spray of white flowers during rains and in winter. A. leptopus bears flowers of rose colour.
3	Asparagus plumosus	Liliaceae	„	A highly ornamental evergreen dwarf climber. The foliage finely divided. Prefers shady places. A. spengri is a dwarf climber with white fragrant flowers.
4	Adenocalymma alliaceum	Bignoniaceae	Ground Layering	Produces pale mauve flowers in large clusters all the year round.
5	Banisteria laurifolia	Malpighiaceae	Ground Layering	A strong extensive climber with dark olive coloured leaves. Bears abundance of bright golden yellow flowers from December to March.
6	Bignonia venusta (Pyrostegia venusta)	Bignoniaceae	„	A quick growing evergreen creeper. Produces in abundance rich yellow tubular flowers from December to March.
7	Bignonia gracilis	„	„	A slender, creeper with pretty yellow flowers. Flowers are seen from Nov. till March
8	Bougainvillia spp.	Nyctaginaceae	Ground and air Layering	Bougainvillas are the most colourful garden plants. They are vigorous growing heavy creepers. Cultivated for showing brightly coloured bracts. Can be trained as standard, hedge and pergola. The important spp. are the following. Budding is possible.
9	B. Spectabilis	Nyctaginaceae	Ground and air Layering & Cutting	A quick-growing creeper. Bears rosy purple colour bracts from Jan. to March.
10	B. Mahatma Gandhi	„	„	Bears pink and purple bracts.
11	B. Louis Wathen	„	„	Bracts bright orange turning pinkish on maturity.
12	B. Mrs. Butt	„	„	A free bloomer with deep crimson bracts.
13	B. Mary Palmer	„	„	Rose pink and white bracts are borne on the same branch.

S. No.	Scientific and Common Name	Natural order	Method of propagation	Description
14	B. Sannet	„	„	Bright rosy purple bracts. Plant makes a compact growth.
15	B. Magnifica	„	„	Produces bright large mauve Colour bracts.
16	B. Snow queen	„	„	A beautiful variety bearing white bracts green veins.
17	B. Thima	„	„	Similar to Mary Palmer except the leaves are varigated.
18	B. Shubhra	„	„	Produces white large bracts on the terminals.
19	Clerodendron splendens	Verbenaceae	Layering	A dwarf evergreen creeper with dark green foliage. Bears profuse beautiful flowers from Dec.-Feb. of vermilion colour.
20	Ficus ripens	Urticaceae	Cutting	A creeping species of fig foliage. Evergreen, without much branching.
21	Ipomea pulchella	Convolvulaceae	Seed	A quick growing, evergreen ex-tensive green creeper. Bears purple flowers during winters.
22	Jasminum grandifloram	Oleaceae	Layering	A small evergreen climber with bright green leaves. Produces pure white star-shaped frag-rant flowers during summer months.
23	Lonicera japonica	Caprifoliaceae	„	A rambling evergreen creeper. Bears white fragrant flowers which turn yellow later.
24	Porana paniculata	Convolvulaceae	„	A strong evergreen creeper. Produces very small white flowers in great abundance during October–November.
25	Quisqualis indica (Rangoon creeper)	Combretaceae	„	A strong, evergreen, bushy, climber. Produces shining scarlet and white flowers in abundance throughout the year. Suitable for training on buildings and walls.
26	Tecoma grandi flora	Bignoniaceae	„	A strong woody creeper. Bears orange coloured flowers in abundance almost throughout the year.
27	Thubergia grandiflora	Acanthaceae	„	A strong evergreen extensive climber. Bears large bell-shaped blue coloured flowers from October till December.
28	Jacquemontia pen antha	Convolvulaceae	„	Produces bell- shaped flower of ultramarine blue colour all year the round.
29	Passiflora recemosa (Passion flower)	Passiflorae	„	Large flowers with whitish green sepals during winter.



Allamanda cathartica Hendersonii

Allamanda cathartica violacea

Allamanda cathartica Williamsii

Allamanda cathartica

Anemopaegma chamberlaynii

Aritigonon Leptopus Alba



Antigonon leptopus

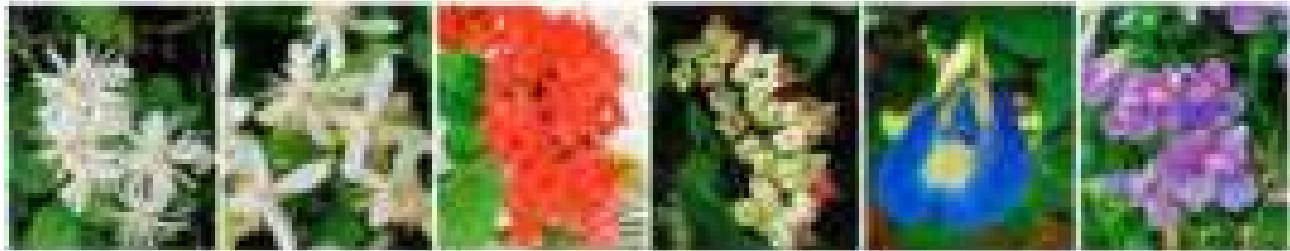
Aristolochia elegans

Arrabidaea magnifica

Beaumontia grandiflora

Campsis grandiflora

Campsis radicans



Clematis flammula

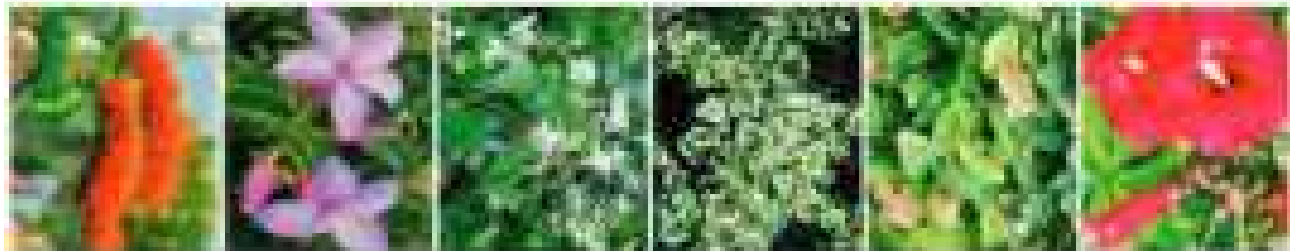
Clematis gouriana

Clerodendrum splendens

Clerodendrum thomsonac

Clitoria ternatea

Clytostoma purpureum



Combretum coccineum

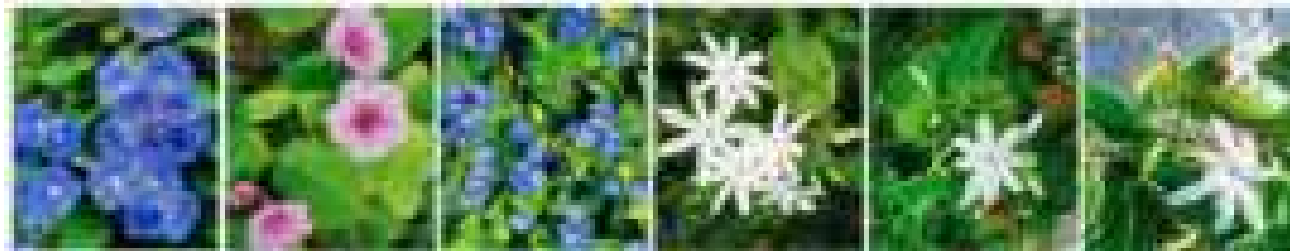
Cryptostegia grandiflora India rubber vine

Echites caryophyllata

Ficus pumila (wall creeper) variegata

Ficus pumila (wall creeper)

Ipomoea horsfalliae



Ipomoea learri

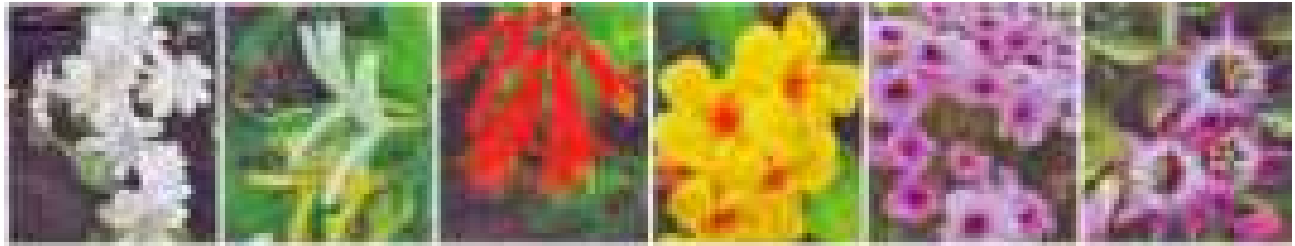
Ipomoea pes-caprae

Jacquemontia violacea

Jasminum angustifolium

Jasminum auriculatum

Jasminum nitidum



Jasminum sessiliflorum

Lonicera japonica
Japanese honey
suckle

Lonicera
sempervirens
Trumpet honey
suckle

Odontadenia
grandiflora

Pandorea
jasminoides

Passiflora violacea
Purple passion
flower



Passiflora caerulea
Blue passion flower

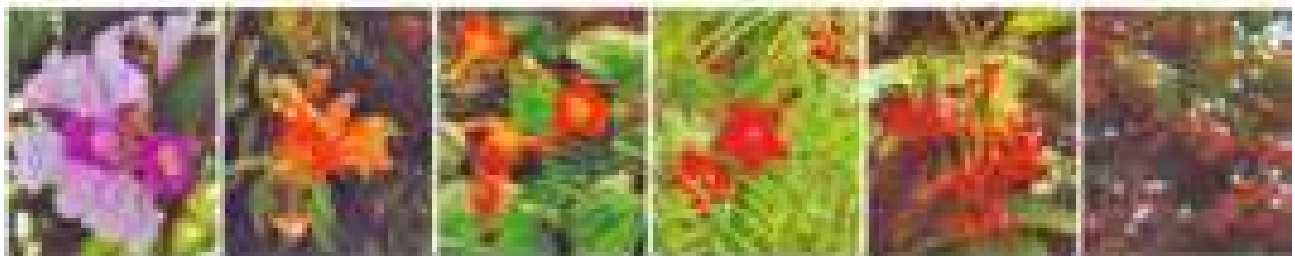
Passiflora coccinea
Red passion flower

Passiflora
decaisneana

Petrea volubilis
purple wreath

Phaedranthus
buccinatorius
Splendent flower

Podranca
ricasoliana



Pseudocalymma
alliace Garlic vine

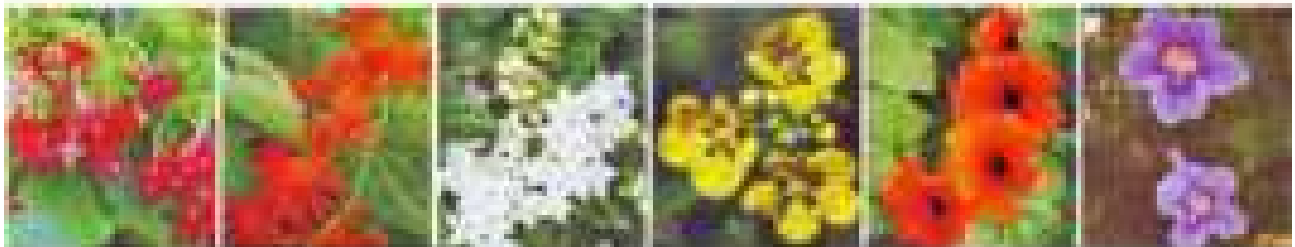
Pyrostegia venusta
Golden shower

Quamoclit coccinea
Star ipomoea

Quamoclit pinnata
Cypress vine

Quisqualis
densiflora

Quisqualis indica
double Ragoon
climber



Quisqualis indica
Ragoon climber

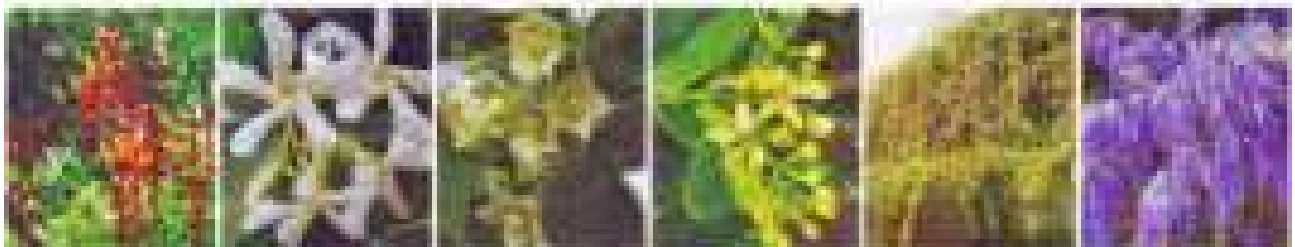
Senecio confusus
Mexican daisy

Stephanotis
floribunda

Stigmaphyllon
periplocifolium

Thunbergia alata

Thunbergia
grandiflora



Thunbergia
mysorensis

Trachelospermum
jasminoides

Vallaris heynei

Tristellateia
australasiae

Vernonia
elaegnifolia

Wisteria sinensis

CHAPTER - 14

ROSES

I. Introduction

The rose has been loved and cherished from very ancient times. In modern age, its importance has become still greater because rose breeders have been increasing its range of colours while at the same time adding valuable characters like disease resistance and a longer period of flowering. It is a versatile plant and the fantastically large number of types available is one of the reasons for its great popularity. There are now roses for every purpose and even the person with only a tiny plot of land will find there are varieties available to him which will provide a welcome splash of colour to a wall or furnish quantities of exquisite cut flowers. Now-a-days, roses are grown throughout the country and perhaps no flower is more loved in India. The rose is valued for purposes of worship and for making garlands in our country. Recently the Rose Society of India has laid out a beautiful National Rose Garden in New Delhi.

II. Climate

The climatic conditions of India are well suited to rose cultivation. Roses need bright sunshine and free ventilation. Sunshine for six hours is ideal for better growth and flowering.

In the northern plains, roses flower best during winter whereas in the temperate hilly regions of the Himalayas in summer. Western part of India have excellent agro-climatic conditions for rose growing. The plains of eastern India are suitable for the cultivation of many rose cultivars. Bangalore

has mild climate Where roses can be grown for flowers throughout the year.

III. Soil

Although any soil is good for rose cultivation provided it has proper drainage, the ideal soil should be medium loam having sufficient organic matter, pH of 6.0 -7.5. The land where the external drainage is poor and water stagnates during monsoon should not be selected for rose growing. In very heavy soils, gravel and sand may be mixed into the bed to allow drainage. The land with high water table is not suitable for rose beds.

IV. Layout of Beds

The plan of rose garden and design of the beds should be simple and informal. Rose beds may be of various design, depending upon the liking of the grower. However, rectangular beds are advantageous for maintenance. The width of the beds should be such that operations like weeding, hoeing, forking, cutting of flowers etc, can be done from both the sides of the bed, without stepping into the bed. A plot size of 6.0 x 1.2m or 6.0 x1.65m is suggested for better management of rose plants. The length can be increased to a limited extent depending upon the specific situations.

V. Growth and Flowering

Factors like genetic or inherent factors, climatic or environmental factors such as light, temperature, moisture, aeration and managemental factors like nutrition and soil conditions influence growth and flowering.

A. Genetic factors

Like other plants, growth and flowering behaviour of roses is governed by genetic factors. The range of variability in roses is very great. There are tall cultivars growing several metres high and are suitable for planting in backdrop and as hedges. On the other hand, miniature roses with dwarf habit and producing small flowers are also available. Several cultivars are bushy in nature while many are climbers and ramblers. A wide choice of cultivars with long sturdy stems having nice flower forms suitable for cut-flowers are also available today. Similarly, there are cultivars blooming in different periods and producing varied yield and quality of flowers. Some possess high quality perfume.

B. Environmental factors

Along with genetic factors, environmental factors play an important role on growth and flowering.

1. Light

Light is one of the most important factors influencing the growth and flowering of roses. This may vary with intensity, duration and quality of light. The total plant weight may be reduced by the decrease in light intensity, and the number of flowers produced increases with increased radiation.

Plants growing under shade produce thinner leaves with low chlorophyll content. However, because of high light intensity and the consistent rise in temperature, summer growers apply a light shading material on the roof of the glasshouse. Colour of rose flowers is also influenced by the high intensity of light. The influence of duration of light is most marked and spectacular on growth and in inducing or suppressing flowering.

2. Temperature

Temperature affects the quantity and quality of the plant and the flower. At a

night temperature of 15.5°C the quality and quantity of roses produced are considered to be satisfactory. Low temperature also brings about the development of pigment in the leaves, stems or flowers. The stem and flower buds need an exposure to cool temperature for their expansion. Winter chilling is necessary for flower bud formation.

3. Humidity

Humidity plays an important role in the incidence of pests and diseases affecting the growth and flowering. Certain diseases like mildew's are associated with high relative humidity. Its importance, however, lies in the internal water conditions of the plants. By maintaining reasonably high humidity, the internal deficiency of water will be less. Enlargement of cells is caused by water and, therefore, we should prevent the loss of water from the plants so that leaves and flowers would be larger and stems longer.

4. Aeration

Proper soil aeration and an exchange of air in green house are also desirable for the normal growth and development. Compact soils have restricted aeration which impedes the activity of roots affecting the plant growth. Air circulation ensures an adequate supply of carbon dioxide and oxygen for physiological processes occurring in the plant and also reduces the relative humidity which may cause serious infections. Carbon dioxide is an important factor in photosynthesis in increasing the stem length and dry matter.

C. Plant management practices

Pruning, pinching, disbudding, deshooting, defoliation and deflowering are the plant management practices done for rose cultivation.

1. Pruning

Pruning is an important operation regulating the growth and flowering of roses. Pruning

in roses is explained in detail the cultivation section. Following are some other plant management practices which influence the vegetative growth and production of flowers.

2. Pinching

Removal of a part of terminal growing portion of stem is called pinching. It reduces the plant height but promotes auxiliary branching and also prevents maturity of flower bud.

3. Disbudding

Removal of undesirable buds is known as disbudding. Keeping only the central bud and removal of others cause development of a quality bloom.

4. Deshooting

Deshooting is generally followed in Hybrid Tea roses. Young vegetative shoots developing from the axils of leaves of basal and lateral shoots are removed to allow only one terminal shoot. In several rose cultivars such side shoots develop from the eyes down the stem below the terminal flower bud. If these shoots are not inched off at the initial stage, plants become much branched and produce a number of small flowers.

5. Defoliation

Although defoliated plants produced about twice as many shoots as un-defoliated, many of them are blind and the total number of flowers is less. Complete defoliation causes atrophy of almost all flower buds. Removal of only mixture leaves causes about 50% blindness. Removal of only young leaves, however does not cause blindness.

Leaf removal on dormant shoots results in the production of short and nonflowering shoots. Removal of the upper most leaf at the time of pinching results in highly significant increase in flower production. Leaf removal from semi mature shoots is more effective on flower production than from young shoots. Flower quality, is also not reduced by this practice.

6. Deflowering

Removal of faded flowers is called deflowering. If the spent blooms are not removed in time, there is a chance of developing fruit bearing seeds. Once the hips are formed and reach the advance stage of development, growth and flowering are severely reduced during the season. Cutting of faded flowers forces strong laterals which produces a good quality flower.

VI. Propagation

Among propagation methods, budding is most popular in our country because it produces better quality flowers and faster growth of plants. Other methods like, seed propagation, layering, grafting are also important. For more details on budding and grafting refer booklet No.6, "Propagation of Fruit Trees".

1. Budding

Budding is the most popular and successful method for multiplying roses. It provides larger number of plants than cuttings, layering or grafting, as a single shoot of the desired scion furnishes a number of buds for budding. Shield or T- budding is the method ordinarily used. On the selected rootstocks, the buds are inserted into a T-shaped incision and then tied with suitable wrapping material. It takes 3-4 weeks for the buds to unite. The side branches of the stocks are removed which compete with the scion for supply of nutrients and water.

2. Grafting

Inarching or grafting is another method of propagating roses but the cost of a grafted plant in the long run may be higher than that of budded plant. The rootstocks are raised in small pots or polythene bags. The scions are selected and the stocks are brought near the selected scion shoots. The scion shoot should be of medium texture, free from pests and diseases and 1-3 eyes in length. Larger

scions are not recommended. A strip of bark, about 3 cm long with a part of wood, is removed from the stock as well as from the scion, and the latter is attached properly on to the stock and wrapped. After union the scion shoot is cut below the graft and the rootstock above the graft union.

3. Layering

This type of vegetative propagation is usually practiced in climbing and rambling roses during the monsoon or early spring season. Layered plants thrive and bloom quite well as budded or grafted plants. This method has two types, ground layering and air layering.

a. Ground layering

It is performed by bending shoots to the ground and covering it with soil, leaving the terminal end exposed. A wooden peg or stone and a bamboo stick can be used to hold the bent shoot and exposed shoot in their position. Rooting at nodes usually takes place in a month or so and the layered shoot is detached 15-20 days after root formation.

b. Air layering

It consists of removing a ring of bark, about 2.5 cm long, from around the shoot to be rooted and covering it with a rooting medium. The use of damp sphagnum moss around the ringed portion and covering with polythene film have been found beneficial. Application of some root promoting substances may further improve the root formation in air layers.

4. Cutting

Propagation of roses by cuttings is normally done to raise stocks for grafting or budding. Climber, Rambler, Polyantha and Miniature roses respond quite well to this method. Although cuttings are almost always prepared from shoots, root cuttings have also been found to form shoots and ultimately a new plant.

a. Root-cutting

Some rose species like *Rosa blanda*, *R. nitida* and *R. virginiana* can be propagated by root-cuttings. The cuttings should be taken from young and healthy plants and it is important to maintain polarity when planting. The proximal end (nearest to the crown of the plant) of root piece should always be up. The cuttings should be inserted vertically with the uppermost level of the rooting media.

b. Stem-cutting

Raising plants by stem-cuttings is one of the least expensive and easiest method of rose multiplication. Usually, stem cuttings give satisfactory results when rooted during the period from late June to November. Cuttings should normally be taken during the monsoon or spring. Each shoot should be cut clean just below the node and lower leaves removed.

Sand is the best rooting medium but vermiculite or perlite also gives satisfactory results. Addition of peat moss to the sand in proper proportions is useful as it increases the water-holding capacity of the medium. In case of Miniature roses, a mixture of perlite and peat moss in the ratio of 1 : 1 is good for rooting of cuttings. The cuttings are usually planted 3 cm apart in a row and 8 cm between rows and watered as per the need. Within a month or so, roots and shoots will develop from the cutting and in about a fortnight, the plants may be transplanted in another well prepared bed or in pots.

Regeneration of rose plants from cuttings is influenced by various factors such as type of cutting, treatment of cuttings, the age and physiological condition of the stock plant, type of wood selected for cuttings and environmental conditions during rooting. Hardwood cuttings are widely used in the propagation of rose rootstocks. Cultivars of Miniature roses are easily propagated by cuttings of soft-wood or semi- hardwood

under mist. Hardwood cuttings taken from basal and mid portion of the shoot shows much better rooting than those taken from apical cuttings.

5. Seed propagation

This method of propagation is generally adopted by breeders for developing new cultivars with desirable characters. When the fruits are fully ripe, they are harvested and thoroughly dried before the extraction of seeds. Most rose seeds when mature are in a resting condition requiring an after-ripening period before germination. Stratification of seeds at 1.6-4.4° C is required after harvest. Stratification for 6 weeks is sufficient for *Rosa multiflora*, *R. rugosa* and *R. hugonis* require 4-6 months, and *R. blanda* requires 10 months. Warm stratification followed by cold stratification has also been found beneficial in *Rosa canina* seeds which requires warm treatment at 26.6°c for 2 months followed by 3 months at 4.4°C for better germination. Hybrid rose seeds usually respond best to a stratification temperature of 1-4.4°C for 69-90 days.

Clean seeds are sown about 5 cm apart in pans or in small plots to raise the seedlings. Soil used for this purpose should be prepared adding a good quality of well rotten farm yard manure. Though the time of sowing mainly depends upon temperature, sowing in the months of October- November is ideal in most of the places. Seeds may take several weeks to germinate. Germination is probably pre-vented in rose seeds by inhibitors occurring in the seed coat, as well as by the mechanical restriction imposed by the massive pericarp. The stage of ripeness is an important factor effecting germination. Temperature is another very important factors influencing the germination. Treatment of seeds with sulphuric acid and for 1-2 hours before sowing was found to improves the germination.

Rose seedlings tend to flower even when they are very small and this exhaust themselves. Therefore, the flower buds should be pinched off as soon as they appear, until the plants are reasonably large and sturdy. It is important to keep the seedlings growing continuously without any check in development. A continuous moisture and nutrient supply, control of weeds and of diseases and pests contribute to successful seedling growth.

VII. Root Stocks

For grafting or budding, proper selection of rootstock is of immense importance. Rootstocks are known to impart marked effects on the vigorous, precocity, productivity, quality of flowers, longevity of bushes, disease resistance, adaptability to soil climatic conditions etc, and therefore, it is necessary to choose the most suitable rootstocks for budding or grafting roses. The rootstock should have the following qualities.

- i. It should produce fibrous root system.
- ii. It can easily be propagated from cuttings.
- iii. It should have vigorous growth habit, be healthy and resistant to diseases and frost.
- iv. Plants should have uniform growth.
- v. It should have a bark, thick enough to hold the bud firmly and provide sap to the budded plant.
- vi. It should be reasonably free from suckers
- vii. It should support the budded plant for a long time.
- viii. It should withstand a wide range of soils and climatic conditions.
- ix. Some of the commonly used rootstocks are given here.

a. Rosa barboniana (Edward rose)

It is one of the most popular stock and used extensively in the northern plains of India. Plants are hardy, vigorous, propagated easily by cuttings, provide straight stems of suitable length and is found useful for budding standards.

b. Rosa canina (Dog rose)

It is usually propagated by seed since the cuttings do not root easily. However, the seeds are difficult to germinate. The prominent thorns make it difficult to handle. It also tends to produce sucker.

c. Rosa indica

This is a large climbing shrub and is used extensively as rootstock for greenhouse forcing roses. It is easily propagated from cuttings and under suitable conditions produces a large symmetrical root system. It is well adapted to both excessively dry or wet soil conditions and can withstand high soil pH. Since it is not cold hardy, it should be used only in areas with mild winters. Plants raised on this rootstock are vigorous and produce flower with longer stems. The rootstock is also quite tolerant to powdery mildew and insect pests. In India, it has been recommended for northern plains.

d. Rosa laxa

This is well adapted to rich heavy soils and plants budded on it have vigorous growth. It can be propagated both by seed and cutting and have a very good root system.

e. Rosa manetti

This is a very old stock used for propagating dwarf roses and for planting in sandy soils. It is easily propagated from cuttings, produces plants of moderate vigour, and is resistant to some strains of verticillium wilt. This rootstock has, however, proved unsuitable for the production of cut flowers in greenhouse.

f. Rosa multiflora

This is a widely used rootstock for outdoor roses. Several strains are available, some giving better bud unions and bud development than others. Cuttings of this species root easily, develop a vigorous, nematode resistant root system, and do not sucker excessively. It is adaptable to a wide range of soil and climatic conditions. In India, it does well in Bihar, Bengal and in the hills when used as rootstocks.

VIII. Preparation of Beds

Preparation of soil is the key to success with roses. It should be rich, porous and well drained. The initial preparation of rose beds should preferably be started during summer season, so that soil gets exposed to sun and air and during the monsoon it gets a chance to settle down before planting. The area selected for rose growing should be cleaned of weeds. According to the plan, the borders of the proposed beds should be properly marked.

If the soil is light, sandy and stony, the top 30 cm of soil in the bed should be dug up to make trench. The dug up soil is heaped on the ground. The next 30 cm of soil in trench should be dug as deep as possible, and properly pulverized and levelled in the trench itself. After that about half portion of the dug out soil, heaped on the ground surface, should be returned to the trench. This layer needs manuring with organic manure @ 50- 60 tonnes/ha or FYM or compost. The remaining portion of the dug out soil should be returned to the trench. Application of superphosphate @ 30 kg/ha, and Aldrin or BHC (5% dust) @ 100 kg/ha is done, and the beds are irrigated thoroughly.

On the other hand, if the soil is heavy it would be necessary to dig out the second 30 cm layer of the soil and heap on the ground

surface. The next layer of the soil should be deeply dug, pulverized and levelled. The second layer of soil after it is pulverized and sun-dried, should be returned to the trench and manured with organic manure. @ 50 tonnes/ha. The remaining operations will be similar as in the case of sandy soil.

IX. Cultivation

Planting, pruning, application of manures and fertilizers, irrigation, weed control are some of the cultivation practices that are described here.

A. Planting

Few important preliminaries for planting are given here.

1. Cut away all immature, dead or diseased shoots and snags. Also as far as possible, each shoot to the next outward growing bud should be cut.
2. Remove all suckers growing below the point of union.
3. Reduce the possibility of loss of moisture, leaves including dried and yellow ones should be removed.
4. If the roses are with shriveled bark, immersing of the plants in water for 24 hours is necessary to plump them.
5. Immerse each plant in a suspension of one gram blitox in one litre of water to lessen the risk of attack of fungi.

At the planting time beds should be thoroughly prepared. At the planting time the soil should neither be too wet nor too dry. At each marked spot, a hole measuring 20-30 cm in diameter and 30 cm deep should be dug, and the plant with earth ball should be lowered into the hole. Then the soil around the plant should be pressed firm to avoid air pockets in the soil. The bed after planting should be thoroughly irrigated.

If the rose plants, are with bare roots, the roots along with stem up to the bud union should be dipped in water for about 6 hours before planting, to restore the loss of moisture during transit period.

Planting should be done with the bud union 2.5 -5.0 cm above the soil level. Roses can be planted any time except in very hot summer and during heavy rains when the soil is very wet. The suitable time for planting roses in most plains of India is during September-October and in the hills it is during October-November or February-March. In general a spacing of 60-75 cm between plants and rows is suggested.

B. Pruning

Pruning refers to the removal of certain portion of plant. It is an important operation for maintenance of floriferousness and flower quality along with vigour of rose plants. The practice of rose pruning consists of two operations.

- i. Thinning out, i.e. removal of old, weak, dry, twigs and diseased stem and branches from the point of start, and
- ii. Shortening of stems, which aims at cutting down of last years growth to a desirable height.

1. Pruning time

The best time of pruning is the period plant is at dormant or near dormant stage. Pruning time will depend entirely on the climatic conditions of the region. The most usual time for pruning is during October-November after the rains are well over and the cold season is approaching. In Bangalore and around the coastal towns of Madras and Bombay pruning is practised twice in the months of November and June for winter season and monsoon season blooms. Pruning in the hills by the end of March or April.

2. Where and how to prune

While pruning a plant a cut has been made at about half- a-centimeter above a vigorous bud and the cut should be slightly slanting, sharp and clean.

All wounds are dressed with cane scaler to protect against attack of fungus and cane boring insects. The cut surface may be painted with fungicide or chaubattia paint(prepared by mixing 4 parts of red lead, 4 parts of copper carbonate, 5 parts of linseed oil, and a small quantity of BHC). Spraying of insecticides like rogor or malathion immediately after pruning.

3. Types of pruning

Depending upon the extent and level of shortening, there are 3 types of pruning light, moderate and hard. In light pruning, the healthy shoots, left after thinning of diseased and unwanted portion, are cut. Moderate pruning is done by cutting back the ripe 'main and lateral shoots of the previous years growth at about half the length of the growth. Hard pruning consists of keeping only 3 or 4 shoots of the last year and heading back at about 3 or 4 eyes from the base.

As preliminary to the main pruning operation, all weak, diseased, dead and slender growing and overlapping branches are to be completely removed. In the remaining healthy growing shoots, the amount of pruning largely depends upon cultivar and class of rose, the health and vigour of the plant, space provided for each plant, fertility of soil and the desired flower quality etc. Generally, strong and sturdy plants are pruned lightly moderate growers moderately and weak plants relatively hard. If the soil is sandy, and the nutrient level in the soil is not high, pruning should be light. In case of heavy and fertile soils, pruning may be a little harder. Hard pruning is also advisable to obtain blooms with longer stems.

4. Pruning of one-year old plants

Rose plants should never be pruned until they are properly established and adapted to the new environment. In the first year of planting the pruning is done of weak, dead and crowded branches to give a definite shape to the plants. The real pruning starts in the second year of the growth of plants. viz. Hybrid Tea and Floribunda groups.

Climbing and rambling do not require any pruning except the removal of weak, unhealthy, dead and interlaced twigs. The polyanthas are pruned lightly whereas the miniatures are not pruned.

5. Pruning of established rose plants

i. Hybrid teas

The established Hybrid Teas should have all dead, weak, damaged and crossing shoots removed from their point of origin, leaving only 4 or 5 healthy basal shoots. It has been observed that hard pruning, reduces the number of flowers per bush but increases the flower size and the length of stem.

ii. Floribundas

The main object of pruning roses of this class is the production of abundant flowers with mass effect in the bed. It is necessary to remove the mass of twiggy growth at the ends of the main stems and extra growths should be trimmed. Thus light or moderate pruning is the general recommendation for floribundas.

iii. Polyanthas

The primary objects of pruning roses of this group are to obtain large number of flowers and to give a good shape to the plant. Thinning of dead, weak and overcrowded shoots and tripping of the end of branches that have already flowered are all that is really necessary.

iv. Miniatures

Miniatures roses are generally not pruned except the removal of dead, diseased and overcrowding branches. Some of the older stems may also be pruned to make a well balanced compact bush which is the most desirable character of this class.

v. Climbers and ramblers

The hybrid tea climbers hardly need any pruning because it is desirable to promote the growth of the lateral and side branches to bear flowers. The best flowers are produced on the short branches that emerge from older canes. So they require only removal of tips. The climbing Floribunda, Polyanthers and some shrubs of the Hybrid Musk group only bloom in the new wood.

vi. Standard

Standards which are generally hybrid teas or floribundas do not need drastic pruning. Growth which comes in the way of its main stem, should be removed to give symmetry to the plant.

vii. Shrubs

In general, the majority will not need any pruning but they may be cut back to keep them in shape. The weak and dead shoots should also be removed.

viii. Species of roses

Rose species and their allies also need no pruning. Once established and growing strongly, the dead and weak growth of the plants should be removed entirely from the base in the first year itself.

C. Manuring and fertilization

Rose is a nutrient loving plant and both major and micro nutrients play an Important role for its proper growth.

1. Manures

Organic manures like FYM, oil cakes, bone meal etc. are very essential which supply

plant nutrients and maintains a good soil structure. Green manuring with sunnhemp and dhaincha can also practised. For the light soils, cattle manure and for the heavy soils horse or pig manure are best suited.

a. Rate of application

Sandy soils need heavier and more frequent application of organic manure than heavier soils. Application of well decomposed cowdung or FYM @ 8-10 kg/plant (4.5 tonnes/ ha) has been found useful for the growth and flowering of roses.

b. Time and method of application

The bulky organic manures in order of preference may be FYM, compost, cow dung slurry from biogas plants, cattle dung and activated sludge. Oil cakes and droppings of poultry, sheep or goat (@ 1 litre/plant) may be used for supplemental manuring. The quantity of these manures is smaller than in the basic manuring. Basic manuring in case of new planting should be done at the time of preparation of rose beds.

Supplementary manuring should be done after the first flush of blowing is over and there is pause for the next flush. The manure should be spread in a band around each rose plant, at least 20-30 cm away from the stem or between the rows of plants.

c. Liquid manures

Manures are decomposed in water so that plant nutrients from complex organic forms are converted to simple soluble forms. The liquid when applied to the soil reaches the plant roots directly and provides them with nutrient elements in readily utilizable forms. Excreta of animals and oil cakes after rotting are also used as liquid manure. The diluted liquid becomes lighter than that of tea liquor. The liquid (about 1 litre) is put around each plant, about 20-25 cm away from the stem. The soil should be moist at the time of liquid manuring. The application may be repeated at an interval of 5- 7 days till the flower buds start opening.

2. Inorganic fertilizers

For sustained production a plant health it is essential to apply fertilizer to roses. Urea, single superphosphate and both potassium sulphate and muriate of potash are the widely used fertilizers. The most common practice is to apply these fertilizers mixed to the soil in certain proportions, known as fertilizer mixtures. Micronutrients are usually supplied through foliar sprays.

a. Fertilizer rates

For improving the growth and flowering of roses, some formulae of the mixtures are given here. (by weight)

i) Groundnut cake	-5kg
Bonemeal	-6kg
Ammoniumphosphate	-2 kg
Ammoniumsulphate	-1 kg
Single superphosphate	-2 kg
Potassium sulphate	-1 kg
ii) Nitrate of potash	-6 parts
Ammonium sulphate	2
Superphosphate	-16"
Sulphate of potash	-8"
Magnesium sulphate	-2
Iron phosphate	-1/2

This mixture is applied @ 50-100 g/plant.

b. Time and method of application

Fertilizers are applied in three split doses and application should be made when there is sufficient moisture in the soil. Normally, the first application of the mixture is given about 15 days after pruning when the new growth has started. After the first flush is over the second does of fertilizer mixture is applied.

The method of application varies according to plant density and size of the plants. If the plant density is low, the requisite quantity of fertilizers mixture can be applied in a continuous band around the plant, 20 -25 cm away from the stem. If the plant population is fairly large, the fertilizer dose should be fixed according to smaller units and placed in continuous band in between the rows of plants, also between the plants and edges of the borders. The applied fertilizers incorporated into the soil but should not be deep.

c. Liquid fertilizers

A solution prepared by dissolving 0.680 gm KNO_3 , 340 gm ammonium sulphate and 170 gm potassium phosphate in 432 litres of water and applied at the rate of half gallon per plant three times a week for a month and thereafter once a week before slow, produced outstanding blooms suitable for exhibition. Another solution prepared by dissolving ammonium sulphate, 56.6 gm superphosphate and 28.3 gm sulphate in 36 litres of water and applied at 9 litres per plant is also found very useful to improve the quality of flowers.

The advantage of this method is that the nutrients in solution reach the plant roots immediately for utilization. The disadvantages are the extra cost of application, the risk of toxicity and fixation of phosphates to soil, rendering it unavailable to plants. As a regular feeding of rose plants this practice seems unnecessary.

d. Foliar feeding

This is an excellent supplement to root feeding because the leaves can directly absorb the nutrients. At minimizes the amounts of fertilizer mixture used. The concentration of solution should not be very high (not more than 0.3%) it damages the leaves.

For supply of macronutrients, the composition of the spray solution should be 7 gm of potassium sulphate, 14 gm ammonium sulphate, 28.3 gm potassium nitrate in 36 litres of water and is applied @ 1.36 g/litre. Good results can also be obtained by using ammonium phosphate and potassium nitrate in equal proportions by weight, and applying the mixture @ 2.5 g/litre of water.

In case of micronutrient deficiency foliar application of a solution prepared from the mixture containing 15g manganese sulphate, 20 g magnesium sulphate, 109 chelated iron I and 5g borax @ 2g/litre has been found very effective for obtaining brighter colour in flowers and foliage.

e. Combination of organic and inorganic manures

A pot mixture of 14 kg castor-cake, 9.5 kg finely powdered charcoal, 226 gm super phosphate, 113.2 gm carbonate of potash, 113.2 gm nitrate of soda, 283 gm leaf mould and 45.5 kg loamy soil is helpful for obtaining increased yield of flowers.

D. Irrigation

Adequate soil moisture at all stages of vegetative growth and flowering is essential for the rose plants to meet the water loss through transplantation and evaporation from soil. Water requirement also depends upon the size of the plant and the growth period.

In lighter soil more frequent irrigation is required than that in heavy soil. Rose beds can be watered once a week or 10 days in winter and twice a week during summer season.

E. Mulching

Mulching conserve soil moisture, supply humus making material and suppress weeds resulting in improved growth and flowering. Mulches also keep the soil some what cooler in summer.

Among the substances used for mulching, well rotten garden compost, FYM, Peat, straw sawdust, ground or whole corn cobs and other similar materials make satisfactory mulches. Mulches can be applied soon after the newly benched plants are established and growing satisfactorily.

F. Hoeing

Light hoeing is a very effective way to keep the soil porous so that light, air and water may reach the roots better to improve moisture retention capacity and to keep rose beds free from weeds. Roses are shallow rooted plants and roots of established plants tend to grow near the surface. Therefore, shallow hoeing is preferred.

G. Weed control

Weeds pose a very serious problem in rose cultivation as they not only consume water and nutrients from the soil, but also act as hosts for a number of diseases and pests. Manual weed control is effective if done frequently. Chemical weed control is comparatively economical, convenient and efficient in eradicating weeds. Application of CMU and DCMU four to five weeks after planting in late December and early January controls all weeds, in a rose nursery.

X. Diseases and Pests

Major diseases and pests on rose are given here.

A. Diseases

Like any other crop, roses are also prone to many diseases, some of which have been found to be very destructive. The most important diseases and the measures for their control are described here.

1. Die-back

The causal organism is a fungus namely *Diplodia rosarum*. The disease causes death of the plant from top to downwards.

When plants are pruned, sometimes, blackening of twigs starts below the pruned surface which extends further down, killing the whole plant. The older plants are more prone to the attack of the disease.

Control

- a. Cut the affected parts and burn it.
- b. The secateur should be disinfected with spirit and the cut ends immediately coated with a paste containing 4 parts of copper carbonate, 4 parts of red lead, and 5 parts of linseed oil.
- c. Add 0.1 % BHC to the paste to check the digger wasp attack.
- d. Grow resistant varieties like white Christmas, royal ascot, blue moon and crimson glory .

2. Black spot

This disease is caused by *Diplocarpon rosae* characterized by dark brown, circular spots with fringe borders, present on both sides of leaflets. At a later stage, the leaves becomes yellow and fall. If left uncontrolled, the whole stem is defoliated and the plant becomes weak. Leaf buds and the flower buds are also affected.

Control

Since the black spot fungus is located under the protecting cuticle, no fungicide can kill it without destroying the leaf. Hence, cure of this disease is difficult and prevention seems to be the only hope. The infected leaves, as soon as they are observed should be clipped off, taken out of field and burnt. Preventive sprays of fungicides like Zineb reduce the damage to a large extent. Martin Frobrisher, Belaya , John Cabot, and Carefree Beauty are also found to be resistant to black spot disease.

3. Rose wilt

It is a viral disease caused by *Marmor flaccumfascines*. The first symptom appears in the form of recurving of leaflets at the tip

of young shoots which are brittle. Defoliation may happen, with leaves turning yellow and falling off. The stem also gets infected and the whole plant dies. In epidemic form, one infected plant could ruin the whole garden within a couple of years.

Control

Control of aphids, which transmit the disease, helps to control the infection. The affected plants should be removed and burnt.

4. Rose mosaic virus

Chlorotic areas along the midribs of the leaflets and localized distortion are the principal symptoms. Sometimes one finds ring and watermark pattern. Another strain of this virus causes brighter and light yellow patterns.

Control

Diseased plants should be destroyed and never used for propagation.

B. Pests

Roses attract a large number of pests which cause considerable damage. At almost every stage, be in the nursery or in beds, rose plants are prone to attack by various pests. Some of the commonly reported insects and other pests attacking roses are mentioned in detail here.

1. White ants

White ants also known as termites cause damage to rose plants even before they are established. Small colonies are formed inside the soil and the insects multiply very rapidly during the rainy season. The insects destroy the underground parts including the roots of the young as well as old plants. Sometimes rose plants wither.

Control

Apply .5% BHC or Aldrin in the pits before planting roses. Drenching of rose beds with Aldrin also controls the damage in established gardens.

2. Red scales

They infest roses in the green house and in the garden and the affected branches become dry. The insects can easily be detected by the reddish brown encrustations on the lower portion of old stem and at times the younger shoots also which sucks the plant sap.

Control

The menace can be removed by rubbing the scurfy encrustations with a used tooth brush, or a cotton swab dipped in methylated spirit. Spraying the affected plants with insecticides like malathion or rogor will control the insect. Application of granular insecticides like carbofuron at 1.5 kg a.i./ha and Disulfoton and Phorate at 3.0 kg a.i. /ha also gives good control of rose scales.

