

**RAJKOT MUNICIPAL CORPORATION**  
**(RMC)**

**BID DOCUMENT FOR**

**CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) UNDER PASS ON KALAWAD ROAD CROSSING AT 150' RING ROAD JUNCTION IN RAJKOT**

**C O N T E N T S**

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**Rajkot Municipal Corporation**  
**E-Tender Notice**  
**CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) UNDER PASS ON KALAWAD**  
**ROAD CROSSING AT 150 FEET RING ROAD JUNCTION IN RAJKOT**

Rajkot Municipal Corporation, Bandhkam Branch, West Zone, Shri Harisinhji Gohil Zonal Office, Behind Big Bazar, 150 Feet Ring Road, Rajkot-360005, invites e-tenders with two bid system by e-tendering for the construction of works detailed in the table below from the bidders having experience for similar type of works, registered in State Government/Central Government in appropriate class and meeting the qualifying criteria as specified.

Sr. No.	Name of work	<b>a) Estimated cost.</b> <b>b) EMD (Bid Security)</b> <b>c) e-TENDER fee.</b> <b>d) Time limit for comp. of work</b> <b>e) Registration Class</b>
1	Construction of 4 Lane (2 Lane + 2 Lane) Under Pass on Kalawad Road Crossing at 150 Feet Ring Road Junction In Rajkot	<b>a) Rs.24,57,72,000/-</b> <b>b) Rs.24,57,720/-</b> <b>c) Rs.23,500/-</b> <b>d) 15 Months (including monsoon period)</b> <b>e) Class 'AA' category and Special Category-1 for bridges OR roads</b>

<b>Milestone Dates for e-Tendering</b>	
1. Downloading of e-Tender documents	07/01/2020 To 27/01/2020 upto 1800 Hrs
2. Pre- Bid Meeting at West Zone Office, RMC	16/01/2020 at 1700 Hrs
3. Online submission of e - Tender	27/01/2020 upto 1800 Hrs.
4. Physical submission of EMD, Tender fee and other required documents as per Financial, Experience criteria etc. for Verification in Person / Regd.A.D, / Speed Post,/ Courier only	28/01/2020 and 29/01/2020 upto 1800 Hrs
5. Verification of submitted documents	30/01/2020 at 1100 Hours onwards
6. Opening of online Technical Bid	30/01/2020 at 1100 Hours onwards
7. Physical Verification of documents submitted (originals to be bought by contractor)	01/02/2020 between 1600 to 1700 Hours
8. Opening of Price Bid for technically qualified bidders only (if possible)	04/02/2020 at 1100 Hours onwards
9. Bid Validity	180 days

- All bidders must submit tender fee and a bid security in person as above either directly deposited in ICICI Bank Account No.015305010638 (Rajkot Municipal Corporation) IFSC Code

ICIC 0000153 or submit at below mentioned address only in form of DD in favor of "Rajkot Municipal Corporation", Rajkot, from any Nationalized OR Scheduled Bank (except Co-operative Bank) in India. The DD No., date and name of the bank, branch shall have to be mentioned online and subsequently same shall have to be submitted during physical submission along with required documents. The physical submission shall be done at address mentioned below:

Office of the City Engineer(sp.)  
Rajkot Municipal Corporation,  
Shri Harisinhji Gohil Zonal Office,  
Room No. 9, West Zone Office,  
B/H Big Bazaar, 150' Ring Road, Rajkot-360005 (Gujarat)

The tender of those bidders who fails to submit documents or to produce the originals for verification within time schedule for these tenders will be out rightly rejected.

## 2. The pre-qualification requirement is as under:

### Minimum Eligibility Criteria:-

For eligibility the bidder shall fulfill following criteria

- I. Only single bidder permitted for bidding.
- II. No Joint venture/Consortium permitted for bidding.
- III. Contractor registered with Government of Gujarat in class 'AA' category and special Category-1 for bridges OR roads, contractors registered in Other State Government/ Central Government in appropriate class and meeting the qualifying criteria as specified.

### A. Financial Criteria:

- (1) An **average annual turnover** of last Seven financial years should not be less than **50%** of estimated tender amount.
- (2) **Working capital** should not be less than **25%** of the estimated tender amount.
- (3) **Solvency** must not be less than Rs. **300Lacs**
- (4) Available bid capacity- ABC must be more than the estimated tender amount

ABC is to be calculated as: -  $ABC = 2 * A * N - B$

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

N = No. of Years prescribed for completion of the work for which tender is invited

B = Value (\*Price level) of existing commitments and ongoing works to be completed during the next N Years (Period of completion of the work for which the tender is invited).

### B. Experience Criteria:

The bidder should possess following minimum experience.

- (1) Bidder should have completed at least one work of similar nature **One Work of 60%** or of **two works of 40%** or of **three works of 30%** of tender amount is completed in last seven years.

Similar nature completed works means work complying following criteria:

- i. Similar nature work shall mean construction of Vehicular Underpass or Flyover Bridge, in which they have successfully carried out the execution like open foundation in rocky strata or pile foundation.

- (2) Bidder should have enough machinery and experienced personnel to supervise the work.

- Note:** - Enhancement factor at 10% per year for last seven years will be applicable to arrive average annual turnover and finalized the magnitude of work done in last seven years.
3. After opening of Technical Bid, the procedure for the pre-qualification shall be adopted and the Price Bid of only successful qualified bidder shall be opened for final evaluation of the contract. The decision of Municipal Commissioner regarding the pre- qualification shall be final and binding to all the bidders.
  4. The Tender of those bidder(s), those who fail to submit the required documents physically within the stipulated date and time will not be accepted, will be treated as non responsive and their Price Bid will not be opened.
  5. Right to accept / reject any or all e-Tender(s) without assigning any reasons is here by reserved.

**Commissioner  
Rajkot Municipal Corporation, Rajkot**

**RAJKOT MUNICIPAL CORPORATION**  
**INFORMATION TO TENDERERS**

**Name of Work: CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) UNDER PASS ON KALAWAD ROAD CROSSING AT 150' RING ROAD JUNCTION IN RAJKOT**

1. Estimated Amount put to Tender: Rs. 24,57,72,000/-
2. Bid Security: Rs. 24,57,720/- to be submitted in form of DD infavor of Municipal Commissioner, Rajkot valid for (180 days) of any Nationalized OR Scheduled Bank (Except Cooperative Bank) OR directly deposited in Account No. 01018640000035 (Rajkot Municipal Corporation) IFSC Code HDFC 0000101.
3. Defect Liability Period: 2 Years after issue of completion certificate or otherwise stated in particular item.
4. Liquidated Damages : Delay : (0.10%) zero point one zero percentage of contract price for uncompleted work per day subject to a maximum upto ten percentage of contract price or as decided by Municipal Commissioner.
5. Workers Welfare cess: 1% workers welfare cess as per Act. 1996 (nonrefundable) shall be deducted from each running bill.
6. The contractor shall have to quote their rates including GST and other taxes and the Invoice has to be submitted accordingly, failing which, such amount will be deducted from the bill of the agency and deposited accordingly.
7. Water, Electricity: Contractor shall have to make his own arrangements for water and electricity for the purpose of construction work at site at his own expense. During construction period temporary lighting arrangement for public facility shall be arranged by contractor at his own cost. RMC may give NOC where ever required for the same.
8. Tender which do not fulfill all or any of condition or are submitted incomplete in any respect or are conditional tenders, will be rejected. Municipal Commissioner reserves the rights to reduce / increase the scope of work and contract without assigning any reason thereof.

9. Maintenance will be valid for period as specified. The maintenance period will commence from the date of total completion of the work under this tender. For completion of works, contractor will be required to request in writing, to get completion certificate from Rajkot Municipal Corporation. Date of completion will be considered as the date mentioned in the completion certificate.
10. Price escalation and price variations will not be paid/recovered for the works mentioned in the tender.
11. No compensation for late handing over of site or not availability of clear site leading to abandoning the work will be admissible. For late handing over the site suitable time extension may be given at the instance of RMC.
12. If any extra item will be operated, then payment shall be paid as per RMC SOR , if not available then R&B SOR followed by GWSSB SOR of Rajkot district or in case item is not available in SOR then market rate will considered with analysis of 3 quotations.
13. The utilities fouling with underpass and approach portion which are directed to be shifted by RMC shall be shifted by contractor in such a manner that it does not foul with any other activity of underpass construction or other requirement. For this, first the utility to be shifted shall be identified, layout prepared along with location where it is to be shifted & shall be got approved from RMC. The existing utility lines shall be safely removed / replaced / shifted as per the direction of Engineer-in-Charge.
14. For payment of this (RMC's utility shifting), the rates to be adopted shall be as per RMC SOR & if not available then R&B SOR shall be adopted and if not available then relevant GWSSB SOR shall be adopted and in absence of all these, rate analysis considering market rates (minimum 3 quotations for material supply) shall be prepared & adopted. Attention is invited to special conditions of contract clause no 84.7 for utility to be got shifted from other agencies.
15. Advance such as machinery advance or materials advance will not be given.
16. Mobilization advance will not be given.
17. For item requiring bitumen consumption, the contractor shall have to procure the bitumen required grade and quantity from the IOCL, BPCL and HPCL only. Contractor shall have to submit original bill of purchase along with batch testing certificate to RMC. **Measurement of the bitumen or the bitumen item will not be written in MB, if original bills are not submitted for the quantity consumed.**

18. As per RMC wide letter no. Ja No/RA/M/PA/NA/JNNURM/742 date on 24/11/11 for third party inspection is must & those charges shall be paid by contractor to the appointed agency. The agencies designated for this work & their fee are mentioned in the attached letter.
19. Necessary surveys&testing suggested by Client / Third Party Inspection agency / Consultant shall be got done from the Designated or Government approved agency & charges shall be paid by the contractor.
20. In any case, Conditional tenders will not be accepted.
21. The sequence of operation shall be decided in consultation with the Engineer-in-charge. The contractor shall prepare the detail program of work in Bar Chart format and get approved from TheCity Engineer (Special), RMC, Rajkot before actual commencement of work and strictly follow the same
22. All the quoted prices must be inclusive of all taxes as per applicable law of Government.
23. No escalation would be allowed due to changes in taxes and duties
24. Batch mix plant will have to be used for bituminous items
25. Contractor has to provide diversion road as per design & drawings at the location of service road during construction period. This diversion road shall be upgraded to service road on completion of work.
26. Contractor has to provide safety barricades for the underpass taken up for execution keeping sufficient space for BRTS & other traffic as per design & drawings.
27. Excavation in hard rock with Blasting is strictly prohibited for Construction of the Underpass and its approaches.
28. RCC stem finish on exposed surface of retaining wall at both sides of Underpass shall be F3 type exposed concrete finish of required quality to be required as per tender item.
29. The earth which has been excavated on site shall be reused while filling behind retaining walls.
30. If required for superstructure & pier-cap of Obligatory span of existing flyover, necessary supporting shall be provided during the execution of twin-cell Underpass Box.