3. Jassids (Leaf hopper)

These are very small, light grey or pale green insects which suck the cell sap from the leaves. It causes yellowing or whitening of the attacked surface, giving the plants a sickly appearance.

Control

Jassids can easily be controlled by spraying with 0.03% parathion, 0.1% Metacid or 8% Thimet as soil application. The use of 0.05% Monocrotophos is also effective in controlling jassids.

4. Red spider mite

As result of their feeding, white specks appear on the leaves and these specks coalesce and appear as white patches. Ultimately, affected leaves become mottled, turn yellow and fall. Some polyantha and floribunda roses completely lose their leaves prematurely due to the attack of this pest. The damage is more pronounced during warm and dry season.

Control

Frequent spray with sulphur helps to control this mite. Several mite-killers such as

kelthane morestan, dimite, Tedion have been reported to be very effective in controlling rose mites, 1 ml of kelthane is thoroughly mixed with 10 m of water with 10-15 drops of any sticker and application of this chemical every 5 or 6 days may be sufficient to control the mites. Spraying the affected plants with 0.05% parathion or 0.1 % Metasystox is also suggested.

XI. Harvesting and Post-harvest Handling

Time and stage of harvesting, storing and transportation of the flowers are the important aspects to be considered.

A. Harvesting

The stage at which flowers should be cut, either for decoration or for despatch, is the tight-bud stage when the buds show full colour but the petals have not yet started unfolding. If harvested at this stage, they last longer and retain colour and freshness during transportation. If a flower bud of red cultivar cut at a little earlier stage it fails to open later. Pink and red cultivars should be allowed to develop to a stage where one or two of the outer petals begin to unfurl. Loose flowers, used for making garlands, preparing perfumes etc. are harvested only when they are fully open and collected in large open baskets.

The flowers should be cut in the early morning before sunrise or late in the afternoon when the sun is about to set as to avoid damage of buds due to high temperature during the day. Late harvest results in short vase life of cut flowers and low oil content in loose flowers used for preparing perfumes. For cut flowers, stem with two, five leaflet leaves should be cut and immediately dipped into clean water up to the base of the flower buds. The delay in keeping the flowers in a bucket of water will cause air entry and result in vascular blockage. The stems should be cut in water

about 2 cm above the previous cut end. If they are not required for immediate use, the cut-flowers along with stems dipped in water in the bucket should be stored at a cool air temperature of 4.4 -7.2 C for about 6-12 hours to harden the buds and thus enhances their keeping quality. During winter (December-January) a shorter treatment for 6-8 hours is sufficient while a longer duration of 8-12 hours is required in March-April.

B. Packaging

The cut blooms are graded according to the length of stem and then packed in corrugated card-board boxes. The size of box varies with the quality and quantity of roses to be packed. The inside area of the box will be cushioned with polythene or soft materials. The blooms are generally packed in bundles. The upper half of each bundle having flower buds is wrapped in a corrugated paper which is fixed with an adhesive tape. Labeled flower bundles are placed opposite to another in such a way that their flower buds face the sides of the box and their stem ends towards the centre of the box. The inside of the box is finally covered with a sheet of tissue paper before putting on the cover of the box. Along the outer edges of the box, adhesive tapes can be fixed to close it.

C. Yield

The yield of cut-flower depends on a number of factors such as type of cultivar, and cultural practices adopted from time to time. Gold strike and pink garnette, are high yielding cultivars which produces 24-28 flowers per plant. Sonora and Coral princess give low yields (15 flowers per plant per years) of 60% grade. Plant density has much influence on the yield of quality blooms per unit area. About 1,20, 000 cut flowers of exportable quality from an area of one hectare is obtained by close planting and providing plastic cover over the plants during November-February. In an essential oil-bearing rose, a yield of 6977

kg petals per hectare was recorded when planting was done at 2.5 x 0.5 cm apart. One of the best methods for maximization in yield and quality of flower is through balanced application of fertilizers.

XII. Importance and Uses

The rose, because of its utility, occupies a pre-eminent, place amongst the flower crops and is one of the oldest of fragrant flowers to be cultivated by man. Its different types having beautiful flowers of exquisite shape, different sizes, bewitching colours and most delightful fragrance has made it an important flower or its varied uses. The various ways in which rose can be used are mentioned in detail here.

A. Exhibition and decorative purposes

Varieties of roses which are most suitable to a particular type of decoration are given here.

1. Shrub or bush

Shrub or bush roses are planted in small groups at a height of 5-10cm from the ground level to create excellent mass effect in a rose or flower garden. They may also be mixed with other plants in a shrubbery, e.g. christian, midele double delight, first prize, gladiator, kiss of fire, midle meilland, montezuma, paradise, peace and super star.

2. Standard Rose

Standard rose or tree rose, is a very important feature in the rose garden. They are allowed to form buds only at the top leaving the entire stem clear of any vegetative growth. According to their height of budding they may be full standard (1.0 -1.5 metres high), half standards (45-60 cm high) or weeping standard (1.6 5m or higher above the ground). Hybrid Teas and few grandiflora are suitable for making the frill standard roses. Floribunda and Polyantha roses are excellent for growing as half standards. For weeping

standards, climbing and rambling roses are used as the long branches of the crown may be allowed to hang down.

3. Climbers

The climbing and rambling roses can be used to cover the walls of houses or fencing or pergolas, arbours and arches. Ramblers produce flowers only once in a year and flowers are in clusters lasting for several weeks. The beautiful climbers and Ramblers like America pillar, Blaze, Delhi Pink Pearl, Don Juan, Golden showers, Lamargue, Mardan white, Mardan Pink, Marechal Neil, royal gold add to the beauty of the garden.

4. Hedges and edges

A rose can also be used for making hedge or edge. Rose hedges except when pruned, remain full of life and colour and give protection due to the presence of thorns. Vigorous Floribundas are suitable for hedge and if necessary the plants can be planted in two rows. Some suitable cultivars are Border coral, Circus, Frensham and Runiba, Climbing or rambling roses may also be used for making tall hedges. Rose cultivars like coral in, Lady Reading, Magic, white Button etc. may be used for making edges.

5. Rockery

Roses may also be grown in rockeries and for this purpose hardy miniature and pompon cultivars such as Fairy Queen and Magic may be selected.

6. Pot plants

Roses can be easily grown as pot plants in suitable containers kept both indoors as well as outdoors. For balconies and terraces which receive limited sunlight miniatures and dwarf polyanthas should be selected. The cultivars like Baby Darling, Cinderella, Starina etc. are quite suitable for this purpose. Bush roses may also be grown in pots for beautifying the compounds around the building and for display in rose shows.

7. Hangers

Miniatures can also be grown in hanging baskets and cultivars suitable for making rose hangers are climbing Miniatures-Red cascade and Yellow Doll.

B. Cut-flowers

Apart from making garlands, bouquets, button-holes their use for worship in temples, rose makes one of the best cutflowers and as such is in great demand in the internal as well as foreign markets. Germany is the biggest consumer and importer of cut-flowers. Rose cut-flowers are being exported from Maharashtra (India) to the Middle East countries.

Rose cut-flowers arranged in flower vases looks extremely beautiful and they have a rightful place in the scheme of interior decoration. In general, cultivars with more petalage and opening slowly with long lasting quality are chosen as cut flowers. Some of the cultivars suitable for this purpose are Christian Dior, Happiness, Montezuma, Queen Elizabeth, Sea pearl and Super star. Presently cvs. Belinda, golden times, Illona, Laminuette, Montreal, Mercedes, Red success, Somia Meiland are in great demand as cut-flower in foreign markets. Two Indian or Arjuna and Raktagandha producing flowers with long stems are also suitable for cut-flowers.

C. Perfume and allied products

Oils, perfumes and other products made from rose petals are of superior quality.

I. Rose oil (Rose perfume)

Rose oil is an important commercial product obtained from rose petals. Apart from sweet fragrance it has medicinal value and is often used in Ayurveda. Bulgarian rose is largely used in perfuming soaps and cosmetics. Limited quantities of the oil are used in flavouring soft drinks and alcoholic liquors.

Rose oil has antibacterial property. The commonly grown rose species for rose oil are *Rosa damascena*, *R. borbonians*, *R. centifolia*, *R. alba* and *R. Gallica*. In India, *R. damascena* and *R. borborniane* are cultivated for rose oil.

Though France, Cyprus, Greece, India, Iran, Italy, Morocco and the USA are important countries producing roseoil, Bulgaria is a major producer and exporter of the roses and the rose perfumery .The oil is extracted by steam distillation and its quality depends much and cultivars and stage of picking. Generally 1 Kg oil is obtained from 3,000-4,000 kg petals. Among the different species, *R. Damascena* gives the maximum oil yield. *R. borboniana* and *R. teptiz* are also good. The principal constituents of normal rose oil are l-citronellol (40-65%), Geraniol, neroll-linalool, phenyl ethyl alcohol, small quantities of esters, nonyl aldehyde, citral, engenol sesquiter penes and the vaxy constituent stearoptene.

To obtain good quality rose oil, the flowers are to be harvested early in the morning, as the percentage of volatile oil decreases with the advancing day.

2. Rose water

Rose water is also an important commercial product obtained from rose petals. It is used as a perfume and in medicines and confectionary. It has the property of cooling the body and is often used in eye lotion and eye drops for its soothing qualities. It is also used in drinking water and social occasions. The roses used for preparing oil are also used for making rose water.

3. Gulkand

Rose petals are also preserved for direct consumption by making gulkand which is prepared by pounding equal proportions of

petals and white sugar. It is considered both a tonic and laxative. *Rose damascena*, *R. chinem's.*, *R. Gallica*, *R. ponifera* and some other scented roses. e.g. Edouard are used for preparing gulkand.

4. Pankhuri

Dried rose petals are known as 'pankhuri' which is occasionally used for preparing sweetened cold drinks.

5. Gul-roghan

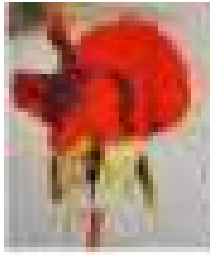
It is a rose hair oil prepared from rose petals by enflurage with wet sesamum seeds.

D. Source of vitamins

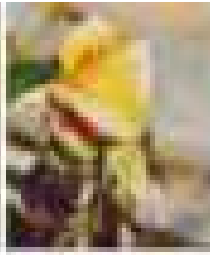
Rose hips are a very good source of ascorbic acid, i.e. vitamin C. Every 100g of rose hips syrup contains 150 mg of ascorbic acid as compared with only 50 mg present in fresh orange juice, 20 mg in tomatoes and 5 mg in apples. The ascorbic acid content, however, varies with species and some of the promising vitamin C bearing species are *R. rugosa*, *R. ambhyotis*, *R. aciculari* *R. davaricas*, *R. pendulina*, *R. glauca* and *R. canina*. Apart from Vitamin C, the hips of *R. roxburghil*, *R. acicularis*, *R. rugosa*, *R. davorica* and some of the species are found to contain vitamins, A_i, B₂, K and E.

E. Other Uses

In Europe, roses are used for making pot-pouri, conserves, rose vinegar and rose petal wine. Jams, jellies and syrups have been made for centuries in Bulgaria and exported. Rose aids in digestion and has certain curative properties. In Czechoslovakla, fruits of wild roses are used for preparing a hot drink like tea and a popular wine. In America, bushes of *R. multiflora* are utilized as shock absorber or crash barrier.



Hybrid tea Black tea Brownish red



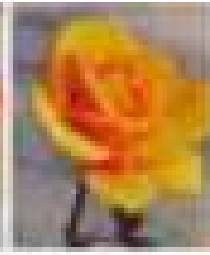
HT rose Hotel calofornia Yellow



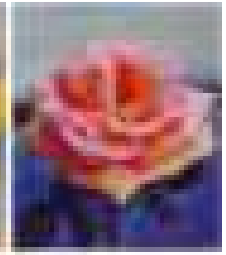
HT rose scandia Mauveblend



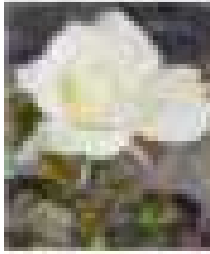
HT rose sweet water Salmon orange



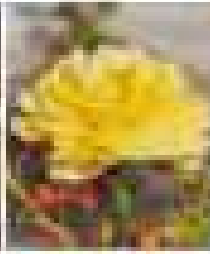
HT rose sungodess Golden



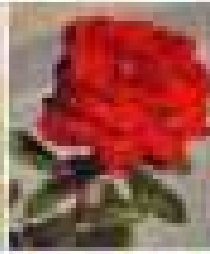
HT rose scentsation Peach blend



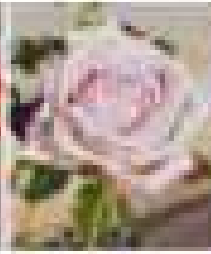
Hybrid tea White arrow White



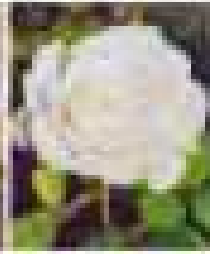
Hybrid tea Kanchan Yellow



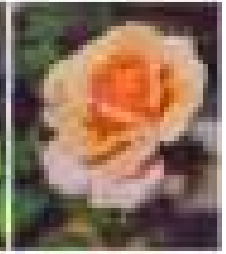
Hybrid tea Norma Red



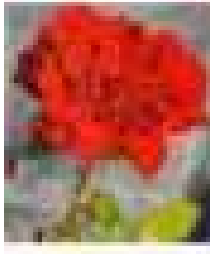
Hybrid tea Majestic Pink



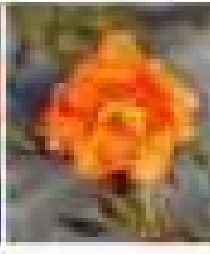
Hybrid tea Maria shriver White



HT Rose Mother of pearl Pink with apricot



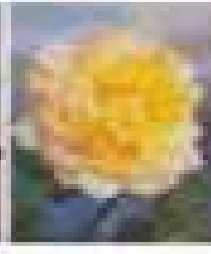
HT Rose Marcel pagnol Red



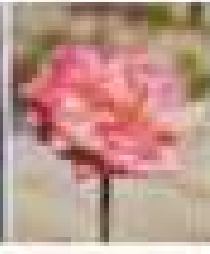
HT Rose Hot romance Orange blend



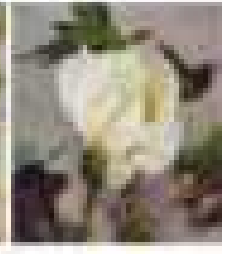
HT Rose Elvis White



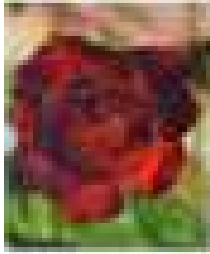
HT rose Shanghai autumn Yellow blend



HT rose Sweet promise salmon orange



HT rose Delicate beauty White



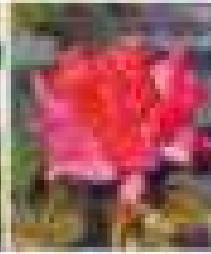
HT Rose Ashwini Blackish crimson



HT rose dream come true Bicolour



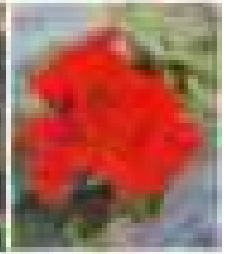
HT Rose Celebration day Pink blend



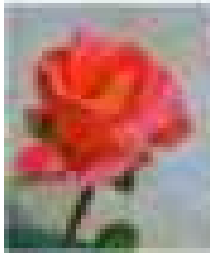
HT Rose Espresso Chocolate vermilio



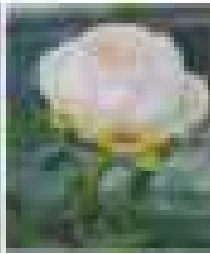
HT Rose lco delight sport White



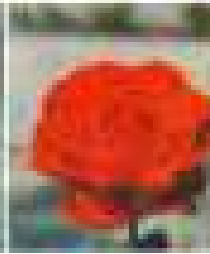
HT Rose Rose osaca Deep red



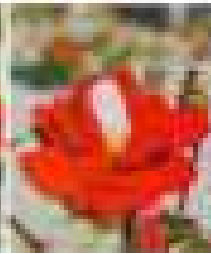
HT Rose Ksg manas Salmon yellow blend



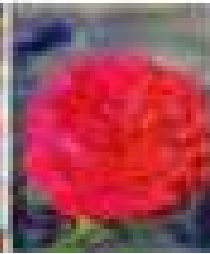
HT Rose Lily the pink Pink



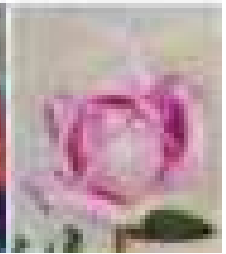
HT Rose Reba mcintire Deep Orange



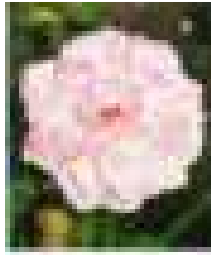
HT Rose Fire and ice Bicolour



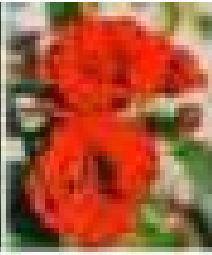
HT Rose Janice Kellog Red



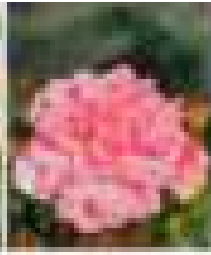
HT Rose Blue time Mouve



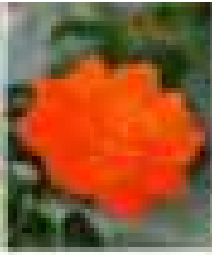
Floribunda cream abundance Creamy pink



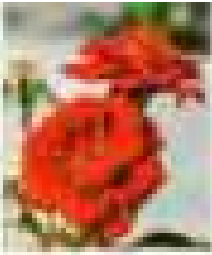
Floribunda Lavaglut Blackish red



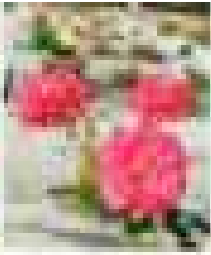
Floribunda bewitched Fuchsia pink



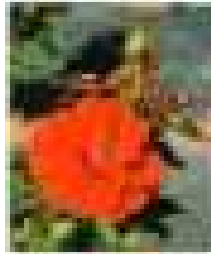
Floribunda living fire Bicolour



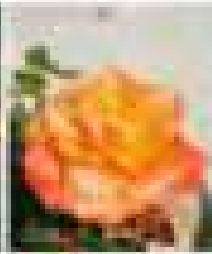
Floribunda raven Red



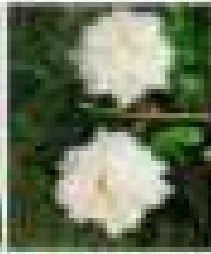
Floribunda deep purple Deep lavender



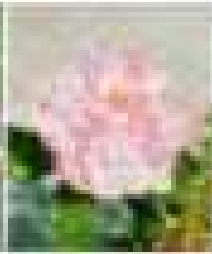
Floribunda remembrance Scarlet



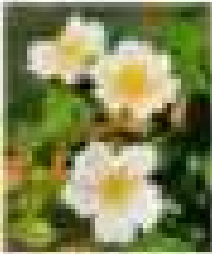
Floribunda Harkness marigold Peach blend



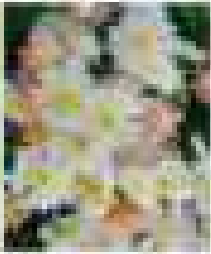
Floribunda Clara Silvery white



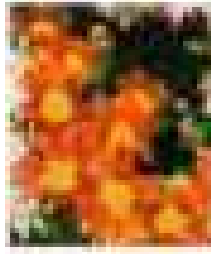
Floribund Home & Garden Pink



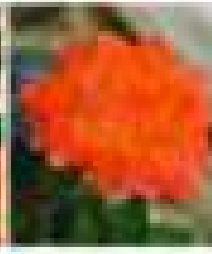
Floribunda Gebruder grimm Bicolour



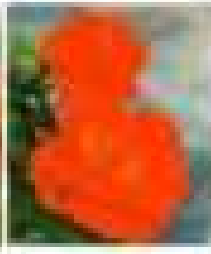
Floribunda Irene Apricot blend



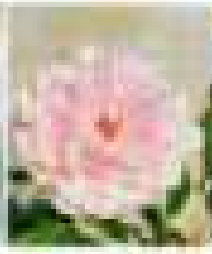
Floribunda Embrsement Scarlet crimson



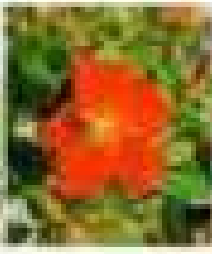
Floribunda Autumn spray multi colour



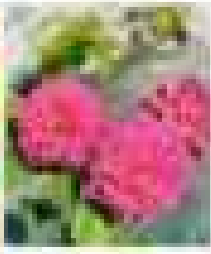
Floribunda For your with love Orange vermilion



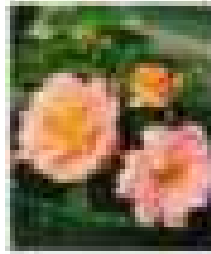
Floribunda Roserarses de chatlet Pink



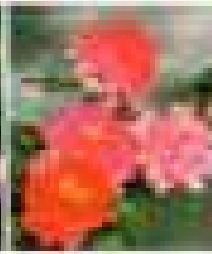
Floribunda Red hot Red



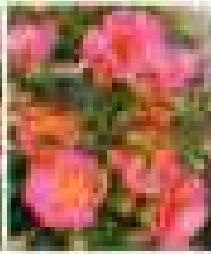
Floribunda Ebbtide Purple



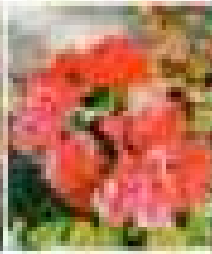
Floribunda Cubana Brilliant apricot



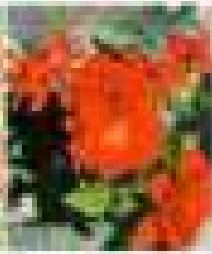
Floribunda Love struck Pink



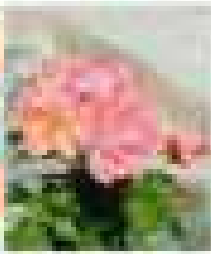
Floribunda Neon Multi colour



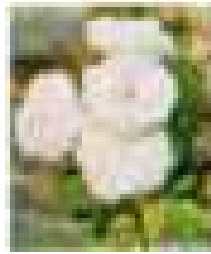
Floribunda Red Finess Red



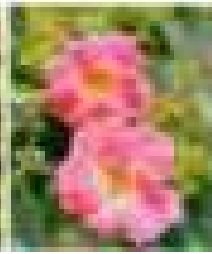
Floribunda Profumo Rosso Red



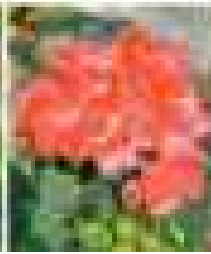
Floribunda Gisella Coral pink



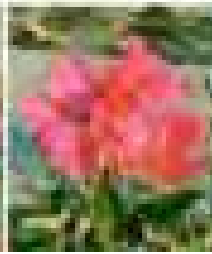
Floribunda Fairy White White



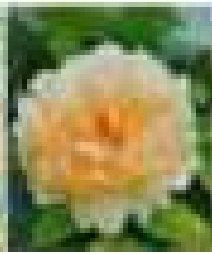
Floribunda Bad Worishofen Rosepink



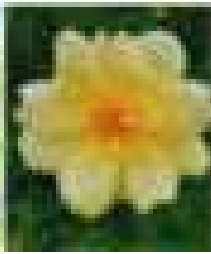
Floribunda Bad brambach Pink



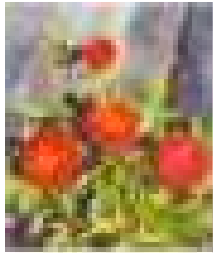
Floribunda Careless Beauty Pink



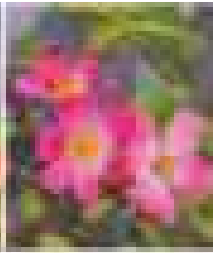
Floribunda Silvina Donvito Yellow blend



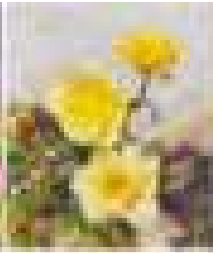
Floribunda Golden memories Yellow



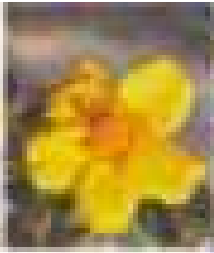
Miniature Phoenix
Bright red



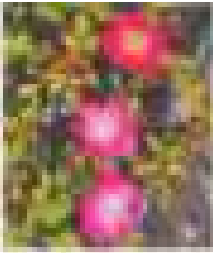
Miniature Candy
free Pink



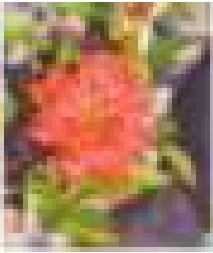
Miniature yellow
fairy Yellow



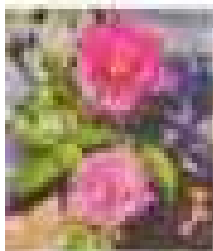
Miniature Baby
love Yellow



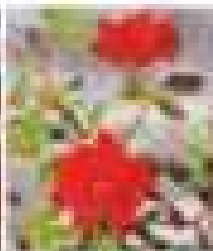
Miniature Lupo
Bright pink



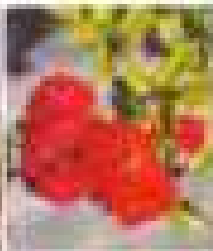
Miniature
Petitefolie
Vermillion Orange



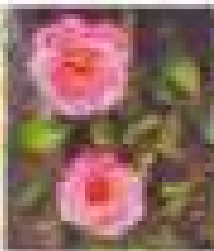
Miniature Incognito
Lavender gold



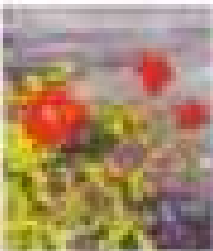
Miniature Red
beauty Dark red



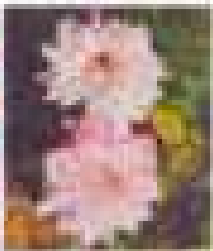
Miniature Red fairy
Scarlet red



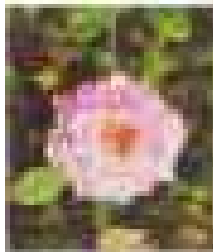
Miniature Magic
carrousal White &
pink



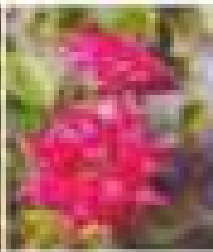
Miniature Spray
delight Scarlet



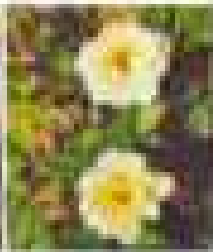
Miniature Choo
Choo Soft pink



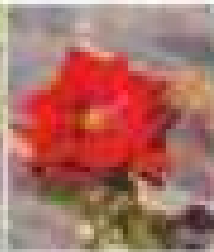
Miniature Libby
White & pink



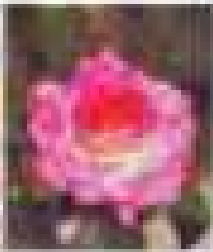
Miniature Wild
plum Lavender



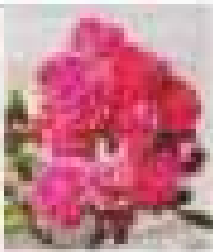
Miniature Flower
power gold Yellow



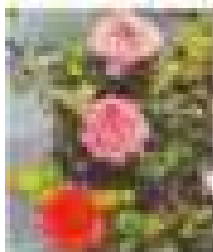
Miniature George
best Red



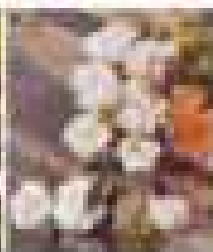
Miniature Janna
sport Bright pink



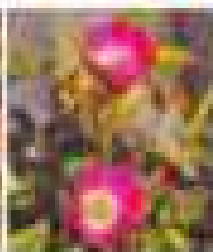
Miniature Pink puff
Pink



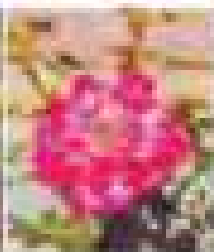
Miniature Cindy
Carmine pink



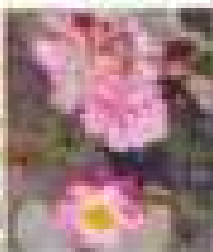
Miniature Ice fairy
Ice white



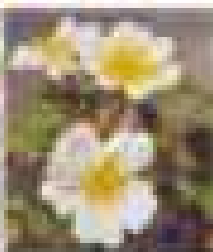
Miniature Sanjit
Pink



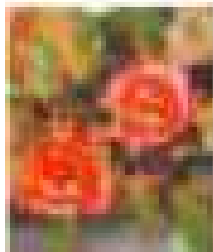
Miniature Hot &
howler



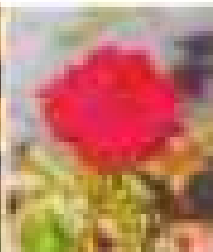
Miniature Happy
trail Bright pink



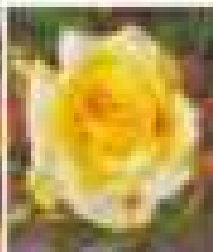
Miniature Tear
drops White



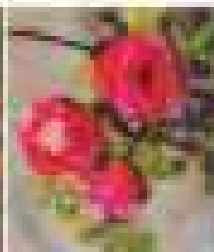
Miniature Hula girl
Orange



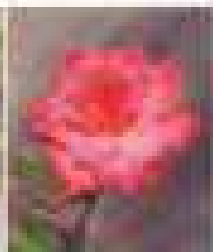
Miniature Don don
Red



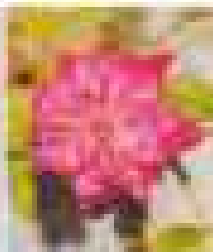
Miniature Careless
moment Bicolour



Miniature Blue
blood Red



Miniature Orange
flame Orange



Miniature Over the
rainbow Pink blend

CHAPTER - 15

LAWNS

Some facts about Lawns:

Lawns and yards transform strangers into neighbors, neighbors into neighborhoods, and neighborhoods into communities.

Rainfall, Erosion and Recharge:

- Lawns are ten times better at soaking up rainfall than crop farms, they serve as rainwater harvesting pits.
- Grass is exceptionally good at preventing erosion. Rain will remove up to 2200% more top soil from bare earth than from a lawn. Properties of Grass:
- Grass is the only plant which responds to severe cutting with increased growth.

Cleaning up pollutants:

- The microorganisms in a turf grass/soil ecosystem can clean up petroleum products, metals such as lead, copper, zinc, and cadmi-um, and a variety of organic chemicals, including pesticides.
- An acre of grass will absorb hundreds of pounds of sulfur dioxide every year.
- Lawn grass can be used as the last step for treating domestic wastewater.

The Lawn Ecosystem:

- A turf grass ecosystem the size of a football field can support up to 13 lakhs earthworms.
- Grass enriches the soil by adding over 2600 kgs of organic matter each year to an area the size of a football field.

Watering:

- Lawns require less water than shrubs or trees.

- Excessive usage rates for watering are a people problem, not a plant problem.
- Restrictions on watering and irrigation during local drought conditions can save potentially significant amounts of municipal water with no lasting harm to lawns that are allowed to go dormant. But the restrictions have to be done right.

Lawns & the Environment:

- A 50' x 50' square of healthy lawn supplies enough oxygen for a family of four.
- More and more homeowners are leaving grass clippings on the lawn where they belong and where microorganisms can recycle the nutrients.
- Lawn pesticides are not harming the environment. Lawn fertilizers properly applied at the right times will stay in the lawn. They will not be washed away by rain or leached down into the subsoil.
- They stay where they are applied, and they are broken down into benign components in short periods of time. They do not accumulate. Where traces are found, they are in harmlessly low concentrations of a few parts per billion.

Lawns & Health:

- Regularly mowed lawns will produce a minimum of pollen and look green all around the year.
- Nothing beats turf for safety and comfort on play areas of children and recreational areas.
- Majority of the gardeners who do all or part of their own yard work; consider it a healthy physical and mental exercise.

- A well-tended lawn and garden will harbor fewer snakes, rodents, mosquitoes, ticks etc. than untended areas.
- 60% of the garden lovers say that the primary benefit of their avocation is peacefulness and tranquility.
- Horticultural therapy is a recognized therapeutic tool.

The Economics of Lawns:

- Homeowners say a well-maintained lawn can add 15% to the selling price of a home. Appraisers estimate that attractive landscaping adds at least 7% to the appraised value of residential property.

Grass & Lawns:

S. No.	Name	Common Name
1.	Cynadon dactylon.Sp	Bermuda Grass
2.	Cynodon dactylon.Sp	Calcutta Doob Grass
3.	Festuca.Sp	Fescue Grass
4.	Paspalum notatum	Buffalo Grass
5.	Poa prapensis	Kentucky Blue Grass
6.	Stenotephrum secundatum	St. Augustine Grass
7.	Stenotephrum secundatum Ver	St. Augustine Variegated
8.	Zoysia japonica	Jade Velvet Grass
9.	Zoyasia matarella	Korean Carpet Grass
10.	Zoysia teunifolia	Mexican Grass

Lawns:

1. Turfed lawns give instant garden effect. Even the dibbled lawns take good shape within 2-3 months time.

2. Lawns prevent dust rising and avoids slushiness during rains, and provide good pavement effect.
3. Walking bare footed on lawns gives best satisfaction and health.
4. Will act as backdrop for other garden features like flower beds, edges, shrub, ground covers.
5. Lawns are the best permanent ground covers.
6. Lawns provide excellent sit out place for the family and small gatherings.
7. It is cool and refreshing in summer. It is pleasant and relaxing in winter.
8. For children lawns provide an excellent space for playing.
9. Any home garden is incomplete without a lawn, smaller or bigger.

Tips for Lawn Laying:

1. Dig out the soil for 16” depth.
2. Pick out weeds, stones, Bricks etc.,
3. Give required shape as gentle slope, terraces, mounds etc.,
4. Spread 4”-6” thickness of weed free red soil, break clods.
5. Wet the land and if there are any shrinkages cover with extra red soil.
6. Turfing or dibbling of selected lawn species such as Calcutta doob, Fescue, Burmuda varieties like Sun bird, transcontinenta I, Mexican or Korean Carpet etc.,
7. Immediately after dibbling sprinkle water, followed by regular daily watering.
8. Rolling of lawn may be done for better set.
9. Application of neem cake, urea, vermicompost and water whenever lawn become pale green or sickly.
10. Periodic lawn mowing and spraying. (Mow Fescue or Burmuda grasses every 15 days and carpet grass every 60 days).

Turf Varieties



Hybrid Bermuda Selection 1 (*Cynodon Dactylon*)

Fast growing soft variety, suitable for well drained areas with moderate rainfall. Easy to care, suitable for very large areas. Repairs itself quickly from damage caused by sports fields, party lawns and public parks. Resistant to drought meaning it is kept in top condition.



Koroara (*Zoysia Matrella*)

Slow growing dense grass, slightly shade tolerant, requiring infrequent mowing at a level of 5". Used for small areas, established, slightly coarse and a little prickly. Mowing this variety is comparatively difficult.



Paspalum (*Paspalum Notatum*)

Suitable for all areas including very heavy rainfall and large lawns. Tolerant to shade. A very easy maintenance Grass, aggressively self-repairing seeds.

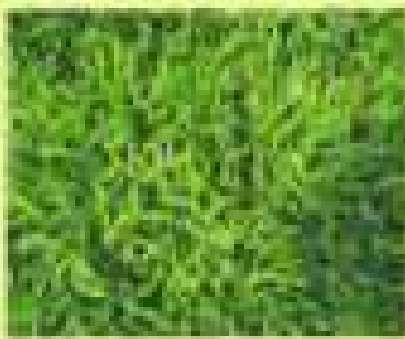


St. Augustine Grass (*Stenotaphrum Secundatum*)

Dark green dense grass, broad flat blades, extremely leaves in "runner". Easy to care as ground cover, underneath trees. Tolerates heavy rainfall, most suitable to establish a difficult situation where grass cannot be put due to shade.



Turf Varieties



Centipede (Erasmetris Cymatodes)

Warm-season lawn grass with fine to coarse textured grass blades, requires low fertilization & maintenance. Excellent growth in broad climates, withstands major submergence. Ideal for large to small with heavy traffic and broad climate such as the Southeast.



Turf Selection Guide

Variety	Color	Texture	Shade Tolerance	Maintenance	Ideal For
Hybrid Bermuda Selection 1	Dark Green 	Very fine and soft	II	Moderate to High	Sports Fields, Public Greens, sunny areas of heavy usage
Green Crystal (Majestic)	Leaf Green 	Medium coarse, stiff and dry	II	Moderate	Small areas, light use, extra effects
Paspalum Notatum	Emerald Green 	Medium coarse	III	Low	Landscape, ground cover and erosion control, shaded areas
St. Augustine Green	Dark Green 	Stiff-coarse	III	Moderate	Landscape, ground cover and erosion control, shaded areas
Centipede	Medium Green 	Medium coarse	IV	Lowest	Heavy use, Public Greens, coastal areas

*The color reflected during a full sun. The actual green color and look depending on soil fertility & climate conditions.

CHAPTER - 16

CHRYSANTHEMUM

Chrysanthemum is next only to rose in importance among the flowers in the world. It is versatile, can be planted in the bed, cultured in the pot, used for garland-making and also as cut flower for flower arrangement.

Chrysanthemum Blooms are Two Types

- a. Disc-floret situated, in the center, tubular with five united petals. They are usually shorter and contain both male and female reproductive parts; they are called perfect flowers
- b. Ray-floret which surround the disc-florets and are comparatively longer, vary in shape, colour and direction of growth. The ray-florets are called imperfect flowers as they contain only the female reproductive parts.

Growing Requirements of Chrysanthemum

Chrysanthemum plants are easiest of all perennials to grow

1. Produce large number of flowers if they are planted / placed in full sunshine. They respond to plenty of food and moisture
2. There are hundreds of varieties of Chrysanthemums, giving you a multitude of options for height, colour, flower size and time of bloom. You can pick and choose to fit your wants and needs when you visit the Nursery.
3. They should be planted into well-prepared, fertile, sandy media, they resent 'WET FOOT'.

Cultivation

1. Chrysanthemum plants have a fibrous root system which is sensitive to waterlogging, prone to attack by diseases and pests, but, fairly tolerant to drought.
2. Ideal soil mixture pH to be 6.2-6.7 is required.
3. Light. Chrysanthemum plants continue to grow vegetatively till the nights are shorter than critical level (9 1/2 hr for most traditium 'I varieties.)
4. Temperature : The growth rate in chrysanthemum remains at low level at or below 10°C. As the temperature is raised to 15°C the growth rate increases rapidly.

Cultural Practices

1. Propagation Age-old method of propagation from suckers, it is easy to establish and almost no mortality and easy take-off due to already persistent roots. However cuttings also root well
2. Feeding : In early stages supply nitrogen using only organic manures. Phosphorus is best applied as basal dressing since it is released slowly. Proportion of Potassium should be increased as the flower buds appear.
3. Water management : The frequency of watering depends on the stage of growth, soil and weather conditions. Avoid water logging during the rainy season. Potted plants are either provided temporary shelter or kept in horizontal position during the constant downpour.

4. Nipping of growing tips encourages multiple branching and results better plant shape and more flowers.

Plant Protection

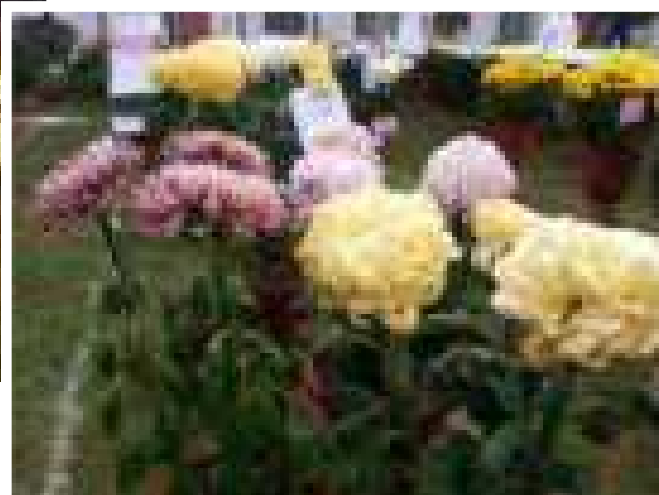
Pests

1. Aphids and Thrips (Sucking pests) : Spraying of mild insecticides like tobacco leaf decoction or malathion 2m1 / liter of water is effective against them.
2. Red spider mite : Spraying with Metasystox or Kelthane 2m1/liter of water controls the pest
3. Hairy caterpillar (*Diacrsia obliqua*) : Manual collection in mild attacks and spray of Ekalux 2m1/litre of water at weekly intervals in heavy infestation.
4. Grub (*Holotrichia*) : Soil application of Carbofuran 3G 10gms/cubic feet of soil in the pot.

Diseases

1. Root rot (caused by *Pythium* spp. or *Rhizoctonia* sp.) : Use sterilized medium, and treatment of cuttings and the medium with Thiram and Captan effectively control it

2. Leaf spot (caused by *Septoria Chrysanthemella*) : Greyish brown spots appear on leaves which turn yellow and ultimately die. The disease spreads from below upwards. It can be controlled by Bavistin 1gms or Dithane M-45 3gms/litre of water
3. Wilt (caused by *Verticillium*) : The leaves turn yellow to grey and the branch or whole plant gradually. The use of disease-free planting material and planting in sterilized medium prevent the infection.
4. Stunt (caused by stunt virus) : Spreads by mechanical means through cutting knife or scateur resulting in the overall dwarfing, paleness in leaf colour and the appearance of small yellow green dots in summer in some varieties.
5. A spermy (caused by aspermy virus) : This virus is transmitted by aphids and results in distortion of flower and reduction in flower size with florets becoming wavy. Heat therapy considerably reduces the incidence and consists of keeping the plant at 40°C for 2 hours and also control of sucking pests







Aloha

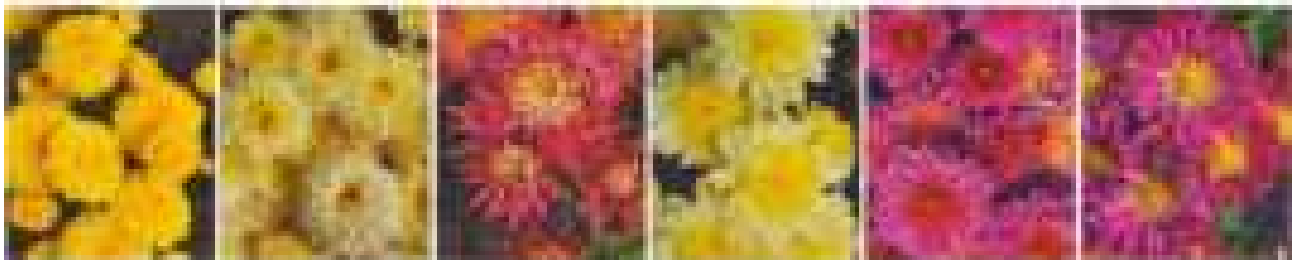
Aztec gold

Candy stripe

Cancun

Courtade

Dean conklin



DWF deciduous

Elena

Fngle wood

Mother theresa

Neelima

Pink cloud



Purnima

Purnima white

Pusa anmol

Shanti

Shanti

Shukla



Swetasagar

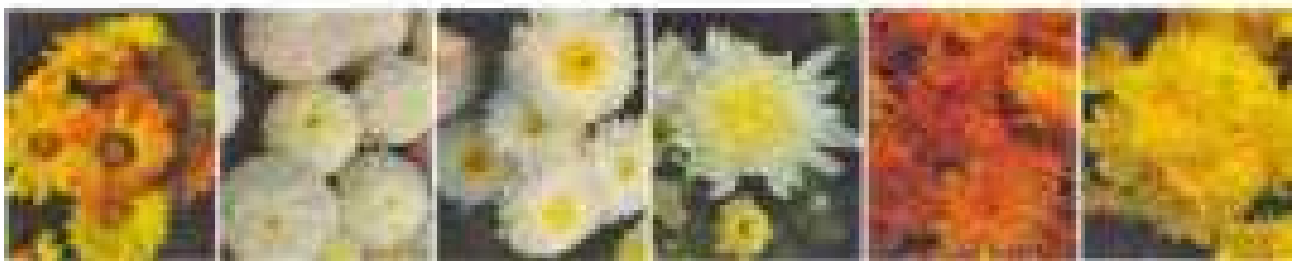
Tata century

Texas gold

Vasastica

Vasilika-B

Vijay



Vijay karan

White bouquet

White prolific

White star

Yellow gold

Yellow reflex

CHAPTER - 17

RARE TREES IN CPWD LOCATIONS



Maha Bodhi Tree at Budha
Jayanti Park

1. Maha Bodhi Tree (*Ficus religiosa*)

A Bal – Boudh Tree was planted in the Budha Jayanti Park by then Prime Minister Shri. Lal Bahadur Shastri on 25.10.1964, which was presented by Her Highness Sri Mao Bhandar Nayake the then Prime Minister of Sri Lanka. A sapling was planted in this park which was taken from the Holy Bodhi Tree in Sri Lanka. It was during the 3rd century when Princess Sanghamitra who was King Ashoka's daughter took a sapling from the ancient original Bodh Tree situated in Bihar believed to be the tree under which lord Buddha spent days during his meditation period up till he attained Nirvana or Enlightenment and hence is considered very Holy and Sacred to all and carried it to Sri Lanka where she planted, nurtured and attended to it with love

and care up till it grew very tall, thick and green. It was also known that she used to preach Buddhism under this very tree which exists even today.

A small temple beneath the Bodhi tree, Bodh Gaya, built in 7th century, after the original built by King Ashoka in 3rd century BCE, c. 1810 The spot was used as a shrine even in the lifetime of the Buddha. King Asoka was most diligent in paying homage to the Bodhi tree, and held a festival every year in its honour in the month of Kattika. His queen, Tissarakkhā was jealous of the Tree, and three years after she became queen (i.e., in the nineteenth year of Asoka's reign), she caused the tree to be killed by means of mandu thorns. The tree, however, grew again, and a great

monastery was attached to the Bodhimanda called the Bodhimanda Vihara. Among those present at the foundation of the Mahā Thūpa

are mentioned thirty thousand monks from the Bodhimanda Vihara, led by Cittagutta.

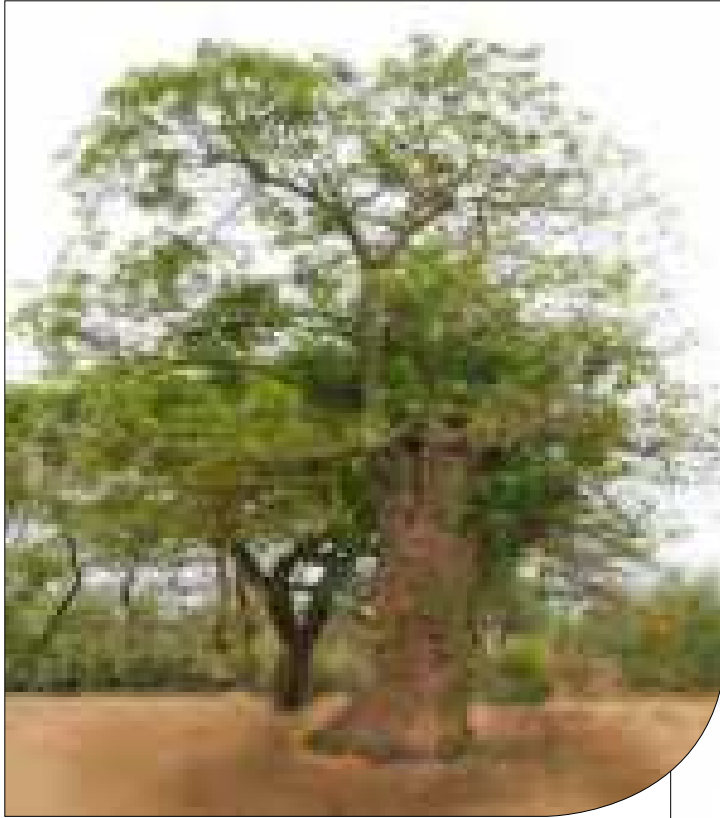


2. Makhan Katori (*Ficus kishnae*)

A small tree with folded leaves joined at the base which appear like containers of ice-cream (kulphis). The legend is that Krishna used to store butter in the leaves.

Propagated from seed, as a curiosity, it should be grown in all public parks and gardens. *Ficus Krishnae* Tree, or Krishna Fig Tree, is known as Makhan Katori or Krishna Badh in local languages. The leaf of the tree is in the shape of a cup – Krishna’s Butter Cup. There is an interesting story which narrates how the leaves of the tree got the

shape of a leaf. It is said that in the beginning, the leaves of Krishna Fig tree were straight and it did not have the cup shape. A naughty episode of Krishna was responsible for the leaves taking cup shape. The “Sacred fig tree” probably a form of *benghalensis*, small tree sacred to the Hindu god Krishna, said to have folded its leaves into cups to leathery, irregularly cupped, deep green leaves with raised ivory ribs, finely pubescent inside, on grayish branches. Very interesting collection plant because of its curious leaves.



Kalapvriksha at
Budha Jayanti Park

3. Kalapvriksh (*Adansonia digitata*)

A genus of eight species of tree, six native to Madagascar, one native to mainland Africa and the Arabian Peninsula and one to Australia. The mainland African species also occurs on Madagascar, but it is not a native of that island, and was introduced in ancient times to south Asia and during the colonial era to the Caribbean. A ninth species was identified in 2012, incorporating upland populations of southern and eastern Africa. A typical common name is baobab. Other common names include boab, boaboa, tabaldi, bottle tree, upside-down tree, and monkey bread tree. The generic name honours Michel Adanson, the French naturalist and explorer who described *Adansonia digitata*. *Adansonia*s reach heights of 5 to 30 m (16 to 98 ft) and have trunk diameters of 7 to 11 m (23 to 36 ft). Glencoe baobab – an African baobab specimen in Limpopo



Kalapvriksha at Raj Ghat

Province, South Africa, often considered the largest example alive – up to recent times had a circumference of 47 m (154 ft). Its diameter is estimated at about 15.9 m (52 ft). Recently the tree split up into two parts and it is possible that the stoutest tree now is Sunland baobab, also in South Africa. The diameter of this tree is 10.64 m (34.9 ft), with an approximate circumference of 33.4 m (110 ft). Some baobabs are reputed to be many thousands of years old, which is difficult to verify, as the wood does not produce annual growth rings, though radiocarbon dating may be able to provide age data.



4. Baheda (*Terminalia bellirica*)

Baheda is a large deciduous tree found throughout India, in areas up to an altitude of 1,000 meters. The tree takes a height of 30 meters, while the bark is brownish grey in color. The alternate, broadly elliptic leaves are clustered towards the end of the branches. They are 10 to 12 cm in length and 7 to 14 cm in breadth. The simple, solitary flowers are in auxiliary spikes, with offensive odor. They blossom in the month of May. The fruits are ovoid grey drupes and the kernels are sweet, but narcotic. The tree is found in abundance in Madhya Pradesh, Uttar Pradesh, Punjab and Maharashtra. It is known as vibhitaki, karshaphala and kalidruma in Sanskrit and bahera in Hindi.

Uses & Benefits of Baheda

- Beleric is a rejuvenative and laxative. It proves beneficial for hair, throat and eyes.
- Beleric seed oil or fruit paste is applied on swollen and painful parts.
- The seed oil gives excellent results in skin diseases and premature graying of hair.
- Fruit pieces are baked and chewed for cough, cold, hoarseness of voice and asthma.
- Beleric fruit is powdered and used to dress wounds to arrest the bleeding.
- Beleric fruits and kernels are used in making medicated hair oil, used to alleviate pain and burning sensation, boost hair growth and impart black color to the hair.
- The paste of the fruit is applied on eyelids, in case of conjunctivitis.
- The herb is used in various eye ailments, such as myopia, corneal opacity, pterigium, immature cataract, chronic and acute infective conditions.
- Beleric helps in loss of appetite, flatulence, thirst, piles and worms.
- The ripened fruit acts as an astringent and anti-diarrheal.
- The decoction of the kernels is used in case of excessive thirst and vomiting.
- Beleric plant alleviates cough, relieves blocked phlegm, controls bleeding in the sputum and eases bronchospasms.
- It prevents ageing, imparts longevity, boosts immunity, improves mental faculties and enhances the body resistance against diseases.
- It helps in lowering cholesterol and blood pressure.



Lagerstroemia Lancasterai at Rajpath

5. Lagerstroemia (Lagerstroemia lancasterai)

Lagerstroemia, commonly known as Crepe Myrtle, is a genus of about 50 species of flowering shrubs and trees. Native to the Indian subcontinent, South Asia and Oceania, most species of Lagerstroemia are found in Pakistan, India, Bangladesh, China, Australia and parts of Central America.

Lagerstroemia Lancasterai bears beautiful flowers of white colors in summer. In full bloom,

bright green leaves and clusters of flowers make it an excellent choice as ornamental tree for homes and gardens. Lagerstroemia sheds its leaves in a gradual process so you would hardly find it completely bare. Flowers contain six or seven crumpled and wrinkled petals, that is why, Lagerstroemia is also called Crepe Flowers tree.

Ficus Macdonald at Rajghat



6. Ficus (Ficus macdonald)

It is a gynodioecious (functionally dioecious), deciduous tree or large shrub, growing to a height of 6.9–10 metres (23–33 ft), with smooth white bark. Its fragrant leaves are 12–25 centimetres (4.7–9.8 in) long and 10–

18 centimetres (3.9–7.1 in) across, and deeply lobed with three or five lobes. The complex inflorescence consists of a hollow fleshy structure called the syconium, which is lined with numerous unisexual flowers.

Olea Europea (Zaitoon) at Rajghat



7. Zaitoon (*Olea europea*)

Zaitoon tree is also known as olive tree and produces the gray green flowers in winter season. The plant of olive reaches the height of 3 meters, leaves are bright green and very attractive and the fruits are of bright bluish or violet color, possesses a metallic taste. It is known from old ages. During

the excavation of ancient Egyptian graves, vessels full of olive oil were found with other articles. According to the scholars of Hadith, on subsidence of Toofan-E-Nooh (The Great Flood of Noah), when water level came down, the first thing on the earth that was seen was the olive plant.

Bombax ceiba tree
at 1 Moti Lal Nehru Marg



8. Cotton tree (*Bombax ceiba*)

Like other trees of the genus *Bombax*, is commonly known as **cotton tree**. This tropical tree has a straight tall trunk and its leaves are deciduous in winter. Red flowers with 5 petals appear in the spring before the new foliage. It produces a capsule which, when ripe, contains white fibres like cotton. Although its stout trunk suggests that it is useful for timber, its wood is too soft to be very useful. *Bombax ceiba* grows to an average of 20 meters, with old trees up to 60 meters in wet tropical weather. The leaves are palmate with about 6 leaflets radiating from a central point, an average of 7~10 centimeters wide, 13~15 centimeters in length. The leaf's long flexible petiole is up to 20 cm longer. Seeds are numerous, long, ovoid, black or gray in colour and packed in white cotton. The fruit, which reaches an average of 13 centimeters in length, is light-

green in color in immature fruits, brown in mature fruits. This tree is widely planted in parks and on roadsides there because of its beautiful red flowers which bloom in March/April. This tree is quite common in New Delhi. The cotton fibers of this tree can be seen floating in the wind around the time of early May. This tree shows two marked growth sprints in India- in spring and during the monsoon months. This tree is commonly known as *Semal* (*Hindi*: सेमल) This tree is also found in the eastern parts of Pakistan, especially in the eastern city of Lahore. The local Urdu and Punjabi name for the tree is 'Sumbal'. Plant pacifies vitiated pitta, wounds, ulcers, skin diseases, hemorrhoids, urinary calculus, cystitis, inflammations, cough, bronchitis and dark discolorations on face.



Swietenia Senegalensis Tree at Govt. Sunder Nursery

9. Swietenia (Swietenia senegalensis)

Swietenia senegalensis (Khaya, African Mahogany) :- It is tree with shining leaves upto 100ft tall. Leaves are compound drying pale glaucous green. Flowers normally have

four parts. Sepals are pale green, petals and stamina tube are cream colored, fruit is normally very much valuable.



Celtis Tetrandra at Govt. Sunder Nursery

10. Khirk (*Celtis terandra*)

A medium sized tree up to 30m height. Leaves simple, alternate, obliquely ovate. Margin, serrate from apex to below. Flowers polygamous, yellow born on leafless shoots.

Fruit is hard when dry, edible bitter to taste. Flowering from January to March. Fruiting from Feb. to April a medium sized tree.



Guazuma Ulmifloia Tree at Govt Sunder Nursery

11. Guazuma (*Guazuma ulmifolia*)

It is small to medium size tree upto 30m height and 30 to 40 cm in diameter. Leaves are in alternates pattern, ovate, finely saw toothed margin with darker green upper surface and pale green below. The flowers

come in panicles and are short stalked, have brown yellow color and are lightly fragrant. The fruits, which are capsules, have many seeds.



Agathis Robusta Tree at Govt. Sunder Nursery

12. Kauri Pine (*Agathis robusta*)

it is a large evergreen trees growing straight. Height 30 to 50m with smooth scaly bark. The leaves are broad, tough and leathery in texture. The seed cones are globose and

mature in 18 – 20 months after pollination. They disintegrate at maturity to release the seeds. The male cones are cylindrical.



Swietenia Mahagoni Tree at Govt. Sunder Nursery

13. Swietenia (Swietenia mahagoni)

it is a tall tree 30 m height upto 1 m dia and large spherical crown, dense shade. The bark is reddish brown on large trees. Leaves are shiny dark green, lance shaped, flowers

greenish yellow. The light brown seeds capsule stands upright with 5 valves. Each valve releases about 20 flat brown winged seeds.



Bolusanthus Speciosus Tree at Govt. Sunder Nursery

14. Bolusanthus (*Bolusanthus speciosus*)

The tree is evergreen may drop leaves in winter. Leaves are lanceolate, shiny green above paler below. Fruit is flat thin light brown to grey, pod, Ofrom Sept. to January.

The dark fissured bark drooping foliage and attractive flower. Low maintenance garden tree.



Atalantia Monophylla Tree at Govt. Sunder Nursery

15. Jangli Nimbu (*Atalantia monophylla*)

Indian atalantia is a small much branched tree with single sharp spines. Leaves are bright green above paler and reticulate-veined

below, ovate or elliptical with margins slightly wavy. Flowers are long stalked in clusters. Fruit globose yellowish green when ripe.



Albizia Lucidor (Potka Siris) Tree at Govt. Sunder Nursery

16. Potka Siris (Albizia lucidor)

It is fast growing beautiful trees. The large compound leaves are unique. Flower are

clusters of small powder puff. Fruit pod is flat, dark brown. Flowering June to July.



Caesalpinia Ferrea (Khirk) Tree at Govt. Sunder Nursery

17. Khirk (*Caesalpinia ferrea*)

It is a beautiful tree with white and chocolate flaking bark thus called leopard tree. The tree is long, drooping branches with feathery

leave. The flower are yellow small fragrant. The wood is used for finger boards of electric basses, guitars, flooring, fancy furniture.



Mesua Ferrea Tree (Nag Keshar or Nag Champa at Govt. Sunder Nursery

18. Nag keshar or Nag Champa (*Mesua ferrea*)

A handsome Indian evergreen tree, of small to medium size upto 13m. Simple oblong green leaves, the emerging young leaves are red to yellowish pink. The flower are white with numerous yellow stamens. The

flower's are used for making incense and used to stuff pillows. The national tree is Sri Lanka. The oil from seeds is used for treating sores, scabies, wounds and rheumatism. The root is used as an antidote for snake poison.



Bridelia Retusa Tree at Govt. Sunder Nursery

19. Kasai (*Bridelia retusa*)

Tree is identified by rigid leathery leaves, strong spines on the barks of young stems. Flowers are arranged on leafless branches appearing as spikes with small acute bract. Fruit is globose, fleshy, sweetish taste, size of

a pea, purple black. Flowering May- August. The bark is used for the removal of urinary concretions in Ayurveda. Root and bark are valuable astringents.



Dillenia Indica Tree at Govt. Sunder Nursery

20. Elephant Apple (*Dillenia indica*)

Elephant Apple (Chalta) is small to medium sized tree upto 15m tall. The leaves are long with corrugated surface. The flowers are large

with five white petals and yellow stamen's. The fruit having seeds with edible pulp. The pulp is used in curries, Jam & Jellies.



Pterospermum xylocarpum (Tada) Tree at Govt. Sunder Nursery

21. Tada (*Pterospermum xylocarpum*)

Trees are small 5-8 m tall. Leaves ovate, elliptic base uniquely cordate white wooly beneath glabrous above. Flower's white

solitary, capsules pyriform seeds winged. Wood is used for furniture.



Largerstroemia Microcarpa (Benteak) Tree at Govt. Sunder Nursery

22. Benteak (*Largerstroemia microcarpa*)

It is a deciduous tree. Grow upto 10-15m height. The bark is of ash color oppositely arranged leaves. White flowers are borne in

large compound panicles. Seeds are winged. Flowers in May – June.



Markhania Lutea Tree at Govt. Sunder Nursery

23. Siala (*Markhania Lutea*)

The tree is 10-15m high having leaves 20-30cm in length. Bark light brown. Flowers are bright yellow trumpet shaped. Fruit is very

long thin brown capsules borne in clusters, release winged transparent seeds.



Bistendu (*Diospyros Cordifolia*) Tree at Vijay Chowk

24. Bistendu (*Diospyros montana*)

Bistendu is a small deciduous tree with spiny trunk and spiny older branches. Leaves are elliptic lanceshaped, somewhat heart-shaped at the base and sharp or blunt at the tip. They are smooth above and velvety on the underside. Male and female flowers grow on separate trees. Male flowers are

borne in 3-flowered clusters, and the female ones singly. Flowers are creamy white or greenish-white, tubular, with 4 petals which are curved back. Sepals are ovate, velvety. Stamens of male flowers are longer than the flower tube. Fruit is spherical, cherry sized, yellow when ripe. Flowering: March-April.



Branch of Rudraksha Tree

Rudraksha Tree at 6 Moti Lal Nehru Marg

25. Rudraksha (*Elaeocarpus Ganitrus*)

Rudraksha grows in the area from the Gangetic Plain in foothills of the Himalayas to South-East Asia. Rudraksha seeds are covered by an outer shell of blue color when fully ripe, and for this reason are also known as blueberry beads. The blue colour is derived not from pigment but is structural. It is an evergreen tree that grows quickly. Rudraksha Tree starts bearing fruit in three to four years. As the tree matures, the roots buttress rising up narrowly near the trunk and radiating out along the surface of the ground.

The seeds show variation in the number of grooves on their surface, and are classified on the basis of the number of divisions that they have. Different qualities are attributed to the rudraksha based on the number of grooves, or 'faces' that it has. A common type has five divisions, and these are considered to be symbolic of the five faces of Shiva. It can only be worn with red string or a gold chain.



According to the Ayurvedic medical system, wearing Rudraksha can have a positive effect on the heart and nerves, and relieve you from stress, anxiety, depression, palpitations and lack of concentration. It is also known for its anti ageing effect, and electromagnetic and inductive properties. People with high blood pressure have been found have benefited from the use of Rudraksha seeds.

CHAPTER - 18

MIRACLE FRUIT

Miracle fruit, (*Synsepalum dulcificum*), also called miracle berry, of the family Sapotaceae, grown for its mild fruits that make subsequently eaten sour foods taste sweet. The miracle fruit is native to tropical where it is used locally to sweeten palm wine and other beverages. The unrelated sweet prayer plant (*Thaumatococcus daniellii*) is also known as miracle fruit for its similar ability to make sour foods taste sweet.

The miracle fruit plant grows as a dense shrub or small tree, usually not more than 5.5 metres (18 feet) in height in the wild and generally smaller when cultivated. The simple leaves are oval and tapering at the

base with smooth margins and feature a waxy underside; they grow in spire like clusters at the ends of small branches. The small white flowers give rise to red drupe fruits that are about 2–3 cm (0.8–1.2 inches) in length. Plants typically begin producing fruit after three or four years and require acidic soil.

The flavour-altering mechanism of miracle fruit is due to a glycoprotein named miraculin, which was first isolated by Japanese researcher Kenzo Kurihara in 1968. Although miraculin itself is not sweet, it binds to receptors on the taste buds and causes acidic foods to be perceived as sweet. The effect typically lasts from a half hour



Miracle Fruit Leaves and unusual flowers of the Miracle Fruit plant (*Synsepalum Dulcificum*)

to two hours, with the intensity declining over time. The fruit has been proposed as a treatment for the taste changes experienced by some chemotherapy patients, though further studies are needed. In the United States an attempt was made in the 1970s to commercialize the fruit extract as a low-calorie or noncaloric sweetener for use by diabetics and dieters, but the U.S. Food and Drug Administration (FDA) classified the product as a food additive requiring further safety testing, and the venture was abandoned. Similarly, the European Union required a safety assessment before miracle fruit extracts could be used as a food additive, though miraculin has been approved in Japan. The purchase of powdered or whole fruits is legal in most places, and the fruit is commonly consumed as a novelty.

For people looking for a delicious and exotic berry to add to their diet, the miracle fruit is an excellent option. It has a plenty of benefits for your body which include its ability to aid in weight loss, improve vision health and boost immunity, among others. That being said, before adding any new food to your diet, it is critical to understand where it comes from, what it contains, and the possible health benefits it may hold.

Miracle fruit is one of the common names of *Synsepalum dulcificum*, a shrub that is native to western Africa, where it has been in use for centuries. Most notably, miracle fruit has the ability to make sour food taste sweet, thanks to a compound called miraculin. Miraculin is able to bind to the tongue's taste buds, which blocks the receptors when the pH level of the mouth is neutral. However, when we eat sour fruit, the pH of the mouth drops, and miraculin is able to activate the sweet receptors while blocking the sour ones.

Aside from the novel aspects of miracle fruit, also known as miracle berry, sweet berry, and

as this fruit has a number of unique nutrients that can positively affect health. These small berries are the size of cherry tomatoes and each contains a single seed, roughly the size of a coffee bean. The berries are typically consumed raw and are actually tasteless when eaten alone, but the fruit pulp can also be mixed into fruit smoothies or other sweet desserts. Some restaurants around the world use miracle fruit as a complement to their dishes, allowing diners to revel in the strangeness of eating sour food, but tasting a sweet treat instead!

Miracle fruit is not a great source of traditional nutrients, but there are notable amounts of vitamin C, vitamin K, vitamin A, vitamin E and various amino acids that the body requires for numerous functions. The fruit is incredibly low in calories, only 1/2 calorie per berry, and also boasts a number of polyphenolic compounds and antioxidants that make you healthy.

The most notable benefits of miracle fruit include its ability to manage diabetic symptoms, aid in weight loss efforts, improve the strength of the immune system, boost vision health and prevent chronic disease, among others.

By acting as a low-calorie, sugar-free additive in many meals, this fruit is an excellent aid in your weight loss efforts. It will not contribute to your overall calorie intake, nor is it packed with simple sugars and carbs that can lead to weight gain.

Although only trace amounts of vitamin C are present in this fruit, it can still give a small boost to your immune system. Vitamin C stimulates the production of white blood cells, which are the body's main line of defense against pathogens and infections.

There are also trace amounts of vitamin A found in this fruit, which has been directly

linked to improved vision health, specifically a lower risk of macular degeneration and cataract formation as you age.

Perhaps the most important health benefit of miracle fruit is enjoyed by diabetic patients, who can safely replace sugar in their diet with this berry. Apart from the flavor impact, some of the active ingredients in this fruit can naturally lower insulin sensitivity, which is good news for diabetic patients.

The number of polyphenolic compounds found in this fruit will give your body an antioxidant boost, which can lower levels of free radicals and reduce oxidative stress in organ systems.

Miracle fruit is used in various ways around the world, but its use is primarily linked to its flavor-altering properties. It is commonly added to desserts and other foods that may have a tart flavor, or it is used as a replacement for sugar in foods. For example, if you have a sweet tooth but are trying to cut down on your sugar intake, using miracle fruit in conjunction with sour food can give you the sweet burst you're looking for.

Miracle fruit is also used by some for medical purposes, such as changing the flavor of unpleasant medications or lessening the side effect of certain treatments. Miracle fruit is often found as a complementary item in a dish at restaurants that advertise unique flavor experiences.

Despite the potential health benefits and novel abilities of this fruit, miracle fruit does have some side effects that should be considered, such as high acidity and gastrointestinal problems.

Acidity – Using this fruit can enable you to eat more sour foods, but only taste them as being sweet. While this is a unique property, it can allow you to eat an excess of sour foods, which could result in elevated acidity levels in the body.

Stomach Issues – Similarly, this fruit could also allow you to eat spicy food without feeling the heat, which could lead to heartburn or gastrointestinal distress. Use this berry in moderation, and be aware of what types of food you are eating to avoid unnecessary problems.



Landscape Design

CHAPTER - 19

DETAILS OF CPWD PARKS

1. Buddha Jayanti Park

Pt. JawaharLal Nehru, pioneer of Modern India and a man of far sightedness had the idea to commemorate the 2500th birth anniversary of Lord Buddha by laying a park commiserative to his status and teachings of making the mankind free from sufferings. The Buddha Jayanti Park is seen with a large Statue of Lord Buddha in a sitting posture covered in Gold Coloured paint erected on a flat raised Platform supported by pavilions on all directions. The platform and Statue were established on October 1993 over an artificial Island created within the premises of this park as a respect and tribute to H.H. Dalai Lama the 14th . A sapling was planted in this park which was taken from the Holy Bodh Tree in Sri Lanka. It was during the 3rd century when Princess Sanghamitra who was King Ashoka's daughter took a sapling from the ancient original Bodh Tree situated in Bihar believed to be the tree under which lord Buddha spent days during his meditation period up till he attained Nirvana or Enlightenment and hence is considered very Holy and Sacred to all and carried it to Sri Lanka where she planted, nurtured and attended to it with love and care up till it grew very tall, thick and green. It was also known that she used to preach Buddhism under this very tree which exists even today.

The speech of 1st Prime Minister of India Pt. JawaharLal Nehru in UN General Assembly New York in Nov. 10th 1961 had also been displayed on a big stone in 1965 on international co-operation year in Hindi and English version. A Bal – Boudh Tree was planted in the park by then Prime Minister Shri. LalBahadurShastri on 24.10.1964, which

was presented by Her Highness Sri Mao BhandarNayake the then Prime Minister of Sri Lanka.

The approximately 70 acres of land for this park was allotted by the L&D.O. long back. A great care has been taken to keep the Buddha Jayanti Park free from all sorts of pollution after preserving the topography of land, rocks and hillocks and flora and fauna of the ridge in which it is located. This Park is being maintained by CPWD . The natural trees, shrubs and other flora and fauna had not been disturbed at all while making the park. Most of the trees planted there are of indigenous nature and ecological balance has been maintained in a nice way. In the last year Colour Garden, Canna Garden, Medicinal Garden, Rose Garden, Palm Garden, Cactus Garden, Bulbous Garden, Bamboo Garden, Rock Garden and Fragrance Garden have been created. The Buddha Jayanti Park is seen crowded with mostly with Youngsters, early morning joggers and Yoga enthusiast; however, most Family along with Friend's are seen here, especially during weekends, where they spend fun time after a good picnic lunch with each other. Young couples mostly visit this park during weekdays as it generally remains quit and free of the usual family crowd and hence gives them a quiet time and ample space to spend private time with each other.

Major part of the Garden is covered by different varieties of Bougainvilleas which gives a very good look during its flowering time and those can be seen in these pictures.



Buddha Statue at Buddha Jayanti Park







Buddha Statue in the Buddha Jayanti Park

The installation of the statue of Lord Buddha at Buddha Jayanti Park in New Delhi is an historic event. This monument with a canopy is being dedicated as a symbol of the gratitude of His Holiness the Dalai Lama to the people and government of India for their sustained effort in promoting the cause of world peace and understanding. In 1983 His Holiness expressed a wish to erect a monument in Delhi under such a dedication. Following that, Tibet House, the Cultural Centre of His Holiness, approached the Government of India with a proposal to install a statue of the Buddha under a canopy in Buddha Jayanti Park. This would not only be an ornament to the park but also a befitting monument in honour of one of the greatest sons of India, who showed the Universal path to Freedom from suffering through personal example over 2,500 years ago.

Through the sympathetic consideration of the Ministry of Urban Development, the Delhi Urban Art Commission and other authorities, a plot of land was made available to Tibet House for the installation of the statue and canopy in Buddha Jayanti Park. In 1987, the then Prime Minister, Shri Rajiv Gandhi, approved a model of the proposed structure, the design and proportions of which were finalized in consultation with the appropriate authorities in 1988. The design as a whole symbolizes a harmonious union of diversities—racial, linguistic, communal etc. – a unit which has been the core of the message of His Holiness the Dalai Lama. The structure in its entirety may be viewed as a journey through stages to this goal, rising from the base to the topmost spire, of the complete realization of compassion and wisdom. It is a symbol of this process of manifestation, and a representation of non-duality.

Its name, natural topography and pattern of vegetation made Buddha Jayanti Park an appropriate setting for the statue of the Buddha. Placed on an island in the Park, this new monument faces east, exactly as the Kalacakra Mandala is oriented, and the direction in which the Buddha sat under the Bodhi tree at Bodh Gaya when He attained Enlightenment.

The entire structure embodies a cluster of Buddhist symbols and meanings. The base is set within an embankment with five concentric rings representing the five elements – earth, water, fire, wind and space. The design of the base is fashioned after the Kalacakra Mandala, the last system of mandalas introduced to Tibet from India. (Besides their deep spiritual message, the teachings of the Kalacakra were a historical response to the various threats, such as internal riots and external aggression, that endangered the unity of the diverse communities of the India of the time.)

The canopy has a three-tiered base on each of its four sides, which together signify the twelve channels (nadis). Its four pillars represent the four energy drops (bindus), apart from supporting the dome and upper parts of the canopy. The ten directions of the canopy represent the ten vitalities (pranas). The nadis, bindus and pranas are the vital constituents of the human body in the Kalacakra system of Tantra. The parapet and the upper reaches of the canopy are ornamented with intricate Tibetan designs, while the dome symbolizes the vital factors of enlightenment. Above the dome, a square and conical structure represent the constituents of the Noble Path, while thirteen rings on the core are symbols of the ten strengths and three mindfulnesses of an Enlightened being. The chatra represents the all pervasive compassion (mahakaruna) of the Buddha, and the topmost spire the nobility of his attainment.

Altogether, the six parts of the canopy – base, columns, dome, cone – chatra and spire, correspond to the six chakras which form the centres of subtle energy in this human body; but the design of the upper reaches of the canopy follows that of the historic Gyantse Stupa, Palkhor Choten – in Tibet.

The statue of the Buddha has been designed in traditional Tibetan style of Mr Pemba Dorje, a skilled Tibetan craftsman in Dharamsala. It is made from beaten copper glided with gold, and is eight feet high including the pedestal. The right hand of the Buddha is shown in the Bhumisparsa Mudra, and the positioning of the statue on a raised throne symbolizes His message that all beings have the potential to attain the highest goal of Buddhahood.

The statue is placed on a throne which contains an engraving of Bhumidevi, the Earth Goddess. When challenged by Mara to provide a witness to testify to the merits He had attained, the Buddha touched the

earth (bhumisparsa), invoking it to bear witness. Bhumidevi emerged from the earth to testify for Him. It is our responsibility now to care more deeply for Mother Earth, who is depicted in the engraving as pleading for the attention of her children.

The canopy is about forty feet at its highest point and is built in sandstone mined and transported from Bansi Paharpur in Sikar district, Rajasthan. The craftsmen who transformed the stone into a beautiful edifice are also from Rajasthan and belong to communities of traditional temple builders. An initial design of the canopy was done by Kazuhiro Nakahari of Thanka Architects and his team, but that assumed a larger structure and site than ultimately became feasible. The beautiful structure that has now been completed was designed and its construction and landscaping coordinated by M.N. Ashish Ganju Mark Warner Rajiv Narain Architects.

2. Bhagwan Mahavir Vanasthali Park

Bhagwan Mahavir Vanasthali Park is situated on the Ridge Road towards the southern ridge which lies close to Dhaula Kuwan or alternatively from Sardar Patel Marg and is easily reachable by local transport. It spreads over the area of 25 acres of land and is seen planted with ornamental and green trees, shrubs, flower beds and lawns that's creates natural effect to the environment. Gardens in Delhi are been constructed since the Mughal Emperor rule over Delhi. The park is seen crowded with mostly young couples, morning walkers and yoga enthusiasts, however most families along with friends are seen here especially during weekends. This park also attracts tourists and sacred for Jain religion.



MAHAVIR VANASTHALI PARK



3. Delhi Chalo Park

Delhi Chalo Park is situated behind the Red Fort along the Ring Road, it's approx area is 12.30 acres seen from this park is Musamman

Brij in the centre. Rang Mahal is the right and Deewan-E-Khas on the left. This beautiful park increase the beauty of the Red Fort.



4. Jai Prakash Narayan Memorial Park

The Lok Nayak Jai Prakash Narayan Memorial Park is situated at Bahadur Shah Zafar Marg. This was offered to public in year 2004. This park was developed by CPWD and it has lush greenery. Having more than 4.50 acres of area, this park is having 127 Nos. of trees of 22 different varieties. A number of trees are planted in a circular manner around a circular lawn having a circular bed of Cannas in the centre. There is a huge statue of Lok

Nayak Jai Prakash Narayan fixed on a high rise mound. Garden light, fittings and fixtures are very beautiful at the night. This park was made open for use of public without any ceremonial/opening ceremony. The park has excellent boundary structure and gates etc. The park is having a huge statue of Dr. Shyama Prasad Mukherjee in a side surrounded by a cluster of good looking Thuja plants.



5. Deen Dayal Upadhyay Park

Deen Dayal Upadhyay Park is located at Deen Dayal Upadhyay Marg, near CAG office, New Delhi. The park is designed and developed by Central Public Works Department in the year 2017. This park covered approximate 16.00 acres area and divided with 3 Pockets known as Pocket-7A, 3A and 6B. The park is developed with concept of Rashiphal, Nakshatra, Navgrah, Panchvati, Tirthankar, etc which is unique and probably first of its kind in Delhi.

Recently BJP Chief Shri Amit Shah inaugurated the Deen Dayal Upadhyay Park. Shri Amit Shah was accompanied by Urban Development Minister Shri Hardeep Puri and Party MP Smt. Meenakshi Lekhi.

The redeveloped park has a rich variety of plants and large expanses of grass lined by flower beds with colourful blooms well laid walking tracks and several plant and bushes with their full names put up alongside.



BJP Chief Shri Amit Shah inaugurating the Deen Dayal Park accompanied by Urban Minister Shri Hardeep Puri.

Nakshatra Garden

One of the attractive areas of Deen Dayal Upadhyay Park is Nakshatra Garden. This garden is developed in Pocket-7A by planting 27 species of plants representing each Nakshatra. List of auspicious plant for nakshtra is:

Nakshtra	Common Name	Botanical Name
Ashvini	Poison nut	Strychnos nux vomica
Bharani	Amla	Embilica officinalis
Krittika	Fig	Ficus racemosa
Rohini	Jamun	Syzygium jambolanum
Mrigashirsha	Kadhira	Acacia catechu
Ardra	Agard wood	Aquilaria agallocha
Punarvasu	Bamboo	Bambusa
Pushya	Peepal	Ficus religiosa
Ashlesha	Naga kesar	Mesua ferrea
Megha	Banyan	Ficus bengalensis

Nakshtra	Common Name	Botanical Name
Purva phalguni	Flame of Forest	Butea monosperma
Uttara phalguni	Juvi	Ficus infectoria
Hasta	Retha	Sapindus mukorrassi gaertn
Chitra	Bel	Aegle marmelos
Swati	Arjun	Terminalia arjuna
Vishakha	Wood apple (Kaith)	Limonium acidissimum
Anuradha	Bakul	Mimusops elengi
Jyeshtha	Chir	Pinus roxburghii
Mula	Black dammar	Canarium strictum
Purva ashadha	Jack fruit	Artocarpus heterophyllus
Shravana	Milk weed	Calotropis gigantea
Dhanishtha	Shami	Acacia ferruginea
Shatabhisha	Kadamba	Anthocephalus cadamba
Purva bhadrapada	Neem	Azadirachata indica
Uttara bhadrapada	Mango	Mangifera indica
Revati	Ippe	Madhuca indica

Nav Garh Garden

This garden developed in Pocket-7A by planting 09 species of plants with every plant symbolically represents or attached with every Graha. It is beautifully designed and maintained. The list of auspicious plants for Nav Graha Garden is:

Garha	Common Name	Botanical Name
Surya (Sun)	Aak	Calotropis
Chandra (Moon)	Dhak, Palash	Butea monosperma
Mangal (Mars)	Kadhira	Acacia catechu
Buddha (Mercury)	Chirchirta	Achyranthes aspera
Brihaspati (Jupiter)	Peepal	Ficus religiosa
Sukra (Venus)	Gular, Udamber	Ficus glomerata
Shani (Saturn)	Shami	Acacia ferruginea
Rahu (Rahu)	Kush	Cynodon dactylon
Ketu (Ketu)	Dev kush	Imperata cylindrica

Rashiphal Garden

This garden developed in Pocket-7A by planting 12 species of plants each plant represents different Rashiphal. The list of auspicious plants for rashi is:

Rashi	Common Name	Botanical Name
Mesha (Aries)	Red Sandal Wood	Petrocarpus santalinus
Vrishabh (Tarus)	Satwin	Alstonia schloaris
Mithun (Gemini)	Jack Fruit	Artocarpus hetrophyllus
Karka (Cancer)	Flame of Forest	Butea monosperma
Singh (Leo)	Wid ber	Ziziphus mauritiana
Kanya (Virgo)	Mango	Mangifera indica
Tula (Libra)	Bakul	Mimusops elengi
Vrischik (Scorpio)	Kadhira	Acacia catechu
Dhanu (Sagittarus)	Peepal	Ficus religiosa
Makar (Capricon)	Shisham	Dalbergia latifolia
Kumbh (Aquarius)	Khejri Tree/ Shami	Prosopis cineraria
Meen (Pisces)	Bargad	Ficus benghalensis

Tirthankar Garden

This garden designed and developed with the concept of Tirthankar Van in which 24 species of identical plants of Tirthankar are planted. The list of plants planted in Tirthankar van is:

Tirthankar	Common Name	Botanical name
Shri Rishabhdeva Swami	Banyan	Ficus benghalensis
Shri Ajitnath Swami	Kalpavriksha	Adansonia digitata
Shri Sambhavnath Swami	Sal	Shorea robesta
Shri Abhinandan Swami	Chir	Pinus roxburghii
Shri Sumatinath Swami	Priyangu	Callicarpa macrophylla
Shri Padmaprabha Swami	Banyan	Ficus benghalensis
Shri Suparsvanath Swami	Siris	Albizia lebbek
Shri Chandraprabh Swami	Sultan champa	Calophyllum inophyllum
Shri Suvidhinath Swami	Bel	Aegle marmelos
Shri Shitalnath Swami	Anjeer	Ficus lacor
Shri Sreyanshnath Swami	Ashok	Sara indica
Shri Vasupujya Swami	Lodh Tree	Symplocos racemosa
Shr Vimalnath Swami	Jamun	Syzygium cumini
Shri Anantnath Sawmi	Ashok	Sarica indica
Shri Dharamnath Swami	Palash	Butea monosperma
Shri Shantinath Swami	Deodar	Cedrus deodara

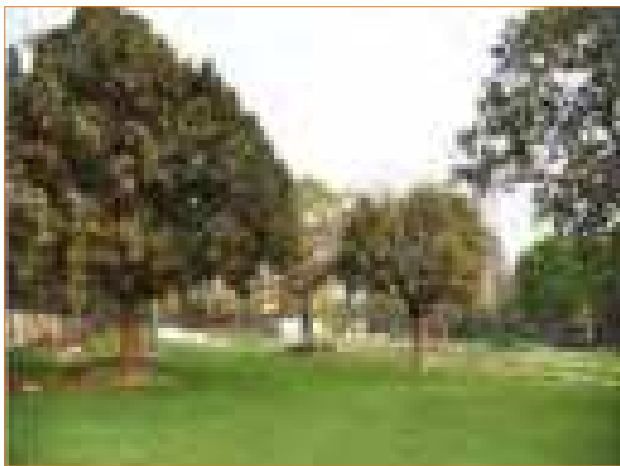
Tirthankar	Common Name	Botanical name
Shri Kanthunath Swami	Lodh Tree	Symplocos racemosa
Shri Arnath Swami	Mango	Mangifera indica
Shri Mallinath Swami	Ashok	Saraca indica
Shri Suvrat Swami	Golden Champa	Michelia champaca
Shri Naminath Swami	Maulshiri	Mimusops elengi
Shri Neminath Swami	Salix	Salix caprea
Shri Parsvanath Swami	Fire Flame Bush	Woodfordia fruticosa
Shri Mahavir Swami	Sal	Shorea Robesta

Play Ground

The playground developed in Pocket-7A. It covered approximate 1.00 acre area. Play Ground is developed for children. The lush green lawn along with children playing equipment is developed in this garden.



DEVELOPMENT OF LAWN AT DDU PARK (POCKET-3A)
DEVELOPMENT OF LAWN AT DDU PARK (POCKET-6B)



DEVELOPMENT OF LAWN AT DDU PARK (POCKET-7A) PARK 3A TRELLIS



PARK 7 A – OPEN AIR THEATRE

6. National Police Memorial Park

National Police memorial park is located in chankyapuri it's approx area is 3.93 acre. This park was developed to commemorate the memory of Martyrdom of all the 9 or 10 Police Forces serving the nation. This forces are such as CRPF, ITBP, BSF etc. Its ownership belongs to Ministry of Home

Affairs. In the beginning a huge global structure was proposed to be established at a much high location in the center of the park. But due to some objection raised by different organization this global structure was removed from here & shifted to some other park probably in Noida.



CHAPTER - 20

COLLECTION OF SPECIMEN BONSAI PLANTS AT GOVERNMENT SUNDER NURSERY, CPWD, NIZAMUDDIN, NEW DELHI

“BONSAI”

Bonsai comprises a tree or shrub planted in a small container for developing as a miniature plant showing the general appearance of that plant species found in nature. It differs from a pot plant where the foliage and flowers are important, whereas for Bonsai the appearance of the plant in a miniature form is to be maintained for many years.

The Government Sunder Nursery is also making Bonsai plants by their trained staff by binding with wire, shaping them, cutting

them, training them, fixing moss grass, using small pebbles repotting, watering and selling to the public also. The Government Sunder Nursery is having specimen collection of bonsai, some of them donated by Shri Agnihotri. These bonsai are preserved in the nursery for imparting training to the scholars as well as to the public. The new bonsai house was also constructed at Government Sunder Nursery and inaugurated by DG, CPWD on 3rd March 2012. The specimen bonsai were displayed in various flower shows and won many prize in the flower show.



1. Khirni (*Manilkara hexandra*)

It is a slow growing evergreen tree. The bark is grayish black and rough. The wood is used for big beams. Its fruits are edible.