31. Between each of the segment of the box, water stops shall be provided to prevent water-seepage.
32. Storm water drainage pipe of 600 mm dia. As per detailed drawing and specification as directed by Engineer-in-charge up to required length to dispose off storm water into Nalla to be executed as per detailed specifications.

**Signature of Contractor:**

**City Engineer  
Rajkot Municipal Corporation  
Rajkot**

**Date**

## Rajkot Municipal Corporation

**CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) UNDER PASS ON KALAWAD ROAD CROSSING AT 150' RING ROAD JUNCTION IN RAJKOT****DISCLAIMER**

1. The information contained in this bid document or subsequently provided to the bidders whether verbally or email or text message or any other electronic media or in documentary form by or on behalf of the Rajkot Municipal Corporation (hereinafter called as RMC) or any of their employees/ advisers/ consulting engineers is provided to the bidder (s) on the terms and conditions set out in this bid document and any other terms and conditions subject to which such information is provided.
2. This bid document and subsequent submissions of the bidders are not an agreement. These will subsequently form a part of agreement between the successful bidder and the Rajkot Municipal Corporation after modifications/ additions/ alterations as mutually agreed to.
3. This document does not purport to contain all the information the bidder may find necessary for the completion of works in a professional manner in accordance with good engineering practice. The bidder is required to check the accuracy, reliability and completeness of the information in this bidding document regarding the site, the movement of traffic, the accessibility, the working conditions, the climatic conditions, the availability of working and storage spaces etc. RMC, its employees/ advisers/ consulting engineers do not incur any liability under any law, rules or regulation as to the accuracy, reliability and completeness of the information in this bidding document.

**SECTION - I**  
**INSTRUCTIONS TO BIDDERS**

**Section I: Instructions to Bidders**

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- 23.0 Clarification of Financial Bids
- 24.0 Examination of Bids and Determination of Responsiveness

25.0 Correction of Errors

26.0 Evaluation and Comparison of Bids

**F. Award of Contract**

27.0 Award Criteria

28.0 Employer's Right to accept any Bid and to reject any or all Bids

29.0 Notification of Award and Signing of Agreement

30.0 Performance Security

31.0 Dispute Review Expert /Arbitration

32.0 Corrupt or Fraudulent Practices

**A. General****1.0 Scope of Bid**

- 1.1** The Municipal Commissioner, Rajkot Municipal Corporation invites sealed bids for the construction of works (as defined in these documents and referred to as “the work”) detailed in the table given in the Invitation for Bid (hereinafter called as IFB.) from competent bidders. The bidders may submit bids for 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 period specified in the Contract data.
- 1.3** Throughout these bidding documents, the terms; ‘bid’ and ‘tender’ and their derivatives (bidder/ tenderer, bidding/tendering etc.) are synonymous.
- 1.4** Blank bidding documents consisting of all the data for e-tender are available from RMC websites : [www.rmc.nprocure.com](http://www.rmc.nprocure.com)
- 1.5** Bidders shall not have any dispute or claim for any kind of compensation,
- i) If the quantity stipulated in the tender items varies or the scope of work changes and thereby total amount of work increases / decreases up to any extent.
  - ii) If the works get delayed / postponed for some administrative / technical decision whatsoever.
  - iii) If the items stipulated in the tender shall not be executed as per site condition/ requirements. No claim shall be entertained for the same.
  - iv) No idle charges shall be paid to contractor for machinery and man power if remains idle and no claim shall be entertained for the same.

**2. Source of Funds**

The expenditure on this project will be met with from the budget of RMC – SJMMSVY.

**3. Eligible Bidders**

For eligibility the bidder shall fulfill following criteria

- I. Only single bidder permitted for bidding.
- II. No Joint venture/Consortium permitted for bidding.

Contractor registered with Government of Gujarat in Class ‘AA’ category and Special Category-1 for bridges OR roads, contractors registered in Other State Government/ Central Government in appropriate class and meeting the qualifying criteria as specified.

**c. Financial Criteria:**

- (1) An average annual turnover of last Seven financial years should not be less than 50% of estimated tender amount.
- (2) Working capital should not be less than 25% of the estimated tender amount.
- (3) Solvency must not be less than Rs. 300Lacs
- (4) Available bid capacity- ABC must be more than the estimated tender amount

ABC is to be calculated as: -  $ABC = 2 * A * N - B$

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

N = No. of Years prescribed for completion of the work for which tender is invited

B = Value (\*Price level) of existing commitments and ongoing works to be completed during the next N Years (Period of completion of the work for which the tender is invited).

#### **D. Experience Criteria:**

The bidder should possess following minimum experience.

- (1) Bidder should have completed at least one work of similar nature of 60% or of two works 40% or of three works of 30% of tender amount is completed in last seven years.

Similar nature completed works means work complying following criteria:

- i. Similar nature work shall mean construction of Vehicular Underpass or Flyover Bridge, in which they have successfully carried out the execution like open foundation in rocky strata or pile foundation.

(1) Bidder should have enough machinery and experienced personnel to supervise the work.

#### **4. Technical Information of the Bidder**

- 4.1 The Bidder is required to demonstrate his capability to execute the job within the specified time frame and up to the required acceptable quality standards. The bidder is, hence requested to go through volume – II Qualification Document and furnish necessary data regarding plant and machinery, manpower experience and financial resources to demonstrate his suitability for successful implementation of the project. The bidders should, however, undertake their own studies and furnish with their Bid, a detailed construction planning and methodology supported with necessary drawings and calculations to allow the employer to review their proposals. The numbers, types and capacities of each plant/equipment shall be mentioned in the proposals along with the optimum cycle time for each operation for the given production capacity to match the requirements. The bidder shall ensure the availability of required key personnel for this project. Detailed bio data of Project Manager and Materials & Quality Control engineer shall be submitted as part of Technical Bid. The bidder, however, can make its own assessment and is free to propose his/her own site organization.
- 4.2 Even though the bidders meeting the qualifying criteria, they are subject to be disqualified if they have:- mentioned misleading or false representations 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, substantial delays in completion, litigation history, or financial failures etc.; and/or
- Participated in previous bidding for the same work and have quoted unreasonably high Bid prices and could not furnish rational justification to the employer.
  - Colluded with other prospective bidders for this work to arrive at quoted prices for the purpose of restricting competition.
  - Indulged in inducement of any official of RMC and/or their consulting engineer and other advisors in any manner whatsoever.
  - Not submitted a safety manual



-Not submitted a proposed site organization chart

## 5. Bidding & Site Visit

### 5.1 Cost of Bidding

The bidder shall bear all costs associated with the preparation and submission of this Bid, and the Employer will in no case be responsible and liable to bare costs.

### 5.2 Site Visit:

The Bidder, at the Bidder's own responsibility and risk is deemed to have inspected and examined the site and its surroundings thoroughly and obtain all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense. If any person will be found misbehaving with RMC officials, then RMC can take necessary action.

Particular attention of bidders is invited to:

- The form and nature of work and subsurface conditions
- The climatic conditions
- The extent and nature of work and materials necessary for the execution and completion of the Works
- The means of access to the site
- All other information as to risks, contingencies and circumstances which may influence or affect bid. Bidders have to work out their own construction methods based on standard practice and codal stipulations and other relevant information about the site. Bidders shall not have any right to claim compensation against any dispute arising
  - (i) if the quantity stipulated in the tender items varies or the scope of work changes and thereby total amount of work increases / decreases up to any extent.
  - ii) If the works gets delayed / postponed for some administrative / technical decision whatsoever taken by RMC same shall be strictly follow by contractor.

**B. Bidding Documents****6 Content of Bidding Documents**

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

**VolumeNo. I****Particulars Section I**

Invitation for Bids

Instructions to Bidders & Form of Bid I

General Conditions of Contract II

Contract Data III

Work Plan and Technical Specifications IV

Drawings V

II Documents to be furnished by bidder for Qualification

III Financial Bid (to be submitted online)

6.2 The bidder is expected to examine carefully all instructions, conditions of contract, contract data, forms, terms, technical specifications, Schedule B, 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. Bids which are not substantially responsive to the requirements of the Bid Documents will be liable for rejection.

**7 Clarification of Bidding Documents**

7.1 A prospective bidder requiring any clarification of the bidding documents may notify the Employer in writing or by cable (hereinafter "cable" includes telex, facsimile) at the Employer's address indicated in the invitation to bid.