2. Saptaparni (*Alstonia scholaris*)

The name scholaris means children used the slated made from wood of tree for writing purpose. In October small green fragrant

flower appear. All parts of the trees is poisonous. The dark green leaves form whorls of 4-7 and regular branching gives tree a beautiful shape.



3. Pakur/Pilkhan (*Ficus infectoria*)

The trees can grow upto 10mtr. to 12 mtr. The leaves are glossy, green thick, copper new growth. The white flower appears in spring.



4. Pipal (*Ficus religiosa*)

It is a semi evergreen tree, normally grown on roadside, near temple. It is a religious tree of India. The leaves are broad cordate in shape. The fruit is a small fig green ripening to purple



5. Ficus (*Ficus long island*)

For making bonsai 3 to 5 year old plant is selected . The height of the bonsai can be maintained upto 30cm. The Bonsai plants require 3 to 4 hours sunlight. The leaves are leathery and thick and branches can be easily train.



6. Savani (*Largestromia indica*)

It is deciduous tree grows near rivers. The plants have separate male & female flowers appear in summer in white, pink or red color.

Height of bonsai can be kept upto 30cm to 45 cm. The pruning is done in late spring. Wiring is essential. Informal, cascade bonsai forms from medium to extra large size.



7. Putranjiva (*Putranjiva Roxburghii*)

Tree with drooping leaves having medicinal properties. Flower yellowish green leaves and fruits used for rheumatism.



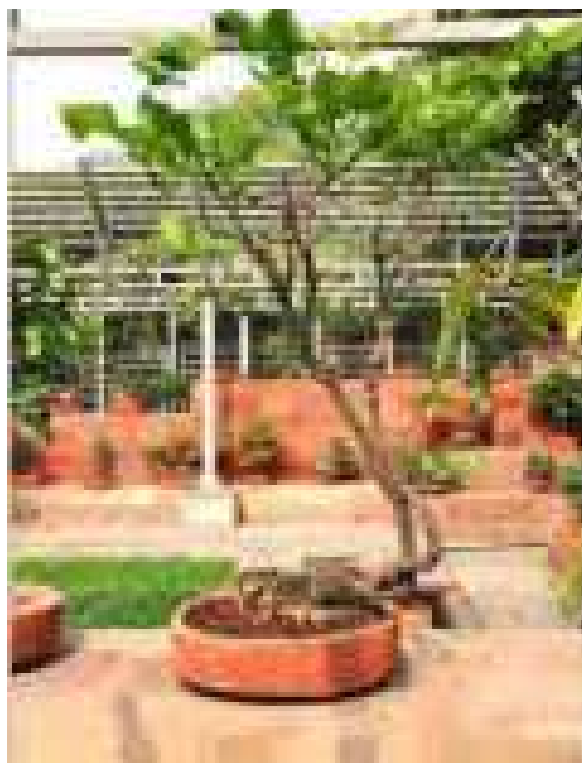
8. Bistendue (*Diospros Montana*)

It is a small deciduous tree. The stem is having thorns. The male and female flower grow on separate trees. The flower are creamy white. The fruit is cherry became yellow after ripening. Flowering



9 Ficus (*Ficus tsiela*)

The tree is large spreading tree without aerial roots. Leaves coriaceous. Fruits when ripe become purple during April to October. A good avenue tree.



10 Papri (*Pongamia glabra*)

It is also called pongam oil trees. The oil kept away the insects from the skin. The oil of the seeds beneficial in treating skin disease and antimicrobial.



11 Amrood (Psidium guajava)

The tree became tall upto 15 mtr. Height having leathery leaves small fruits but very sweet and white flowers in March & October.



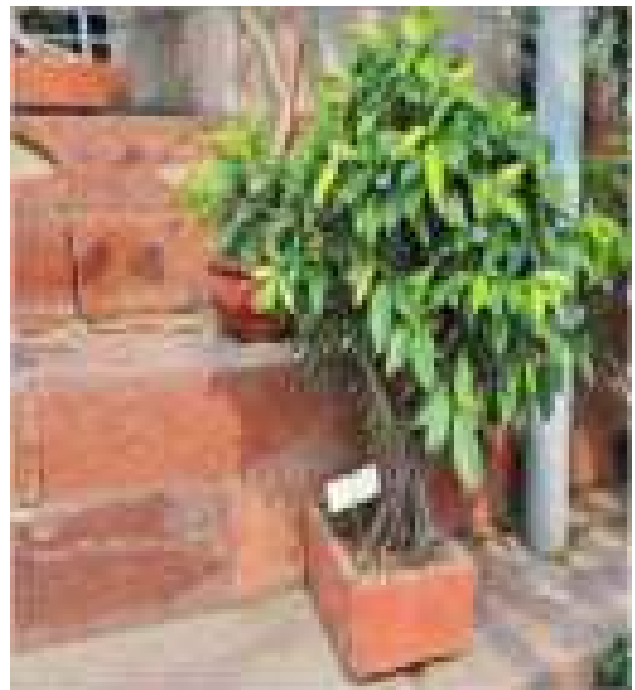
12 Schefflera (Schefflera sp.)

It is having more than one leaflet. Due to the wood and bark it is bit difficult to shape with wire. The cutting of branch a new apex grown on the cut.



13 Savani (Largestromia indica) dwarf

The plant is attractive to bees, butterflies and birds, due to violet/ lavender color flowers. The plant can be grown by soft wood cutting. Average water requirement bloom in April. The leaves are shiny/ Glossy.



14 Ficus (Ficus panda)

The Bonsai plant of this plant can be made in one month by using air layering. It is big tree having shining leaves.



15 Maulsiri (*Mimusops elengi*)

The plant is having small shiny leaves. The flower are tiny cream colored fragrant star shaped. In the morning the flower spread scent in the air. The flower are offered in temples and shrines. Fruits are eaten fresh. It medicinal value is to prevent the bad breath and keep the gum healthy.



16 Limonium (*Limonium* sp.)

It is a herbaceous perennial plant produce from a rhizome. The leaves are simple the flowers are of pink, violet or purple color. The fruits is small having single seed. These are grown "as everlasting flower.



17 Jatropha (*Jatropha* sp.)

It is small flowering plants. The plant is resistant to drought and pests and produce seeds. Seed is used for extracting future biodiesel. The flower appear from April to Sept.



18 Malpighia (*Malpighia coccigera*)

The plant is having less height, toothed leaves, pinkish/ white flower throughout the year. It makes a beautiful bonsai. It has light fragrance. Height of the plant 15.



19 Chiku (*Achras zaptoa*)

It is much branched tree upto 8mtr. Height. Flower are hairy outside. Fruit sare brown and fleshy, having 5 or more shiny blackish brown seeds. The fleshy part is sweet with flavor. Seeds are diuretic, and antipyretic. It contain sapotin (which is rich source of sugar, protein, vitamins c and mineral).



Landscape Design

CHAPTER - 21

DECORATION AT DIFFERENT SAMADHIES

1. Flower Decoration at Shanti Van. Shanti Vana (Samadhi of Late Sh. Pt. Jawahar Lal Nehru, Former Prime Minister of India)

One of the most able sons of India who not only shaped India's destiny but also played an instrumental role in framing the future of the world, Pandit Jawaharlal Nehru was cremated here at the Shanti Vana. The Campus of Shanti Vana is around 60.00 acres area including forest and lawn area. It has 2776 Nos. of trees of 65 different species.

Shanti Vana or the Forest of Peace truly lives up to its name. Lush greenery, sprawling gardens, numerous trees & saplings keep the atmosphere cool & serene. The stretches of greenery run endlessly and in almost every nook & corner, a beautiful plant stands in humility to welcome you.

All the visiting dignitaries & the heads of the states include a visit to Shanti Vana as an integral part of their itineraries. As a sign of respect, one has to take off his footwear to visit the sacred site of his cremation on 27th May of every year. On 14th November of



every year, which is his birth anniversary, he is remembered & honoured by the country's people; and for his ardent love for kids, 14th November has been recognized as National Children's Day.

Certain prayer sessions & cultural programmes are organised in Shanti Vana to celebrate the event. The place provides you with an absolute peace & calm and has a perfect atmosphere for meditation.

2. Flower Decoration at Vir Bhumi (Samadhi of Late Sh. Rajiv Gandhi, Former Prime Minister of India)

Vir Bhoomi stands near the memorials of Sh. Mahatma Gandhi (Father of Nation) & other prominent leaders of the country on the Mahatma Gandhi Marg (Main Ring Road) New Delhi. Sh. Rajiv Gandhi was India's youngest Prime Minister when he was sworn in as the Prime Minister of India in 1984. Unfortunately Sh. Rajiv Gandhi assassinated by an LTTE lady suicide bomber in 1991 and India lost one of its most dynamic and visionary Prime Minister. Vir Bhoomi (the land of the Brave) is a memorial dedicated to him, where he was cremated. The campus of Vir Bhoomi is around 22.30 acres. It has 950 Nos. of trees

of 54 different species. The lawns of this site is seen covered with well trimmed green grass and lined with trees, plants and shrubs that add on heavenly look to the entire area and its surroundings.

As a sign of respect, one has to take off his footwear to visit the sacred site and can also attend the special prayer sessions held every 20th of August (Birthday) and 21st of May (Death Anniversary) every year in order to remind us of the dreams and aspiration he had for his country and admire the fact that after his demise



3. Flower Decoration at Kissan Ghat. Kisan Ghat (Samadhi of Late Sh. Ch. Charan Singh, Former Prime Minister of India)

The literal meaning of Kisan Ghat is “Farmer’s Court”. Kisaan Ghat is the Memorial of Chaudhary Charan Singh, was the sixth Prime Minister of India. He was born on 23rd December 1902 and died on 29th May 1987. He was appointed as a prime minister of India for a very short period in 1979. The area of Kisan Ghat has a beautiful park surrounded with trees planted by visiting dignitaries and heads of state. The campus of Kisan Ghat is

around 8.84 acres area. It has 255 Nos. of trees of 19 different species.

As a sign of respect, one has to take off his footwear to visit the sacred site of his cremation on 29th May of every year. On 23rd December of every year, which is his birth anniversary, he is remembered & honoured by the country’s people.



4. Sadaiv Atal Samadhi

1. Sadaiv Atal, the Samadhi of Atal Bihari Vajpayee was dedicated to the Nation on the birth Anniversary of the former Prime Minister Atal Bihari Vajpayee 25-12-2018.
2. The Bharat Ratna awardee was born on 25 December. The day is celebrated as 'Good Governance Day' by the BJP.
3. Prime Minister Modi, President Ram Nath Kovind and Home Minister Amit Shah, among other BJP bigwigs, were in the attendance to pay their respects. President Ram Nath Kovind pays his respects to Atal Bihari Vajpayee on his first death anniversary.
4. To emphasise on the unity in diversity, stones from various parts of the country have been used in the construction of Samadhi near Rajghat in New Delhi. The Samadhi has a central platform comprising of nine square blocks, capped with a Diya in the centre. The number nine represents the navarasas, navaratras and navagrahas. The placement of the nine square blocks is in a circular lotus shaped pattern.
5. "Tributes to Atal Ji on his Jayanti. We reiterate our commitment towards creating the India he dreamt of," PM Modi said in his tweet.
6. Land was made available for the memorial at Rashtriya Smriti Sthal by the Union Housing and Urban Affairs Ministry.
7. It was constructed by the Centre Public Works Department (CPWD) at a cost of Rs 10.51 crore. The project was funded by the Atal Smriti Nyas Society.
8. The memorial is spread over approx. 10 acres of land at Rashtriya Smriti Sthal, where Vajpayee was cremated on August 17, 2018.
9. Not a single tree was cut down in developing 'Sadaiv Atal' at Rashtriya Smriti Sthal, which also houses samadhis (memorials) of former presidents, prime ministers among others.
10. Sadaiv (always) Atal memorial will be managed by a trust headed by Ex. Lok Sabha Speaker Sumitra Mahajan.

Former prime minister of India Atal Bihari Vajpayee passed away on 16 August 2018. Marking his first death anniversary, a 'Saidev Atal' memorial was organised in New Delhi on 16th August 2018.



President Ram Nath Kovind, Vice-President M Venkaiah Naidu and Prime Minister Narendra Modi were among the dignitaries who paid floral tributes to the former statesman at the memorial built near the Rashtriya Smriti Sthal, where his mortal remains were consigned to flames on 17th August 2018.



Namita Kaul, daughter of Atal Bihari Vajpayee with her family members and others pays tributes to former prime minister AB Vajpayee on his 95th birth anniversary at his memorial, Sadaiv Atal, in New Delhi. “Tributes to Atal Ji on his Jayanti. We reiterate our commitment towards creating the India he dreamt of,” Modi.



Prime Minister Narendra Modi pays tributes to former prime minister AB Vajpayee on his 95th birth anniversary, in New Delhi.

A vacant piece of land was made available for the memorial at the Rashtriya Smriti Sthal here by the Union Housing and Urban Affairs Ministry. Spread over approx. 10 acres of land, the memorial was constructed by the Central Public Works Department in a very short period. The project was funded by the Atal Smriti Nyas Society.



President Ram Nath Kovind with Prime Minister Narendra Modi, Amit Shah, JP Nadda & other BJP leaders attend prayer meeting to pay tributes to former prime minister Atal Bihari Vajpayee at his memorial, Sadaiv Atal, on his first death anniversary, in New Delhi.



President Ram Nath Kovind with Prime Minister Narendra Modi pays tributes to former prime minister Atal Bihari Vajpayee at his memorial, Sadaiv Atal, on his first death anniversary, in New Delhi.



Prime Minister Narendra Modi and BJP President Amit Shah arrive to pay tribute to BJP veteran late Atal Bihari Vajpayee at Sadaiv Atal Samadhi, ahead of former's swearing-in ceremony as prime minister for the second consecutive term, in New Delhi.

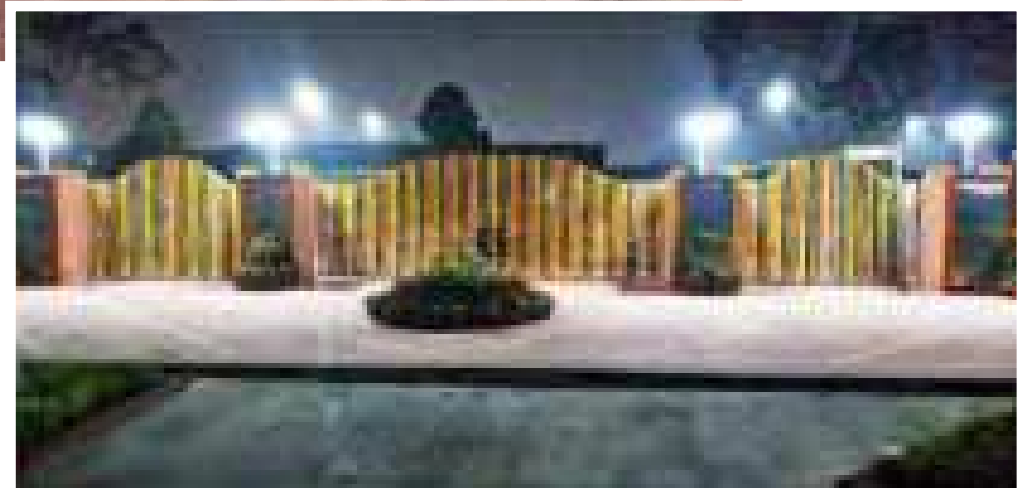
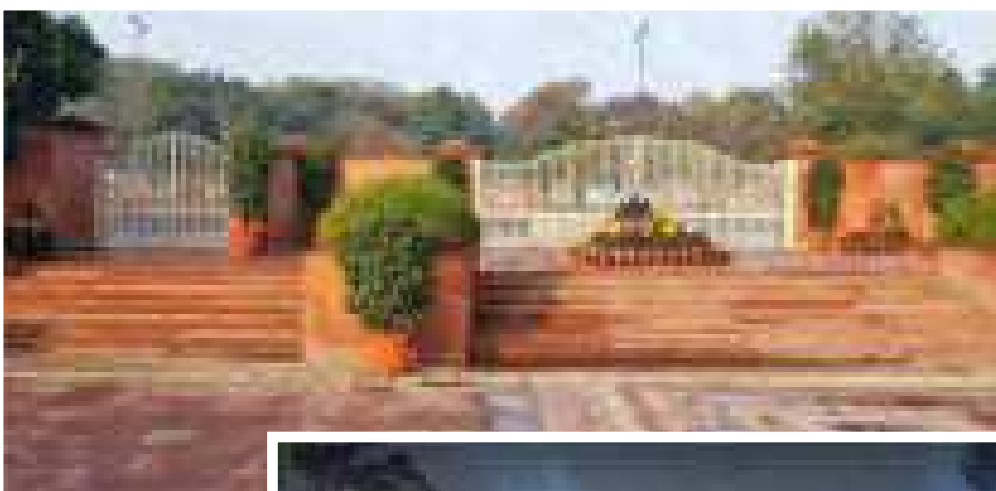
5. Rajghat

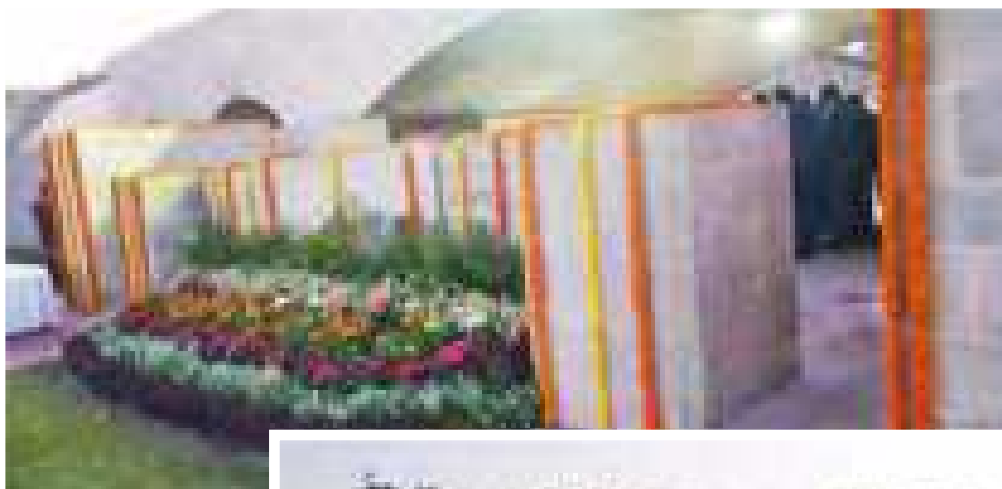
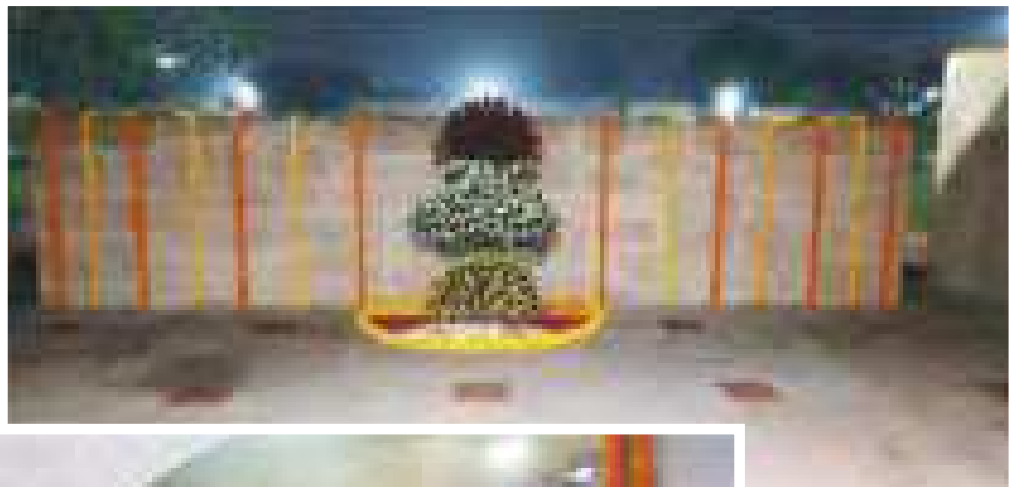
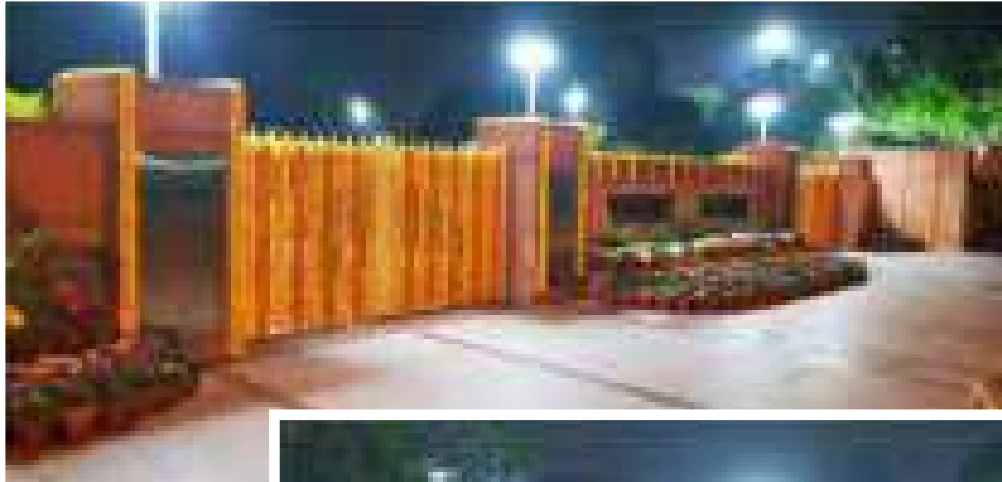
1. Raj Ghat is the memorial of Mahatma Gandhi, the Father of the Nation.
2. Black stone platform in an open air complex marks the spot where Gandhi was cremated.
3. A flame constantly burns at one end of the platform and visitors are required to remove their footwear before they enter Raj Ghat.
4. This memorial is located between Ring Road and the banks of the Yamuna River, towards the southeast of Red Fort.
5. His last words, 'Hey Ram,' are inscribed on the marble which is always adorned with flowers.
6. Foreign dignitaries visiting India pay respect to Gandhi by laying flowers on the platform.
7. United State Ex-President Barack H. Obama visited the Rajghat on 25, January, 2015.
8. United State President Donald Trump visited the Rajghat on 25 February, 2020.
9. Horticulture Activity in the Rajghat Complex:-
 - a. Samadhi of Mahatma Gandhi is the well-known place in the world.
 - b. Specially landscaped beautiful and lush green lawn (35.47 Acres).
 - c. It has 1056 numbers of trees of 42 different species
 - d. Large number of tourists and school children visiting every day.
 - e. All the heads of Nations visit this place during their stay in India.
 - f. Flower decoration of Rajghat Samadhi on the occasion of birth and death anniversaries.
 - g. There is also a Gandhi Memorial Museum where a film is shown – between 9:30 am and 5:30 pm except on Thursday – about his life and philosophy. It is also presented on Sunday in Hindi at 4 pm, and at 5 pm, it is shown in English.

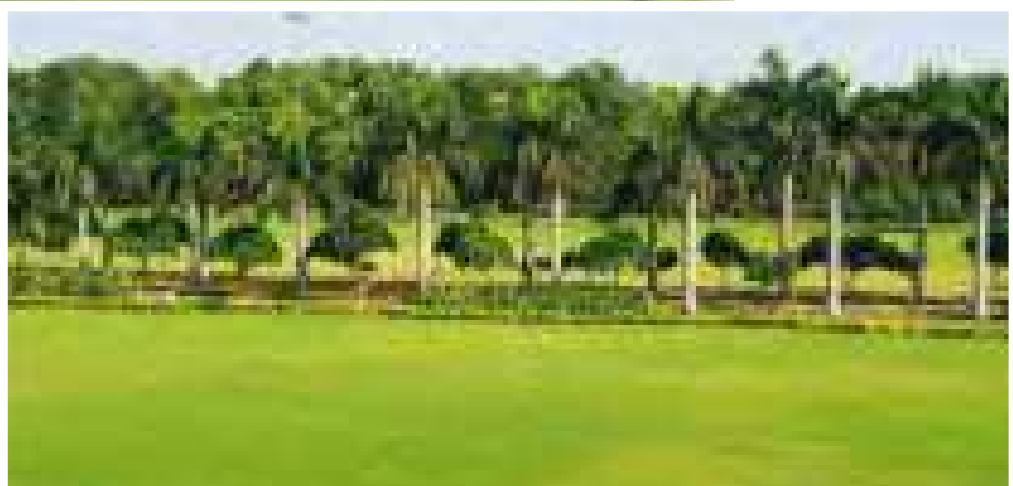
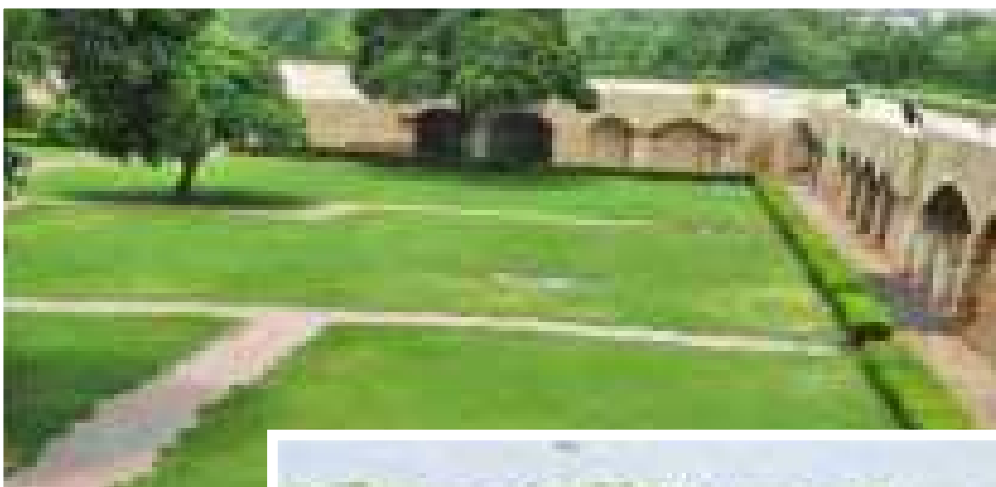
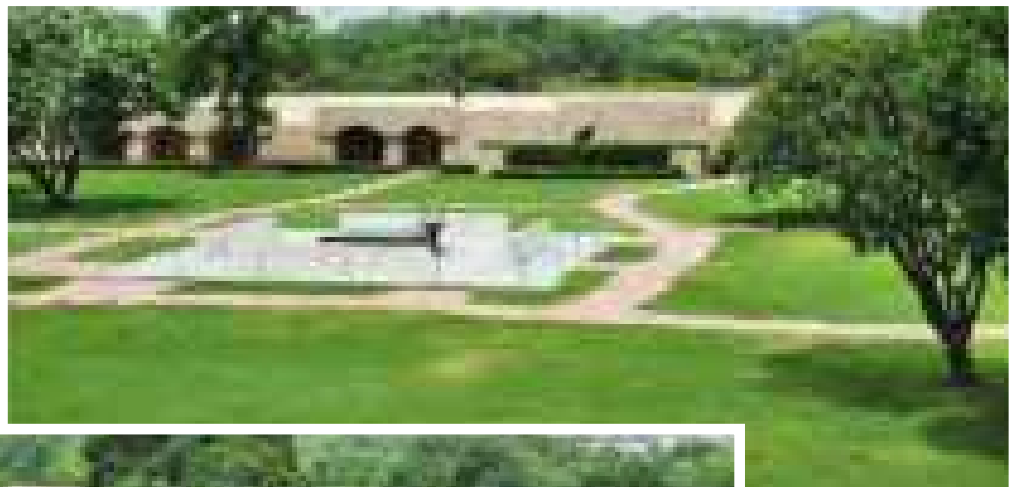














No. 5- DDR/VIP/2000-DDVI
Ministry of Urban Development and Poverty Alleviation
(Delhi Division)

Nirman Bhawan, New Delhi

Dated 21st July 2000

OFFICE MEMORANDUM

Sub: Environmental damage use to unnecessary and wasteful building exercises undertaken by Municipal agencies – Issuing of guidelines.

The undersigned is directed to state that after considering the view of experts Government agencies local bodies and NGO's the Guidelines for Greening of Urban Areas and landscape have been formulated. These guidelines are issued to all concerned for taking follow up action.

(MAHENDRA KUMAR)

Under Secretary to the Govt. of India

To

8. Principal Secretary (UD) GNCTD, Vikas Bhawan, I.P. Estates, New Delhi.
9. Commissioner, MCD, Town Hall, New Delhi.
10. Chairperson, Palika Bhawan, New Delhi.
11. Vice Chairman, DDA, Vikas Sadan, New Delhi.
12. CEO, Delhi Jal Board, Jhandewalan, New Delhi.
13. Chairman, DVB, Shakti Sadan, New Delhi.
14. DG (W), CPWD, Nirman Bhawan, New Delhi.
15. Engineer –In-Chief PWD(Delhi Admin), GNCTD, K.G. Marg New Delhi.
16. Director of Horticulture, CPWD, I.P. Bhawan, New Delhi.
17. Director of Horticulture, MCD, Under School Lane Fly over. Deen Dayal Upadhyay Marg, Rouse Avenue, New Delhi.
18. Director of Horticulture, NDMC, Palika Kendra, New Delhi.
19. Director of Horticulture, DDA, Vikas Minar, New Delhi.
20. Conservator of Forest, GNCTD, Kamla Nehru Ridge Delhi 110007.
21. Head of Department Floriculture IARI Pusa Road, New Delhi.

Copy to

1. APS to UDM/PS to MOS (UD)
2. SPPS to Secretary (UD)/ PS to JS (UD)/PS to JS(DL)/PS to DS(DD)

Guidelines for greening of urban areas and landscaping

3. **To avoid use of excessive tiling of pavements : porous materials to be used**
:- Unnecessary and excessive tiling of the road side pavement should be avoided. The area around trees lined along the road should not be covered with tiling as it hampers the basic necessary function and needs of the trees i.e. root aeration and availability of water get drastically reduced. Whenever tiling is done, porous tiles preserved while taking up civic works Indiscriminate tiling of road dividers and footpaths should be avoided.
4. **Tiling should be done only on pavements with heavy pedestrian traffic:** - Tiling should be only done don't on the roadside which have heavy pedestrian movements. In case of bridges and such areas where there are no pedestrian movement, tiling may be avoided and in case tiling is to be done, preference is to be given to porous tiles as porous materials allows seepage of ground water. The species of trees may be chosen for their pollution reduction abilities including dust trapping to avoid reliance of a single species, a combination of trees, shrubs, grasses should be grown.
5. **Growth of grasses to be encouraged :** - The necessary of grasses playing a vital role in making soil suitable for vegetation should be realized and unnecessary digging of soil should be stopped forthwith.
6. **Excessive pruning to be avoided:** - Practice of excessive pruning of crops should be avoided. Pruning of plants in a well nurtured garden and pruning of roadside plants should be differentiated Excessive pruning may lead to upsetting the root shoot ratio. Leaf pruning should not be resorted to.
7. **Compost to be made of leaves:** - Leaf is an excellent material for making of compost and burning of leaves causes pollution. A system of composting of leaves in nearby parks should be adopted which will provide water retentive manure to civic agencies. Some fallen leaves may be left near the base as water retentive mulch.
8. **Adequate space to be left around trees:** - An area of 6"x 6" around the trees should be left un-cemented. Widening of roads, upto the trunk of trees is to be avoided as roots come under the asphalted roads and will gradually die. In case of storm, these trees can topple down. Activities which adversely affect the roots are to be kept at a minimum.
9. **Digging near trees to be avoided:** - Digging near the trees by allowing telephone, electricity, sewage lines should be avoided to avoid root injury, sufficient space should be left along the ground for the trees. In no case should roots be exposed. Washing avenue trees foliage may be done on a tri-monthly basis to get rid of particulate matter from the foliage.
10. **Use of Organic Compost:** - The dead trees may be replaced by young plants after providing sufficient compost in the pits. Organic manure added with compost FYM mix with nitrogen fixing bacteria culture and neem cake should be spread on the green and poured into the soil before either irrigating the tree basin or before rains.
11. **Planting of second line trees to be encouraged:** - New trees which may be called as second generation trees must be planted preferably 2-3 meters behind

12. the existing road trees in an alternate position or inside the bungalow compounds. A mix of foliage and fruit trees should be planted. Planting of fairly well established large trees should be undertaken as chances of their survival will be more. Cues of species to be adopted may be taken from the old trees lining Delhi's roads.
13. **Initiation of EEC Activities:** - Horticulture department may initiate education/awareness campaign with school students and elders and users of the park where the difficult species of trees are present in the particular park and importance about preservation of eco-systems is explained. School Student may be taken for nature walks in a major garden to get them associated with the flora and fauna around them. Also the citizens of an area residing near a park can be involved for this awareness campaign.
14. **Compactness of soil near trees to be avoided:** - Compactness of soil should be avoided within at least one meter around the tree. Perforated metallic frame can be used for this purpose. Soil surveys around the trees should be done by removing stones.
15. **Setting up a Central Resource Centre :** - A Central Resource Centre should be set up to aid and **advise** the State Government, Municipal Corporations and other development agencies dealing with matters pertaining to Horticulture and landscaping. A manual on the subject should also be prepared.
16. **Stress on shelter beds of thick trees :-** Around the cities vulnerable to desert winds, shelter-beds of special design of thick trees should be planted.
17. **Updating technology of transplantation of trees:** - Technology of transplantation of trees should be updated to ensure at least 80 percent of the success rate of planted trees. As far as possible, trees grown in the nursery with a height of four to six meters should be planted. Presently, survival rate of trees is less due to animal menace and non-caring of trees. The public participation in caring of trees planted around their houses may be ensured.
18. **Setting up of a tree disease surgery unit in Horticulture Department:** - A small tree disease/surgery unit should be created in all Horticulture departments to cure tree maladies.
19. **Earmarking of some cost of projects for landscaping:** - In any layout plan of land and housing development, at least two and a half percent of the cost of the project should be earmarked for landscaping and green development.
20. **Use of kitchen and garden waste for compost:** - Technology to use kitchen waste to fabricate building and landscaping material should be perfected and made available to all the urban development agencies.
21. **Proper care of water fronts :-** Underground water does not get recharged sufficiently because of use concrete around them. Efforts should be made to get the water fronts recharged and these fronts kept clean.
22. **Heritage building to be landscaped:** - Areas around heritage buildings should be suitable landscaping and beautified.
23. **Greening of void areas not required for minimum construction:-** Urban void areas should not be allowed to exist and the area not required for immediate

development or construction, should be made green and fenced with suitable landscaping. Similarly road berm/right of way required for future road widening should be landscaped and maintained as green.-

24. **Encouragement for water harvesting technologies:-** Information regarding water harvesting has to be disseminated in public and its use encouraged. It should be ensured that quality of water does not get deteriorated for which required measures are to be taken.
25. **For maintenance of greens internally :-** Criss-cross paths should be provided for in the gardens and lawns. There should

be connecting gated at all corners so that people do not walk on the grass.

26. **Public participation to be ensured :-** Public participation at present is poor in maintenance of green. This has to be activated and Residents Welfare Association and to be involved in planting of new trees and in their survival. User groups need to be activated, NGO's can play a catalytic role in this. Each NGO may earmark a selected area for its activities thereby dividing the entire net area. Committee with officials from MCD, NDMC, DDA, GNCTD etc. will act as a nodal agency and will review every month or as necessary.



Landscape Design

GUIDELINES
FOR PRUNING OF TREES
UNDER DELHI PRESERVATION OF TREES ACT, 1994

1. The Delhi Preservation of Trees Act, 1994 was enacted to safeguard the forest area in and around NCT of Delhi and to provide for preservation of trees. The Department of Forests & Wildlife, DCTD has regulatory control for implementation of DPTA 1994 which prohibits felling or pruning/ head backing of trees.
2. The Sec 2 (4) of DPTA, 1994 states that "to fell a tree" with its cognate expression, means severing the trunk from the roots, uprooting the tree and includes bucking, cutting, girdling, topping, pollarding, applying arboricides, burning or damaging a tree in any other manner as factors causing the death of a tree. Thus it would be apparent that its implied meaning does not appear to carry any implicit connotation that pruning of trees which do not cause damage or death of a tree could be termed as a Tree Offence.
3. In the light of above, general guidelines for pruning of trees are prescribed for adherence by all concerned, so that the trees grown with great care and precision over a period of several years are not snatched recklessly leading to their untimely death (which is an offence under Section 8 of DPTA, 1994) or result in reduction of green cover of Delhi which is an essential strategy to combat pollution.
4. Pruning means cutting off or removing dead or living parts or branches of a tree to improve shape or growth. It is a horticultural and silvicultural practice involving selective removal of parts of a plant, such as branches, buds, or roots. Reasons to prune plants include deadwood removal, shaping by controlling or directing growth, improving or maintaining health, reducing risk from falling branches, preparing nursery specimens for transplanting, etc. However, the pruning cut should not be too large so as to damage the tree.
5. For the purpose of clarity and transparency in the meaning of light and heavy pruning, following would constitute as above:

Term	Branches of girth size	Permission required or not	Remarks
Regular Pruning/ General Tending	Upto 12.7 cm.	No	May be get done by Civil Agri-cult at regular intervals.
Light Pruning	Greater than 12.7 cm but less than and equal to 40 cm.	Required	From concerned Tree Officer on submission of prescribed Form B and other documents as prescribed in DPTA, 1994.
Heavy Pruning	Greater than 40 cm	Required	From concerned Tree Officer on submission of prescribed Form B and other documents as prescribed in DPTA, 1994.

6. The forest department does not get the trees felled or pruned/ head backed directly but only accords permission for the same to the owner of land on which the concerned tree is standing after due inspection/ investigation.
7. The actual pruning of the concerned tree/ trees is got done by Deputy Director (Hort.) of the MCDs/ NDMC/DDA/ FWD/CPWD (whichever is the land owning agency) of the concerned area or by the property owner himself/ herself.
8. For obtaining permission for felling or pruning/ head backing of trees, guidelines are in place for information to all and ease of Public/ Govt. agencies towards achieving their desired objective which are available on the department website "www.forest.delhi.gov.in".
9. If individuals/ General Public/ Society (RWAs) is desirous that any tree inside his house/ premises is posing problems to him or the public and needs to be felled or pruned/ head backed, then he may apply for the same in Form B along with photographs and number of trees/ trees in situation to the DCF/ Tree Officer of his area for the permission. After inspection, the permission or otherwise is communicated to him/ her within 60 days as per merit of the case.
10. If the tree/trees for which felling or pruning/ head backing is required is standing on Govt. land/ roads/ Parks/ govt. property in front of the houses/ shops/ private property of an individual and is posing problem to him, he has to apply for felling or pruning/ head backing of such tree on a simple piece of paper to the Deputy Director (Hort.) of the MCDs/ NDMC/ DDA/ FWD/ CPWD (whichever is the land owning agency) with photographs of such tree/ trees.
11. It should neither be applied directly to concerned DCF nor Form B submitted directly which has to be filed and signed by the concerned Dy. Director (Hort.) of the land owning agency. After inspection, the permission or otherwise is communicated within 60 days of receipt of such completed application/ Form B to the concerned Dy. Director (Hort.) as per merit of the case.
12. If a tree is standing on govt. land but leaning on private land/ building and is considered dangerous and likely to cause damage to life and property, it should be informed immediately with photograph to the concerned aggrieved person. Permission is granted for its felling or pruning/ head backing within 48 hours of inspection, as per merit of the case. In case permission/ any intimation to the contrary is not received within this time, the person can go ahead and fell or prune/head back the dangerous/ leaning tree and intimate the concerned Tree Officer (DCF) within 24 hours of such felling or pruning/ head backing.
13. There are three (3) Deputy Commissioner of Forests (DCFs) who are designated as Tree Officers to look after the cases of tree felling or pruning/ head backing and accord permissions for the same, after inspections, as per merit of the case. Their respective jurisdictions in Delhi are shown in table below.

S.N.	Name of the Division	Name of the Revenue Districts	Name of the Subdivision
1.	North Forest Division	North	Mulla Town, Kumbh & Alpur
		North West	Wafar, Kuchaman & Suroost Yhar
		West	Fuzari Naga, Fari Naga & Nagan Naga
		North East	Kumbhar, Yaman Yhar & Kumbh Naga
		East	Umar Naga, Fari Yhar & Yaman Yhar
		Shahar	Shahar, Kumbhar & Yaman Yhar
		Control	Civil lines
2.	West Forest Division	South West	Dwarka, Nighat & Kuchaman
		New Dohal	Chandpura, Dohal East & Yaman Yhar
3.	South Forest Division	South	Sahel, Hara Khan, Mahmal
		South East	Indra Colony, Sahel & Naha Yhar
		Control	Kumbh & Kumbh Naga

14 Pruning/ pollarding/ burning/ topping/ applying arboricides or damaging a tree in any other manner would be considered as tree offence when, as per local estimation of such damage, the Tree Officer, in all his wisdom, holds that such act is likely to lead to the death of the tree, in near future.

15 If a tree standing on any govt. land/ road side/ private land/ building is considered dangerous and likely to cause damage to life or property, or hindrance to traffic signal, it should be pruned immediately by the concerned Civil Agency and referred to concerned Tree Officer within 24 hours and for which no permission is required from Tree Officer.


 Deputy Conservator of Forests (HQ)
 Member Secretary (Tree Authority)

R.No.8(133)/CF/TA/CF-28/Pat No/28-VN/5473-20

Date: 07/10/19

Copy to:

1. All DOPs for information.
2. All DDOs/ Forest Guards for information.
3. The Director (Hort) of all Civil Agencies viz. MCDU/ NDMC/ DCU/ PWD/ CPWD etc.
4. Notice Board
5. Programmer, Environment Department, GNETS with a request to upload on the official web site of the Department.

Distribution:

1. Secretary to Hon'ble Minister (S&F), GNETS for information.
2. PS to Principal Secretary (S&F), GNETS for information.
3. PCOT/ MOO, GNETS for information.


 Deputy Conservator of Forests (HQ)
 Member Secretary (Tree Authority)

FORM 18'

(See sub-rule (1) of rule 4)

The Tree Officer,

Sir,

I apply for grant of permission for felling trees located in the property situated in the village _____ and District _____. I furnish below the following details in support of my application:

- i. Applicant's name and address (in block letters).
- ii. Name and address of the owner of the property (if different from applicant).
- iii. Title of the applicant i.e., whether owner/occupant of the property, etc.
- iv. Name of the village and house number of property.
- v. Total area of the property with description of the boundaries.
- vi. Total number of trees (specieswise) whose trunk or body is not less than 30cm in diameter at a height of 100cm from the ground and whose height is not less than one metre from the ground.
- vii. The exact area (in sq. metres) from which felling of trees for which permit is sought (description of the boundaries).
- viii. Total number of trees to be felled.
- ix. Trees to be felled are numerically numbered in paint, their girth measured at a height of 1.35 metres from ground level and their details specieswise are:

Species	No.	Girth
---------	-----	-------
- x. Purpose for which the felling of trees are intended.
- xi. Intended use of felled trees (e.g.) for sale, for domestic use, etc.
- xii. Intended use of land after felling of trees.
- xiii. Number and species of trees intended to be planted after felling (give details of arrangement for raising, planting and protecting trees).
- xiv. Name /s and address/es of the owners/occupants adjoining property/es.

2. I am enclosing an affidavit and below mentioned papers in support of my application.

CHAPTER - 22

DISPLAY OF FLORAL TABLEAU DURING REPUBLIC DAY CELEBRATIONS PREPARATION OF FLORAL TABLEAU

Republic day celebration is the responsibility of the Ministry of Defence, Government of India. Ministry of Defence circulates its letter for the preparation of different tableau to the various states and some of the Ministries for the Republic day celebrations in each year. Our Ministry receives this letter in the month of May then this work is assigned to CPWD, and till the month of June, it comes to the Directorate of Horticulture. Director of Horticulture assigns the duty of a particular division for the fabrication of the floral tableau. Normally, six sketches of themes are being submitted to the Ministry of Defence by the month of July as per their guidelines. Then discussion regarding the theme of the floral tableau being discussed before the tableau expert committee. Expert committee suggests their view points regarding the theme, colour scheme and its suitability to the occasion. Then department has to make rectification in the theme, colour scheme, etc. as desired by the tableau expert committee. After they get satisfied with our proposal then we are being asked for the preparation of the model. Then again meeting takes place regarding the selection of model and expert committee suggests their view points regarding the model. After the model being selected by the tableau expert committee then the department is asked to submit music with relevant to the theme and model. Then again meeting takes place regarding the selection of music, if any suggestion comes then music is also modified as per the view points of expert committee. After the theme, model, music and colour scheme being cleared by the tableau expert committee then the department gets ready for the

preparation of floral tableau for the Republic day celebrations.

Director of Horticulture selects the site for the preparation of floral tableau by taking concern of all the sensitivity and security angles of the Republic day celebrations. In the last week of December the department gets a new tractor along with a trailer from the Ministry of Defence (OSD, RR Camp), duly received by the Assistant Director Horticulture and Section Officer Horticulture in-charge of the floral tableau. The whole arena of the fabrication site is being taken by DCP (PM security), Delhi Police and the site is being monitored by CCTV round the clock as per the security norms. Director of Horticulture convenes a meeting of whole department and takes the view points of everyone regarding the availability of flowers and other suggestions regarding fabrication of floral tableau. Thereafter duties are being assigned to all the Horticulture Divisions situated at Delhi. In the first week of January skeleton work starts thereafter wire mesh and mossing works starts. Mossing is done and it is being watered regularly for the conservation of moisture so that longevity of the flowers may be ensured. On 23rd onwards collection of flowers starts and the pinning of the flowers starts on 25th morning and entire Horticulture department works during this occasion as per the duties already assigned to them and it completes around 11:00 PM in the night. A dinner is also being hosted by the Director of Horticulture for all those who are involved in the fabrication work during this occasion, all the senior officers of the CPWD including Director General and Secretary, Ministry of

Urban Development also grace the occasion with their presence. CPWD floral tableau is continuously winning special prize since year 2007 and in the year 2007 this floral tableau won four prizes i.e. Special prize, Best theme,

Best colour scheme and Best presentation. Probably this floral tableau is one of the longest floral fabrication work where this much infrastructure, floral craftsmanship and skilled man power is involved.

CPWD TABLEAU- 2000

Theme : Basant

The theme of the Floral Tableau of the year 2000 is 'Basant' depicting Ideas of rejuvenation, renewal, regrowth. Basant festival is celebrated to mark the preliminary preparations for the arrival of spring. The beautiful Tableau shows the colour yellow represents good fortune, spirituality, the ripening of the spring crops and the recent harvest. Yellow flowers are used in abundance to decorate the places of worship. In the Tableau Garden adornments like Fountain

and patio adding the beauty. This design and concept re beautiful depicted in this tableau.

The Tableau describes plants and animals compliment and supplement with each other and truly depict the quotes i.e. spending time in nature is energizing.

Chrysanthemum, Carnation, Rose, Gladiolus and Marigold are blended on the Tableau in a way that perceives a natural landscape.



2000 (BASANT)

CPWD TABLEAU- 2001

Theme : Shanti Sandesh

The theme of the Floral Tableau of the year 2001 was “Shanti Sandesh” showing three monkeys of Mahatma Gandhi depicting moral gestures-see no evil, speak no evil, and hear no evil.

The rear part of tableau shows the portrait of mahatma Gandhi decorated with beautiful white colour chrysanthemum flowers gives the message of peace and purity. The front portion of Tableau shows the Teen Bander of Mahatma Gandhi. These monkeys have

come to resemble our actions or observation, listening, and speaking which depicts don't see flaws in every one, don't listen irrelevant things don't speak any things that hurt others. Always look for the good in people and believe in truth.

The beautiful flowers of different varieties of Lily and Asparagus are used in the Tableau which gives message of renewal, growth, and hope.



2001 (SHANTI SANDESH)

CPWD TABLEAU- 2002

Theme : Ghar

The theme of the Floral Tableau of the year 2002 was 'Ghar' depicting Home, a place of happiness, peace and harmony happiness lies within individual but home environment also plays very crucial role this tableau depicts that happy home is one which is surrounded by aesthetic view. Money is not the secret of happiness.

Floral Tableau decorated with beautiful colours of Gerbera flowers. Yellow marigold usage on the Tableau representing passion and creativity. The trees all around the houses keeps the macro environment cool and brings happiness and positively.



2002 (GHAR)

CPWD TABLEAU- 2003

Theme : Chatur Khargosh

The theme of the Floral Tableau of the year 2003 was 'Chatur Khargosh' indicates popular story about clever Rabbit and foolish Lion. In this story a greedy lion started killing animals in the forest indiscriminately and to bring an end to this animals decided to sacrifice themselves by volunteering one animals every day. The wise rabbit let the lion towards the deep well and showed his reflection in water as claimed as his competitor. Foolish lion in the well to attack

his competitor and lost his life. Thus the wise rabbit saved the inhabitant of the forest. The story gives the moral 'Wit is superior to brute force'. The front part and the rear part of Tableau shows the Lion stands on the deep well waiting the animals.

On the Tableau the diversity of animals made from the flowers of various colours giving the look of forest whereas other things are given natural colour. All the decorations are made with fresh flowers.



2003 (CHATUR KHARGOSH)

CPWD TABLEAU- 2004

Theme : Teej

The theme of the floral tableau of the year 2004 is “Indian Festival Teej”, which showcases Indian Culture and Happiness. The very colourful festival of Teej is presented through tableau by CPWD. The Teej festival welcome monsoon season and monsoon and primarily dedicated to Goddess Parvati and her union with Lord Shiva. It is celebrated throughout the country.

The front trailer has a depiction of an elephant howdah, the throne where king (Maharaja) used to sit. Two peacocks placed at side of this trailer, representing monsoon season

festival teej. The attached trailer shows a group of womens in traditional costumes, dancing on the folk music and welcoming monsoon.

Blemish- free flowers are selected to create the display, of the theme with floral rangoli two elephants on the sides of the trailer posing in welcome manner. Chrysanthemums, marigolds, gladioli, anthuriums, different varieties and many types of foliage plants are used to bring out this showcase of indian culture and happiness.



2004 (TEEJ)

CPWD TABLEAU- 2005

Theme : Chatur Bandar .

The theme of the floral tableau of the year 2005 is “Chatur Bandar”, Intellectual mind of monkey. It depicts the story of clever monkey and foolish crocodile which is believed to be featured in the Panchatantra, folk tales written by an Indian scholar Vishnu Sharma. The crocodile and monkey become friends after the later offers berries to the former. The crocodile’s wife gets jealous of this friendship and demands her husband to bring her the heart of monkey. Being persuaded by her, the crocodile tricks the monkey to come with him for dinner at his place. Once they reach the middle of river, the crocodile spills his plan.

At this point, the monkey stays calm and thinks wisely. He devises a plan, and tells the crocodile that he keeps his heart safe on tree. The crocodile falls for this scheme and takes the monkey back to his tree, for retrieving the heart. Once home, the monkey flees to the top of the tree and bids farewell to crocodile and his friendship.

Different scenes of this story are depicted on the tableau, Blemish- free flowers are selected to create the whole scenery, also shown floral rangoli. Chrysanthemums, marigolds, gladioli, ferns and berry trees are used to bring out the story of ancient wisdom.



2005 (CHATUR BANDAR)

CPWD TABLEAU- 2006

Theme : Sagar Sampada

The theme of the floral tableau of the year 2006 is “Sagar Sampada”. The Indian Ocean is the largest which surrounds India from three sides. These ocean has conserved many natural including shall resources coral reefs, fungi, and mineral resources. Ocean provides marine life to abundant aquatic organisms and supports livelihood to millions of people. But due to climate change and global warming , ecosystem of marine life is in danger. Lots of marine species are being extinct due to water. This tableau giving

the message to save the wealth of marine ecosystem.

The front part of tableau showed octopus crafted with flowers. The mid, rear and side portion of trailer showed different types of marine fishes, sharks, coral reef, turtles, marine mammals and many more benthos and planktons. Ocean is depicted by using blue coloured flowers and other marine organisms are beautifully crafted with different types of flowers and foliage.



2006 (SAGAR SAMPADA)

CPWD TABLEAU- 2007

Theme : Nanhi Duniya

The Tableau depicts children in moods and is intended to get them identified with the Republic Day Celebration.

Placed on the tractor are a happy boy and a girl with a pet rabbit in the background. A number of slides, swings and children in playful moods have been shown scattered all over the trailer.

On the both side panels of the trolley has been fascinated by showing the famous

Panchtantro story. The story is based of the theme “Slow and Study win the race” In which a rabbit following a tortoise which is leading the race. Other than rest of the animals watching the race.

Natural flowers will be lavishly used to create an eye pleasing experience. Children and Parents characters are live, while the cartoon characters and other things are created out of floral designs.



2007 (NANHI DUNIYA)

CPWD TABLEAU- 2008

Theme : 60th years of Independences

This Floral Tableau is depicting patriotism unique cultural heritage made up to colourful and fresh flowers. This Floral Tableau also won special prize among the Tableau which

paraded in the Republic Day Celebration 2008. Natural flowers had been lavishly used to create and eye caching experience.



2008 (60th YEARS OF INDEPENDENCES)

CPWD TABLEAU- 2009

Theme : Toy and Games

This year CPWD Floral Tableau is depicting Toys and games.

The Tableau leads with first Indus valley Toys. Indus Valley people seem to have loved toys. They made many toys, such as toy Bird, toy monkeys that could slide down ropes.

On the trailer part has been shown different type of toys like wooden toy, terracotta toys,

and chess, modern Bat and ball kite. Middle part of the trailer shows the children's playing and enjoy with toys.

The tableau would be crafted in flowers in their natural colours.



2009 (TOY AND GAMES)

CPWD TABLEAU- 2010

Theme : Global Warming

This year CPWD Floral Tableau is depicting effect and solutions of Global Warming. These days hardly a day goes by without a news story reporting an aspect of global warming. The Tableau leads the reasons of global warming. Hence burning earth has been shown on the front part of the Tableau. Deforestation, industrial and traffic pollution, the land pollution by throwing garbage is shown on the side part of the tractor. On the trailer part has been shown plant new trees and preserves existing trees. Middle part of the trailer shows the activities, a teacher

educating children to grow more trees to keep the environment clean. We educate children to be eco-friendly and to protect our environment. Back part of the trailer show the lovely glaciers where young children are enjoying the nature's beauty. On the side panel it has been shown that animals are moving freely around the protected environment. The tableau would be crafted in flowers in their natural colours.

WHEN WE HEAL THE EARTH, WE HEAL OURSELVES.



2010 (GLOBAL WARMING)

CPWD TABLEAU- 2011

Theme : Save The Tiger, Save Earth

These days hardly a day goes by without a news story reporting an aspect of save tigers. India has been home to Tigers for a very long time. Tigers were found all over India and still as many as 16 States of India are home to the Tigers. The latest census report released on 12th. February, 2008 by the Government of India reports that there are **only 1411 tigers left**.

The population of the Tiger has been reduced by nearly 50% and that too in a period of 6 to 7 years. It is time that emergency and drastic steps are taken to save the pride of jungle and pride of India from becoming extinct. Agriculture, industrialization and degradation and fragmentation of natural habitats, forests and natural grasslands are one of the main reasons for the decrease of Tiger population and for that matter all wildlife in India. The immediate effect of this is lack of natural food and habitat causes the wild animals to come out of the forest area.

If we make sure tigers live, we will have to make sure that deer, antelope and all other

animals that the tiger eats or its prey base live. To make sure that these herbivores live, we must make sure that all the trees, grass and other plants that these prey animals need for food are protected. In short, in this way the whole forest gets saved! Saving the tiger means indirectly saving the forests and in turn saving the environment that is reeling under global warming due to massive deforestation. Not only is tiger a beautiful animal but it is also the indicator of the forest's health. Saving the tiger means we save the forest since tiger cannot live in places where trees have vanished and in turn secure food and water for all. This year CPWD Floral Tableau is depicting the save tigers. The Tableau leads tiger kids playing and enjoying the natural habitats, forest and natural grassland. Shown at the front part of the trailer. The rear part of the trailer the pear of tiger setting on rock in its full wild majesty its natural beauty. The tableau would be crafted in flowers in their natural colour.



2011 (SAVE THE TIGER, SAVE EARTH)

CPWD TABLEAU- 2012

Theme : Snow Valley

This year CPWD Floral Tableau is depicting SNOW VALLEY a beautiful landscape of north India. These days hardly a day goes by without a news story reporting an aspect of global warming. There is no doubt that global warming is felt in many ways now and this will worsen. Effects are, and will, be increasingly noticeable in these areas.

We educate children and tourist to be eco-friendly and to protect our environment. All the activities show the people are having fun

and enjoying in fresh nature. On an average snowfall patterns have changed across the glaciers are melting rapidly. To stop deforestation and to protect our environment.

The trailer shows the lovely glaciers where young children are enjoying the nature's beauty. The tableau would be crafted in flowers in their natural colours. The tableau is intended to make an extremely eye pleasing experience by using natural flowers lavishly.



2012 (SNOW VALLEY)

CPWD TABLEAU- 2013

Theme : Seasons (Ritus)

C.P.W.D. Floral Tableau is depicting the cycle of seasons (Ritus). Front portion of the Tableau displays “Vasant Ritu” (Spring season), Shown by dancing boy and girl. The front part of the trailer is showing “Grishma Ritu” (Summer season). Middle part of the trailer is showing “Varsaha Ritu” (Monsoon season) depicted as dancing peacock

and water fall, after that deciduous tree is shown in “Sharad Ritu” (Autumn season), followed by bonfire by the live characters under “Hemant Ritu” (Pre-winter) and snowy mountain under “Sisir Ritu” (Winter season). The whole Tableau is crafted by beautiful and vibrant colorful fresh flowers.



2013 (SEASONS - RITU)

CPWD FLORAL TABLEAU -2014

Theme : Rajpath

The theme of the floral tableau of the year 2014 is “Rajpath” illustrating the landscape beauty of Rajpath. Rajpath which means the Royal Path. It is a ceremonial venue located in the heart of New Delhi, the capital of India. Rajpath runs from the Rashtrapati Bhawan on Raisina Hills on one end to the National Stadium on the other end and passes through Vijay Chowk and Inda Gate. Rajpath is also popularly referred as “The Rajpath”. Rajpath is surrounded by beautiful and lush green lawns, rows of trees and canals on the both sides.

The Front part of the tableau illustrating the India Gate made up of different flowers

and leaves. The flower which is used in front tableau are: orange and yellow (marigold), white and pink (anthurium), pink (carnation), orange (French marigold) and green asparagus. Middle tableau shows the running water in the form of fountain covered with blend of flowers in all around. Boy, girl, man, women, couples are shown in middle of tableau close to fountain to make a picturesque image of Rajpath. On the background the parliament is designed with the use of orange and yellow colour marigold flowers and ferns and green plants on its side. The whole picture of the floral Tableau is a masterpiece.



2014 (RAJPATH)

CPWD FLORAL TABLEAU -2015

Theme : Maa Ganga

The theme of the floral tableau of the year 2015 was of “Maa Ganga”. The Ganga is the most sacred and longest and river of India. This river originate from Gangotri, and passes through across country and falls into Bay of Bengal. It is lifeline of millions people who live along its course. Govt has launched Namami Ganga programme to clean the Holy Ganga.

The front part of tableau symbolizes kalash decorated with beautiful flowers depicts the Holy Ganga Jal. Middle of trailer showing the peoples enjoying on the bank of river. The rear part of tableau is designed like beautiful Gangotri glacier of Himalayas from which holy river emerges and also Kedarnath temples. The whole tableau were crafted with green foliage and flowers to give picturesque view.



2015 (MAA GANGA)

CPWD FLORAL TABLEAU -2017

Theme : Clean India Green India

The theme of the floral tableau of the year 2017 was of “Clean India Green India”. During 2014, Hon’ble Prime Minister launched the Swachh Bharat campaign which is the largest cleanliness drive in the history of India aims to achieve the vision of a ‘Clean India ‘ by 2nd October 2019. As a part of Swachha Bharat Abhiyan, Clean India , green India, initiated. cleanliness is a clean habit which is very necessary for all of us. This is also habit of keeping ourselves physically and mentally

clean including our home, pets, surroundings, environment, office, school etc.

The rear part of tableau showed a hermit was doing meditation near mountains area that promotes healthy minds are developed in clean environment. The whole tableau were crafted with green foliage symbolizes to promote the greenery that leads to cleaner and pure air.



2017 (CLEAN INDIA GREEN INDIA)

CPWD FLORAL TABLEAU -2018

Theme : Diwali

The theme of the floral tableau of the year 2018 is of “Festival of Diwali portraying lighting festivity” depicting the message of Peace and Happiness. Diwali is the festival of victory of light over darkness, good over evil, joy and happiness. It has been celebrated for welcoming Lord Rama return to his kingdom Ayodhya after staying in exile for fourteen years. To mark the occasion, people lighted lamps and decorated whole Ayodhya with diyas.the ideas behind lighting diyas and fireworks on the day of Diwali is to spread

the light of positivity in the world, despite the darkness of negativity.

The trailer part of tableau symbolizes temple decorated with beautiful flowers lightened with diyas.The middle part symbolizes people were greeting each other with happiness, joy and sweets. the back part of tableau represents Kingdom Ayodhya, decorated with flowers and lightened with diya. Whole tableau beautifully represents peace and happiness. Side of tableau were decorated with blends of different colours of flowers.



2018 (DIWALI)

CPWD FLORAL TABLEAU -2019

Theme : Dandi March

The year 2019 is being celebrated as 150th birth anniversary of Father of Nation. Therefore the theme of the Floral Tableau of year the 2019 is “Dandi March” movement started by Mahatma Gandhi and Title is **“VANDE MATARAM”**. In this floral tableau different varieties of flowers, foliage and ground covers have been used. Different flowers like chrysanthemum, marigold, liliun, gerbera, china aster and many more have been fixed up by the skilled men to make JHANKI a perfect masterpiece.

Marigold and Chrysanthemum are used to frame the Gandhi Ji figurine which spread the message of “Unity in Diversity” and “Non-violence” during Dandi March (1930). The middle part of tableau is our national flag “Pride of Nation” beautifully decorated with flowers and foligae. The Back Part of tableau is symbolized by Pigeon decorated with white chrysanthemum over the globe, spread the message of peace across the world. The “charkha” was beautifully decorated by marigold represents the Gandhi jis ideology.



2019 (DANDI MARCH)

CPWD FLORAL TABLEAU -2020

Theme : KASHMIR SE KANYAKUMARI

Sare jahan se accha, Hindostan hamara hum bulbulen hain is ki , yeh gulsitan hamara.

Indian has different religion, different language, different culture but known for unity $\frac{1}{4}$ usdrk esa ,drk $\frac{1}{2}$ - This year the CPWD Horticulture tableau is depicting the nation "KASHMIR SE KANYAKUMARI" and different parts of country are shown at floral decorated tractor and trolley.

On the trailer it represent natural landscape of Kashmir valley, dull lake where tourists are enjoying on "Shikara" which is part of tourist attraction.

On the front part of the trailer represents **Sanchi Stupa**, which is one of the oldest stone structures in Sanchi at Madhya

Pradesh. Spreading the message of peace and love.

The tractor enhances the southernmost point i.e. Kanyakumari surrounded by the sea, a memorial of Swami Vivekananda.

Besides their other part of country lake Rajasthan represents the western part of the subcontinent holds up the side panel of the tractor and binding all these elements with Jahaj of desert.

Apart from this the ground artists will showcase different religion representing unity and integrity.

The tableau crafted with their identical places in flowers in their natural colours.



2020 (KASHMIR SE KANYAKUMARI)

CHAPTER - 23

WINTER SEASONAL FLOWERS

The winter season in India starts from the month of October and continues till the month of March. This is the season when the flowering plants bloom and fill the dull landscape with their vibrant and eye-soothing colours. It is up to the choice of the gardener, what variety he wants to grow. Definitely he should be aware that the variety that he chooses should be suitable with his land conditions for a perfect bloom. The conditions required for a great bloom may involve different light requirements depending on their variety, i.e. full, semi-shaded or shade, most winter annual flowers require full sun and water throughout.

The characteristic feature of every winter flowering plant would be their striking appearances and a colourful display of flowers. Annual flowers and plants live their complete lifecycle in one season and once they start to flower they continue blooming, some just until they have produced seed, other until the weather is incompatible for their growth/survival. You should intend filling the colourless places in the garden with colourful flowering plants. Winter can be dull if we have not prepared for it with the grey skies and so many plants dormant. Winter annual flowers can be a fantastic way of filling the gap in the time between dormancy and spring with sparky colours. Fortunately, North India offers a very rich variety of winter annuals to choose and to arrange them in order to create a colourful display in the garden. There are two ways to grow them, firstly from seedlings which grow in seed pans, secondly by directly sowing seeds in beds or pots.

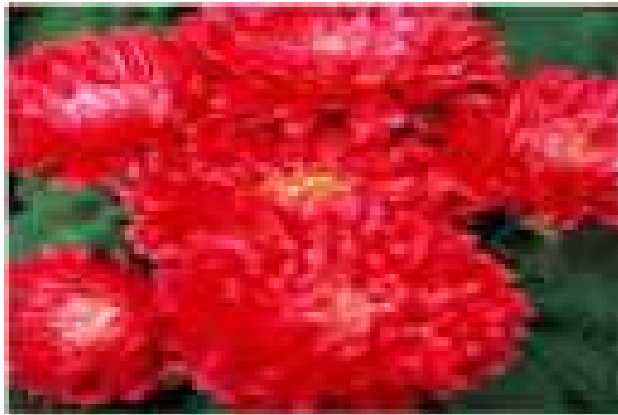
No joy in this world would match the level of joy to gaze upon the seedling sown by you, break first into a bud and then blossom into a riot of colours, an unsurpassed beauty that only Mother Nature can bestow on mankind. Sheer aesthetics apart, growing plants would take care of your contribution towards conserving our environment. This in turn would help save the fast-depleting green cover on earth. So go out and plant now. Happy gardening!

Herewith are a few examples of winter annuals which are easy to grow in Indian conditions, easy to maintain and bloom into absolutely stunning flowers.

1. Aster (*Callistephus chinensis*)

Asters get their name from the Latin word for “star,” and their flowers are indeed the superstars of the garden. Some the height of the plants varies from 30 cm to 75 cm according to varieties. Aster has most cheerful different colours. It requires full sun for growth. The flowers attract butterflies and drought-tolerant plants and very easy to grow during winter in India.





2. Sweet William (*Dianthus barbatus*)

The quintessential cottage flower, pinks are treasured for their grass like green foliage and abundant starry flowers, which are often spicily fragrant. Depending on the varieties of pink, red and other colours flowers appear in late winter and continue till spring. This is used as cut flower in flower vases . Plants height varies from 10 cm to 75 cm approx. The flowers attract the humming bird, butterflies.



3. Petunia (*Petunia hybrida*)

Petunias are fail proof favourites for gardeners everywhere. They are vigorous growers and prolific bloomers from mid spring through late fall. Colour choices are nearly limitless, with some sporting beautiful veining and intriguing colours. Many varieties

are sweetly fragrant (sniff blooms in the garden centre to be sure.) Some also tout themselves as “weatherproof,” which means that the flowers don’t close up when water is splashed on them. Height of the plant varies from 15 cm to 45 cm according to varieties . It is more useful in pots and border of the lawn.



4. African marigold (*Tagetes erecta*)

There’s nothing subtle about an African marigold, and thank goodness for that! It’s a big, flamboyant, colourful punch of colour for the sunny bed, border, or pots. Mostly it finds in orange, yellow, cream and white. Plants height varies from 30 cm to 90 cm according to different varieties The foliage of the plants dark green fresh and tidy. It require full sun and a common man flower in India.



5. Marigold French (*Tagetes patula*)

Shorter and not as upright as African Marigolds, French Marigolds form mounds that are often wider than they are tall. These aromatic annuals are easy to grow and brighten the garden with their cheerful shades of yellow, orange and red. They grow roughly 8-12 inches high with a chic, neat, little growth habit and elegant dark green foliage. They do best in full sun with moist, well-drained soil and will flower all summer long. They may reseed, coming back year after year, in spots where they're happy.



6. Phlox (*Phlox drummondii*)

Annual phlox is good choice for gardeners in India because it's easy to grow and puts on such a great display for beginning gardeners who have to tackle a hot, dry spot. Remove the flower clusters as they fade to encourage more blooms and pinch the plants back in summer if they start to get leggy. Plant is grown easily in beds, pots and border etc. Height of the plants varies from 10 cm to 45 cm and has the wider choice of colour white, pink, red, blue, violet, lavender etc.



7. Statice (*Limonium sinuatum*)

Old-fashioned annual statice is found more often dried in crafts stores than growing in gardens. But this easy-to-grow plant is a great pick for containers or the middle of a border, especially if you want to harvest it for everlasting bouquets indoors.

The plant is also very drought-tolerant, so you can enjoy its blooms even if you forget to water it from time to time. In fact, statice thrives in hot, sunny spots with well-drained soil. The plants to be planted middle of the border and height goes to 30 cm to 60 cm. This is a wider choice of floweriest because the flowers to be used for cut flowers and dry flower.



8. Begonia (*Begonia valvata*)

Annual begonia is about as easy as it gets. It does well in a variety of conditions, but to keep it its most luxuriant best, give it light shade; rich, well-drained soil; and ample water. It also loves plenty of fertilizer, so be generous. The plant can be grown in semi shade or shaded area. The plant height varies from 15 cm to 45 cm according to the varieties It is specially use in container, border as well as hillock also.



9. Black-eyed Susan (*Rudbeckia occidentalis*)

Add a pool of sunshine to the garden with a massed planting of black-eyed Susan. From midsummer, these tough native plants bloom their golden heads off in sun or light shade and mix well with other perennials, annuals, and shrubs. Tall varieties look especially appropriate among shrubs, which in turn provide support. Add black-eyed Susans to wildflower meadows or native plant gardens for a naturalized look. Average soil is sufficient for black-eyed Susans, but it should be able to hold moisture fairly well. The Plant ht. 60-300 cm tall, 3-11 plants, Width: 1-1/2 to 3 feet, Depending on variety flower color: Yellow or Orange Flower, Depending on variety Bloom, Time: Bloom midsummer into fall.



10. Calendula (*Calendula officinalis*)

The Calendula is a most common winter annuals after the African Marigold in India. Sometimes grown as an herb, cheerful calendulas look good in every garden. The cream, yellow, apricot, or orange flowers are edible, adding bright colour and tang to soups and salads. And they're great cut flowers, adding a burst of sunshine to bouquets. Cool-season annuals, these plants do best in early flowering.

They like a variety of soils but need good drainage and moderate water. Deadhead them regularly to prolong bloom. Calendula will reseed in ideal conditions. The plant requires full sun it can be easy to grow and uses for cut flowers, border plant and pot plants. Height of the plant varies from 20 cm to 75 cm according to different varieties.





11. California poppy (*Eschscholzia californica*)

California poppy, a native wildflower, adds an easy going dose of color hot, dry sites. Beautiful, satiny flowers in sunset colors wave above ferny, blue-green foliage. They like poor soils, especially sandy soils. If soil is too rich and moist, they won't bloom well. California poppies are a cool-season annual, which means they offer great color early in the growing season but fade once the heat of summer hits. The Plant ht. 30 cm tall , width: 1 foot wideLandscape, Easy to Grow. California poppies will reseed easily; for more plants next year, allow some flowers to ripen to seed on the plant and scatter when you tear up those plants. Replant in fall if you like, especially in warmer-climate areas.



12. Hollyhock (*Alcea rosea*)

The ultimate cottage garden choice, hollyhock sends up tall spires that cover themselves in flowers in beautiful colors. They're easy to grow from seed -- in fact, that's usually the only way they are found in garden centers. Most hollyhocks are biennials, that is, they grow only foliage the first year, flower the second, and die that fall. However, if you establish a stand of hollyhocks, they'll reseed each year so there will always be plenty blooming. Interestingly, the flowers open from the bottom to the top of the spike throughout the summer. These tall (up to 8 feet) beauties are ideal against fences or buildings where they can get natural support. Red forms are especially attractive to hummingbirds and butterflies. The plant ht. 90-240 cm, width. 30-90 cm, colour available. Red, Pink, apricot, yellow, lavender, purple and near black, Easy to Grow.



13. Cosmos (*Cosmos bipinnatus*)

The simple, daisy like flowers appear in cheery shades on tall stems that are great for cutting. The lacy foliage makes a great backdrop for shorter plants, as well. Cosmos often self-seeds in the garden, so you may only have to plant it once, though the colors can appear muddy or odd in the reseeds. The plant ht. 60-150 cm tall, 2-11 plants, width: 30-60 cm wide landscape, Easy to Grow Plant cosmos from seed directly in the ground in spring. Or start from established seedlings. This flower doesn't like fertilizing or conditions that are too rich, which causes the foliage to be large and lush but with fewer blooms.



14. Flowering kale (*Brassica oleracea*)

Thank goodness for kale. It's one of the few plants available to add a fresh burst of color and life to the fall landscape! Its leaves come with beautiful variegations in pinks, purples, and reds that blend beautifully with changing autumn foliage. Plant it in spring or in the fall after you tear out tired or frost-damaged annuals such as marigolds and impatiens. It likes rich, well-drained but moist soil. The

flower ht. 12-18 inches tall, width: 12-18 inches wide landscape, Easy to Grow.



15. Gazania (*Gazania linearis*)

This tough plant endures poor soil, baked conditions, and drought beautifully and still produces bold-color, daisy like flowers from summer to frost. A perennial in Zones 9-11 -- the hottest parts of the country -- gazania is grown as an annual elsewhere and blooms from mid-summer to frost. A summer plant often grown as an annual, gazania bears boldly colored daisy-shaped flowers from



summer to frost. The flowers appear over toothed dark green or silver leaves between varieties). Plant established seedlings outdoors after all danger of frost has passed. Do not fertilize, and keep soil on the dry side. The plant ht. 30 cm, width: 30 cm, 8-10 plant, Easy to Grow.

16. Geranium (Geranium oreganum)

Geraniums have been a gardener's favorite for well over a century. The old-fashioned standard for beds, borders, and containers, geranium is still one of the most popular plants today. Traditional bedding types love hot weather and hold up well to dry conditions; many offer colorful foliage. Regal, also called Martha Washington, geraniums are more delicate-looking and do better in the cool conditions of spring and fall. Though most geraniums are grown as annuals, they are perennials in Zones 10-11. Bring them indoors to overwinter, if you like, then replant outdoors in spring. Or they can bloom indoors all year long if they get enough light. The plant ht. 60 cm & width. 60 cm, Easy to Grow.



17. Gerbera (Gerbera jamesonii)

Gerbera daisies are so perfect they hardly look real. They bloom in nearly every color (except true blues and purples) and produce fantastically large flowers on long, thick, sturdy stems. They last for a week or more in the vase, making them a favorite of flower arrangers. This tender perennial will last the winter in only the warmest parts of the country, Zones 9-11. In the rest of the country, it is grown as an annual. It does well in average soil; it likes soil kept evenly moist but not overly wet. Fertilize lightly. The plant ht. 30 cm, width. 60 cm, 10-11 plants, Easy to Grow.



18. Brachycome (Brachycome iberidifolia)

Easy, always fresh, and always eye-catching, Shasta daisy is a longtime favorite. All cultivars produce white daisy flowers in various degrees of doubleness and size. The sturdy stems and long vase life make the flowers unbeatable for cutting. Shasta daisy thrives in well-drained, not overly rich soil. Taller sorts may need staking. The plant ht. 60-150 cm tall, width. 30-60 cm wide landscape, 5-8 plants, Easy to Grow.



19. Godetia (Clarkia amoena)

This under-appreciated annual bears the most beautiful, satiny pink or white flowers for weeks in summer. It also goes by the charming name farewell-to-spring, perhaps because it blooms just as spring temperatures are rising. Plant it once and you won't want to go a growing season without it.

Native to areas of North America, this plant does best in areas with cool summers and in moist, well-drained soil. It's a great cut flower, too. Although you can sometimes find it as established seedlings, most gardeners will need to start it from seed. Plant directly



in the ground in early spring; it dislikes transplanting. Don't fertilize. If it has too many nutrients, it will have lots of foliage and few flowers. The plant ht. 30-150 cm tall, width 30 cm wide landscape



20. Larkspur (Delphinium ajacis)

Larkspur is basically an annual version of delphinium, an all-time favorite perennial. Larkspur produces lovely spikes of blue, purple, pink, or white flowers in spring and summer. They look best clustered in small patches.

Like many cool-season annuals, it's a good winter-blooming plant for the Deep South.



Larkspur is so easy to grow that it often self seeds in the garden, coming back year after year. Plant larkspur from seed directly in the garden in early spring. Larkspur doesn't like to be transplanted. It prefers rich, well-drained soil and ample water. The plant ht. 60-120 cm, width. 6-12 inches, Easy to Grow.

21. Shirley Poppy (*Papaver rhoeas*)

The Shirley poppy was created from 1880 onwards by the Reverend William Wilks, vicar of the parish of Shirley in England. Wilks found in a corner of his garden where it adjoined arable fields, a variant of the field poppy that had a narrow white border around the petals. By careful selection and hybridization over many years he obtained a strain of poppies ranging in colour from white and pale lilac to pink and red, and unlike the wild poppies these had no dark blotches at the base of the petals. Further selection has given rise to semi-double and double forms, as well as flowers with a ring of contrasting colour around the edge: the picotee form.



22. Nasturtium (*Tropaeolum majus*)

Nasturtiums are so versatile. They grow easily from seed sown directly in your garden's poorest soil and blooms all season until frost and are never greedy about food or fertilizer. Nasturtiums are available in either spreading

or climbing types. Plant spreading types in large containers to spill over the sides. Plant them alongside wide paths to soften the sides for a romantic look. Use nasturtium to brighten a rock garden or between paving stones. Plant them at the edges of beds and borders to fill in between other plants and add soft, flowing color. Train climbing types up trellises or alongside fences. The leaves and flowers are edible; use them as a showy plate garnish or to jazz up salads. The plant ht. Mounding varieties from 9-16 inches, width. 12-18 inches depending on type landscape, Easy to Grow.



23. Mesembryanthemum (*Mesembryanthemum crystallinum*)

Mesembryanthemum is a member of the family Aizoaceae; like many members of this family, it is characterized by long-lasting flower heads. Flowers of *Mesembryanthemum* protect their gametes from night-time dews or frosts but open in sunlight. There is an obvious evolutionary advantage to doing this; where sun, dew, frost, wind or predators are likely to damage exposed reproductive organs, closing may be advantageous during times when flowers are unlikely to attract pollinators.



24. Paper Flower (*Helichrysum petiolare*)

This plant is attractive to bees, butterflies and/or birds, Average Water Needs; Water regularly; do not overwater Self-sows freely; deadhead if you do not want volunteer seedlings next season. This plant is resistant to deer Flowers are good for drying and preserving Suitable for growing in containers Height: 6-12 in. (15-30 cm) Width. 12-18 in. (30-45 cm)



25. Corn Flower (*Centaurea cyanus*)

The annual blue cornflower is a slender plant of great charm. Its rich shades of blue are much sought after, both for garden

decoration and for flower arrangements. Garden varieties have added red, pink, lilac and white to the colour range, and even bright yellow is available in the closely related sweet sultan *Amberboa moschatus*. The wiry plants may need some discreet support, and deadheading helps to prolong the flowering season, as does autumn sowing, an option that will produce larger, earlier-flowering plants. This fully hardy plant requires a sunny site, growing in most well-drained soil types, even poor soil. The plant Height: 90cm, Spread: 30cm, Time to plant seeds: March to May.



26. Salvia (*Salvia splendens*)

“Annual” salvia is a tender tropical perennial that is typically grown as a warm weather annual bedding plant. It has long been a garden standard, reliably blooming over an extended period. Ever more varieties are being developed, giving a wide range of colors, including white, salmon and purple, as well as the traditional bright red, and heights from about 8 in (20 cm) to nearly 3 ft (0.9 m).

Leaves are bright to dark green, elliptical and toothed. Flowers grow on spikes and are two-lipped, with a flat lower lip and helmet-shaped upper lip.



27. Cineraria (*Cineraria longipes*)

These are herbaceous perennials that are often grown as annuals. There are three basic types: the large-flowered; the stellata or Star-flowered; the intermediate, with flowers similar to the stellata and having the compact growth of the large-flowered; and the dwarf intermediate strain, growing 1-foot tall and having a compact, free-flowering growth. They all come in a wide range of colors. There are two main types of the tall, small-flowered Cinerarias. The most popular is the Star-flowered, which produces an abundance of small flowers in blue, pink, salmon, white and other hues. The large-flowered Cinerarias come in a brilliant array of colors. Mixed seeds of a good strain will provide flowers in blue, purple, rose, pink



and other gorgeous colors, many having noticeable white sections.



28. Pansy (*Viola tricolor*)

The pansies are a large group of hybrid plants cultivated as garden flowers. Pansies are hardy annuals whose flowers have “faces.” These plants offer colorful flowers for any season in your garden. They have one of the widest ranges of colors and are good for containers, borders, and ground covers.



29. Verbena (*Verbena brasiliensis*)

Verbena is a spreading plant ideal for cascading over retaining walls, pots, baskets, and window boxes. As long as the soil is extremely well drained, verbena will reward gardeners with countless clusters of small

blooms all season. It's fairly drought-tolerant, making it a great choice for hanging baskets, rock gardens, planting in cracks between stones, and other tight places. The plant ht. From 9 to 18 inches tall, Width: From 12 to 20 inches Landscape, 7-9 Plant.



30. Nemesia (*Nemesia violiflora*)

Nemesia is a charming cool-season annual with pretty little snapdragon-shape flowers -- often fragrant -- that bloom in a wide range of colors. It does best in spring and fall (winter in mild-winter climates), though



some varieties have better heat-tolerance than others. In cool-summer areas, such as the Pacific Northwest, nemesia will continue to bloom right through the summer into fall. Nemesia prefers moist, well-drained soil that's rich in organic matter. The plant ht. 60 cm, Width: 60 cm blooms best in spring and fall Landscape.

31. Candy Tuft (*Iberis gibraltarica*)

Sparkling white candytuft, with its cool evergreen foliage, brightens any rock garden or wall for several weeks in spring. At bloom time, plants are covered with umbels of pure white flowers that fade to pink. Compact selections are now available. Where happy, this plant will spread. Supply good drainage, and cut back spent flowers to keep plants neat. The plant ht. 30 cm, width 8-16 inches, 5-9 Plants, Easy to Grow.



32. Antirrhinum (Antirrhinum majus)



Season Winter Name Antirrhinum Common Name Snapdragon, dwarf Description These are bright, jolly flowers and look great in the garden or in big flower pots. If you look at their flowers carefully they look like a dragon's mouth! They like a sunny position in any garden soil. Seeds can be sown from January to March.

33. Tulip (Tulipa tarda)

The tulip is one of the most popular garden flowers. Tulips are hardy and require little care. Some types of tulips bloom for years, once established. Tulips generally are divided into 15 different classes, which vary



in appearance and season of bloom. The early bloomers include single early, double early, kaufmanniana, and fosterana tulips.

34. Carnation (Dianthus caryophyllus)

The old-fashioned carnation name pinks comes from the serrated flower edges, which look as if cut with pinking shears. And the name of the color pink is said to come from these perennials, which have been popular in gardens for hundreds of years. The many dianthus species and hybrids come in red, white, orange, purple, cranberry, and of course, many shades of pink. Flower size ranges from less than an inch to several inches wide, and height ranges from just a few inches to several feet tall. How to grow: Dianthus prefers average to rich well-drained soil in full or nearly full sun. Refresh older plantings by dividing and resetting plants every few years.



35. Alyssum (Lobularia maritima)

Sweet alyssum, with its dainty, fragrant flowers, is often used in containers and hanging baskets to spill over the edges,

creating a soft, frothy look. It's also a great edging plant because of its tidy, compact habit. Regardless of how you use it, sweet alyssum does best in spring and fall's cool conditions (or use it for winter color in very warm climates). In cool-summer conditions, such as the northern third of the United States, sweet alyssum will bloom steadily through the summer. It halts bloom in summer in warmer areas. The plant ht. 8 inches tall, width 30 cm, Easy to Grow.



36. Stock (*Matthiola incana*)

Stock is best known for its spicy, sweet fragrance and as an excellent choice for flowerbeds and cut flower arrangements. Depending on the variety, stock can grow from about a foot tall to almost three feet, making it a versatile choice for any garden bed. Use taller varieties towards the back of a design to add height, or smaller ones towards the front so you can better admire their scent and their wide range of colors; stock is available in shades of white, yellow, purple, pink, peach, and red. While many varieties are single, meaning that they have four petals per flower, some are double, giving them a softer, more ruffled and romantic appearance.



37. Primrose (*Primula malacoides*)

Take a walk down the primrose path and you'll never look back! Primroses are a classic cottage flower and are popular with collectors. They covet the hundreds of different primroses available, especially some of the tiny rare alpine types. Many are staples of cottage gardens and rock gardens, while others provide spring color to damp places, rain gardens, and bog gardens. Their basal rosettes of oval leaves are often puckered or are very smooth. The colorful flowers may be borne singly or rise in tiered clusters, or even spikes. Provide humus-high soil that retains moisture and some shade for best results. The plant ht. 2 inches, width 4 inches, colour whites, pink, lavender, purple red, yellows, orange and green, 2-8 plant, Easy to Grow.



38. Dianthus (Dianthus caryophyllus)

The species are mostly herbaceous perennials, a few are annual or biennial, and some are low subshrubs with woody basal stems. The leaves are opposite, simple, mostly linear and often strongly glaucous grey-green to blue-green. The flowers have five petals, typically with a frilled or *pinked* margin, and are (in almost all species) pale to dark pink. One species, *D. knappii*, has yellow flowers with a purple centre. Some species, particularly the perennial pinks, are noted for their strong spicy fragrance.



39. Daisy (Bellis perennis)

Easy, always fresh, and always eye-catching, Shasta daisy is a longtime favorite. All cultivars produce white daisy flowers in various degrees of doubleness and size. The sturdy stems and long vase life make the flowers unbeatable for cutting. Shasta daisy thrives in well-drained, not overly rich soil. Taller sorts may need staking.

Light: Sun, Part Sun Zones: 5-8 Plant Type: Perennial Plant Height: 20-30 cm

tall Plant Width: 1-2 feet wide Landscape Uses: Containers, Beds & Borders Special Features: Flowers, Attractive Foliage, Cut Flowers, Dried Flowers, Attracts Butterflies, Drought Tolerant, Easy to Grow.



40. Asiatic Lilies (Lilium chalconicum)

Asiatic lilies are one of the most beautiful flowers that you can grow. I love to walk in the garden and see the new blooms and my garden just wouldn't be complete without them. These are my favorite flowers next to daylilies which aren't really lilies at all. Here you will find all the information you need to grow asiatic lilies.

Once you plant lily bulbs or plants they will give you pleasure for years to come and multiply and become even more beautiful. They are grown from a hardy bulb that multiplies quickly and takes little care. They come in many sizes, heights and shapes. Lilies are called bulbs but are really tubers with fleshy scales that never go into

dormancy like other bulbs that you might be familiar with.



41. Gladiolus (*Gladiolus angustus*)

Gladiolus is a perennial favored for its beautiful, showy flowers. Its flowers grow on tall spikes and are often found in cutting gardens or in the back along the border (because they are tall). Gladioli have many different colored flowers, and grow between 60 to 180 cm in height. It's good for cut flowers.



42. Hyacinths (*Hyacinths orientalis*)

Hyacinth bulbs are planted in the fall and borne in spring. The Victorians revered hyacinths for their sweet, lingering fragrance, and carefully massed them in low beds, planting in rows of one color each. The loose to dense racemes of strongly fragrant flowers are closely packed with tubular-bell-shaped, single or double flowers. As well as growing in the ground, colorful hyacinths are excellent for forcing in containers and some are available for early flowering indoors.