7.2 Pre-bid meeting

7.2.1 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 this document face sheet.

- 7.2.2 The purpose of the meeting will be to clarify issues and to answer queries on any matter which may need clarifications.
- 7.2.3 The bidder is requested to submit his questions/queries in writing or by cable to reach the Employer not later than 24 hours before the meeting.
- 7.2.4 Minutes of the meeting, including the text of the questions that are raised during the meeting (without identifying the source of enquiry) will be issued to all bidders. Any modification of the bidding documents which may become necessary as a result of the pre-bid meeting shall be published by the employer exclusively either by issuance of an Addendum or through the minutes of the pre-bid meeting. The minutes of the Pre-bid meeting will be considered as a part of bid document.
- 7.2.5 Non-attendance at the pre-bid meeting will not be treated as a cause for disqualification of a bidder.

## **8 Amendment of Bidding Documents**

- 8.1 Before the deadline of submission of bids, the Employer may modify the bidding documents by issuing addenda.
- 8.2 Any addendum thus issued shall be part of the bidding documents and shall be placed on n-procure website [www.rmc.nprocure.com](http://www.rmc.nprocure.com) and intimated accordingly. The prospective bidder is requested to refer to website [www.rmc.nprocure.com](http://www.rmc.nprocure.com) to check any addendum. RMC will not publish any advertisement for the same.
- 8.3 To give prospective bidders reasonable time, to incorporate an addendum into account in preparing their bids, the Employer may extend, at his desecration, and as necessary the deadline for submission of bids, in accordance with Sub-Clause 18.1.

## C. Preparation of Bids

### 9 Language of the Bid

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

### 10 Documents comprising the Bid

10.1 The bid to be submitted by the Bidder through e-tender as bid document (refer clause 8.2) shall be in three separate parts.

**Part I** Shall be named "**Technical Bid**" and shall comprise as below:

- (i) Tender fee as submitted with specified scanned copy of DD/Pay order shall be tender while original copy shall be submitted as mentioned in bid Information.
- (ii) Bid Security in the form specified in Clause 14.0
- (iii) Technical Information of the Bidder for Qualification (pursuant to Clause 4.0 and Volume – II)
- (iv) Undertaking that the bid shall remain valid for the period specified in Clause 13.1
- (v) Acceptance / non-acceptance of dispute review expert in clause 31.1
- (vi) Affidavit as per format provided in Annexure – I
- (vii) Forms of bid as specified in volume II
- (viii) Undertaking in form given in Annexure II of volume I

**Part II** shall be named **tender fee and bid security** and shall comprise as below and shall be submitted original to The City Engineer, Room No 9. West zone, Rajkot Municipal Corporation, Rajkot.

- (i) Tender fee as specified in Bid Information
- (ii) Bid security in the form as specified in clause 14.0. Each part will be separately submitted as specified.
- (iii) Copy of documents to be attached must be self-attested or attested by gazetted officer.

**Part III** Shall be named "**Financial Bid**" and shall comprise as below:

Percentage rate tender specified in Volume - III

10.2 The successful bidder will be required to sign each page of these documents and submit them to the Employer. These signed documents along with the documents of accepted bid, shall form a part of the contract agreement between the Employer and the bidder.

## 11 Bid Prices

11.1 The contract shall be for the whole works as described in various documents as listed in Sub-Clause 10.1 including the schedule B.

11.2 Percentage rate tender – The bidder has to quote only % (percentage) above or below the estimated cost Rs. 24,57,72,000/- and payment will be made as per actual quantity executed and the rate mentioned in price bid with the % (percentage) above or below as the case may be.

11.3 All duties, taxes, and other levies payable by the contractor under the contract, or for any other cause shall be included in the rates, prices and total Bid Price submitted by the Bidder, except otherwise stated in the Bid document.

11.4 The rates and prices quoted by the bidder shall be fixed for the duration of the Contract or up to completion of the project and shall not be subject to adjustment on any account, except where expressly specified, otherwise, in the contract.

## 12 Currencies of Bid and Payment

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

## 13 Bid Validity

13.1 Bids shall remain valid for a period not less than 180 days after the deadline date for tender specified. A bid valid for a shorter period shall be rejected by the Employer considering the bid as non-responsive.

13.2 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

additional period. The request and the bidders' responses shall be made in writing or by cable. 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 bid security for a period of the extension, and in compliance with Clause 14.0 in all respects.

#### 14 Bid Security

14.1 The Bidder shall furnish, as part of his Bid, a Bid Security of the amount as shown in column 4 of the table of IFB for this particular work. This bid security in the form of DD payable at Rajkot of any nationalized bank (except cooperative bank) in favor of "Rajkot Municipal Corporation" OR directly deposited in Account No. 01018640000035 (Rajkot Municipal Corporation) IFSC Code HDFC 0000101.

14.2 Any bid not accompanied by an acceptable Bid Security and not secured as indicated in Sub-Clauses 13.1 and 13.2 above shall be rejected by the Employer as non-responsive.

14.3 The Bid security of unsuccessful bidders will be returned within 30 days of the award of the contract. The Bid security of successful bidder shall be returned after submitting Performance Security and entering into the agreement.

14.4 The Bid Security of the successful bidder will be reimbursed when the bidder assigned the Agreement and furnished the required Performance Security.

14.4.1 The Bid Security shall 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, pursuant to Clause 25; or
- c) In the case of a successful Bidder, if the Bidder fails within the specified time limit to
  - (i) Sign the Agreement; or
  - (ii) Furnish the required Performance Security.

In such case, the bidder will be debar for any work in RMC for three years.

No interest shall be paid by the owner on any e-Tender guarantee/bid security.

**15 Format and Signing of Bid**

- 15.1 The Bidder shall prepare one original and one copy of the documents comprising the bid as described in Clause 10 of these Instructions to Bidders, bound with the volume containing the 'Technical Bid; and 'Financial Bid' in separate parts and clearly marked "ORIGINAL" and "COPIES" as appropriate. In the event of discrepancy between them, the original shall prevail.
- 15.2 The original and copies of the Bid shall be typed or written in indelible ink and shall be signed by a person or persons duly authorized to sign on behalf of the Bidder. All pages of the Bid where entries or amendments have been made shall be initiated by the person or persons signing the bid.
- 15.3 The Bid shall contain no alterations or additions, except those to comply with instructions issued by the Employer, or as necessary to correct errors made by the bidder, in which case such corrections shall be initiated by the person or person assigning the bid.
- 15.4 Sufficiency of bid: The bidder shall be deemed to have satisfied himself as to the correctness and sufficiency of the bid and of the rates and prices stated in the schedule B, all of which shall, cover all his obligations under the contract and all matters and things necessary for the proper execution and completion of Works and the remedying of the defects therein.

**D. Submission of Bid.****16 E-Tender**

This e-tender shall be submitted in three parts as described in clause 10.0 as below:

**Part I** shall be named "**Technical Bid**" and shall be submitted online and same shall be submitted in 2 hard copies through RPAD or speed post only.

**Part II** shall be named **Tender Fee** and **Bid Security** and shall be submitted through RPAD or speed post only

**Part III** shall be named "**Financial Bid**" and shall be submitted through e-tender

**17 Sealing & Marking of Bids**

17.1 The bid shall be submitted online as describe in bid information.

Hard copies of documents (except financial bid which shall be submitted online only) like (1) Bid security & tender fee and (2) Volume-I, qualification documents, etc. shall be submitted in separate sealed envelopes duly marked as "**ORIGINAL**" and "**DUPLICATE**". These envelopes (called as inner envelopes) shall then be put inside one outer sealed envelope and will be submitted under formal forwarding letter address to the Employer inter alia containing an undertaking that the bid documents does not contain any amendment, modification or change of any type whatsoever in the bid documents and to any amendment issued.

17.2 The each envelope shall be addressed to Employer as mentioned in Bid Information bearing the following Identification.

- Bid for \_\_\_\_\_ (name of work)
- Bid reference No. \_\_\_\_\_
- DO NOT OPEN BEFORE \_\_\_\_\_ ( time & date for bid opening)
- ORIGINAL / Duplicate
- Name and address of the Bidder.

17.3 If the outer envelopes are not sealed and marked as above, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.



**18 Deadline for Submission of the Bids**

- 18.1 Completed Bids (including Technical and Financial) shall be submitted through e-tenderprocess as specified not later than the date indicated on the face sheet of the document. In the event of the specified date for the submission of bids falls on a holiday, the Bids will be accepted on the next working day by the specified timeschedule.
- 18.2 The Employer may extend the deadline for submission of bids by issuing an amendment in accordance with Clause 8, in which case all rights and obligations of the Employer and the bidders previously subject to the original deadline will then be incorporated with the new deadline.
- 18.3 All bidders are requested to see the website [www.rmc.nprocure.com](http://www.rmc.nprocure.com) for corrigendum & addendums, if any.

**19 Late Bids**

- 19.1 Any Bid received after the deadline prescribed in Clause 18 will be rejected.

**20 Modification and Withdrawal of Bids**

- 20.1 No modification or withdrawal is allowed.
- 20.2 No bid may be modified after the deadline for submission of Bids, except in pursuant to clause 8.
- 20.3 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 13.1 above or as extended pursuant to Clause 13.2 shall result in the forfeiture of the Bid security pursuant to Clause 14.

**E. Bid Opening and Evaluation****21 Bid Opening**

- 21.1 The Employer will open all the Bids received (except those received late), including modifications made pursuant to Clause 20, in the presence of the Bidders or their representative. In the event of the specified date of Bid opening being falls on holiday, the Bids will be opened by the specified time and location on the nextworking day.
- 21.2 The file Part-I containing "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 2), and has not been furnished in the specified form in Clause 14, the bid may be considered as non-responsive.
- (i) After receipt of confirmation of the bid security, the bidder will be asked for submission in writing (usually within 10 days of opening of the Technical Bid) to clarify technical bid, if necessary, with respect to any rectifiable mistakes which will also indicate the date, time and venue of opening of the Financial Bid.
  - (ii) The bidders will respond in not more than 7 days of issue of the clarification letter.
  - (iii) After receipt of these clarifications the list of responsive bidders whose financial bids are eligible for consideration will be finalized.
- 21.3 In no case the modification in financial bid will be allowed.
- 21.4 At the time of opening of "Financial Bid", the names of the bidders who were qualified to open financial bid & found responsive in accordance with Clause 20.3 will be announced (if withdrawal is not done). The financial bids of these bidders will be opened online. The responsive Bidders' names, the Bid prices, the total amount of each bid, any discounts, bid modifications and Withdrawals, and such other details as the Employer may consider appropriate, will be announced by the Employer at the opening. Any bid price or discount, which is not read out and recorded, will not be taken into account in Bid Evaluation.
- 21.5 The Employer shall prepare minutes of the Bid opening, including the information disclosed to those present in accordance with Sub-Clause 21.3.

**22 Process to be Confidential**

22.1 Information relating to the examination, clarification, evaluation, qualification 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 a Bidder to influence the Employer's processing of Bids or award decisions may result in the sole rejection of his Bid.

**23 Clarification of Financial Bids**

- 23.1 To assist in the examination, evaluation, and comparison of Bids, the Employer may, at this 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 fax or e-mail, but no change in the price or substance 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 in accordance with Clause 25.
- 23.2 Subject to sub-clause 23.1, no Bidder shall contact the Employer on any matter relating to his bid from the time of the bid opening to the time the contract is awarded. If the Bidder wishes to bring additional information to the notice of the Employer, he should do so in writing.
- 23.3 Any effort by the Bidder to influence the Employer in the Employer's bid evaluation, bid comparison or contract award decisions may result in the sole rejection of the Bidders' bid.

**24 Examination of Bids and Determination of Responsiveness**

24.1 During the detailed evaluation of 'Technical Bids', the Employer will determine whether each bid (a) meets the eligibility criteria defined in Clauses 3 and 4; (b) has been properly signed; (c) is accompanied by required securities and; (d) issue substantially responsive to the requirements of the 'Bidding Documents'. 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 schedule B, technical specifications, and drawings.

- 24.2 A substantially responsive "Financial Bid" is one which conforms to all the terms, conditions, and specifications of the 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.
- 24.3 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.

## 25 Correction of Errors

- 25.1 "Financial Bids" determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer as follows:
- a. Where there is a discrepancy between the rates in figures and in words, the rate in words shall govern;
- 25.2 The amount stated in the "Financial Bid" will be corrected by the Employer in accordance with the above procedure and the bid amount adjusted with the concurrence of the Bidder in the following manner:
- a. If the Bid price increases as a result of these corrections, the amount as stated in the bid, before applying corrections, will be the 'bid price' and the increase will be treated as rebate;
  - b. If the bid price decreases as a result of the corrections, the decreased amount will be treated as the 'bid price'

## 26 Evaluation and Comparison of Bids

- 26.1 The Employer will evaluate and compare only the Bids determined to be substantially responsive in accordance with Sub-Clause 24.2.

- 26.2 In evaluating the Bids, the Employer will determine for each Bid the evaluated BidPrice by adjusting the Bid Price as follows:
- a) Making any correction for errors pursuant to Clause 25; or
  - b) Making an appropriate adjustments for any other acceptable variations,deviations; and
  - c) Making appropriate adjustments to reflect discounts or other price modifications offered in accordance with Clause 23.1.
- 26.3 The Employer reserves the right to accept or reject any variation or deviation and other factors, which are in excess of the requirements of the Bidding documents or otherwise result in unsolicited benefits for the Employer. However the same shall not be taken into account in Bid evaluation
- 26.4 If the Bid of the successful Bidder is substantially unbalanced in relation to the Consulting Engineers estimate of the cost of work to be performed under the contract, the Employer may require the Bidder to produce detailed price analysis for any or all items of the schedule B, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analysis, the Employer may require that the amount of the performance security set forth in Clause 30 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.
- 26.5 A bid which contains several items in the schedule B which are unrealistically priced on and which cannot be substantiated satisfactorily by the bidder may be rejected as 'non-responsive'.

**F. Award of Contract****27 Award Criteria**

27.1 Subject to Clause 29, 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 (In case of multiple similar works) adjusted to account for his bid price which is evaluated the lowest in any of the packages opened earlier than the one under consideration.

In no case, the contract shall be awarded to any bidder whose available bid capacity (In case of multiple similar works) 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 his evaluated bid price.

The same process will be continued in case the second lowest bidder fails to meet with the bid capacity criteria described above.

**28 Employer's Right to Accept any Bid and to Reject any or all Bids**

28.1 Notwithstanding Clause 27, 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 Bidders or any obligation to inform the affected Bidder or Bidders of the grounds for the Employer's action.

**29 Notification of Award and Signing of Agreement**

29.1 The Bidder whose Bid has been accepted will be notified for the award by the Employer prior to expiration of the Bid validity period by writing, facsimile or e-mail confirmed by registered letter. This letter (hereinafter and in the Conditions of Contract called the "Letter of Acceptance" as per format given in Annexure - II) 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").

- 29.2 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 30
- 29.3 The successful bidder is required to enter into the agreement and submit the Performance Security within 10 days from the issuance of Letter of Acceptance.
- 29.4 Upon entering into the agreement and furnishing by the successful Bidder of the Performance Security, the Employer will promptly notify the other Bidders that their Bids have been unsuccessful.

### **30 Performance Security**

- 30.1 Within 10 days of issuance of the Letter of Acceptance, the successful Bidder shall deposit to the Employer a Performance Security in of the forms given below for an amount equivalent to 5% of the Contract price (plus additional security for unbalanced Bids in accordance with Clause 26.4 of Information to Bidders as decided by the Employer if necessary). Bank Guarantee as indicated in Appendix.
- 30.2 The performance security provided by the successful Bidder, in the form of a Bank Guarantee, should be issued by a nationalized / scheduled bank (Except Co-Operative Bank) only.
- 30.3 Failure of the successful Bidder to comply with the requirements of Sub-Clause 30.0 shall constitute sufficient grounds for cancellation of the award and forfeiture of Security.
- 30.4 The Performance Security shall remain in force until the issuance of the Defects Liability Certificate and the security shall be returned to the Contractor within 28 days of the issuance of the completion of Defects Liability Certificate and after engineer has certified that all defects notified by engineer to the contractor before the end of this period have been corrected.
- 30.5 Prior to making a claim under the performance security the Employer shall, in every case, notify the Contractor stating the nature of default in respect of which the claim is to be made.

**31 Dispute Review Expert /Arbitration**

31.1 In case of all the disputes, decision of the Municipal Commissioner shall be final and binding to the bidder. Municipal Commissioner shall be the sole Arbitrator.

**32 Corrupt or Fraudulent Practices**

32.1 The Employer will reject a proposal for award if it determines that the Bidder recommended for award has engaged in corrupt or fraudulent practices in competing for the contract in question and will declare the firm ineligible, either indefinitely or for a stated period of time.

32.2 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 23.3



Annexure - I

**AFFIDAVIT**

- a. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.
- b. The undersigned also hereby certifies that neither our firm M/s \_\_\_\_\_ have abandoned any work \_\_\_\_\_ in India nor any contract awarded to us for such works have been rescinded, during last seven years prior to the date of this bid.
- c. 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 my (our) competence and general reputation.
- d. The undersigned understand 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

Annexure - II

**UNDERTAKING**

I, the undersigned do hereby undertake that our firm M/s \_\_\_\_\_ would invest minimum cash up to 15% of the value of the work or as required for implementation of this Contract.

(Signed by an Authorized Officer of the Firm)

Title of Officer

Name of Firm

Place & Date

**Letter of Acceptance**

(Letterhead paper of the Employer)

\_\_\_\_\_ [date]

To: \_\_\_\_\_

[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 our Agency.

We note that as per bid, you do not intend to subcontract any component of work.

You are hereby requested to furnish Performance Security, plus additional security for unbalanced Bids in terms of ITB Clause 26.4, in the form detailed in Para 30.1 of ITB for amount of Rs. \_\_\_\_\_ within 10 days of the receipt of this letter of acceptance valid up to 28 days from the date of expiry of Defects Liability Period i.e. and sign the contract, failing which action as stated in Para 30.3 of ITB will be taken.

We have reviewed the construction methodology submitted by you along with the bid in response to ITB Clause 5.2 and our comments are given in the attachment. You are requested to submit a revised Program including environmental management within 14 days of receipt of this letter.