43. Dahlia (*Dahlia variabilis*)

Planting dahlias in a spot that gets at least eight hours of direct sunlight a day. In dry, hot-summer climates, choose a spot that provides direct sun from the morning into midday, offering shade or filtered shade by the hottest part of the late afternoon.

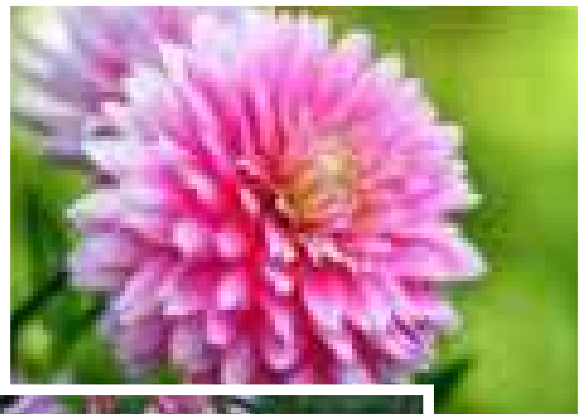
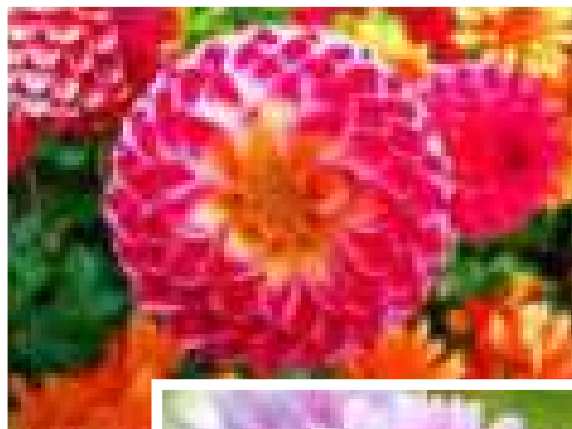
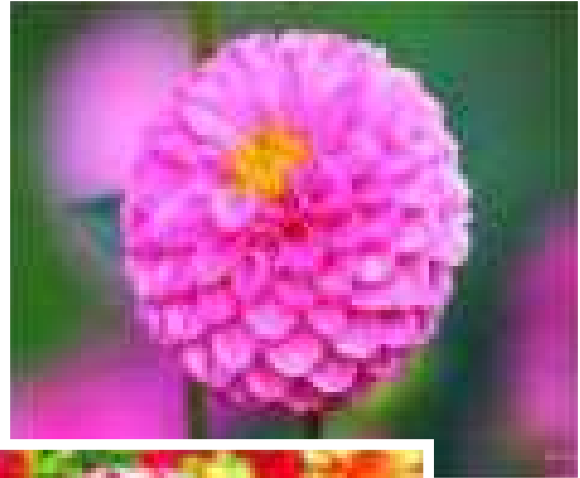
Like potatoes, dahlias grow from tubers so good soil preparation is key to best performance. Loosen or dig soil to a depth of about 10 inches. Your soil should be easily worked and offer superb drainage. If you have heavy soil, amend with peat moss, compost, or aged cow manure.

Planting is a good time to incorporate an organic fertilizer with an N-P-K ratio of 5-10-15 or 5-10-10, 10-20-20, or 0-20-20. The higher middle number -- phosphorous -- assists with bloom production. The third number -- potash or potassium -- helps root development. Any fertilizer recommended for vegetables can be used for dahlias.

Although you can start dahlias from seeds, it's easiest to begin with tubers. After the soil is prepared, dig a hole 4-6 inches deep, lay the tuber horizontally, and cover with soil. If you're planting several dahlias, grow the smaller varieties 9-12 inches apart. Taller dahlias can be spaced 2-3 feet apart, or half their final height (some can grow taller than 6 feet, so be prepared!).

Except in hot climates, don't water the tubers until the first shoots and leaves appear. Because the surface of the ground needs to stay warm (at least 60 degrees F) for the tubers to sprout, avoid mulching until the plants are actively growing.

Once the plants are established, add mulch to conserve moisture and prevent weeds. Because dahlia roots are shallow, pulling large weeds can easily disrupt the roots, so pull weeds only by hand when they are still small. Avoid using chemical weed controls and weeding instruments like hoes because they kill dahlia roots.



A - Flowering Winter Season Annual

Sowing time : October - Novemebr except those marked with asterisks

All raised by seed - Other methods used are mentioned in column 9)

S. No.	English Common name	Botanical name and Natural order	Pot or Bed	Sown in situ or transplanted	Planting distance in bed (cm)	Height (cm)	Colour	Remarks
1	2	3	4	5	6	7	8	9
1	Acroclinium	Akraclinium album A roseum (Compositae)	Both	Situ	7.5-15	30-60	White, rose colour	Flowers may be single or double, keeping colour and form even dry.
2	Ageratum	Ageratum houstonianum (Curciferae)	Both	Transplanted	20-25	30-45	White and Blue	Good for edging and massing in beds. Good as cut flower. Well suited for rockery
3	Alyssum (Madwort)	Lobularia maritima Sym Alyssum maritimum (Curciferae)	Both	Transplanted	05-10	15-25	White, yellow and pink	Sweet scented flower as of candytuft. Suits well a long the edge of a flower-bed or a rocky. Suitable for hanging baskets.
4	Anchusa	Anchusa capensis (Boraginaceae)	Both	Transplanted	15-20	45-60	Blue	Good for edging and massing in beds. Good as cut flower. Well suited for rockery
5	Antirrhinum (Snap dragon)	Antirrhinum majus (Scrophulariaceae)	Both	Transplanted	15-30	30-90	Pink, Yellow, rose, orange, crimson, white and mauve	Three distinct strain (a) Tall, (b) Intermediate, (c) Dwarf. Good for mixed borders. Good as a cut-flower.
6	Arctotis	Arctotis grandis (Compositae)	Both	Transplanted	10-15	30-60	Pink	Can also be multiplied by division. Cut-flowers have long keeping quality.
7	* Aster	Callistephus chinensis (Compositae)	Both	Transplanted	20-25	30-75	Expect yellow all colours are met	Important groups, (a) Giant asters (b) Comet, (c) Branching aster, (d) Imbricated pampon. All are very good for pots and borders.

S. No.	English Common name	Botanical name and Natural order	Pot or Bed	Sown in situ or transplanted	Planting distance in bed (cm)	Height (cm)	Colour	Remarks
8	Brachycome (Swan Daisy)	Brachycome iberidifolia (Compositae)	Both	Situ	10-15	20-35	White , blue, rose	Seed should be sown in August-September.
9	Calendula (Pot-Marigold)	Calendula affinalis (Compositae)	Both	Transplanted	20-30	30-45	Yellow or orange	Flower may be single or double. It is good cut-flower
10	Candytuft	Iberis umbellata (Crucifere) l. amara	Both	Transplanted	15-20	24-36	Pure white, rose, purple	Flower may be single or double. Plants have medicinal value.
11	*Carnation	Dianthus spp. (Carpophyllaceae)	Pot	Transplanted	-	30-60	Rose white, pink and spotted	Cuttings. layerings are also possible, flowers are sweet scented.
12	Chrysanthemum (Annual)	Chrysanthemum spp. (Compsitae)	Both	Transplanted	15-30	30-60	Colour depends upon species	Very goof annual for borders. Grows well in poor soil.
13	Calleopsis (Coreopsis)	Calleopsis tinctoria (Compositae)	Bed	Transplanted	15-20	45-60	Golden yellow orange and bronze	Flowers are single or double. Good for pots as well for beds.
14	*Cineraria	Cinceraria spp. (Compositae)	Pots	Transplanted	-	20-46.25	All possible colour and combinations	Very good for pet—sown in July-Aug. Single and double flowers are common. Does better in cool and shady places.
15	Clarkia	Clarkia elegans (Onagraceae)	Both	Transplanted	20-30	30-45	Pink, white, red	Flowers are borne in long spikes, very good for cut flower.
16	Dianthus (indian Pink)	Dianthus nobilis (Caryophyllaceae)	Both	Transplanted	15-20	20-30	Pink, white in various other combinations	Flowers are single as well as double.
17	Dimprphotheca (Capemaringold)	Dimporphotheca pluvialis (Compositae)	Both	Transplanted	-	30-45	Orange, white golden yellow	A good pot annual. Flowers open in bright sunlight. Prefers a sunny situation.
18	Eschscholtzia (Californian poppy)	Eschscholtzia Californica (Papaveraceae)	Both	Situ	-	30-45	Orange light yellow and white	Flowers open in bright sunlight.

S. No.	English Common name	Botanical name and Natural order	Pot or Bed	Sown in situ or transplanted	Planting distance in bed (cm)	Height (cm)	Colour	Remarks
19	Gaillardia (Blanket flower)	Gaillardia drummondii (Compositae)	Both	Transplanted	15-20	30-45	Combination of orange purple yellow and crimson	Flowers may be single or double, some are perennial.
20	Godetia	Godetia grandiflora (Onagraceae)	Both	Transplanted	20-30	30-45	Pure white, rose and red	May be single or double. Does well in partiable shade
21	Heliotrope	Heliotrope Sp. (Borangenaceae)	Both	Transplanted	20-30	20-45	White, blue and purple	Flowers are sweet scented, and are borne in clusters
22	Helichrysum (Everlasting, or straw flower)	Helichrysum bracteatum (Compositae)	Both	Transplanted	20-30	30-60	White, pink, yellow and gold	Very good as cut flowers. Does well in any garden soil.
23	Larkspur	Delphinium spp. (Compositae)	Bed	Situ	15-20	45-60	Purple, white and Blue pink	Single or double flowers are produced in spikes. Requires thinning.
24	Leptosyne	Leptosyne meritima (Compsitae)	Both	Both	20-30	45-60	Yellow	Good for borders and pots. Flowers are borne singly.
25	Linaria (Toadflax)	Linaria bipartite (Scrophulariaceae)	Both	Transplanted	10-15	20-30	Blue, pink and Mauve	Flower spike look like miniature antirrhinum prefers a sunny situation.
26	Linum (Flax)	Linum grandiflorum (Linaceae)	Both	Situ	15-20	”	Scarlet	Good for beddings, flowers are five petalled.
27	Lobelia	Lobelia erinus (Campanulaceae)	Pot	Transplanted or Situ	10-15	”	Blue, scarlet	Good for hanging baskets; makes excellent edging.
28	Lupin	Lupinus hartwegii (Leguminosae)	Both	Situ	15-20	30-45	White, yellow and Mauve	Flowers are produced in long spikes.
29	Nasturtium	Tropaeolum majus, T.minor (Geraniaceae)	Bed	Situ	10-15	20-25	Orange and Yellow	Thinning of foliage is essential; good for hanging basket.

S. No.	English Common name	Botanical name and Natural order	Pot or Bed	Sown in situ or transplanted	Planting distance in bed (cm)	Height (cm)	Colour	Remarks
30	Nemesia	Nemesia strumosa (Scrophulariaceae)	Both	Transplanted	5-10	15-20	Yellow with brown stripes	Good for mass effect.
31	Pansy	Viola tricolor (Violaceae)	Both	Transplanted	5-10	15-20	Flowers of different shades and combinations	Single and double kinds are excellent for borders, rockery and for pots.
32	Petunia	Petunia hybrid (Solanaceae)	Both	Transplanted	20-30	30-45	Except yellow all colours with stripes	Can be used for hanging baskets. Produces flowers even in summer months. Very good for mass effect. Double flowering varieties are also available.
33	Phlox	Phlox diumondi (Polemoniaceae)	Both	Transplanted	20-30	15-30	All colours and bicolours	One of the best annuals for beds and pots. Requires well-drained soils and sunny situation for good results.
34	*Salvia (Scarlet Sage)	Schizanthus wisetonensis (Solanaceae)	Both	Transplanted	20-30	30-45	Red, blue, white and yellow	Flower spikes are 15-30 cm. long; good as cut-flower. Seed should be sown in July—August.
35	Schizanthus	Schizanthus wisetonensis (Solanaceae)	Both	Transplanted	20-30	45-60	White with pink shade	Seeds take long time for germination. Good for pots.
36	Stock	Mathiola incana (Cruciferae)	Both	Transplanted	20-25	20-30	Pink and white	Flowers are either single or double, and are scented. Flowers are borne on spikes.
37	Verbena	Verbena hybrid (Verbenaceae)	Both	Transplanted	15-20	20-30	Pink, pale yellow, blue white	One of the best annuals for pots and beds. Good for rockery and edging.
38	Vendedium	Venedium fastuosum (Compositae)	Both	Transplanted	20-30	20-30	Orange and yellow	Flowers are fairly large which are daisy like yellow.

S. No.	English Common name	Botanical name and Natural order	Pot or Bed	Sown in situ or transplanted	Planting distance in bed (cm)	Height (cm)	Colour	Remarks
39	Wallflower (Gilli flowers)	Cherianthus cherrii (Crucifrae)	Both	Transplanted	15-20	20-30	Orange and yellow	Flowers are borne in long spikes, good as cut-flowers.
40	*Dahlia	Dahlia varibilis (Cpositae)	Beds	Transplanted	30-45	60-1.20	All possible colours and combinations	Varieties true to type, are multiplied by cutting or tubers. The eyes are present on stalk attached with tuber. One of the best winter-annuals. The seeds as well as the tuber should be planted in August - September. Thinning of the flowers buds to 1-2 gives flower of larger size. Requires heavy feeding.

B - Rainy Season Annual (Sowing Time : June - July)

All raised by seed - Flowering Time : September - November

S. No.	English Common name	Botanical name and Natural order	Pot or Bed	Sown in situ or transplanted	Planting distance in bed (cm)	Height (cm)	Colour	Remarks
1	Amaranthus	Amaranthus tricolor (Amarantaceae)	Both	Transplanted	15-20	31-90	Crimson and red	Leaves are also very attractive as they are coloured. Good for edging and mixed border.
2	Balsam	Imatiens balsamina (Balsaminaceae)	Beds	Transplanted	15-75	30-45	Red, crimson, white, pink scarlet and purple.	Flowers are single as well double, should be trained to clean stem.
3	Celosia (Cockscomb)	Celosia crestata, C. plumose C. chidsi (Amarantaceae)	Beds	Transplanted	20-30	30-45	Yellow, crimson, purple and red	Large compact velvety head of flowers of large size 30 cm x 25 cm. are borne well above the foliage.

S. No.	English Common name	Botanical name and Natural order	Pot or Bed	Sown in situ or transplanted	Planting distance in bed (cm)	Height (cm)	Colour	Remarks
4	Cosmos (Mexican Aster)	<i>Cosmos bipinata</i> (Compositae)	Beds	Transplanted	25-5	90-120	White, crimson, rose purple and orange	Pinching the short is desirable to encourage the branching.
5	Gaillardia (Blanket flower)	<i>Gaillardia grandiflora</i> (Compositae)	Both	Transplanted	20-30	45-60	Orange, purple yellow and crimson	Both single and double kinds of flowers are met.
6	Gomphrena (Bachelor's Button)	<i>Gomphrena globosa</i> (Amarantaceae)	Both	Transplanted	15-20	20-30	Red, crimson and white	Plants in pot are good for verandah and indoor decoration.
7	Helianthus (Sunflower)	<i>Helianthus</i> Sp. (Compositae)	Bed	Transplanted	2.5-5	150-210	Orange and yellow	Flowers are single or double.
8	Marigold	<i>Tegetes</i> Sp. (Compositae)	Bed	Transplanted	20-30	60-90	Orange and yellow	Flowers are single or double, can continue to flower up to winter.
9	<i>Mina lobata</i>	<i>Mina lobata</i> (Convolvulaceae)	Pot	Transplanted	Creeping	-	Red and creamy	Good for training on arches and arbors.
10	Torenia	<i>Torenia speciosa</i> (Compositae)	Both	Transplanted	10-15	20-25	Blue with white spots	Good for beds and rockeries and verandah decoration.
11	Vinca	<i>Vinca rosea</i> (Apocynaceae)	Both	Transplanted	20-25	30-45	Red and white red with white eye	Plant can also be multiplied by cuttings.
12	Zinnia	<i>Zinnia elegans</i> (Compositae)	Bed	Transplanted	20-30	45-60	White, red orange, scarlet, yellow and pink.	Pompon, Cupid Tom Thomb, California gaint are important groups of Zinnia. Linearis produces single bright yellow flowers. Excellent for edging and beds.

C - Summer Season (Sowing Time - February - March)

All raised by seed - Flowering Time : September - November

S. No.	English Common name	Botanical name and Natural order	Pot or Bed	Sown in situ of transplanted	Planting distance in bed (cm)	Height (cm)	Colour	Remarks
1	Cosmos	Same as given above			20-30	20-30		Cultivated for green leaves, can be trimmed to any desired shape.
2	Kochia (Mock Cypress)	Kochia scoparia var. trichophylla (Chenopodiaceae)	Both	Transplanted	20-25	10-15	Red, white, crimson, yellow and scarlet	The flowers are rose in shape and are single and double, can also be multiplied by cuttings. Flowers open only in the mornings.
3	Portulaca	Portulaca grandiflora (Portulacaceae)	Bed	Transplanted	20-30	45-60	White, red orange, scarlet, yellow and pink.	Pompon, Cupid Tom Thomb, California gaint are important groups of Zinnia. Linearis produces single bright yellow flowers. Excellent for edging and beds.
4	Zinnia	Zinnia elegans (Compositae)	Bed	Transplanted	20-30	45-60	White, red orange, scarlet, yellow and pink.	Pompon, Cupid Tom Thomb, California gaint are important groups of Zinnia. Linearis produces single bright yellow flowers. Excellent for edging and beds.

D-Classification of Winter Annuals		
I. White	II. Purple and Mauve	III. Pink and Light Red
Antirrhinum	Ageratum	Acroclinum
Aster	Antirrhinum	Antirrhinum
Daisy	Cornflower	Asters
Candytuft	Phlox	Daisy
Gypsohylla	Heliotrope	Candytuft
Phlox	Larkspur	Clarkia
Stock	Sweetpea	Cosmos
Petunia	Lobelia	Godetia
Sweet alysum	Negella	Larkspur
Verbena	Pansy	Lupin
Dahlia	Pentunia	Petunia
Larkspur	Salvia	Phlox
Dimorphoteca	Stock	Poppy
Eschacholtzia	Torenia	Verbena
	Verbena	
	Viola	
	Aster	
	Anchusa	
	Lupin	
	Sweet Williams	
E-Classification of Winter Annuals		
Dwarf		Medium
(Upto 30 cm)		(Up to 60 Cm)
Gamolepsis	Stock	Antirrhinum
Lobillia	Sweet alyssum	Aster
Linum	Torenia	Ageratum
Mimulus	Viola	Anchusa
Nemesia		Acroclinum
Nasturtium		Cornflower
Nigella		Candytuft
Phlox		Calendula
Pansy		Daisy
		Gillardia
		Heliotrope

According to their colour		
IV. Crimson and Scarlet		V. Orange and Yellow
Argemone		Antirrhinum
Antirrhinum		Calendula
Aster Candytuft		Calliopsis
Celosia		Dimorphoteca
Salvia		Leptosyne
Phlox		Eschscholtiza
Stock		Marigold
Petunia		Nasturtium
Linum		Pansy
Dianthus		Sunflower
Cosmos		Phlox, Chrysanthemum (annual)
Salvia		Cosmos
Verbena		Minulus
Marigold		
According to their height		
	Tall	
	(Above 60 Cm)	
Larkspur	Antirrhinum	Leptosyne
Petunia	Chrysanthemum	Marigold
Salvia	Clarkia	Sunflower
Wallflower	Calliopsis	Schizanthus
	Cosmos	Sweetpea
	Eshscholtiza	
	Dahalia	
	Dimorphoteca	
	Gypsohila	

CHAPTER - 24

SUMMER AND RAINY SEASON FLOWERS

The summer season start in India from the month of April and continues till the month of June, from July to September the season is rainy. In summer the temperature rise up to 45 c and winds are dry all around. After the sparky spring, where various choice of flowers are available, in summer season there are very limited variety available because of adverse weather conditions, which the gardener can grow for adding color and flowers in his garden. The way of planting are by grow seedlings and planting them in beds or pots, secondly showing the seed directly in the beds or pots. During propagation for summer flower gardener should keep in mind to add the compost and sand in mixture to maintain the moisture during dry summer before planting seedling or seeds. The gardener should also keep in mind about the availability of irrigation water. Here, we are suggesting some popular summer and rainy season flowers for gardeners to choose from them.

1. Portulaca (Portulaca oleracea)

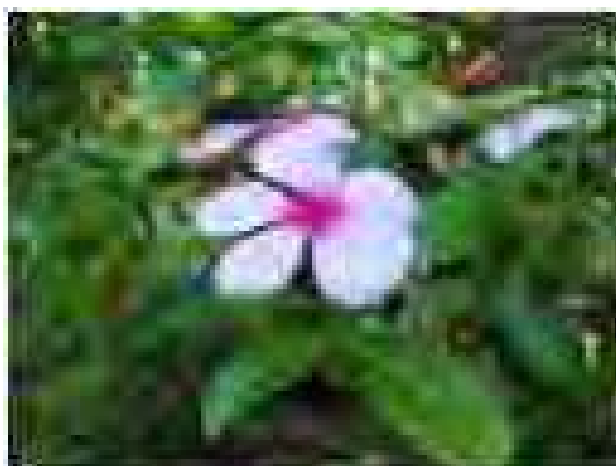
Portulaca also known as Moss roses, they are excellent flowers to have if you live in a dry climate, since they can store water well, and also provide lots of low lying color for your garden. They also are very easy to take care of after you get started. Moss rose is the gardener's choice for the hottest, driest, most problematic spots in the garden. This succulent plant thrives in heat, drought, and lousy soil, rewarding gardeners with nonstop color. Coming in sunny warm reds, oranges, magentas, and yellows, moss rose looks at

home in a sun-drenched area. There's also a whole pastel color palette for moss rose -- creamy white, pink, and peach varieties. It often happily reseeds, coming back every year with gusto. The plant ht. 7-20 cm, width. 30 cm, Easy to Grow.



2. Cosmos (Cosmos bipinnatus)

Cosmos are annuals, grown for their showy flowers. The flower heads may be bowl- or open cup-shaped and are atop of long stems. Cosmos are easy to grow and make good border or container plants. The cosmos plants are able to flower from early summer and long lasting up to winter season. They make for good decorations in flower arrangements and also attract birds, bees, and butterflies to your garden. The height of the plants should be very from 15 cm to 45 cm according to the variety. Its commonly available in dark orange to yellow colour. It is easy to grow.



3. Vinca Flowers (Cartharanthus roseus)

Annual vincas aren't new or flashy flowers on the gardening scene, but recent cultivar developments warrant a new examination of this common bedding plant. Horticulturists have been hard at work bringing us new colors in plants with showier flowers that are easier to start from seed. The height of the plants varies from 15 cm to 45 cm according to variety, the common Vinca plants have only two colours white and dark pink. Now a days various colours in hybrid varieties are available in single colour or contrast. But the hybrid varieties are very susceptible to the water logging and they can not be prolonged during rainy season.

4. Sunflower (Helianthus annuus)

Sunflower is an annual plant, growing up to 4.6 m tall. It has large, rough and hairy leaves, oval to cordate in shape. Flower heads are also large, growing about 20-30 cm in diameter. It consists of numerous, densely arranged florets. Sterile ray florets on the outer side vary in color- they can be yellow, red or orange. The disc florets inside the circular head produce seeds. The florets inside the circular head are called disc florets, which mature into seeds. The florets inside the sunflower's cluster are spirally arranged, which is a most efficient packing of seeds within the flower head. **Parts used:** Seeds, leaves, root.



5. Sunflower dwarf (*Helianthus annuus*)

These dwarf sunflowers are free of pollen, making them perfect as indoor gift plants. They are also tolerant of mildew to perform well in the garden. Miss Sunshine flowers uniformly about 7 to 10 days earlier than Ballad. It is shorter, and flowers are 25% smaller than Ballad's 4 to 5-in.(10 to 13-cm) blooms. Miss Sunshine displays warm golden flowers, and produces secondary blooms more quickly. For larger flowers and bright yellow color, Ballad excels.



6. Zinnia (*Zinnia acerosa*)

Zinnias are one of the easiest **annuals** to grow, grow quickly, and bloom heavily. They make a massive burst of color in your garden. Zinnias have bright, solitary, daisy-like flowerheads on a single, erect stem. The most common zinnia is “dahlia-flowered” and grows up to three feet. Other types are “cactus-flowered.” Use in an annual or mixed border. Smaller zinnias are suitable for edging, windowboxes or other containers. The narrow-leaf zinnia also works well in hanging baskets. Zinnias are very popular for cut flowers.



7. Gaillardia (Gaillardia aristata)

Gaillardia, or Blanket Flower, is a group of about 30 species that include both annuals and perennials. With bright and colorful daisy-like flowers it is no wonder this native wildflower has earned a spot on the heart of gardeners everywhere. The most common species for garden use is *Gaillardia grandiflora*. It is this perennial, and some of its most unique cultivars that we will discuss here. Hardy, sun-loving and easy to keep it deserves a place in every garden.



8. Gomphrena (Gomphrena globosa)

Gomphrena easily grown in average, well-drained soils in full sun. Although mature plants exhibit good drought resistance, plants grow best with regular moisture throughout the growing season. Extremely good heat tolerance. Sow seed directly in the garden. Use ample amounts of seed since germination rate can be quite low. Set seedlings or purchased plants out. Pinch young plants to promote more foliage and flowering. The plants ht. 30 to 60 cm. The plant is hardy nature and easy to grow.



9. Cladium (Cladium californicum)

Cladium is a very popular bulbous plant for rainy and summer season. It can be grown easily from April to September in north India plain. On onset of winter the plants leaves dried and bulb can be collected for the next season and they can be stored in cold storage during dormancy. The *Cladium* have very decorative leaves of different colours and shapes. It can be easily planted in semi shaded beds or pots. The lower dry leaves should be eradicated regularly for new shoots / leaves. The height of plants vary from 15 cm to 40 cm mainly leaves of the *Cladium* is a combination of red, white and green colour. According to the variety.



10. Balsam (*Impatiens balsamina*)

Balsam is a very favorite rainy season flower this old-fashioned annual adds an exotic, almost gaudy touch to the garden. It offers interesting, trumpet-shape blooms, mostly in shades of pink. Many selections have bicolor flowers. Balsam often self-seeds in the garden and is very easy to grow. Plant established plants outdoors in spring after all danger of frost has passed. Balsam needs rich, well-drained soil to do best, so work in plenty of compost. (It's ideal in containers as long as you don't let the plants dry out for even a second.) Fertilize lightly but regularly. The plant ht. 30-90 cm tall, width 30-60 cm wide and easy to grow.



CHAPTER - 25

FLOWER BEDS

Plants which flower profusely, when planted in groups to give a mass effect are termed as flower beds. They may be perennial (living for more than two years), biennials (living for two years) and annuals or seasonal (living for one season or for one year). They enhance the outdoor surroundings and are a good source of cut flowers. They are a good source for attracting pollinators, such as bees and butterflies.

Perennial plants are plants that lives for more than two years. The term is often used to differentiate a plant from shorter-lived annuals and biennials. The term is also widely used to distinguish plants with little or no woody growth from trees and shrubs, which are also technically perennials.

The most popular type of flowers in gardens are annuals which are raised from seed. They grow, bloom, seed and exhaust them selves during a season. It has the advantage of a tremendous variety of colour, size and form and occupies garden space for less time and can be easily replaced. The seasonal flowers allow the gardener to see all the stages of growth in the shortest possible period. This satisfies the “Growth Instinct” of gardener more than any other type.

Seasonal and perennial flower beds in various shapes and sizes can be designed. Flowers of all rainbow colours are available.

Perennials offer a lot of color without a lot of work. Among seasonal flowers, some species are specific to winter; summer and rainy season and some can be grown throughout the year.

Laying of Flower Beds:

1. Dig Trenches of 1'- 6" depth of required shape and size.
2. Remove weeds and other unwanted materials.
3. Fill up trenches with dug out soft soil by adding 3 kg compost or 1kg vermicompost + 0.5 kg neem cake +
4. + 0.25 kg super phosphate per cft. + 25 gms of folidol dust.
5. Water the beds and refill the trench to cover up the shrinkage and form a bund around the bed to form a basin.
6. Plants seedlings at 6'-9" spacing after clipping lower 1/3rd leaves.
7. Water gently with a rose can.
8. Regular weeding, mulching and watering are required.
9. Clipping of primary buds to promote bushy growth and better flowering should be done.

(a) Seasonal Flower Beds

S. No.	Plant Name	Ht.	RWS	S	Plant Name	Ht.	RWS	S	Plant Name	Ht.	RWS
1.	Plant Name Antirrhinum	M	W	12	Dianthus	L	W	23	Pancy	L	W
2.	Aster	L	AYR	13	Gaillardia	L	AYR	24	Petunia	L	AYR
3.	Balsum	M	AYR	14	Gamphrena	L	AYR	25	Phlox	L	W
4.	Callendula	L	W	15	Galdiolus	M	AYR	26	Poppy	L	W
5.	Candytuft	L	W	16	Hollyhock	T	AYR	27	Portulaca	L	AYR
6.	Carnation	M	W	17	Kochia	M	w	28	Salvia	M	W
7.	Chrysanthemum	L	W	18	Lady's Lace	T	w	29	Sunflower	T	AYR
8.	Coreopsis	T	AYR	19	Larkspur	M	w	30	Verbena	L	AYR
9.	Celosia	MT	AYR	20	Marigold- tall	M	AYR	31	Zinnia	M	AYR
10.	Cosmos	T	AYR	21	Marigold-dwarf	L	AYR	32	Zinnia linearis	M	AYR
11.	Dahlia	T	w	22	Nasturtium	L	w				

(b) Perennial Flower Beds:

S.No	Plants Name	S.No	Plants Name	S.No	Plants Name	S.No	Plants Name
1	Balsam impatiens	5	Gazania	9	Lantanas	13	Tuberose
2	Beloperone guttata	6	Geranium	10	Portulaca	14	Verbena- Perennial
3	Cannas	7	Gerbera	11	Russalia	15	Azalea
4	Daisy	8	Lilies	12	Roses-Miniature	16	Lobelia

(c) Biennial Flower Beds:

S. No.	Plant Name	S. No.	Plant Name
1.	Onion	5.	Sweet William
2.	Parsley	6.	Colic weed
3.	Lunaria	7.	Carrot
4.	Silverbeet	8.	Hollyhock (some varieties)

H = Height, T = Tall, M = Medium, L = Low

W= Winter Season, AYRV = All year Round





CHAPTER - 26

POTTED PLANTS

Potted plants are displayed both indoors and outdoors, as groups or singles, on plane areas or steps, on ground or pot stands. Hanging pots are also used extensively. Pots in a group give very good effect.

Plants grown in pots are called pot plants. When open spaces are not available, as in the case of apartments, residences and offices, pot plants can be effectively used. Pot plants have the advantage of mobility. For indoor locations and rooftop gardens pot plants can be both indoor and outdoor. Most of the plants can be potted and used as pot plants.

Pot plants are used as indoor plants and also as outdoor plants on terraces, balconies, in driveways & also as decorative plants for display during special functions, conferences and other events. Pot plants comprise of Seasonal plants Flower, Foliage, Fruits, and Specimen plants.

Lot of plants can be grown as pot plants. When a plant is selected for planting in a pot, care should be taken that the nutritional requirements of the plant is fulfilled, as the media in a pot is restricted to the size of the pot. If the nutritional requirement of the plant is high, we have to replenish the same by periodical application of fertilizer and manure

Depending on the growth potential of the plant species, the container or pot size is selected. Plants which are used as ground covers or which like to droop are planted in hanging baskets (such plants have shallow root system). Plants which grown up to a certain height, and which require less area

for spreading can be used in small and medium containers and species which have a tendency to grow big and tall are used in big pots. Generally fruit plants and trees are planted in bigger containers, or in planter boxes.

Whatever the size of the container are size of the plant, pot plants require regular application of manures and fertilizers and pest control measures taken to keep them healthy. It is recommended to apply fertilizers and pesticides at regular intervals of 15 days 30 days, by loosening the top soil. Repotting of plants is recommended once in a year. Whenever repotting is done, it is advised to go in for a bigger pot than the existing pot, for a healthy growth. It is advisable to prune some of the roots at the time of repotting as it allows the plants to develop new roots which help in absorbing the nutrients better. Some plants like Cycads, Adeniums and Beau-carneas etc. Have to be repotted once in 2 to 4 years.

The media for potting should be porous and rich. For making the media porous Cockpit and perlite are used. For making it rich, use Vermicompost. Sand or broken clay pieces are added to media to improve the drainage, before repotting the plant, as improper drainage kills the plant due water logging.

Watering of potted plants should be regulated with care, as excess/ shortage of water can damage the plant. Generally in ground plantation, a plant can tolerate irregularity in watering because of sub-soil moisture which is not possible in pot plants.

POTTING MEDIA

1. Soil Media or Pot Mixture is prepared for plants grown in containers.
2. Media normally means, soil mixed with other ingredients in a particular proportion as required by a specific group of plants. Presently soil media is available which allows better growth, good moisture retention, thereby preventing diseases and weeds. It contains Vermiculite, Perlite, Sterilized Coco peat etc.
3. Different types of Soil media are available which contain materials like soil, sand, compost, vermicompost, wood Ash, Coco peat, Leaf Mould, Charcoal, Brick Bats, Neem Cake, Bio Fertilizers and Bone Meal etc. which are mixed in different proportions as per plant requirement.
4. Small quantities of fertilizers including micro nutrients and pesticides are also mixed in pot mixture
5. Basic criteria for selection of ingredients are aeration, moisture retention, and availability of nutrients.
6. Soil should neither be alkaline nor acidic; it should be neutral with PH value ranging from 6 to 7.5
7. The media should neither be very sticky due to excess clay content, which causes drainage problem, nor very sandy, which does not allow moisture retention to the required extent.
8. Function of the media is to hold the plant upright, holding moisture for a good period and nutrients for a long period and gradually supply to the plant.
9. For aeration of roots and conservation of moisture in media its top layer of about 4 - 5 cms should always be kept loose by periodic mulching.
10. Media should be changed or enriched once or twice a year for better nourishment and maintain physical condition of the soil media.

S. No.	Plant Name	S. No.	Plant Name
1.	Aechmea chantinii	16.	Asparagus densiflorus sprengeri
2.	Aglaonema colour	17.	Asparagus plumosus
3.	Aglaonema commutatum elegans	18.	Asparagus setaceus pyramidalis
4.	Aglaonema commutatum maculatum	19.	Aspidistra elatior variegata
5.	Aglaonema commutatum	20.	Begonia rex
6.	Alocasia amazonica	21.	Begonia semperflorens red pearl
7.	Alocasia korthalsii	22.	Bromelia balansae
8.	Alocasia macrorrhiza variegata	23.	Caladium hortulanum conbidum
9.	Alocasia macrorrhiza	24.	Caladium hortulanum attala
10.	Alpinia sanderae	25.	Calathea insignis
11.	Alpinia zerumbet	26.	Calathea rufibarba
12.	Anthurium andraeanum	27.	Codiaeum variegatum gold dust
13.	Aphelendra squarrosa	28.	Codiaeum variegatum mammy
14.	Asparagus densiflorus myers	29.	Codiaeum variegatum petra
15.	Asparagus densiflorus myriocladus	30.	Codiaeum variegatum

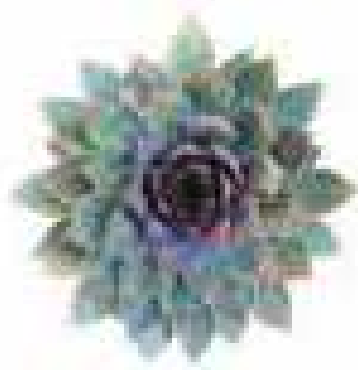


CHAPTER - 27

CACTUS & SUCCULENTS



Variegated Sempervivum



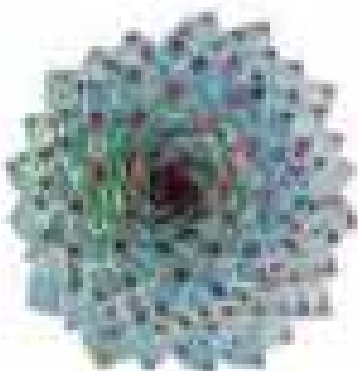
Sempervivum Grape Tone



Sempervivum Cobweb



Sempervivum Red Lion



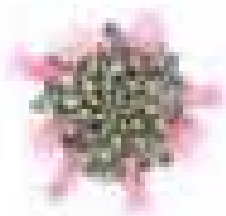
Sempervivum Calcareum



Sempervivum Ciliosum



Powder Puff



Powder Puff



Red Thorn



Britton & Rose



Corn Cob



Blue Candle



Paper Spine



Joseph's Coat



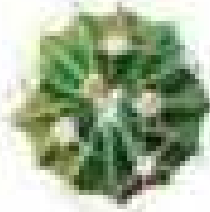
Domino



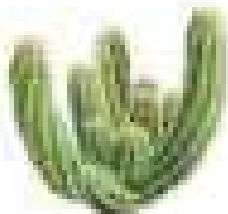
Bishop's Cap



Golden Barrel



Latispinus



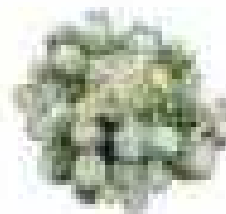
Peanut



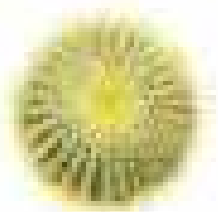
Pine Cone



Angel Wing



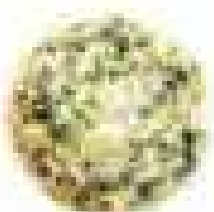
Thimble



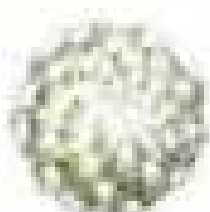
Golden Ball



Peruvian Old Man

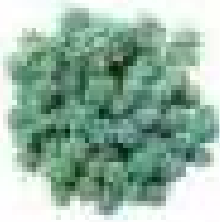


Pincushion

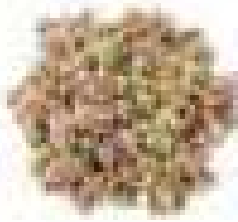


Albiflora

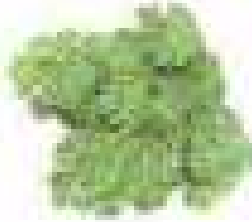
SEDUM



Major



Minor



White Diamond



Dragon Blood



Little Gem



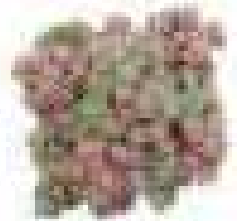
Cape Blanco



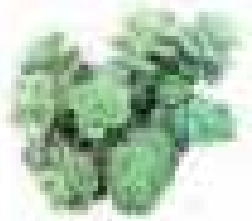
Little Missy



Tricolor



Hispanicum



Sieboldii



Fire Storm



Lime Zinger



Fuzzy Wuzzy

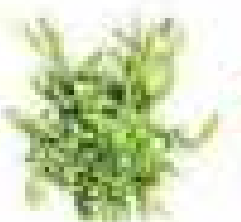


Sunsparkler

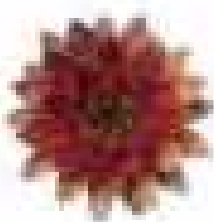


Green Jelly Bean

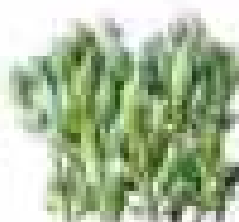
SENECIO & SEMPERVIVUM



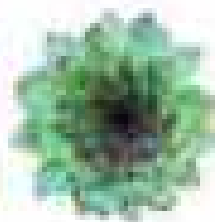
Ruby Necklace



Red Lion



Citriformis



Mahogany



Vertical Leaf

COTELYDON & KALANCHOE



Key Lime Pie



Bear Paw



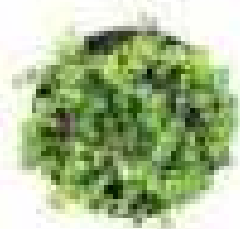
Orbiculata



Mother of Millions



Chocolate Soldier



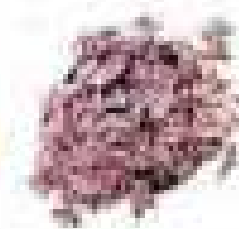
String of Pearls



Purple Heart



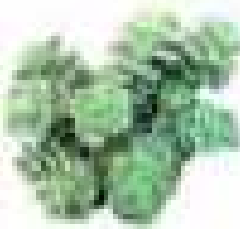
Donkey's Tail



Calico Kitten



Ruby Necklace



Sedum Sieboldii



Baby Necklace



String of Hearts



Little Missy



String of Bananas

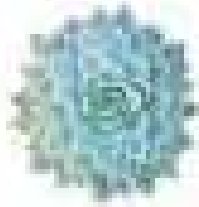
ECHEVERIA



Black Prince



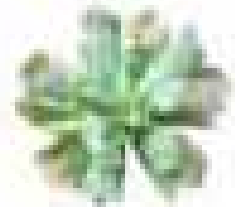
Blue Rose



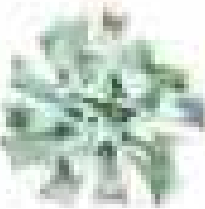
Violet Queen



Cubic Frost



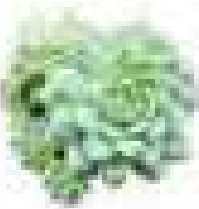
Culibra



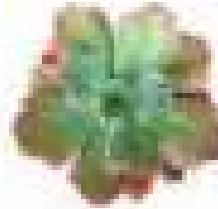
Topsy Turvy



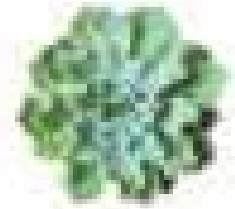
Lipstick



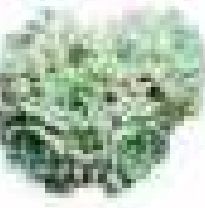
Painted Lady



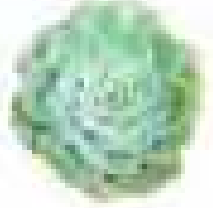
Crinoline Ruffles



Gray Curl



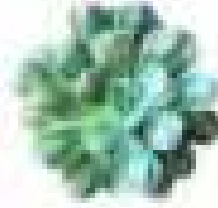
Minima



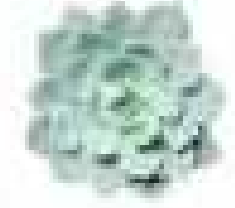
Atlantis



White Rose



Raindrops

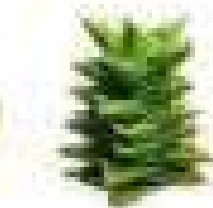


Blue Fairy

CRASSULA



Devil's Horns



Tiger Jade



Red Pagoda



Gollum Jade



Campfire



Springtime



Baby Necklace



Hummel's Sunset



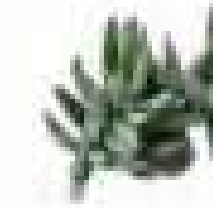
Brevifolia



Ruffle Jade



Giant Watch Chain



Mesembryanthemoides



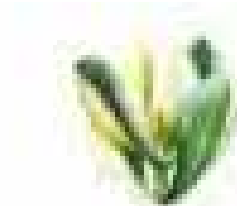
Pagoda Village



Devil's Horns



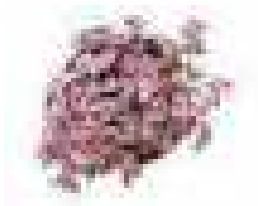
Tiger Jade



Ovata f. variegata



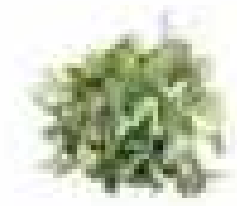
Red Pagoda



Colico kitten



Campfire



Ruffle Jade



Baby Necklace



Silver Springtime



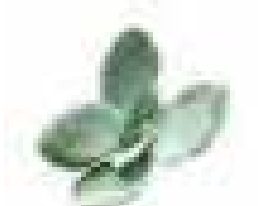
Tiger's Jaw



Ivory Towers



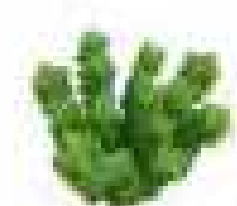
Springtime



Cotyledonis



Moonglow



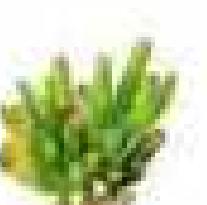
Green Pagoda



Rubricaulis Candy Cane



Rupestris High Voltage



Gollum Jade



Falcata Propeller



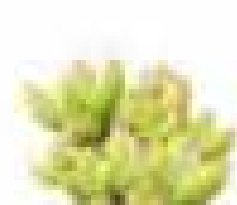
Tom Thumb



Orbicularis



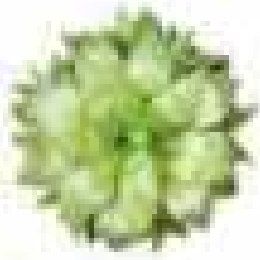
Giant Watch Chain



Nudicaulis var. herrel



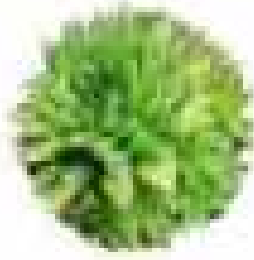
Pagoda Village



Window



Venosa



Cooperi



Cuspidata



African Pearls



Batesiana



Silver



Zebra Plant



Panda Plant



Flapjacks



Panamensis



Chocolate Soldier

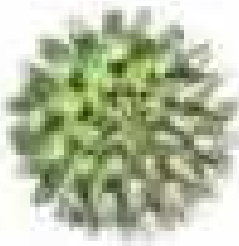


Mother of Thousands



Mother of Millions

CACTUS



Powder Puff



Thimble



Hedgehog



Bishop Cap



Paper Spine



Corn Cob



Pine cone



Joseph's Coat



Golden Barrel



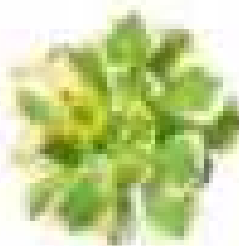
Angel Wing



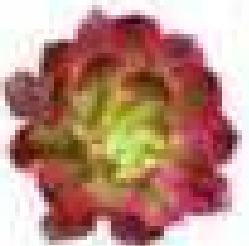
Dwarf Chin



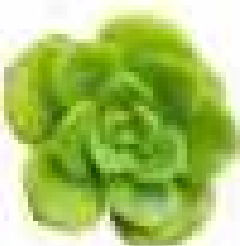
Echinopsis



Sunburst



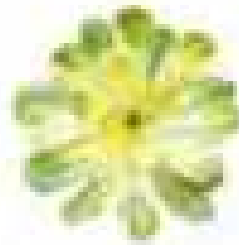
Mardi Gras



Lily Pad



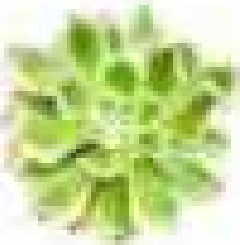
Black Rose



Suncup



Kiwi



Luteovariegatum



Sedum
cuspidatum



Senecio
rowleyanus



phedimus



crassula
ovata



crasula
ovata 'gollum'



crassula
ovata 'hobbit'



graptosedum
bronze



sedum
luteoviride



kalanchoe
rombophilosa



crassula
wolkensii



cyanotis
somalensis



kalanchoe
houghtonii



kalanchoe
blossfeldiana



portulaca
gilliesii



lenophyllum



sedum
rubrotinctum



echinopsis



sedum
diffusum



pachyveria
'powder puff'



echeveria
palida



tradescantia
sillamontana



pachyphytum
oviferum



sedum
sediforme



crassula
capitella 'campfire'