Yours faithfully,

Authorized Signatory

Name and Title of Signatory

Name of Age

**Agreement Form****Agreement**

This agreement, made the \_\_\_\_\_ day of \_\_\_\_\_ 2018, between \_\_\_\_\_ [name and address of Employer] (hereinafter called "the Employer") of the one part 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 contract price 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 and construed as part of this Agreement.
- 2) In consideration of the payments 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 Contract.
- 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 the 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 read and construed as part of this Agreement, viz.:
  - I. Letter of Acceptance;

- II. Notice to proceed with the works;
- III. Contractor's Bid after amendments, addenda and corrections as mutually agreed with the Employer;
- IV. The notice inviting bids,
- V. The information to bidders,
- VI. Minutes of Pre-bid meeting
- VII. Contract Data;
- VIII. General Conditions of contract;
- IX. Technical Specifications;
- X. Drawings;
- XI. Schedule B;
- XII. Any other document listed in the Contract Data as forming part of the contract;

In witness whereof the parties thereto 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 \_\_\_\_\_

Binding Signature of Employer \_\_\_\_\_

Binding Signature of Contractor \_\_\_\_\_

In the presence of \_\_\_\_\_

**Annexure - V**

**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 performance security as stipulated in Information to bidders (ITB) clause 30.1 and signing of the contract agreement for the construction of \_\_\_\_\_ at the accepted Bid Price of Rs. \_\_\_\_\_ ( In words ), 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)

## Annexure - VI

**FORM OF PERFORMANCE SECURITY (BANK GUARANTEE)**

To: \_\_\_\_\_(name of Employer)

\_\_\_\_\_ (address of Employer)

WHEREAS \_\_\_\_\_(name and address of Contractor) (hereinafter called "the Contractor") has undertaken, in pursuance of Contract

No. \_\_\_\_\_ dated \_\_\_\_\_ 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 sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such as Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you as principal obligator, on behalf of the Contractor, un conditionally and irrevocably

guarantee the payment of an amount to total of \_\_\_\_\_

(amount of Guarantee) \_\_\_\_\_(amount in words), such sum

being payable in the types and proportions- of currencies in which the Contract Price is

payable, and we undertake to pay you, upon your first written demand and without cavil

or argument, any sum or sums within the limits of \_\_\_\_\_(amount of

Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for

your demand for the sum specified therein.

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

We further agree that no change or addition to or other modification of the terms of the Contract or 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 change, addition or modification.

This guarantee shall be valid until the date of issue of the performance certificate.

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_



**SECTION - II**  
**GENERAL CONDITIONS**  
**OF**  
**CONTRACT**

## Section II: General Conditions of Contract

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**A. General****1.0 Definitions**

- 1.1 In the contract (as hereinafter defined) the following words and expressions shall have the meaning hereby assigned to them, except where the context otherwise requires.
- 1.2 Terms which are defined in the Contract Data are not also defined in the Conditions of Contract but keep their defined meanings. Capital initials are used to identify defined terms.

**“Commencement Date”** means the date on which the Contractor receives from the Engineer the notice to commence works.

**“Time for completion”** means the time for completing the execution of the works and passing the tests on completion of the works calculated from the commencement date.

**“Taking over certificate”** means a certificate issued pursuant to clause 54 of these Conditions of Contract.

**“Contract”** means the contract agreement between the Employer and the Contractor to execute, complete and maintain the Works as described.

**“Specifications”** means the specification of the works included in Contract and/or modifications/alterations made thereto by Contractor and approved by the Engineer.

**“Drawings”** means all drawings, calculations and technical information of a like nature provided by the Engineer to the Contractor.

**“Contract Data”** means the documents and other information which comprise the Contract.

**“Contractor”** means a person / corporate body / registered company / consortium of companies whose Bid to carry out the Works has been accepted by the Employer and the legal successors in title to such person / corporate body / registered company / consortium of companies.

**“Subcontractor”** means any person/corporate body/ registered company/ a consortium of companies to whom a part of the works have been subcontracted with the consent of the Engineer.

**“Contractor's Bid”** means the priced offer to the Employer for the execution of the works and remedying defects there in accordance with various terms and conditions set out in the Contract as accepted by “ Letter of Acceptance.”.

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

**“Retention money”** means the aggregate of all monies retained by Employer pursuant to clause 51 of these Conditions of Contract.

**“Interim payment certificate”** means any payment certificate issued by the Engineer other than the final payment certificate.

**“Final payment certificate”** means the certificate of payment issued by the Engineer pursuant to clause 46.1 g of these Conditions of Contract. **Days** mean calendar days; **“months”** mean calendar months.

**“Defect”** means any part of the Works not completed in accordance with the Contract.

**“Owner”** means the Rajkot Municipal Corporation and is the party who has ownership of the project.

**“Employer / Client”** means The Rajkot Municipal Corporation (RMC) / Municipal Commissioner and is the party who will employ the Contractor to carry out the Works.

**“Engineer”** means the person appointed by the Employer as named in the Contract Data or as informed to the contractor in writing for the purposes of the contract. The Contractor is obliged to accept the Engineer appointed by the Employer.

**“Engineer’s representative/ Consultant / Consulting Engineer”** means the person / organization appointed by the Employer for carrying out such duties and exercising such authority as delegated to him from time to time by the Engineer with written intimation to the Employer and the Contractor.

**“Third Party Inspection Agency (TPI)”** means the Agency, having represented to the client that they have the required professional skills and personal and technical resources, have agreed to provide for services on the terms and conditions set forth in RMC’s Standing Committee resolution no. 370 date 21-10-2011.

**“Equipment”** means the Contractor's machinery and vehicles brought temporarily to the Site to construct the Works.

**“Completion date”** means the date arrived at by counting the Contract period (inclusive of any time extensions granted by the Engineer from time to time) after the commencement date.

**“Plant”** means any integral part of the Works, which is to have civil, mechanical, electrical, electronic or chemical or biological function.

“**Site**” means the places provided by the Employer where the works are to be executed and any other places as may be specifically designated in the contract as forming part of the site.

“**Specification**” means the Specification of the Works included in the Contract and any modification or addition made or approved by the Engineer.

“**Works**” means permanent works and/or temporary works.

“**Permanent works**” means the permanent works to be executed in accordance with the Contract.

“**Temporary Works**” are works of every kind in or about the permanent works designed, constructed, installed, and removed by the Contractor, which are needed for construction or installation of the Works.

“**Cost**” means all expenditure on or off site properly accounted and incurred or to be incurred including all overheads.

“**Writing**” means all handwritten or typewritten or printed communication including cable, facsimile or email communication.

1.3 Wherever in the contract provision is made for the giving of notice, consent, approval, certificate or determination by any person such notice consent, approval, certificate or determination by any person shall be given in writing unless otherwise specified in the contract. Any such consent, approval, certificate or determination shall not be unreasonably delayed or withheld.

## 2.0 Interpretation

2.1 In interpreting these Conditions of Contract, singular also means plural, male also means female or neuter, and the other way around. Headings and marginal notes have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. All the notices, consents, approvals, certificates, decisions, determinations to be given under this contract by all the concerned parties (Employer, Consulting Engineer and Contractor) shall be given in writing only.

2.2 If sectional completion is specified in the Contract Data, The completion date for each section of work is arrived at by counting the period of completion assigned for that section of work from the date of commencement assigned to that section of the work.

2.3 The several documents forming the Contract are to be taken as mutually explanatory to one another, but in case of ambiguities and/or discrepancies the same

shall be explained and adjusted by the Engineer who shall thereupon issue to the contractor instructions thereon and in such event unless otherwise provided in the contract, the priority of the documents forming the Contract shall be as follows:

- (1) The notice inviting bids,
- (2) The Contract Agreement,
- (3) The instructions to Bidders
- (4) The Letter of Acceptance and notice to proceed with the works
- (5) The accepted Contractor's Bid
- (6) The Contract Data
- (7) The General Conditions of Contract
- (8) The Technical Specifications
- (9) The Drawings
- (10) Any other document listed in the Contract Data as forming part of the Contract.

### **3.0 Language and Law**

The language of the Contract shall be English and the law governing the Contract shall be the Law as prevailing in India.

### **4.0 Engineer's Decisions**

4.1 Except where otherwise specifically stated, the Engineer will decide contractual matters between the Employer and the Contractor as specified in the contract.

4.2 Except as expressly stated in the contract, the Engineer shall have no authority to relieve the contractor of any of his obligations under the contract.

4.3 Engineer shall act impartially while dealing with the contractual matters arising between the Contractor and the Employer while

- Giving decisions, opinion or consent,
- Expressing his satisfaction or approval,
- Determining value, or
- Otherwise taking decisions which may affect the rights and obligations of the Employer or the Contractor

4.4 The Engineer shall obtain specific approval from the Employer before carrying out his duties in accordance with following clauses and any other sub clauses that will have cost or time implications on the Contract:

5.0 Delegation,

7.0 Subcontracting

17.5, 17.6	Suspension of work
21.0	Possession of site
32.0	Extension of completion date
44.0	Valuation of variations
50.0	price variation
52.0	Liquidated damages
56.0	Taking over
57.0	Claims
59.0	Termination
61.0	Default of Contractor

## 5.0 Delegation

5.1 **Engineers Representative** (Team Leader in this case) shall be appointed by the Employer and shall carry out such duties and exercise such authority as may be delegated to him by the Employer under sub clause 5.2 from time to time.

5.2 The Engineer may delegate in writing any of his duties and responsibilities to other persons appointed by the Engineer to carry out the duties assigned to him under the contract (except to the Dispute Review Expert ) after notifying the Contractor in writing ) and may cancel any delegation in writing after notifying the Contractor.

## 6.0 Communications

6.1 A notice shall be effective only when it is delivered (in terms of Indian Contract Act).

6.2 All communications from Engineers Representative shall have the same effect although given by the Engineer. The Engineer shall however retain the authority to disapprove any work, materials or Plant in the event of the Engineers Representative failing to do so or revoke the decisions/instructions issued by the Engineers Representative.

6.3 All certificates, notices or instructions to be given to the Contractor by the Employer or the Engineer under the terms of Contract shall be sent by post, cable, fax, e-mail to or placed at the Contractors principal place of business or such other address as the Contractor shall nominate for that purpose.