Echeveria
black prince



sedum
golden glow



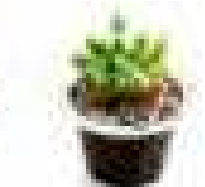
crassula
capitella thyrsoflora



scilla
pauciflora



sedum
hernandezii



sedum
pachyphytum



echinopsis
chamaecereus silvestrii

Kalanchoe
laetivirens

aeonium
haworthii

portulacaria
afra

echeveria

crassula
perforata

crassula
lycopodioides

kalanchoe
fedtschenkoi

kalanchoe
beharensis

crassula
rogersii

orostachys

sedum
morganianum

crassula
fragilis

kalanchoe
tomentosa

anacampseros

aeonium
decorum

stapelia
variegata

plectranthus
australis

callisia
repens

callisia
fragrans

haworthia
rigida

graptoveria
opalina

haworthia
cymbiformis

graptosodium
francesco baldi

sempervivum

crassula
sarmentosa variegata

sedum lineare
variegatum

tradescantia pallida
'purple heart'

graptoveria
titubans

graptoveria
douglas huth



Pink Blush



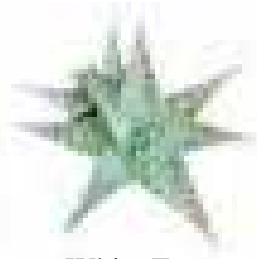
Aloe Brevifolia



Window



Cuspidata



White Fox



Debbie



Silver Haworthia



Fred Ives



Little Jewel



Ghost Plant



Zebra



Variegated Butterfly



Gasteria Flow



Coral Aloe



Agave Butterfly



Lavender Pebbles



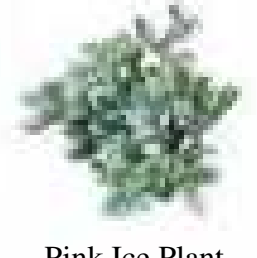
Ice Plant



Concrete Leaf



Lobster Flower



Pink Ice Plant



Variegated Ghost



Ruby Necklace



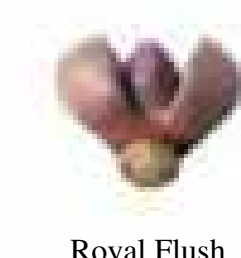
Citriformis



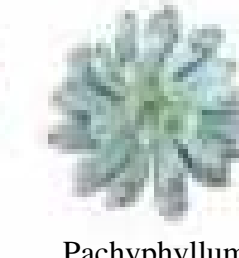
Brevicaule



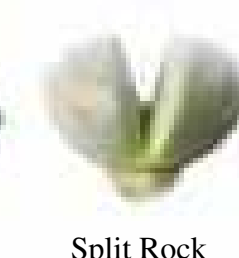
Superbum



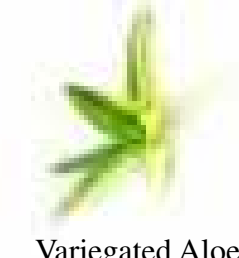
Royal Flush



Pachyphyllum

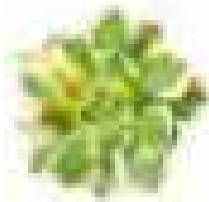


Split Rock

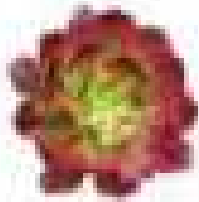


Variegated Aloe

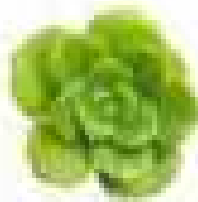
AEONIUM



Sunburst



Mardi Gras



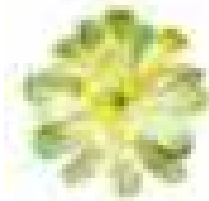
Lily Pad



Kiwi



Crested Sunburst



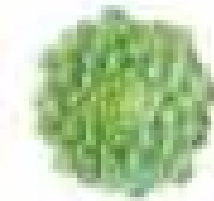
Suncup



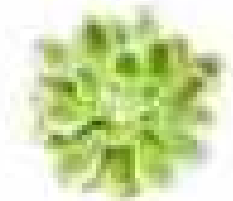
Green Platters



Black Rose

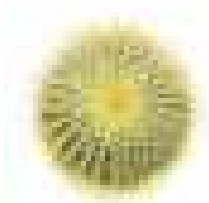


Dinner Plate

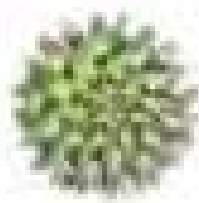


Luteovariegatum

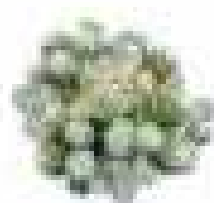
CACTUS



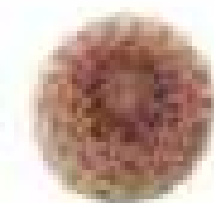
Golden Ball



Powder Puff



Thimble



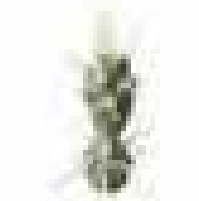
Hedgehog



Bishop Cap



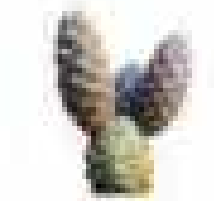
Britton & Rose



Paper Spine



Corn Cob



Pine cone



Joseph's Coat



Old Man



Golden Barrel



Angel Wing



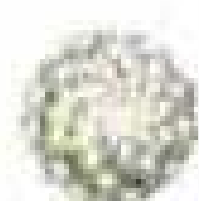
Dwarf Chin



Echinopsis



Lady Finger



Mammillaria Albiflora



Devil's Tongue

CHAPTER - 28

ESSENTIAL ELEMENTS AND THEIR SOURCES

MAJOR		MINOR	
Essential elements used in relatively large amounts		Essential elements used in relatively small amounts	
Mostly from Air and water	From Soil		
Carbon (C)	Calcium - (Ca)	Copper	- (Cu)
Hydrogen (H)	Magnesium - (Mg)	Manganese	- (Mn)
Oxygen (O)	Sulphur - (S)	Zinc	- (Zn)
	Nitrogen - (N)	Molybdenum	- (Mo)
	Phosphorus - (P)	Cobalt	- (Co)
	Potassium - (K)	Boron	- (Bo)
	Iron - (Fe)		

ROLE OF PLANT NUTRIENTS

Group I	Energy Exchanges	Hydrogen and Oxygen
Group II	Energy Storers	Carbon, Nitrogen, Phosphorus, Sulphur
Group III	Translocation Regulators	Potassium, Sodium, Calcium and Magnesium
Group IV	Oxidation-Reduction Regulators	Iron, Manganese, Zinc, Copper, Boron and Molybdenum

C-Deficiency Symptoms of Major and Minor Elements

Major (Macronutrients) Elements

S. No.	Element	Symptoms Major (Macronutrients) Elements
1	Nitrogen	1 Older or lower leaves of plant mostly affected; effects localized or generalized.
		2 Effects mostly generalized over whole plant ; more or less drying or firing of lower leaves ; plant light or dark green.
		3 Plant light green ; lower leaves yellow, drying to light brown colour; stalks short and slender if element is deficient in later stages of growth.

S. No.	Element		Symptoms Major (Macronutrients) Elements
2	Magnesium	1	Effects mostly localized ; mottling or chlorosis with or without spots of dead tissue on lower leaves ; little or no drying up of lower leaves.
		2	Mottled or chlorotic leaves, typically low ridden, as with cotton, sometimes with dead spots ; tips and margins turned or capped upwards stalks slender.
3	Phosphorus		Plant dark green, often developing red and purple coulurs, lower leaves sometimes yellow, drying to greenish brown or black colour, stalk short and slender if element is deficient in later stages of growth.
4	Potassium	1	Mottled or chlorotic leaves with large or small spots of dead tissues.
		2	Spots of dead tissue small, usually at tips and between veins, more marked at margins of leaves, stalk slender.
5	Calcium	1	New or bud leaves affected, symptoms localized.
		2	Terminal bud dies, following appearance of distorts on at tips or bases of young leaves.
		3	Young leaves of terminal bud at first typically hooked, finally dying back at tips and margins, so that later growth characterized by cut-out appearance at these points, stalk finally dies at terminal buds.
6	Sulphur	1	Dead spots not commonly present, chlorosis may or may not involve veins, making them light or dark green in colour.
		2	Dead spots not commonly present, chlorosis may or may not involve veins, making them light or dark green in colour.
7	Zinc		Spots generalized, rapidly enlarging, generally involving areas between veins and eventually involving secondary and even primary veins; leaves thick ; stalks with shortened internodes.
8	Boron		Young leaves of terminal buds becoming light green at bases, with final breakdown here, in later growth; leaves becomes twisted, stalk finally dies back at terminal bud.
9	Copper	1	Terminal buds commonly remain alive, wilting or chlorosis of younger or bud leaves with or without spots of dead tissue, veins light or dark green.
		2	Young leaves permanently wilted (wither-tip effect) without spotting or marked chlorosis; twig or stalk just below tip and seed head often unable to stand erect in later stages when shortage is acute.
10	Manganese	1	Young leaves not wilted, chlorosis present with or without spots of dead tissue scattered over the leaf.
		2	Spots of dead tissue scattered over the leaf, smallest veins tend to remain green, producing a checkered or reticulating effect.
11	Iron		Young leaves chlorotic, principal veins typically green, stalks short and slender.

CHAPTER - 29

IMPORTANT FERTILIZERS

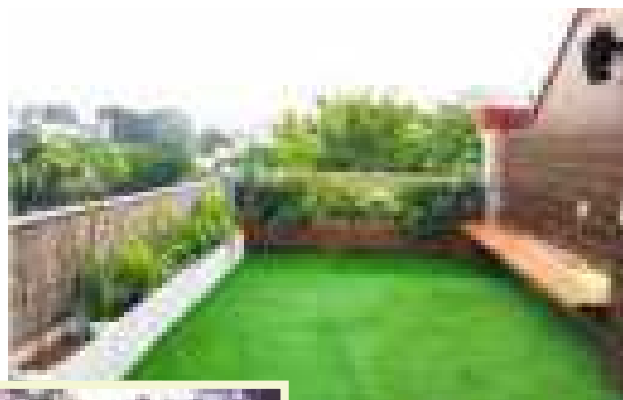
The fertilizers and their uses in addition to the percentage of elements contained in them

S. No.	Name of the fertilizer	Chemical formula	Percentage of the elements	Equivalent		Remarks
				Acidity/ basicity		
Nitrogenous Fertilizers						
1	Sodium Nitrate	Na NO ₃	16.0	-	29	Produces alkalinity in the soil. No accumulation in light soil suitable for use in acid soils. Soils not used in larger amounts.
2	Ammonium Sulphate	(NH ₄) ₂ SO ₄	20.5	110	-	Mostly used in present days. Acid forming fertilizer. Higher doses are harmful. It does not leach easily. Easy to handle.
3	Ammonium Nitrate	NH ₄ NO ₃	33.5	60	-	Best for dryland crops. It is completely used. More effective on heavier soils, because leaching is not very pronounced. In heavy rain-fall area, nitrate is completely leached out.
4	Ammonium Chloride	NH ₄ CL	25.0	128	-	Can be applied to light as well as heavy soils without loss of nitrogen. Nitrogen is absorbed by soil particles. Should not be used in acidic soils.
5	Ammonium Phosphate	(NH ₃) ₂ HPO ₄	21.0	55-77	-	They are primarily used on leguminous crops including pulses. They can be applied to any type of soil. Loamy, neutral soils are best, because phosphate and nitrogen both will be available.
6	Ammonium Sulphate Nitrate	-	26.0	93	-	It has the same effect as ammonium sulphate. Where leaching occurs on heavier soils, it is better. Transplanted paddy responds better to this fertilizer. It is safe to apply on highly acid soils than ammonium sulphate.

S. No.	Name of the fertilizer	Chemical formula	Percentage of the elements	Equivalent		Remarks
				Acidity/ basicity		
7	Urea	$\text{CO}(\text{NH}_2)_2$	46.0	80	-	Well aerated soil helps in the decomposition of urea which is converted into ammonical nitrogen. Applied in dry land. Being less acidic, hence can be used on wider range of soils. Anaerobic condition may cause loss of nitrogen from urea. Very good for foliar application.
8	Calcium Cyanamide	Ca CN_2	22.0	63	-	It is highly based producing fertilizer, well aerated soil condition may help in the reduction of nitrogen in acid soils. It take longer time to release nitrogen for crops.
9	Calcium Ammonium Nitrate	-	20.5	-	-	This neutralizes the acidity of the soil due to the presence of lime. It should be used in those soils, where leaching is not heavy. For light soils it should be given in smaller doses.
10	Calcium Nitrate (Calnitro)	$\text{Ca}(\text{NO}_3)_2$	15.0	-	-	It is suitable for acidic soils more prominently than for calcareous or saline alkaline lands. Should not be used under wet conditions as nitrate is likely to leach out in the soil.
11	Potassium Nitrate	KNO_3	13.0	-	29	It is a basic salt and is more for the supplying of potassium rather than nitrogen. It leaches out very quickly in wet soils.
Phosphatic Fertilizers						
			P_2O_5 Content	Acidic or Alkaline		
1	Single Super-phosphate	16.0-20.0	neutral	90		Suitable for all types of soil. The effect of it on heavy soils more than on lighter soils because of low level of other nutrients.
2	Triple Super-Phosphate	48.0-50.0	Acidic	95		Alluvial soil of North India responds very much to this fertilizer. Both are water soluble.

S. No.	Name of the fertilizer	Chemical formula	Percentage of the elements	Equivalent		Remarks
				Acidity/ basicity		
3	Basic Slag	3.4 Indian	alkaline			It reacts on acidic soils. The availability is more under water soils, which contain high contents of organic matter. It is not soluble in water. It is applied much earlier than it is required for the crops.
4	Rock Phosphate	Ca (Po ₄ With impurities	20.0-25.0	acidic	-	It is much more effective on acidic soils than alkaline soils. Insoluble in water. It does dissolve in soil water in the presence of organic matter or green manure. Highly effective on heavily leached soils. Its effectiveness increases if it is mixed with super-phosphate.
5	Bonemeal	Ca ₃ (PO ₄) ₂	25-28 and 1.2% N	alkaline	70	As already stated, it is not water soluble fertilizer. It takes time to get dissolved in the soils. The efficiency of this fertilizer increases in the presence of organic matter in large quantities. Suited for acidic soils. The availability of phosphorus from bone meal is higher in water soil conditions than in drylands.
6	Ammonium Phosphate	NH ₄ H ₂ PO ₄ and (NH ₄) ₂ PO ₄	48-54 And 11-21% N	acidic	100	Most suitable fertilizer for Indian soils. Ammo. phos. is liked on account of 20 : 20 percentage P and N with water solubility Can be used on light medium and heavy soils. Its response is most pronounced on medium and heavy soils than on lighter ones. It is equally effective in wet as well as dry lands,

S. No.	Name of the fertilizer	Chemical formula	Percentage of the elements	Equivalent		Remarks
				Acidity/ basicity		
Potassic Fertilizers						
1	Potassium Sulphate	K_2SO_4	47-52			Response to this has been obtained on all soils in India where it is deficient. Soils of high calcium content retain the sulphate ions than low content ones Suitable for application on calcareous and alkaline soils. Not suited on heavy soils. In highly leached acid soils sulphur deficiency is actually observed. It contains 38 — 49% Sulphur.
2	Potassium Chloride (Muriate of potash)	KCl	60-62			It is imported in large amounts due to high percentage of K_2O . In acidic soils it has greater response than potassium sulphate. Cl ions are not retained by soils of heavy type hence can be used on such soils. In alkaline soils Cl ions prove toxic for crops.



CHAPTER - 30

MEDICINAL PLANTS

Common Name : Ghrita Kumari
Botanical Name: Aloe vera
Family Name : Asphodelaceae



MEDICINAL PROPERTIES / USES

Aloe Vera is very popular and also called as “Ghrita Kumari”. Aloe is commonly used can be grown in various climatic conditions. It is sensitive to water logged conditions and also cold climate is not favourable for this plant.

Medicinal Uses: Detoxifies the body, hydrates skin, lowers high cholesterol, stabilizes blood sugar, prevents kidney stone, reduces high blood pressure, supports immune system, and helps in inflammation, wounds, burns and eczema, etc.

Other Uses: Aloe Vera has been widely used for cosmetic use such as for making lotions, facial creams, etc. The commonly used element is leaf juice and leaf gel.

Common Name : Ashwagandha
Botanical Name: Withania somnifera
Family Name : Solanaceae



MEDICINAL PROPERTIES / USES

Ashwagandha Withania somnifera is also known as Poison gooseberry. It is a short shrub herb of 35 to 75 cm with a single stem with branches extend radially. The flowers are small and green while ripe fruit is orange red and has milk coagulating properties. The plants long, brown roots are used for medicinal purpose.

Medicinal Use: In Ayurveda, the leaves and fruit of ashwagandha are applied to tumours, tubercular glands and ulcers. It has capability of improving arthritis symptoms, helps in reducing symptoms of anxiety, reduces cholesterol level and can improve attention and impulse control in children with ADHD (Attention deficit hyperactivity disorder).

Side Effects & Safety: Higher dose of ashwagandha might cause stomach upset, diarrhoea and vomiting and can irritate the gastro intestinal tract. So the patient having stomach disease are advised not use ashwagandha.

Common Name : Brahmi
Botanical Name: Bacopa monnieri
Family Name : Scrophulariaceae



MEDICINAL PROPERTIES / USES

Brahmi (*Bacopa monnieri*) is one of the most valuable medicinal plants in Ayurveda and has been used traditionally from several years. This is well known as “Brahmi” in Ayurveda and considered as “Medhya Rasayana” i.e. Brain Tonic. This herbal plant is also known as Thyme leaved gratiola. It is a small prostrate herb with fleshy leaves which can be propagated by cuttings. Brahmi can be grown in rich soil with regular and heavy watering up to 2 to 3 times a day and should permanently be kept in moist.

Medicinal Uses: It is extensively used as neurotonic in traditional Indian Medicine. Brahmi is also used for treating mental and nervous disorders. It is also beneficial for the patient of Alzheimer’s disease and of Liver cancer. It is also used as herbal supplement in epilepsy, anxiety and depression.

Common Name : Chirata
Botanical Name: Swertia chiraytia
Family Name : Gentianaceae



MEDICINAL PROPERTIES / USES

Chirata is an annual herb mostly found in temperate region. The part used in the medicine is that which grow above the ground. It is also known as Indian gentian.

Medicinal Uses: Chirata is a powerful anti-inflammatory agent which is good for rheumatoid arthritis, for joint diseases, swelling, pain and redness. It is a ayurvedic therapeutic plant and used for fever, constipation, upset stomach, loss of appetite, intestinal worms, skin diseases and cancer. It is often called as a “Bitter tonic”. In India it is used for malaria.

Side Effects & Safety: Diabetes patient are not allowed to use chirata in their diet as it might lower the blood pressure. Pregnant and Breast feeding ladies should stay on safe side and avoid use.

Common Name : Giloy

Botanical Name : Tinospora cordiflora

Family Name : Menispermaceae



MEDICINAL PROPERTIES / USES

Giloy is also known as Guluchi, is a famous ayurvedic perennial climber herb found in India. It has a significant heart shaped leaves, yellow flowers and ripe berry fruit of red colour. Guluchi is an excellent rasayana for the treatment of various diseases. Though it is used broadly these days but it has the reference in Ramayana and Durga Saptashati. The roots, stems, leaves and fruits are used in the treatment of various diseases.

Medicinal Uses: The benefits of giloy are countless. It is used in increasing immunity of the body, its fight against infecting organisms. The leaves of the plant in juice cure psychological disorder. Even leaves are also used in swine flu treatment; it is also used for the treatment of fever due to infection. Giloy is a remedy for diabetes. The traditional use of the leaves is to cure urine infection and stomach ulcer. Its helps in purifying blood and helps in controlling level of Blood Pressure. It is also used in curing rheumatic pain. When leaves of giloy are mixed with cow milk it helps in curing leucorrhoea. The leaf extract also used in curing jaundice and anaemia. It also removes the toxins from the brain. It adds strength and vigour to the body and removes the weakness.

It is considered a most divine herb because of its various ayurvedic uses. Therefore, it is also called as “Amruta” for its divine healing nature.

Common Name : Gurmar

Botanical Name : Gymnema sylvestre

Family Name : Asclepiadaceae



MEDICINAL PROPERTIES / USES

Gurmar is also known as Madhunashini. It is a vulnerable species, slow in growing, perennial, medicinal woody climber which has much therapeutic application in Ayurveda. Leaves of Gurmar in India are well known for their sweet taste suppressing activity.

Medicinal Uses: Since India is becoming the diabetic capital of the world, here is the hope called as Gurmar. It is used for reducing blood sugar level since centuries; the paste of the root is used for the treatment of snake bites or wounds. It also brings down a high cholesterol level. Leaf juice is helpful in avoiding constipation and also helps in regulating the weight of the body. The plant extract is used as a liver tonic and is used to refresh the cardiac activities by improving circulation of blood. Traditionally, it is used for the treatment of gastric troubles. The leaf extracts also cures eye problem and root bark is useful for the treatment of piles. It's give comfort in colic pain and dropsy.

Common Name : Holy Basil
Botanical Name: *Ocimum basilium*
Family Name : Lamiaceae



MEDICINAL PROPERTIES / USES

Holy Basil is commonly known as “Tulsi” which is a common herb grown in many households with wide range of therapeutic properties. Tulsi is an erect much branched sub shrub of 30 to 60 cm tall with green or purple leaves that are strongly scented and hairy at stem. Generally two varieties of Tulsi are found Rama Tulsi and Krishna Tulsi.

Medicinal Uses: Tulsi has a beneficial effect in cardiac disease and reduces the level of blood cholesterol. The juice of Tulsi is beneficial in the treatment of ringworms, leucoderma and other skin diseases. Tulsi leaves have strengthening effect on the renal stone. It is rich in antioxidant properties and can reduce stress, enhance stamina, promote healthy metabolism and is a natural immunomodulator. Its oil is also used against the insects and bacteria. The Rama Tulsi is the effective remedy for the severe acute Respiratory Syndrome. Juice of its leaves gives relief in cold, fever, bronchitis and cough. Tulsi oil is also used as the ear drop. Tulsi helps in curing malaria. It is very effective against indigestion, headache, hysteria, insomnia and cholera. The fresh leaves of Tulsi are taken by the people every day. Due to its remarkable healing properties it is also known as “Queen of Herbs”

Common Name : Sarpagandha
Botanical Name: *Rauvolfia serpentina*
Family Name : Apocynaceae



MEDICINAL PROPERTIES / USES

Sarpagandha is also known as “Indian Snake Root” is an evergreen plant which has been in use since years in Indian Medicines. It is an erect under shrub with spear shaped leaves and with white and red flower. It is a useful herb in Ayurveda and Homoeopathy treatments.

Medicinal Uses: It is used for the treatment of high blood sugar, it cures hysteria and hypertension. It is also useful for in the treatment of cataract. It also cures plague and fever. Sarpagandha is used for the treatment of Schizophrenia. In different countries it is used as a sedative. It is also used against irregular heart action in old ages. It can also cure rheumatism, edema and intestinal diseases. It is also used against constipation and dizziness.

Common Name : Thyme
Botanical Name : *Thymus vulgaris*
Family Name : Lamiaceae



MEDICINAL PROPERTIES / USES

Thyme is a small perennial shrub with lots of branches and light purple to pink flowers. It grows in hot and sunny locations. The parts which are used for medicinal purposes are flowers, leaves and oil.

Medicinal Uses: Thyme is used for curing bronchitis, whooping cough, sore throat, colic, arthritis, upset stomach, gastritis, diarrhoea, a movement disorder in children (dyspraxia), parasitic worm infection and skin disorders. It is also used to increase urine flow, to disinfect the urine and as an appetite stimulant. Thyme oil is used as a germ killer in mouthwashes. It is also applied to the scalp to treat baldness and to the ears to fight bacterial and fungal infections.

Common Name : Calihari
Botanical Name : *Gloriosa superba*
Family Name : Colchicaceae



MEDICINAL PROPERTIES / USES

Gloriosa superba is composed of two words “*Gloriosa*” means full of glory and “*superba*” means superb is a perennial herb and grown as a climber. It is also known as Glory Lily because of its eye catching and multi-coloured glorious flowers. The tendrils which are present in the leaves help the plant to grow with the support of other plants in order to get sunlight. The flowers are red, orange, yellow and multi-coloured. It is the state flower of Tamil Nadu. The height of plant is about 3.5 m to 6 m. This medicinal plant is having underground V shaped tubers.

Medicinal Uses: The plant *Gloriosa superba* gives ease from the neuralgic pain. It helps in curing skin disease and itching in the skin. It also kills worm in the body. It gives comfort from abdominal pain and used in the treatment of piles and chronic ulcer. The extract from the root is used as a tonic that can add vigour to the body. Since, this plant is rich in colchicine's, so the seeds are used in the treatment of rheumatism and gout. The tubers of glory lily are used against snake bite and the extract is used to kill lice. The tubers of this plant are also used for the treatment of kidney problem. Due to its laxative nature, it can be used as a home remedy for constipation. It also cures haemorrhoids disease and also helpful for the treatment of small pox.

Common Name : Isabgol
Botanical Name: Plantago ovata
Family Name : Plantaginacea



MEDICINAL PROPERTIES / USES

It is called as “Psyllium”. Isabgol is a stem less annual herb. The part used in medicinal property is husk and seed. Husk of Isabgol is having absorbing and retaining property. Isabgol requires light soil and well irrigation. It can grow in cool climate and dry weather. It is propagated by seeds.

Medicinal Uses: It is beneficial in chronic dysenteries and for treating constipation and intestinal disorders. It work as calorie free fibre food and promotes regular bowel movement. The seeds of isabgol are having cooling effect as is used in ayurvedic, unani and allopathic medicines. The seed and husk cures inflammation of the mucous membranes of gastro intestinal and urinary tracts, piles and gonorrhoea. It can treat diarrhoea, can lower blood sugar levels and also lowers cholesterol levels and is good for heart.

Common Name : Neem
Botanical Name: Azadirachta indica
Family Name : Meliaceae



MEDICINAL PROPERTIES / USES

It is also called as “Margosa” in English. Azadirachta indica is derived from words Azad means Free, Dirakht means Tree and Indica means Indian Origin which literally means “The Free Tree of India” or “Noble Tree”. It is commonly called as Indian Lilac and is very fast growing, evergreen tree which reaches the height of 15 to 20 meters. Its fruits and seeds are the source of neem oil.

Medicinal Uses: All parts of neem tree are anti-fungal, anti-diabetic, antibacterial, antiviral and sedative in nature. The neem oil obtained from the seeds is used as a medicine. Neem gum is used as a bulking agent and for the preparation of special purpose food (for diabetics). The neem leaf paste is applied to the skin to treat acne and also used against pox viruses in India. People who are affected with pox viruses are generally made to lie in bed of neem leaves and branches. The flower produces nectar that can be used as a sweetener. Roots of neem are used in relieving fever. Neem is also helpful in the treatment of cough, asthma, ulcers, piles, intestinal worm, and urinary diseases.

Common Name : Kalmegh
Botanical Name : Andrographis paniculata
Family Name : Acanthaceae



MEDICINAL PROPERTIES / USES

Kalmegh is commonly called as “King of Bitters” and the part used in medicinal properties is leaves. This medicinal plant grows up to the height 110 cm. The seeds are yellowish brown and small white flowers with rose purple spots are borne in this plant. All plant parts are extremely bitter in taste.

Medicinal Uses: Kalmegh is an antioxidant and anti-inflammatory in nature. It is used for the treatment of cancer and HIV. The regular use of Kalmegh is helpful to cure cough, cold, sinus and body pain. It is also used as a blood purifier and enhances immunity. It protects the liver and used as a liver tonic. Traditionally, Kalmegh is used in the treatment of leprosy and Cholera. The tonic made by kalmegh is used against weakness to add strength and vigour to the body. The extract of Kalmegh is used in the treatment of slow digestion, bowel irritation and irregular menstrual syndrome. The syrup of kalmegh is used against fever and malaria. It is also used against the respiratory infection and juice of kalmegh is used to cure ulcer. The bitter extract of the leaves is useful in killing worms in the stomach. The entire plant is very useful in the treatment of snake and scorpion bite. It is also used against heart disease and helps in reducing high blood sugar.

Side effects and Safety: The plant is strongly avoided during pregnancy because of its anti-fertility property.

Common Name : Mandukparni
Botanical Name : Centella asiatica
Family Name : Apiaceae



MEDICINAL PROPERTIES / USES

It is commonly called as “Indian Pennywort”. Mandukparni is known since the ancient times to enhance intellect and wisdom. Its leaves resembles with human brain, thus this medicinal plant is treated as brain food.

Medicinal Uses: It is used as a nerve tonic, cardiac tonic, sedative, laxative and blood purifier. It also help in curing skin diseases like eczema and prevents from leprotic ulcers. It is good for healthy hair. It also act as a mood elevator from the conditions like stree, anxiety, tension, depression, etc. Respiratory conditions like asthma, bronchitis, hiccups, etc may be treated with the help of mandukarni. It is beneficial in case of epilepsy. It is also recommended to the patients ho have low red blood cell count.

Common Name : Jawarnkush
Botanical Name: Cymbopogon
jwarancusa
Family Name : Poaceae



MEDICINAL PROPERTIES / USES

It is an important perennial medicinal herb found as a weed throughout India. Roots and shoots are the important parts which are used medicinally. Traditionally, the species name has been derived from two sanskrit words “Jwar” and “Ankusha” meaning “Fever” and “Breaker”.

Medicinal Uses: This medicinal plant is used against different diseases like vomiting, abdominal tumors, unconsciousness, blood impurities, skin problems, etc. It is used in the treatment of gout, rheumatism and fever.

Common Name : Sadabahar
Botanical Name: Catharanthus roseus
Family Name : Apocynaceae



MEDICINAL PROPERTIES / USES

It is commonly called as “Periwinkle” and “Nityakalyani”. It is a very commonly grown plant in India. It is an evergreen shrub that grows to about 90 cm in height having smooth, glossy and dark green leaves and flowers throughout the year.

Medicinal Uses: This medicinal shrub helps in treating gastritis, cystitis, diarrhoea and diabetes. The leaves and stem are a source of alkaloids that have anti-tumor and anti-cancer properties. Sadabhar controls nosebleeds, bleeding gums, mouth ulcers and sore throats. It also helps in increasing blood circulation in the brain, support brain metabolism, prevents memory and concentration problems, prevents early ageing of brain cells. Periwinkle also helps in cough, lung congestion, eye irritation and skin infections.

Common Name : Shatavari
Botanical Name: Asparagus racemosus
Family Name : Asparagaceae



MEDICINAL PROPERTIES / USES

Shatavari is considered one of the most beneficial ayurvedic herbs for health issues to women. It is perennial climbing plant extending to a height of 1 to 2 meters. The flowers having fragrance are white in colour with small spikes. Roots are white tuberous, radish in shaped and found in clusters.

Medicinal Uses: The root powder of this herb supports female reproductive system, promotes fertility, strengthens female reproductive system, strengthens the uterus, helps in removing pathogen and other toxins, help in digestion, boosts the immune system, helps in regulating menstrual cycle, helps in treating PMS and relieves menstrual pain. It also helps in ease for menopausal symptoms. Support healthy milk production in lactating mothers and also helps in maintain normal hormone levels. It also supports normal oestrogen (hormone) production and utilization. Shatavari can enhance the level of white blood cell count and has properties to fight against cholera, typhoid fever and dysentery.

Common Name : Gudhal
Botanical Name: Hibiscus rosasinensis
Family Name : Malvaceae



MEDICINAL PROPERTIES / USES

It is an annual growing shrub grows up to the height of 2.5m. The leaves are simple and dark green in colour. The flowers are long, trumpet shaped with five petals in the shades of white to pink, red, purple or yellow with size of 4 to 15 cm.

Medicinal Uses: It is used in kidney stone remedy and helps in reducing blood pressure. This medicinal plant also helps in liver protection and is having anti-oxidant and anti-cancerous properties. It also helps in wounds, boils and in scalp treatment. It reliefs from headache and from upset stomach. Hibiscus also lowers the cholesterol and helps in managing blood pressure. It has anti-ageing and anti- depressant properties.

Common Name : Mahuwa
Botanical Name: Madhuca indica
Family Name : Sapotaceae

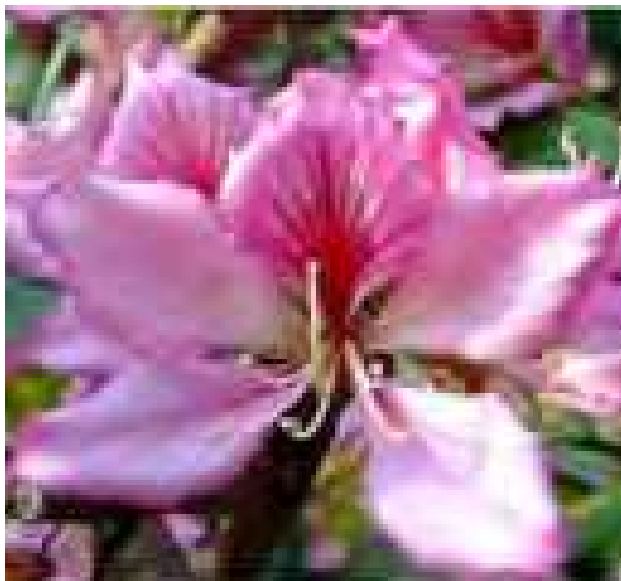


MEDICINAL PROPERTIES / USES

The bark of this tree is grey to dark brown in colour, leaves are dark green and flowers are small pale yellow which grow in dense clusters. The Part used in medicinal properties is seeds, bark, flowers, and fruits, oils of seeds, leaves and bark.

Medicinal Uses: Various parts of mahuwa are used for the treatment of a variety of diseases. The bark of trees is used for rheumatism, chronic bronchitis, diabetes mellitus, bleeding, spongy gums, diarrhoea and in curing scabies and other skin diseases. The fruits are also edible and used to treat ulcer and chronic tonsillitis and pharyngitis. The edible flowers are nutritive and used as tonic, analgesic, diuretic, cooling agent, in treatment of helminths, bronchitis, etc. The leaves of Mahuwa are used in the treatment of eczema and the roots of the tree can be applied on ulcers.

Common Name : Bauhinia
Botanical Name: Bauhinia variegata
Family Name : Fabaceae



MEDICINAL PROPERTIES / USES

It is commonly called as “Kachnar”. It is a deciduous medicinal plant whose height is moderate. Its bark is greyish brown with irregular dark patches. The flowers are pink in colour.

Medicinal Uses: Kachnar is very useful in various glandular diseases. Flowers are laxative in nature and flower buds are helpful in piles, cough. It is also beneficial in case of obesity, osteoporosis, swelling glands and in menstrual cycle. It helps in healing up the wounds and also helpful in providing relieve due to burning sensation in the body.

Common Name : Dhak
Botanical Name: Butea monosperma
Family Name : Fabaceae



MEDICINAL PROPERTIES / USES

It is commonly called as “Dhak” or “Palaash” and is found throughout India. It is deciduous medicinal tree with terminal flowers which are red in colour giving tree an appearance of fire flame. Due to this reason it is also called as “Flame of Forest”. The part which is used in medicinal properties is seeds, leaves and flowers.

Medicinal Uses: It is useful in treating inflammation, swelling conditions related to bones. The seeds of Palaash are also laxative in nature and are often used to treat worm infection. The gum of Butea monosperma is used to treat dysentery and diarrhoea. Dried flowers are used to cure skin rashes and infection in summers. Paste of flowers is also applied externally to cure joint pain, swelling, sprain injury and arthritis. The bark of the tree also helps in blood purification. Roots of Palaash tree are useful to cure night blindness.

Common Name : Papaya
Botanical Name: Carica papaya
Family Name : Caricaceae



MEDICINAL PROPERTIES / USES

It is commonly known as “Papaya” or “Tree melon”. It is an evergreen herb having tree like appearance which is 2 to 10 m tall. It contains white latex with green colour leaves of 25 to 75 cm in diameter. Flowers are yellow and tiny funnel shaped. Fruit of papaya is large with fleshy orange pulp when ripe skin is thin yellow in colour.

Medicinal Uses: Papaya is a fruit which is highly helpful for weight loss. Its provides approximately 39 Kcal per 100 gm. Papaya is helpful in preventing atherosclerosis and other heart diseases, diabetes as it’s an excellent source of vitamin C as well as a good source of Vitamin E and Vitamin A. Due to its antioxidant properties papaya prevents the oxidation of cholesterol. It is also rich in fibre content so helpful in lowering the bad cholesterol level. The nutrients present in papaya are found to be helpful in the prevention of colon cancer. Papaya contains protein digesting enzyme namely papain which are responsible to lower inflammation and improves healing from burns. Papaya is found to be beneficial for the immune system and helps in preventing from cold, infections and flu. It is also responsible in providing protection against inflammatory polyarthritis. Taking papaya regularly in diet is helpful in reducing the risk of prostate cancer.

Common Name : Dhania
Botanical Name: Coriandrum sativum
Family Name : Apiaceae



MEDICINAL PROPERTIES / USES

Coriander commonly known as “Dhania” in India is an herb that is extensively used around the world as a condiments, garnish or decoration on culinary dishes. Its leaves and fruits have a pleasant aroma and are commonly used raw or dried for culinary applications. The part used in medicinal property is leaves and seeds.

Medicinal Uses: Coriander oil is used as stimulant for gastric secretion. It has benefits as a carminative, digestive, wormicidal, diuretic. It is also found beneficial for brain development and can be used as tonic for various neurological disorders. It is helpful in reducing cholesterol level, blood pressure. It acts in diarrhoea treatment by helping in smooth digestion and regular functioning of liver. Coriander is rich in iron that can directly give positive effects in anaemic conditions. It also helps in treating mouth ulcers, menstrual problems and in getting remedy from eye problems as it is rich source of Vitamin A, Vitamin C and Minerals like Phosphorus which are beneficial for eye problems. Coriander leaves and seeds are also beneficial in health problems like small pox, conjunctivitis and diabetes. It can also cure ulcers and inflammations.

Common Name : Haldi
Botanical Name: Curcuma longa
Family Name : Zingiberaceae



MEDICINAL PROPERTIES / USES

Turmeric is commonly called as ‘Haldi’. It is used in India, as food substances as well as medicine. It can be used both internally & externally. It is found in rhizome with oval, long and thick roots. It is bitter in taste, pungent with warm effects.

Medicinal Uses: It is anti-septic, useful in ulcers, wounds, antimicrobial, antibacterial, Anti-viral treatment, cold, cough, bronchitis, conjunctivitis, liver diseases, sprain, and painful oedema. It is helpful in improving digestion, in relieving from arthritis, prevents cancer. Boost up the immune system. Haldi is found beneficial for weight management and also is reducing cholesterol level. It is also helps in preventing Alzheimer’s disease. Turmeric is also such in Iron so helpful for anaemic person. It is used in the treatment of all skin disorders, discoloration of skin, anomalies of urine and of blood. Turmeric is very effective in eosinophilia. Effective medication in all nature of allergies.

Common Name : Long pepper

Botanical Name : Piper longrum

Family Name : Piperaceae



MEDICINAL PROPERTIES / USES

It is commonly called as 'Pippali' cultivated for its fruit which is usually dried. It is a slender, aromatic climber with perennial woody roots creeping and jointed stems, fleshy fruits embedded in the spikes. Long piper leaves are numerous, dark green, shining above and pale & dull beneath. Fruit is long and attains red colour when it ripens and when it dries it turn into black.

Medicinal Uses: Long pepper has a wide range of application in medicines. It is used as a "Rasayana" in the treatment of respiratory disorders and also an important constituent in digestive formulations. It treats stomach-ache, heartburn, indigestion, intestinal gas, diarrhoea and cholera; it is also used for lung problem including asthma, bronchitis & cough. Other uses include treatment of headache, toothache epilepsy, fever, and stroke, trouble sleeping (insomnia), leprosy, extreme tiredness, enlarged spleen, muscle pain, nasal discharge, paralysis, snakebites, tetanus, thirst, tuberculosis and tumours. It is also used in treating menstrual cramps infertility.