- 6.4 Any notice to be given to Employer or to the Engineer under the terms of the Contract shall be sent by post, cable, fax or e mail to or left at the respective addresses nominated for that purpose given in contract data.
- 6.5 Change of address shall be informed to respective parties well in advance.

#### **7.0 Subcontracting**

- 7.1 The Contractor shall not, without the prior consent of the Employer assign the contractor any part thereof. The contractor shall not subcontract the whole of the works. Part of the works may be subcontracted after obtaining Engineers prior consent. Any such consent shall not relieve the Contractor from any liability or obligation under the contract. The contractor shall remain responsible for all the acts, defaults and/or neglect of the contractual requirements and obligations by any Subcontractor.

#### **8.0 Other Contractors**

- 8.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer as and when required without prejudice to any of his contractual obligations. The Contractor shall as referred 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 modification.

#### **9.0 Personnel**

- 9.1 The Contractor shall employ the key personnel named in the Schedule of Key Personnel as referred to in the Bid document 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.
- 9.2 If the Engineer asks the Contractor to remove a person, for his misconduct or inadequacy of technical skills and experience, who is a member of the Contractor's staff or his work force, the Contractor shall ensure that the person leaves the Site within seven days and has no further connection with the work in the Contract.

- 9.3 No residential accommodation is allowed at the site of work. The labour huts shall not be erected on the site of work and contractor shall make his own arrangements to provide such accommodations as per the rules of the local bodies. He shall make his own arrangements for housing, stores, field office etc. He shall submit a site layout plan indicating the location of various site facilities to be created by him at his cost for the execution of work. The Owner shall in no way be responsible for any delay on this account and no claim on this account whatsoever shall be entertained.
- 9.4 A Project Manager who is a graduate civil engineer having a minimum twenty years of experience in similar nature work i.e. construction of Vehicular underpass or Flyover Bridge, open foundation in rocky strata or pile foundation etc. shall be the responsible authorized representative of contractor at site. The Project Manager shall always be available at the site during the actual execution of the work. This is in addition to the number of graduate engineers (of civil and other disciplines as required) who shall be appointed by contractor to execute all items of work.

#### **10.0 Employer's and Contractor's Risks**

- 10.1 The Employer carries the risks which this Contract states are Employer's risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

#### **11.0 Employer's Risks**

- 11.1 The Employer is responsible for the excepted risks which are (a) in so far 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, or riot, commotion, disorder (unless restricted to the Contractor's employees), natural disaster and contamination from any nuclear fuel or nuclear waste or radioactive toxic explosive. Contractor will execute rectification of damaged portions of work due to such risks and Employer shall suitably compensate for works in accordance with the terms and conditions of the contract.

#### **12.0 Contractor's Risks**

- 12.1 All risks of loss or damage to physical property and of personal injury, death which arise during and in consequence of the performance of the Contract, are the responsibility of the Contractor. Contractor shall rectify damages to works, loss of materials, property, plant and machinery, life etc. at his own costs
- 12.2 The contractor shall assume all liability, financial or otherwise in connection with his contract and shall protect and indemnify the Employer from any and all damages and claims that may arise on any account. The contractor shall indemnify the owner against all claims in respect of patent rights, royalties, damages to adjacent buildings, roads or members of public in course of execution of work or any other reason whatsoever and shall himself defend all actions arising from such claims and shall keep the Owner saved harmless and indemnified in all respect from such actions, costs and expenses. The contractor shall be liable for any loss or damage to the Works occasioned by him in the course of operations carried out by him. All such damage (except that arising out of excepted risks defined in clause 11.1 above) to works will be rectified by contractor at his own cost.

### **13.0 Insurance**

- 13.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Commencement Date to the end of the Defects Liability Period, in the amounts and deductibles as stated below and the contract data, for the following.
- (a) Loss of or damage to the Works, Plant and Materials. (Minimum full replacement costs and additional 15% costs);
  - (b) Loss of or damage to Contractors Equipment and other things at site (minimum full replacement costs);
  - (c) Loss of or damage of property and personnel (other than the Works, Plant, Materials and Equipment in connection with the Contract); i.e. Third Party Insurance; and
  - (d) Personal injury or death. (i.e. Workmen compensation policy)
- 13.2 Policies and certificates for insurance shall be delivered by the Contractor to the Engineer for the Engineer's approval before the Commencement Date. All such insurance policies shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.

- 13.3 No work (Temporary or Permanent) shall be permitted at site in absence of proper insurance policies and up to date payment of premier.
- 13.4 The responsibility of any amounts not insured or not recovered from the insurer shall be borne by the Employer or the Contractor in accordance with their responsibilities as defined in these clauses.
- 13.5 The Employer shall indemnify the Contractor against all proceedings, claims, damages, costs, charges, expenses in respect of the matters for which the Employer irresponsible.
- 13.6 The insurance policy shall include a cross liability clause such that the insurance shall apply to the Contractor and the Employer as separate insured.
- 13.7 The minimum amount of insurance shall be as specified in these clauses and the Contract data. In the event of mismatch insurance shall be for higher amount.
- 13.8 The Contractor shall keep notified the insurer of changes in the nature, extent or
- 13.9 Programmer for the execution of the works and ensure the adequacy of the insurances at all the times in accordance with the terms of the contract.

#### **14. Site Investigation Reports**

- 14.1 The bidder is advised to inspect and examine the site and its surroundings and satisfy himself with the nature and extent of site and work, the hydrological and climatic conditions the means of access to the site, the constraints of space for stacking material/machinery, labour etc. he requires, if any, weather conditions at site, general ground/subsoil conditions etc. or any other circumstances which may affect or influence their bid. No claim, whatsoever, shall be entertained from the bidder, on the plea that the information supplied by the Owner is insufficient or is at variance to the actual site conditions.

#### **15. Queries about the Contract Data and Contract agreement**

- 15.1 The Employer / Engineer will clarify queries on the Contract Data. These clarifications shall form a part of the Contract and shall be binding on both the Employer and the Contractor.
- 15.2 The Contractor shall enter into and execute the contract agreement to be prepared at the cost of the Employer in the form given in the instructions to bidders.

**16. Contractor to Construct the Works**

- 16.1 The Contractor shall with due care and diligence design (to the extent as provided for in the contract), execute and complete the works and remedy the defects if any in accordance with the provisions of the contract.
- 16.2 Contractor shall provide all superintendence, labour, materials, plant, contractor's equipment and all other things as may be required to design, execute, complete and maintain during defects liability period the works. (Refer clause 16.1 above).
- 16.3 Any defect, error, omission, fault shall be immediately brought to the notice of the Engineer before or during the execution of the works.
- 16.4 The Contractor shall take full responsibility for the adequacy, stability, safety of all site operations and methods of construction. Contractor shall not be responsible for the design and specifications of the Permanent works not designed by him.
- 16.5 The Contractor shall be responsible for:
- The accurate setting out of the Works in relation to original lines, levels and points of reference given by the Engineer in writing.
  - The correctness of all positions, levels, dimensions and alignment of all parts of the Works, and
  - The provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.
  - Contractor shall rectify all errors during execution of works at his cost except for the errors that occur due to supply of incorrect drawings or instructions by the Engineer.
- 16.6 The checking and approval by the Engineer of any alignments, levels and setting out shall not relieve the Contractor of his responsibility for accuracy thereof.
- 16.7 The Contractor shall provide a well equipped site office for the Engineer and his staff for the complete duration of the contract including defects liability period. Following facilities are to be provided.
- Office area of 100sq.m.
  - Well ventilated sitting area with fans and with 1 A. C. Cabins of 10 sq. m. each and conference cum meeting room with conference table, revolving chairs of Godrej or equivalent make and appropriate size of display board.

- Tables, chairs and cupboards of Godrej or equivalent make of appropriate size suitable for offices.
- Two latest computer of H.P. make with 17" monitor, 80 GB HDD, DVD combo drive, and latest necessary software, H.P. Laser jet Printer and internet facility.
- Drinking water facility
- Toilets

### 17. The Works to Be Completed by the Completion Date

- 17.1 The Contractor may commence execution of the Works on the Commencement Date and shall carry out the Works in accordance with the program submitted by the Contractor, as updated with the approval of the engineer, and complete them by the completion date.
- 17.2 The Employer shall in no way be responsible for either any delay in getting electric and/or water and/or telephone connections for carrying out the work or not getting connection at all and no claim whatsoever on this account shall be entertained from the contractor. Also contingency arrangement of standby water & electric supply shall be made by the contractor for smooth progress of the work on account of power failure or disconnection for any reason whatsoever it may be. No claim of any kind whatsoever shall be entertained on this account from the contractor. Nothing extra shall be payable on this account.
- 17.3 The Contractor shall provide necessary superintendence matching with working hours.
- 17.4 The Contractor shall afford every facility for and every assistance in obtaining the right to access for the Engineer or any of his representative at all reasonable times to the site and to all workshops, places where materials or plant are being manufactured, fabricated or prepared. If materials, plant or parts of works are manufactured, fabricated or prepared in places not belonging to the contractor, the contractor shall organize necessary permissions from the owners of such facilities for the engineer to inspect such materials or plant.
- 17.5 **Suspension of work:** The Contractor shall, on the instructions of the Engineer, suspend the progress of the works or part thereof for such time and in such manner as the Engineer may consider necessary and shall, during such

suspension, properly protect and secure the works or any part thereof so far as is necessary in the opinion of the Engineer. Unless such suspension is:

- i. otherwise provided in the contract,
- ii. Necessary by reason of some default or breach of contract by the contractor or for which he is responsible,
- iii. Necessary by reason of climatic conditions on site or
- iv. Necessary for the proper execution of the work or for safety of the works or any part thereof, following sub clause shall apply.

17.6 Effect of suspension.

With reference to clause 17.5 the Engineer shall after due consultations with the Employer and the Contractor determine

- a. The time effect of such suspension on the contract period and
- b. The cost effect of such suspension on the contract price and shall notify the Contractor with a copy to the Employer.

**18. Approval by the Engineer**

- 18.1 The Contractor shall submit specifications and drawings showing the proposed temporary work to the engineer, who shall approve them if they comply with the Specifications and Drawings.
- 18.2 The Contractor shall be responsible for design of temporary Works.
- 18.3 The Engineer's approval shall not alter the Contractor's responsibility for design of the temporary Works.
- 18.4 All Drawings prepared by the contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Engineer before their use.

**19. Safety**

- 19.1 The Contractor shall have full regard throughout execution, completion and defects liability period to following safety aspects and shall take all necessary steps to ensure that danger to safety is avoided all the time in respect of
- a. Safety of the works
  - b. Safety of the Contractors employees and all the persons directly or indirectly engaged by him for the works

- c. Safety of all the employees including persons working on other contracts of Employer at the same site of the Employer and Engineers employees engaged at work site.
  - d. Any authorized third party persons on the site.
  - e. Contractors plant and equipment
- 19.2 Contractor shall provide and maintain at his costs all lights, guards, fencing, warning signs, watching when and where necessary or required by Engineer or by any duly constituted authority for the protection of the works or for the safety and convenience of the public or others.
- 19.3 Contractor shall take all reasonable steps to protect the environment on and off the site and avoid damage or nuisance to persons or property of the public and others arising as a consequence of his method of operation.
- 19.4 The contractor shall maintain in good condition all work throughout execution, completion and defects liability period. The contractor shall be responsible for and to make good all injuries, damages and repairs, rendered necessary by fire, rain, traffic, floods or other causes.
- 19.5 All the scaffolding work, wherever required for the execution of work, shall be provided by the contractor. Nothing extra shall be payable on this account. It shall be provided strictly with double scaffolding system with all the accessories etc. with adjustable suitable working platforms to access the areas, with ease for working and inspection. It shall be designed to take all incidental loads. It should cater to the safety features for workmen. It shall be ensured that no damage is caused to any structure due to scaffolding.
- 19.6 All temporary warning/ caution boards display such as "Construction Work in progress", "keep away", "No parking" etc. shall be provided and displayed board showing all information in the plate during ay as well as night time by the contractor, wherever required and as directed by theEngineer.
- 19.7 Arrangement of temporary water and electricity and telephone connection required, by him, shall be made by the contractor at his own cost and also necessary permissions directly from relevant Owners shall be obtained by him under intimation to the Owner. Also all initial and running charges and security deposit, if any in this regard shall be borne by him. The contractor shall abide by all the rules/ bye laws applicable in this regard and he shall be solely responsible



for any penalty on account of violation of any of the rules and byelaws in this regard.

19.7.1 The contractor shall be responsible for maintenance and watch and ward of the complete installation and shall also be responsible for any pilferage, theft, damage, penalty etc. in this regard. The contractor shall indemnify the owner against any claim arising out of pilferage / theft, damage, penalty etc. whatsoever on this account. Security deposit for the work shall be released only after the clearance is obtained from the local authorities from whom temporary electric/ water / telephone connection have been obtained by the contractor.

19.8 The contractor shall depute Site Engineer & skilled workers as required for the work. Necessary protective and safety equipment shall be provided to them by the contractor at his own cost and used at site.

19.9 Security & Traffic Arrangements

In event of any restriction being imposed by the Security Staff of Owner, Rajkot Municipal Corporation traffic or any other local governing body having control over the project, on the working or movement of labour, materials, the contractor shall strictly follow all such restrictions or instructions issued regarding the same and nothing extra shall be payable to the contractor on account of such restrictions or instructions. In case of loss of time on this account if any, shall have to be made up by generating additional resources etc.

General security restrictions are given as under:

i. The movement of trucks and vehicles shall be regulated in accordance with rules and regulations as approved by competent authorities.

ii. The contractor shall inform in advance, if required, the truck registration numbers ownership of the trucks, names and addresses of the drivers for necessary action by the security agency.

iii. As and when there will be security requirements, certain additional restrictions can be imposed as per the requirement of the situation.

iv. No claim whatsoever will be entertained by the Owner on account of restriction that can be imposed as per the requirement of the situation.

19.10 No inflammable materials including P.O.L shall be allowed to be stored in huge quantity at site. However, reasonable quantity may be permitted for storage, subject to the compliance of all rules & instructions issued by the relevant authorities and as per the direction of Engineer -in- Charge in this regard.

- 19.11 The contractor shall save harmless and indemnify the Employer in respect of all claims, proceedings, damages, costs, charges and expenses whatsoever arising out of, or in relation to, any such matters in so far as the Contractor is responsible thereof.
- 19.12 Movement and diversion of traffic during construction.
- 19.13 Contractor shall provide barricades during construction period and dismantled and taking away the same after completion of work as directed by employer and as per site requirement.

## **20. Discoveries**

- 20.1 Anything of geological or archaeological or other interest or articles of value or antiquity discovered on the Site shall be the absolute 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 without damages, thefts etc. In carrying out the Engineers instructions to dealing with such articles if the contractor incurs extra costs or suffers delays, the Engineer shall determine after due consultation with the Employer and the Contractor amounts of such costs and extension of time in accordance with the corresponding clauses of the contract.

## **21. Possession of the Site**

- 21.1 The Contractor shall commence the work as soon as is reasonably possible on receipt of the "commencement of work notice" from the Engineer.
- 21.2 The Employer shall give possession of parts of the Site to the Contractor from time to time as agreed in the contract in the order in which such portions will be made available to the Contractor. This shall be based on the contractor's construction program and method of construction.
- 21.3 Access to site shall also be provided by the Employer to the Contractor in order and manner as set out in the contract to enable the Contractor to commence and proceed with the works in accordance with his construction program and method of construction.
- 21.4 The site of work shall be always kept clean. The excavated material shall be disposed off as directed by the Engineer, from the premises and all necessary permissions in this regard from the local bodies shall be obtained by the

contractor. The water / slush / bentonite slurry etc. shall not be allowed to be collected at site or to be discharged into public drainage system. The work shall be carried out in such a way that the area is kept clean and tidy without causing any nuisance due to overflowing or spilling of bentonite slurry or any other material all over the place. Nothing extra shall be payable on this account.

- 21.5 If the Contractor suffers delays and /or incurs costs on account of delays in giving possession of site from the Employer in accordance with sub clause 21.2 and 21.3, the Engineer shall then decide if any extension of time and/ or amount of such costs in accordance with the terms and conditions of the contract and notify the Contractor and Employer accordingly.

## **22. Access to the Site**

- 22.1 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 plant are being manufactured / fabricated / assembled for the works.

## **23. Instructions**

- 23.1 The Contractor shall, unless it is legally or physically impossible, execute and complete the works and remedy defects therein in strict accordance with the contract to the satisfaction of the Engineer. The contractor shall comply and adhere to the Engineer's instructions on any matter, whether mentioned in the contract or not, concerning the works. The Contractor shall take instructions only from the Engineer (or his delegates).

## **24. Disputes:**

- 24.1 If the Contractor believes 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 the municipal commissioner within 15 days of the notification of the Engineer's decision.

## **25. Settlement of Disputes:**

In case of all the disputes, decision of the Municipal Commissioner, Rajkot Municipal Corporation shall be final and binding to the Bidder.

**26. Avoidance to damage of roads. :**

26.1 The Contractor shall ensure that no damage to roads and bridges on the route to the sites occurs due to his or his subcontractor's traffic. He shall ensure minimum possible hindrance to the traffic movements on public roads and bridges due to his materials, plant, temporary works etc. No materials shall be stacked on public roads and thoroughfares.

**27. Transport of Contractor's equipment:**

27.1 The Contractor shall specifically notify the Employer in case he plans to transport materials, equipment, plant etc. which might induce such loads on roads and bridges enroute to site for which the roads and bridges are not designed. In every such case the Contractor shall carry out all such strengthening works as may be necessary to ensure the safety of the roads/ bridges. All such works should be approved by the Engineer in writing. The Contractor, despite the strengthening measures and written approval by the concerned authority, shall be responsible for the safety of the roads and bridges as well as his own plant, materials and equipment's.

**28. Opportunities and Facilities for other Contractors:**

**Opportunities:**

The Contractor shall afford all reasonable opportunities to

- a. any other contractor and his workmen engaged by the Employer
- b. the Workmen of the Employer
- c. Workmen of any other agency permitted by the Employer to work in or around the site of works.

**Facilities:**

- a. Make available any roads or ways for the maintenance of which the Contractor irresponsible.
- b. Permit the use of any temporary works or Contractors Equipment on site. (To be charged wherever applicable).

- c. Provide any other services of whatsoever nature (to be chargeable wherever applicable.)

**29. Contractor to keep site clean:**

29.1 During the execution of the work, the Contractor shall keep the site clean. All wreckage rubbish, excess materials, temporary works no longer required will be removed from site.

**30. Clearance of site on completion:**

The Contractor shall clear away and remove all Contractor's equipment's, surplus materials, rubbish, temporary works of every kind, except those Contractor's equipment's, surplus materials, rubbish, temporary works that may be required by him during the Defects Liability period and leave the site clean and in a workmanlike condition to the satisfaction of the Engineer on issue of the Taking Over Certificate.