Common Name : Baheda

Botanical Name : Terminalia bellerica

Family Name : Combretaceae



MEDICINAL PROPERTIES / USES

Terminalia bellerica is also known as "Baheda". The plant grows up to 60-80 feet in height. The trunk is straight and dark brown in colour. The leaves are broad, oval and 4 to 8 inches long. The flowers grow in both upper and lower part. When fruit dries it looks like a pentagon and is fibrous. In Sanskrit it is called as "VIBHEETA" which means the one which takes away the fear of diseases.

Medicinal Uses: It is rejuvenating, presents ageing and adds longevity. It is also cures vomiting and excessive thirst. The plant is useful for improving mental disorder. It cures lose of appetite and also proved anti-diarrheal because of its astringent property. Baheda is useful for piles and curing intestinal worms. The fruit is useful for curing eye related problems such as immature cataract or nay kind of infection. It is used to lower the blood pressure and levelling the cholesterol. Terminalia bellerica promotes hair growth, adds nutrition's and useful against greying. The fruit chewed is believed to cure cough, cold, asthma and hoarse voice. It is also helpful in stopping bleeding, in curing bronchitis, and in curing digestive problem. It is also helpful for ear pain. It has been proved beneficial against jaundice, leprosy and anaemia. Baheda is useful against cardiac problems, diabetes & urinary disorders. The tonic is good for brain and stomach.

Common Name : Vacha
Botanical Name : Acorus calamus
Family Name : Acoraceae



MEDICINAL PROPERTIES / USES

Acorus calamus is commonly known as “Sweet flag” or “Sweet Root”. It is a perennial, erect, aromatic herb common on river banks and marshes. The medicinal purpose the roots of the plant are used. It has aromatic leaves and rhizomes.

Medicinal Uses: The rhizome of vacha has stomachic, carminative and nervine properties. It is used in the treatment of diseases of the body and mind. It is given to improve memory and functioning of brain. Vacha is also used in the treatment of paralysis, cholera, headache, joint pain, fever, cough, diarrhoea epilepsy, and retention of urine, intestinal worms, cough, bronchitis, diarrhoea, gas, hair loos, indigestion, vocal problems and various skin disorders. It can also be useful in syphilis, boils, wounds for acne, etc.

Common Name : Bael
Botanical Name : Aegle marmelos
Family Name : Rutaceae



MEDICINAL PROPERTIES / USES

Bael is the most ancient sacred tree in India. Mostly it is planted near the temple and used as a dedication to Gods. The use of this plant is seen in scripture like Vedas and Mahabharata. The plant act as a climate purifier by absorbing poisonous gas from the atmosphere.

Medicinal Uses: The juice of the fruit gives comfort from constipation and dyspepsia. The fruits are use against viral and intestinal parasites. It is also used for the treatment of tuberculosis and gynaecological disorders. It can also be used against the urinary complaint. The fruits are also used to increase appetite. Due to bitter and pungent taste of fresh fruit, it can be used to decrease the Blood Sugar. The fruit is also used in intestinal disorder. It is also used in the treatment of diarrhoea, dysentery and irritation in the elementary canal. The juice can be used as brain and heart tonic. The leaves are used for a diabetic person and can be used against peptic ulcers. Leaves are also useful for the treatment of jaundice, leucorrhoea, wounds, deafness; conjunctivitis raw leaves can be used to cure gastric problems and irritation in the bowel. Flowers of Bael is use to prepare tonic for curing epilepsy and the extract can be used for the treatment of dysentery and diabetics.

Common Name : Motha
Botanical Name: *Cyperus rotundus*
Family Name : Cyperaceae



MEDICINAL PROPERTIES / USES

Cyperus rotundus is commonly called as “Motha” which can be seen growing as weed in garden, lawn, fields and waste lands. It looks like grass and have tuberous roots underground. It is a perennial plant. Its blacklists lustrous roots have distinct small due to the presence of essential oil. These rhizomes roots are rich in medicinal properties and are used for the treatment of diseases since time immemorial. They are used fresh and dried.

Medicinal Uses: Motha is used in the treatment of a variety of diseases. It is one of the best herbs for treating many female disorders like yeast, candida and premenstrual syndrome. It is also used for menopause, menstrual disorders and breast tumours. It is used for treating digestive disorders and breast tumours. It is used for treating digestive disorders pain in abdomen, low appetite, digestive weakness, indigestion, diarrhoea and bleeding dysentery.

Common Name : Amla
Botanical Name: *Emblica officinalis*
Family Name : Phyllanthaceae



MEDICINAL PROPERTIES / USES

Emblica officinalis is also known as “Amla” (Indian gooseberry). It is a medium sized plant that grows not more than 18m in height. The trunk is slightly curved and the branches are scattered around. The bark of amla plant is grey with hard reddish wood. It has a yellowish green or pinkish colour flower and the fruit is pale yellow in colour round in shape. The leaves are lighter in weight, long in shape and small like lemon.

Medicinal Uses: The Vitamin C content in Amla helps in improving the digestive system, rejuvenates the body, cures stomach constipation, helps in blood purification, reduces cough and asthmatic problems and improves eyesight, Along with these amla improves immunity and also improves physical strength. It is used for scalp treatment as it is having carotene and iron; Amla ensures proper absorption of calcium that directly or indirectly is beneficial for bones, teeth and nails. Amla is good for weight loss and helps in preventing eye related problems such as cataract, vision improvement. The presence of vitamin A and carotene over comes many problem related with eyes. It is also used for healthy heard by reducing the level of cholesterol. It also relieves from asthma, bronchitis respiratory congestion, chronic cough and cold.

Common Name : Amaltas
Botanical Name: Cassia fistula
Family Name : Fabaceae



MEDICINAL PROPERTIES / USES

Cassia fistula commonly called as 'Amaltas' is a medium sized tree with brilliant yellow flowers growing at roadside and garden long cylindrical pods are used in medicinal property seeds are shiny black in colour for medicinal purpose, all parts of the tree viz. roots, bark leaves, fruits are used.

Medicinal Uses: Amaltas is very effective laxative. This herb is used to treat fever, heart disorders, bleeding disorders, abdominal distension, and abdominal pain. Fruit are used to treat leprosy and are best anti-pyretic and purgative in nature. It is also used in skin disorders and in protecting liver. Cassia is also used in the treatment of rheumatism, gout the fruit pulp is a medicine for curing constipation the leaves are rubbed on skin in case of severe itching. It is also used in treating fever, inflammation and legatorial infections.

Common Name : Ashok
Botanical Name: Saraca indica
Family Name : Caesalpiaceae



MEDICINAL PROPERTIES / USES

Ashok tree is one of the most legendary and sacred trees of India. It is an evergreen tree 15-20 meter high. The leaves are 15cm long and of oblong shape. The flowers are yellowish orange and scarlet. All parts of the tree such as bark, leaves, flowers and seeds are used medicinally. Due to its medicinal value, it is known as a universal plant.

Medicinal Uses: Ashok tree is popularly used in the treatment of gynaecological problems and menstrual disorders in women. The Ashok herb can naturally improve the skin's complexion. The bark is used to cure bacterial and fungal infections. Ashok helps in treating irritations and burning sensation in the skin. It also helps in curing diarrhoea and purification of blood. Ashok is also used for curing of piles and bleeding caused due to piles. Powder made from Ashok seed cures kidney stones and act as a memory enhancer, helps in urine retention. Saraca indica is also used for heart diseases and tumours.

Common Name : Ginger
Botanical Name : Zingiber officinale
Family Name : Zingiberaceae



MEDICINAL PROPERTIES / USES

Ginger is also known as 'Adarak' is a flowering plant whose rhizome/root is widely used for medicine. It is an herbaceous perennial which grows through pseudo stems about a meter tall bearing narrow leaf blades.

Medicinal Uses: It is carminative, analgesic, antiviral, and anti-inflammatory in nature. Ginger can treat many forms of Nausea like nausea caused by cancer treatment by HIV/AIDS, reduces muscle pain and soreness. Due to anti-inflammatory in nature it can help with Osteoarthritis. Ginger is commonly used for various types of "stomach problem" including motion sickness. Other uses include pain relief from rheumatoid arthritis menstrual pain. The oil made from ginger is sometimes applied to the skin to relieve pain.

Common Name : Elaichi
Botanical Name : Elettaria cardamomum
Family Name : Zingiberaceae



MEDICINAL PROPERTIES / USES

Elettaria cardamom, commonly known as "Green or True Cardamom", is an herbaceous perennial plant. It is also been called as Queen of Spices." It grows about 2 to 4 m in height. The leaves are alternate about 40-60 cm along with long pointed tip.

Medicinal Uses: Cardamom is a stimulant and carminative which is used for indigestion and flatulence. In India, is broadly used to treat infections in teeth and gums. It is used to prevent and treat throat troubles, congestion of the lungs and pulmonary tuberculosis. It is also used in inflammation of eyelids and also digestive disorders. It is also used as an antidote for both snake and scorpion venom. Cardamom is used as a breath- freshener and is use to thin the blood.

Common Name : Yastmadhu / Mulethi
Botanical Name: Glycyrrhiza glabra
Family Name : Fabaceae



MEDICINAL PROPERTIES / USES

It is commonly called as “Mulethi” or “Licorice”. It is a hardly leguminous undershrub attaining the height of about 3 meters with compressed pods. The roots are sweet in tastes and used in medicinal property. The flowers of mulethi is whitest purple in colour with green colour leaves.

Medicinal Uses: It is conventionally used in the treatment of respiratory and digestive disorders. Mulethi is specifically use in the treatment of chronic acidity, ulcers and chronic bronchial conditions. It is also used in reducing stress, depression and anxiety. Mulethi is also effective remedy for lowering the level of bad cholesterol in the body. The root of mulethi is beneficial in boosting the immune system of body which helps in giving body strength to fight against various harmful diseases. It also keeps liver healthy and is extremely beneficial for skin against eczema and dryness. The root of Licorice is considered to be extremely effective remedy for weight loss. Mulethi is also beneficial for treating sore throat and cough. It reduces the infections such as bronchitis and asthma

Common Name : Pudina
Botanical Name: Mentha spp.
Family Name : Labiatae



MEDICINAL PROPERTIES / USES

It is commonly called as “Mint” and is a popular branching; perennial grows up to 60-80cm in height. It is propagated mainly by its stolons. Leaves are sharply toothed, green in colour. Flowers are abundant in number and purplish in colour. This plant does not produce seeds.

Medicinal Uses: Pudina is helpful in promoting digestion, it can help in weight loss, it is a good treatment for irritable bowel syndrome and colic spasms. It can also treats nausea and headache. Pudina is an effective relief for respiratory disorders and cough. It fights against depression and fatigue. It is also helps in improving memory and can promote oral health. It is also helpful in preventing cancer and is good for skin health. It alleviates allergies, hay fever and protects against radiation induced DNA damage. Mint is also useful from getting relief from muscle pain and from sinus disorder. It also reduces risk of cancer and Alzheimer’s disease. It is beneficial in treating arthritis and ulcerative colitis.

Common Name : Cinnamon
Botanical Name: Cinnamomum zeylanicum
Family Name : Lauraceae



MEDICINAL PROPERTIES / USES

Cinnamon is commonly called as “Dalchini”. It is evergreen tree which grows from 20 to 30 feet. The plant has strong branches and thick scabrous bark which is smooth and yellowish. Leaves are dark green on top and lighter green underneath. It has small yellowish-white flowers which bears dark purple berries (Fruit). Bark of cinnamon is used in medicinal property.

Medicinal Uses: The Bark of cinnamon is carminative, astringent, stimulant, antiseptic in action. The essential oil which is extracted from cinnamon is a potent antibacterial, anti-fungal and uterine stimulant. It stops vomiting, relieves flatulence and is useful in diarrhoea and haemorrhage of the womb. It is also useful in reducing blood sugar and cholesterol level. Dalchini is also useful in prevention of acne, pimple, cough, cold. It is also helpful in arthritis pain in improving memory and in insomnia.

Common Name : Garlic
Botanical Name: Allium sativum
Family Name : Amaryllidaceae



MEDICINAL PROPERTIES / USES

Garlic is one of the most widely used medicinal plants since ancient times. It is commonly called as “Lahsun”. Allium sativum is an herbaceous, annual, bulbous plant grown for its pungent and edible bulb. The bulb is up to 7cm in diameter and is made up of 1 to 15 cloves. The flowers are spherical in shape initially enclosed in a cluster of papery bracts which splits and open into a green white or pinkish flower.

Medicinal Uses: Garlic is used to treat cough, contains allicin, which reduces blood pressure and improves circulation. It is good for rheumatism, arthritis, gout, fluid retention and obesity. Garlic is also useful in strengthening the immune system. It has vitamin B6 which helps in boosting up the mood. It is also helpful in regulating blood sugar, in treating fever, cough & stomach ache. It may prevent cancer of the prostate colon and stomach. It is applied to skin for fungal infections. Garlic cures from urinary tract, kidney infection and yeast infections. It is also helpful in weight control & weight loss. It also helps in preventing heart attack and atherosclerosis.

Common Name : Drumstick
Botanical Name: Moringa oleifera
Family Name : Moringaceae



MEDICINAL PROPERTIES / USES

Moringa oleifera is commonly called as “Senjana” fast growing, deciduous tree. It can reach a height of 10-12m. The Bark has a whitish grey colour. The flowers are fragrant with yellowish white petals.

Medicinal Uses: Moringa is used for anaemia, arthritis, rheumatism, asthma, cancer, constipation, diabetes, diarrhoea, epilepsy, stomach pain, stomach and intestinal ulcers, intestinal spasms, headache, heart problem, high blood pressure, thyroid disorders, fluid retention and bacterial, fungal, viral and parasitic infections. It is also use in reducing swelling, boosting immune system and helps in increasing breast milk production. Drumstick is helpful in protecting and nourishing skin and hair. It also helps in treating edema and protects the liver. Moringa contains Calcium and Phosphorous which helps in making bones healthier. It is also helpful in treating depression, anxiety and fatigue.

Common Name : Parsley
Botanical Name: Petroselinum crispum
Family Name : Apiaceae



MEDICINAL PROPERTIES / USES

Parsley is a biennial herb grows up to 80 cm long with thin stem and triangular outline leaves. The part used in medicinal property is the entire plant: leaves, fruits and roots.

Medicinal Uses: Parsley has been used as a source of certain vitamins and minerals. The seeds of parsley have been traditionally as a carminative to decrease flatulence and colic pain. The root of parsley is use as a diuretic and the juice to treat kidney ailments. The oil of parsley is been use to regulate menstrual flow in the treatment of amenorrhea. Leaves are been used to treat tumours, insect bites, lice, skin parasites. It also helps in the treatment of diseases of the prostate cancer. It is also been use as a scalp lotion to stimulate the growth of hair. Parsley is also helpful in stimulating the appetite, improving digestion and increasing urine production.

Common Name : Arjun
Botanical Name: Terminalia arjuna
Family Name : Combretaceae



MEDICINAL PROPERTIES / USES

Terminalia arjuna is commonly called as “Arjun” is an evergreen large tree, grows up to 20-25 meters in height. Bark is smooth and grey. Leaves are simple, hard and around 10-20 cm long. Flowers are yellowish white and blooms in March – June. Fruiting in Arjun takes place in September- November.

Medicinal Uses: The Bark of Arjun has been used from ages for the treatment of heart and blood vessels disorders. It helps in relieving chest pain, high blood pressure and high cholesterol. It is also used for urinary tract diseases. Arjun is helpful in protecting liver and to treat respiratory conditions including respiratory tract infections, cough and sore throat. It is also used for dysentery. The wine of Arjun bark is very useful in treating bleeding piles and leucorrhoea. The paste of the bark is applied over the fractures helps in promoting the early healing. The herb contains a substance called casuarinin that seems to prevent breast cancer. Arjun helps in promoting normal blood flow and reduces the symptoms of giddiness, headache and insomnia.

Common Name : Tejpatta
Botanical Name: Cinnamomum tamala
Family Name : Lauraceae



MEDICINAL PROPERTIES / USES

It is commonly called as “Talisha Pattri” or “Tejpatta” and is a medium sized evergreen tree of about 2 to 10 m tall. Its mature leave are dried and commonly known as bay leaves are used in medicinal properties.

Medicinal Uses: Cinnamomum tamala leaves and bark have aromatic, astringent, stimulant and carminative qualities. It is used in rheumatism, colic, diarrhoea, nausea and vomiting. Tejpatta is also used in the treatment of cold, cough, allergy and headache. It can also be used for scalp infection, for lice in hairs. Abdominal pain, abdominal gas, indigestion can be cured by Tejpatta. Regular intake of bay leave can prevents stone formation in kidney. Heart diseases, uneasiness and uterus infection can also be prevented by the use of Tejpatta. Arthritis, joint pain, gout are also cured by the application of bay leaves at the affected area.

Common Name : Fenugreek / Methi

Botanical Name : Trigonella foenum-graecum

Family Name : Fabaceae



MEDICINAL PROPERTIES / USES

Fenugreek also known “Methi” is an herbaceous annual plant that stands around 2-3 feet (60-90cm) tall. It has green leaves, small white flower and pods that contain small, golden-brown seeds. The plant has an erect growth habit and have strong, sweet aroma.

Medicinal Uses: Fenugreek is helpful in digestive problem such as loss of appetite, upset stomach, constipation, gastritis. It is also used for diabetes, painful menstruation, polycystic ovary syndrome, atherosclerosis and for high cholesterol. Fenugreek is helpful in kidney ailments, mouth ulcers, boils, bronchitis, cellulitis, tuberculosis, baldness, cancer and Parkinson’s disease. Methi is also used for hernia, male infertility and in women’s methi promotes milk flow after child birth and reduces menstrual cramps.

Common Name : Lemon Grass

Botanical Name : Cymbopogon citratus

Family Name : Poaceae



MEDICINAL PROPERTIES / USES

It is commonly called as “Lemon grass” and is a perennial grass grown for its fragrant leaves and stalk which is used as a flavouring agent. Lemongrass is also referred to as Ginger grass or citronella grass.

Medicinal Uses: Lemon grass is useful in relieving anxiety, lowering cholesterol, preventing infection, boosting oral health, relieving pain, boosting red blood cell level and relieving bloating. It also helps in reducing fever, blood sugar level and stimulates the uterus and menstrual flow.

Common Name : Beetroot
Botanical Name : Beta vulgaris
Family Name : Chenopodiaceae



MEDICINAL PROPERTIES / USES

Beets are herbaceous biennial root vegetable. The plant is usually erect with long main root and purple green leaves growing on stems. The beets are propagated by seeds.

Medicinal Uses: Beet is commonly used in the treatment of liver diseases and fatty liver. They are also useful in reducing the levels of triglycerides (a type of fat) in the blood, blood pressure and muscle soreness. Beet root also helps in preventing cancer of breast and prostate. It help is boosting up the energy level fight against inflammation. It promotes brain health by preventing Alzheimer's disease. It controls blood sugar, aid digestion, helps in the treatment of Anaemia. Beets are the great source of carotenoids which reduce the risk of cataract formation. It also promotes stronger bones and teeth as they are good source of calcium.

Common Name : Ajwain
Botanical Name : Trachyspermum ammi
Family Name : Apiaceae



MEDICINAL PROPERTIES / USES

Trachyspermum ammi is also known as ajwain or bishops weed is an annual herb. Both the leaves and the seed like fruit of the plant are consumed for medicinal properties. The leaves are green in colour and flowers are of white colour. The height of plants is approximately 60-90 cm.

Medicinal Uses: Ajwain helps in providing instant relief from acidity and indigestion. It also helps in treating common cold, provides relief from migraine headache. Ajwain is also useful for ear tooth ache. A component called thymol in ajwain seed act as a strong germicide. Thus ajwain seeds can be crushed and applied on the skin to treat injection or cuts. Ajwain seeds help in halting pre-nature greying of hairs. It also eases the pain due to arthritis and helps in cleaning the skin by lightening acne scars.

Common Name : Clove
Botanical Name : Syzygium aromaticum
Family Name : Myrtaceae



MEDICINAL PROPERTIES / USES

Cloves are the aromatic dried flower buds. The tree of clove is an evergreen that grows to a height ranging from 8 to 12m, having large leaves with blood red colour flowers which are numerous in groups.

Medicinal Uses: Clove is most commonly applied directly to the gum for toothache, pain control during dental work and other dental related issues. Cloves are applied to minor cuts for healing purposes. Tea of clove is a popular warm beverage to relieve congestion. Oil of clove is helpful in relieving headache, flatulence as well as reduces stretch marks clove is used as a carminative and also use for boosting the immune system by purifying the blood and help to fight against various diseases. Cloves are good expectorants that promote the discharge of mucous and secretions in the respiratory passage. Clove oil stimulates blood flow and circulation making useful for the people having cold extremities. It is also helpful for preventing the breakdown in retina of the eye and also enhances memory retention. Clove is also beneficial for diabetic patients by controlling the blood glucose levels. Eugenol found in clove is powerful enough for preventing blood clots. Sucking of clove bud reduces the desire of alcohol. Clove oil is very effective in curing foot and nail fungus.

Common Name : Fennel
Botanical Name : Foeniculum vulgare
Family Name : Apiaceae



MEDICINAL PROPERTIES / USES

Fennel is an aromatic perennial herb grown for its edible shoots, leaves, and seeds. The height of the plant is about 1 meter (3 feet) tall and has stalks with finely divided leaves. The flowers are small yellow in color and fruits are small, dry, greenish-brown to yellowish-brown. The dried ripe seeds and oil are used to make medicine.

Medicinal Uses: There are many health benefits of fennel which include relief from anaemia, indigestion, flatulence, constipation, colic, diarrhoea, respiratory disorders, and menstrual disorders. It also aids in eye care. It has anti-cancer properties and reduces heart diseases. It also helps in regulating blood pressure and improves brain function. Fennel helps in boosting immunity and regulates menstruation. It also protects against the harmful effects of radiation during cancer treatment.

Common Name : Rosemary
Botanical Name : *Rosemarium officinalis*
Family Name : Lamiaceae



MEDICINAL PROPERTIES / USES

Rosemary has a strong fragrance. It is used in oil, perfumes and cooking. The leaves are evergreen 2-4cm (0.8-0.16 in) long and 2-5mm broad, green above and white below with dense short woolly hair. It is considered easy to grow for beginner gardeners. It grows all year round and strong healthy plants flower in summer with pale to deep blue colour flowers.

Medicinal Uses: Rosemary improves memory, helps in reducing blood sugar, body weight, helps in preventing cataracts, protects the body's cell and DNA from radical free damage, simulates liver enzyme which help inactivating estrogen hormones which can cause breast cancer. Rosemary also helps in preventing age related skin damage, encourages enzymes which flush harmful toxins out of the liver and body. Rosemary also helps in improving kidney function and increases urine flow. It act as a stimulant for hair growth, boost mental activity, relieve respiratory problems and pain due to menstrual cramps, prevents from peptic ulcers, leukaemia and kidney stone.

Common Name : Aak
Botanical Name : *Calotropis procera*
Family Name : Asclepiadaceae

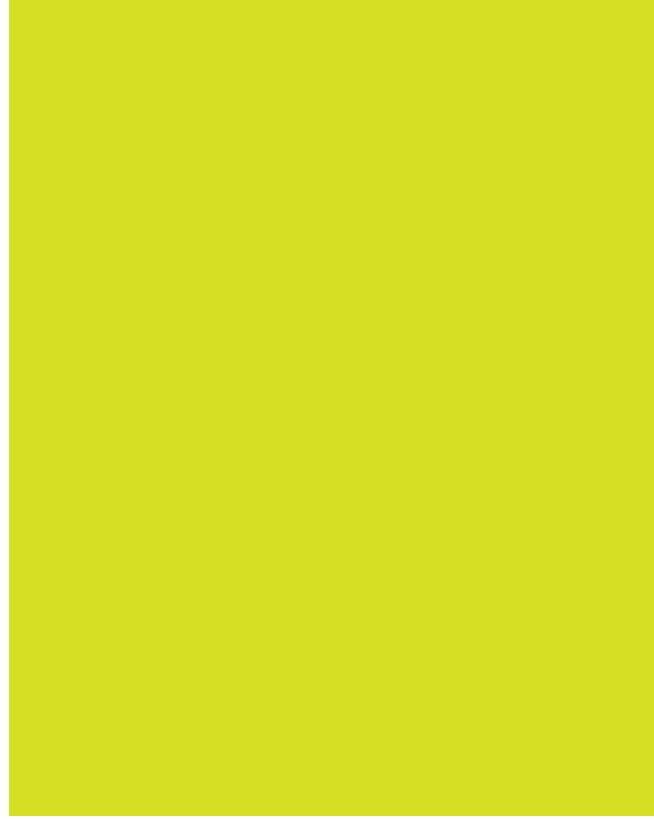


MEDICINAL PROPERTIES / USES

Aak is commonly called as "Madar". It is a perennial shrub growing 2.5 m high with various branches and sub branches. Leaves are simple. It has bunch of waxy flowers that are white or lavender in colour and in shape of crown. The name of this plant is synonymous with Sun as the herb is very strong and astringent in action same as powerful rays of sun.

Medicinal Uses: Whole plant is used to treat common diseases such as fever, rheumatism, indigestion, cold, and eczema, diarrhoea for the treatment of boils and for the treatment of jaundice. Root is use for the treatment of elephantiasis, asthma, cough and leprosy. Stem of madar is use for the treatment of skin diseases, intestinal worms, and leprosy and cure leucoderma. The leaves and latex of Aak are used as an antidote for snake poison. It also improves appetite thereby fighting anorexia and also helps in healthy working of the respiratory system.





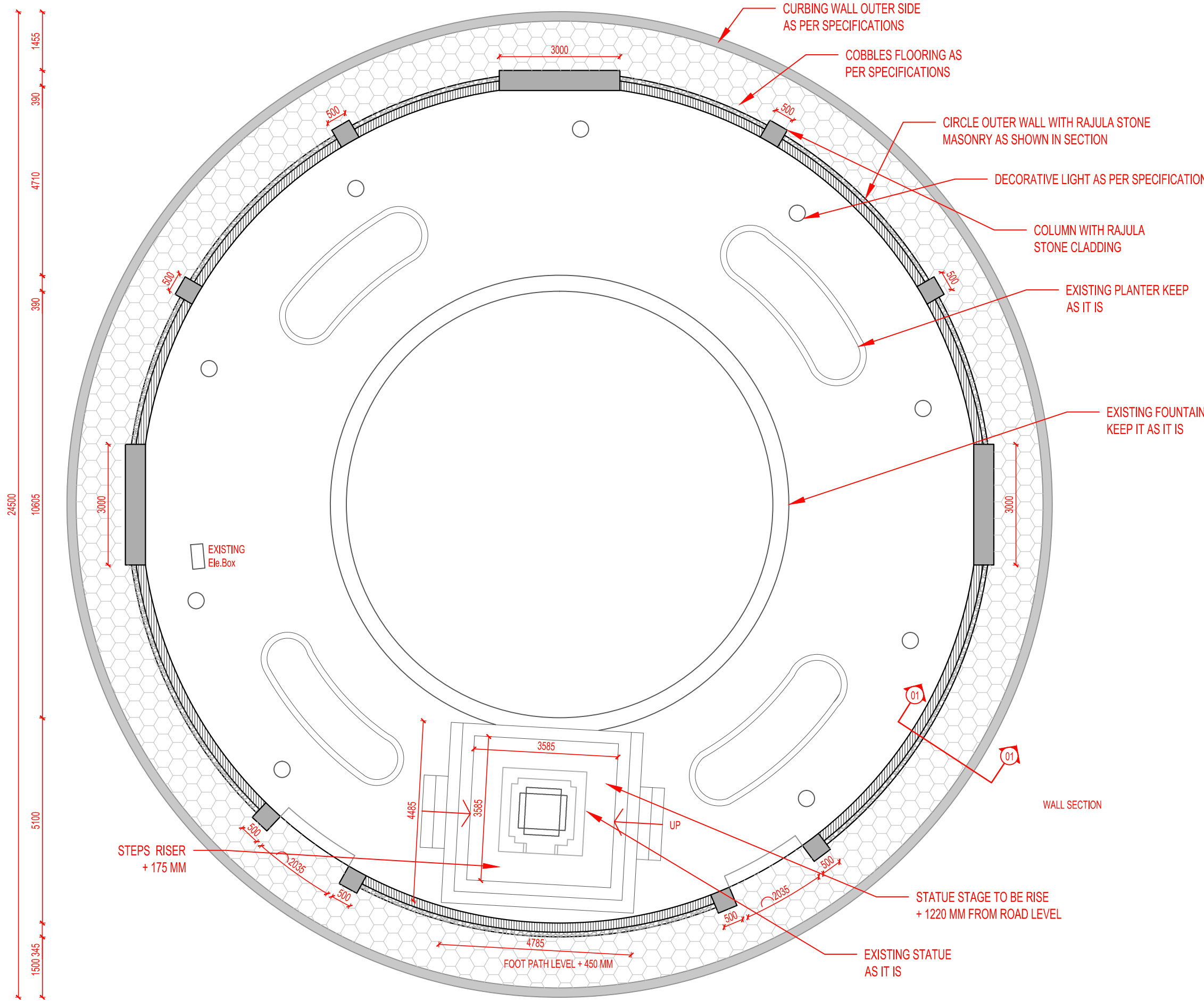
California Poppy
Flowers





CENTRAL PUBLIC WORKS DEPARTMENT
Ministry of Housing and Urban Affairs

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OWNER : BHAVNAGAR MUNICIPAL CORPORATION

PROJECT : REDEVELOPMENT OF TRAFFIC ISLAND CIRCLE AT- NILAMBAG, BHAVNAGAR.

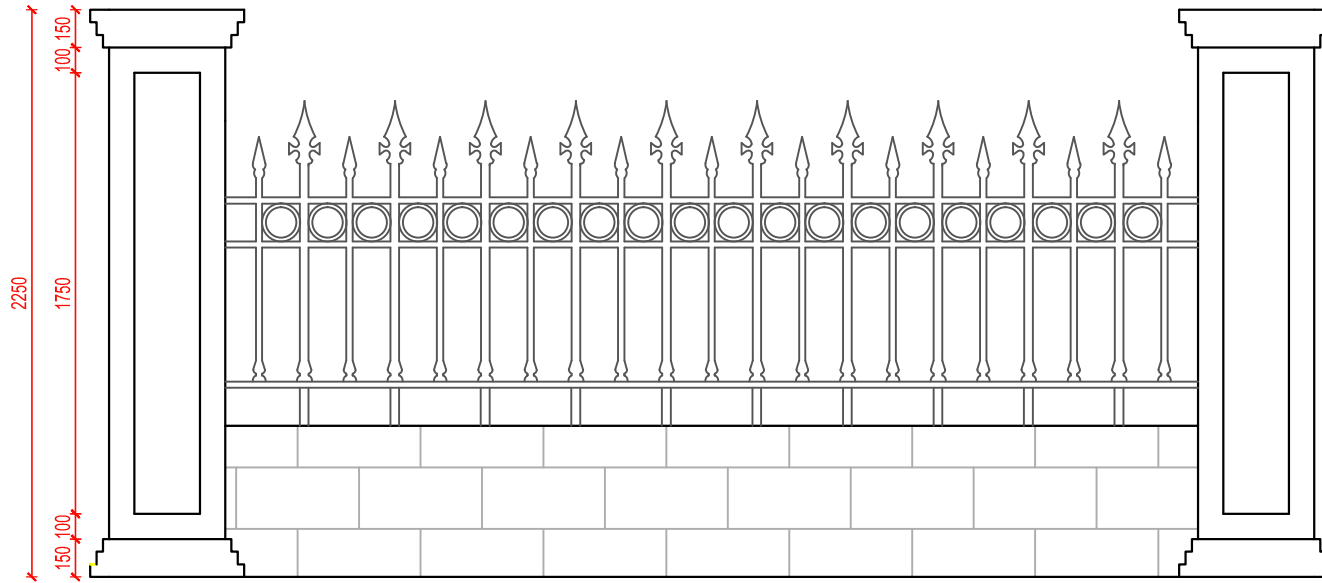


ARCHITECT : SURYARAJ.SINH. N. GOHIL
 suryarak.architect@gmail.com

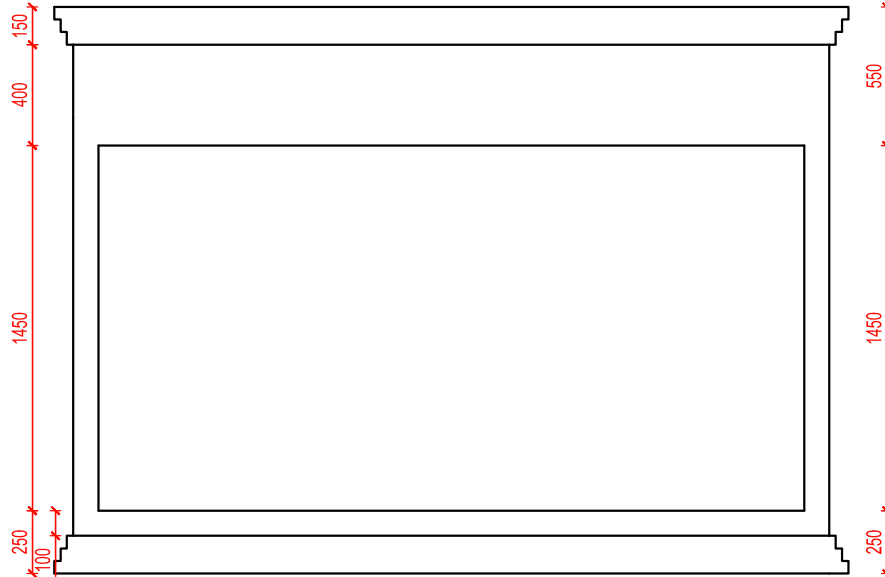
CIRCLE LAYOUT PLAN

TENDER DRAWING	DRAWING NO. AR_WD_01
DATE : 27 - 11 - 2024	
SCALE : N.T.S	
SHEET : A3	
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CIRCLE WALL WITH RAILING



SCREEN WALL DETAIL

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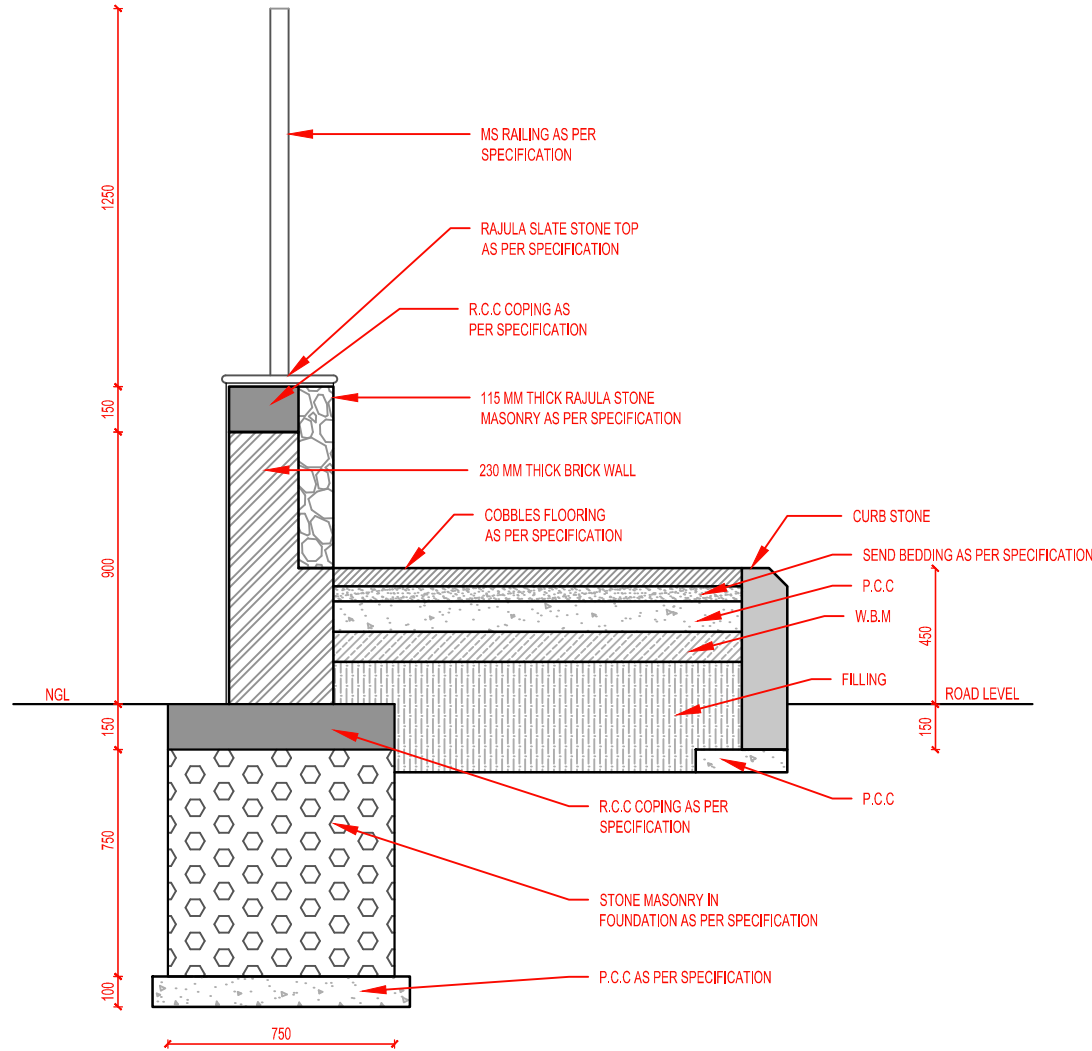


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COLUMN AND RAILING DETAIL

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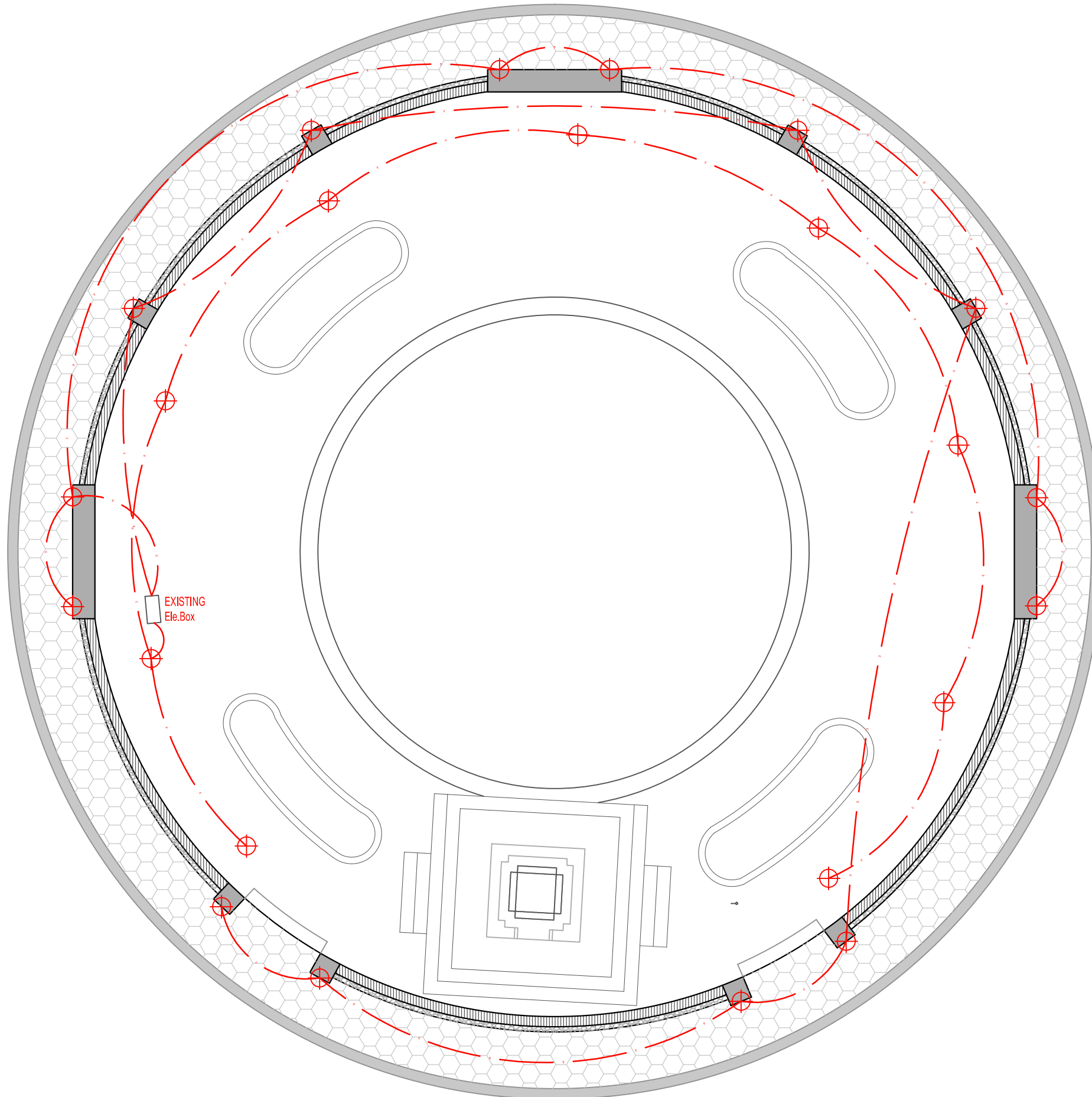


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OUTER WALL DRAWING

TENDER DRAWING	DRAWING NO.
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SHEET : A4	
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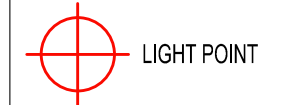


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PROJECT : REDEVELOPMENT OF TRAFFIC ISLAND CIRCLE AT-NILAMBAG, BHAVNAGAR.



ARCHITECT : SURYARAJ.SINH. N. GOHIL
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CIRCLE ELECTRIC PLAN

TENDER DRAWING	DRAWING NO. AR_ED_01
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સી.ઈ.ક.જવક નં. ૪૩૮

તા. ૨૦/૦૧/૨૦૨૫

દફતરી લુકમ

આથી તા.૧૫/૦૧/૨૦૨૫ ના સ્ટેન્ડીંગ કમિટિના ઠરાવ નં. ૫૨૮ મુજબ નીચે જણાવેલ કંપની/પ્રોડક્ટનો ભાવનગર મહાનગરપાલિકાના વેન્ડર લીસ્ટમાં સમાવેશ કરવામાં આવે છે. જેની નોંધ કરીને સંબંધિત વિભાગે અમલ કરવો. સમાવિષ્ટ વેન્ડર્સ હવે પછી તૈયાર થનાર ટેન્ડરમાં લઈ શકાશે.

ક્રમ	કંપનીનું નામ	પ્રોડક્ટ/બ્રાન્ડ
1	shree digvijay cement co. ltd	Product: Kamal cement Brand : Kamal
2	YUG INNOVATION	Product : LED LIGHTS (all types of indoor and outdoor light) Brand : DG CREE
3	GERMAN GREEN STEEL AND POWER LIMITED (formally known as HAQ STEELS AND METALIKS LIMITED)	Product : GERMAN TMX TMT BARS High strength deformed bars and wires for concrete Reinforcement Brand : GERMAN TMX
4	MEMIGHTY inventions private limited	Product : street light control panel Brand : MEMIGHTY

ઓફિસર ઓન સ્પેશ્યલ ડ્યુટી (OSD)
ભાવનગર મહાનગરપાલિકા
ભાવનગર

ધક્ક રવાના : તમામ સંબંધિત વિભાગો તરફ જરૂરી અમલવારી સારૂ

બિ. ઇન્વર્ડ.
નં. ૨૫૨૪
તા. ૨૦/૧/૨૫

DEની & તમામ અમલદારોમાં
તમા ટેન્ડરમાં ઉપરોક્ત product/
Brandના સમાવેશ કરી vendor list
upload કરવી.
S. Jivil
૨૦૨૫

"अहर्निशं सेवामहे"