**B. Time Control****31. Programme**

- 31.1 The contractor should plan the work to be executed round the clock without violating labour and environmental control norms specified by the governing bodies (National, State and local).
- 31.2 Within the time stated in the Contract Data the Contractor shall submit to the for his consent program showing the general methods of construction, arrangements, order, and timing and sequence for all the activities including traffic diversion, resource schedules including material, manpower and machinery and equipment scheduling monthly cash flow forecast and any other details the Engineer may require.
- 31.3 If at any time it should appear to the Engineer that the actual progress of works does not confirm to the program to which consent has been given as per clause 31.2 above, the Contractor shall produce, at the request of the Engineer, a revised program showing modifications to the program consented to under clause 31.2 above necessary to ensure completion of works within the Time for Completion.
- 31.4 If the Contractor fails to submit such a revised program, the Engineer may withhold the amount stated in the Contract Data from the next payment certificate and continue to withhold this amount in all future payments until the date on which the revised Program is submitted.
- 31.5 The Engineer's consent to the program shall not relieve the contractor from his duties and responsibilities under the contract.
- 31.6 The Engineer shall monitor the rate of progress of work. In case the Engineer finds that the rate of progress of work is too slow to comply with the Time for completion, he shall notify the Contractor who shall thereupon take necessary steps to expedite progress. No extra payments on account of such actions shall be due to the Contractor.

**32. Time for completion and Extension/s of Time for completion**

- 32.1 The whole of the works, and if applicable any section of the works required to be completed within a particular time as stated in the Contract data, shall be completed within the stipulated time for the whole of the works or the Section (as

the case may be) calculated from the Commencement Date, or such extended time as may be allowed under following sub clauses.

- 32.2 The Engineer shall, after due consultation with the Employer and Contractor, determine the amount of extension of time for completion to which the Contractor becomes fairly entitled in the event of
- a) Amount and nature of extra work
  - b) Any cause of delay referred to in these conditions
  - c) Exceptionally adverse climatic conditions
  - d) Any delay, impediment or prevention by the Employer
  - e) Other special circumstances which may occur, other than through a default or breach of contract by the contractor

The Engineer shall notify the Contractor about all such extension of time with a copy to the Employer.

- 32.3 The Engineer shall however not be bound to make any determination unless the Contractor has notified the Engineer within 28 days of occurrence of event as furnished detailed particulars of the extension of time arising out of such an event within 28 days of the issue of notice of occurrence of the event.

### **33. Delays Ordered by the Engineer**

- 33.1 The Engineer may instruct the Contractor to delay the start or progress of any activity within the Works. These delays shall be suitably compensated for time in accordance with the provisions of the Contract.

### **34. Management Meetings**

- 34.1 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.
- 34.2 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.

**35. Early Warning**

- 35.1 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.
- 35.2 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.

**36. Drawings and contract documents:**

- 36.1 The drawings shall remain in the sole custody of the Engineer, but two copies thereof shall be provided to the Contractor free of cost. The Contractor can avail a soft copy in PDF format from the Consulting Engineer for making further copies at his cost.
- 36.2 All the contractual documents and drawings shall not be given to a third party or used for any other purpose than contractual work. On receipt of the Defects Liability Certificate, the Contractor shall return all the drawings and the Contract documents including the drawings to the Engineer.
- 36.3 Four hard copies and two soft copies of the drawings, specifications and other documents (submitted by the Contractor and approved by the Engineer for all temporary and permanent works in accordance with the contract requirements) shall be submitted by the Contractor to the Engineer, free of cost.
- a) **Disruption of progress:** The Contractor shall give notice to the Engineer with a copy to the Employer, whenever planning or execution of the Works is likely to be delayed or disrupted unless any further drawing or instruction is issued by the Consulting Engineer within a reasonable time. The notice shall include details of the drawing or instruction required and of why and by when it is required and of any delay or disruption likely to be suffered if it is late.
- b) If by reason of any failure or inability of the Consulting Engineer to issue, within a time reasonable in all circumstances, any drawing or instruction for which the Contractor has given a notice in accordance with clause 33 and 35, the



Contractorsuffers delay then the Consulting Engineer shall, after due consultation with the Employer and the Contractor, determine:

- c) Any extension of time to which the Contractor is entitled.
  - d) Negative time and cost effects shall be calculated by the Engineer and deducted from the Contract Sum in the event of delays in issue of drawings arise out of Contractors failures or delays in submission of drawings of temporary works.
- 36.4 Supplementary drawings and instructions: The Engineer shall have authority to issue supplementary drawings and instructions to the Contractor. The Contractor shall carryout and be bound by the same.

### C. Quality Control

#### 37. Quality of Materials, Plant and Workmanship

37.1 All materials, plant and workmanship shall be:

i. Of the respective kinds and quality as described in the contract and in accordance with the Engineers instructions and subject to tests as the Engineer may require at any or all places, such as manufacturers facility, site, during fabrication, preparation etc, as specified in the contract.

ii. The Contractor shall provide all assistance required by Engineer for carrying out the tests. Costs of tests are covered by the contractor's quoted rates for the works.

iii. All samples shall be provided by the Contractor free of costs.

37.2 The Engineer and his personnel shall have access to all locations of work all the time for inspection of work. Contractor shall provide all necessary assistance to the Engineer and his personnel for this at no extra costs.

37.3 On inspection, if the Engineer finds that certain works, materials and/or plant are defective and/or not in accordance with the contract, he shall notify the contractor thereof immediately with his objections and reasons. The Contractor shall then promptly make good the defect or remove defective materials, plant from site.

37.4 All work or any part of shall be covered up only after approval of the Engineer in respect of the quality of materials used and workmanship.

37.5 The Contractor shall uncover any part of the work or make openings in or through as required by Engineer from time to time for inspection and shall make good such part only after approval of the Engineer to such covered up work.

37.6 In case of default on the part of the contractor in removal and making good of any defective materials, workmanship and/or plant, the Employer shall engage another agency to carry out the same at the contractors' risks and costs.

#### 38. Specifications of Contract

38.1 This tender is for a firm and fixed price contract and therefore no price escalation clause is provided under the conditions of contract. Any increase or decrease in quantity of work or material will be paid as per the price quoted in price schedule.

- 38.2 The tenders are invited under Local Competitive Bid procedure and therefore the bidders will not be eligible to avail the facility of deemed export. At present there is no GST exemption for these kinds of works.
- 38.3 However, if such exemptions are made available during the performance of the contract, the contractor shall be liable to pass on the benefit to OWNER appropriately.
- 38.4 Employer will appoint a third party inspection agency for inspection and quality control of the materials procured by the contractor. The contractor shall provide necessary access and necessary facilities for the purpose. The costs of the remuneration to be paid to such agencies shall be borne by the contractor.
- 38.5 The rates shall be inclusive of all the taxes, duties; local tax etc. prevailing at the time of quoting and statutory variation if any will also be borne by the contractor.

**39. Tests**

- 39.1 If the Engineer instructs the Contractor to carry out a test not specified in the Specification to check whether any work has any Defect or not, Contractor shall perform the same and submit the results to the Engineer at contractor's cost.

**40. Correction of Defects during Defects liability period**

- 40.1 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.
- 40.2 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.

**41. Uncorrected Defects during Defects liability period**

- 41.1 If the Contractor does not rectify or correct 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 bear the costs of such defective work as well as all works carried out over such defective work until the defect is removed to the satisfaction of the Engineer.

- 41.2 Only the Defects Liability Certificate referred to in following clause shall be deemed to constitute the approval of the works.
- 41.3 **Defects Liability Certificate:** The Defects liability certificate shall be given by the Employer to the Contractor, within 28 days of the expiry of the Defects Liability Period. The Contract shall remain incomplete until issue of the Defects Liability Certificate.
- 41.4 The defects Liability Certificate shall mention clearly that the Contractor has completed his obligations to execute and complete the works and remedy defects therein to the satisfaction of the Engineer.
- 41.5 **Unfulfilled obligations:** Despite issuance of the Defects Liability Certificate, the contract between the Employer and the Contractor shall remain in force in respect of unperformed obligations incurred under the provisions of the Contract prior to the issue of the Defects Liability Certificate.

## D. Cost Control

### 42. Schedule – B

42.1 The schedule-B shall contain Memorandum showing items for the construction, installation, testing, and commissioning work to be done by the Contractor.

42.2 The quantities stated in the schedule B are estimated quantities. The Contractor shall be paid only quantities calculated after taking measurements of executed work. The rate stated in the schedule B for each item of work shall apply. The works shall be measured by the contractor jointly with the authorized representative of the Engineer and all particulars required by the representative of the Engineer shall be supplied by the contractor.

42.3 The work shall be measured net. No allowance for general or local custom, working space etc. is to be made.

### 42.4 Deleted

### 43. Variations

43.1 The Engineer shall make any variation of form, quality or quantity of the Works or any part thereof that may, in his opinion, be necessary and for that purpose, or if for any other reason it shall, in his opinion, be appropriate, he shall have the authority to instruct the Contractor to do and the Contractor shall do any of the following:

- Increase or decrease the quantity of any work included in the contract,
- Omit any such work,
- Change the character or quality or kind of any such work,
- Execute additional work of any kind necessary for the completion of the Works or
- Change any specified sequence or timing of construction of any part of work.

No such variation shall in any way vitiate or invalidate the contract, but the effects, if any, of all such variations shall be valued in accordance with the following sub clauses. Provided that where the issue of an instruction to vary the Works is necessitated by some default or breach of contract by contractor or for which he is responsible, any additional cost attributable to such default shall be borne by the Contractor.

43.2 The Contractor shall not make any such variation without an instruction of the Engineer. No instruction is required for quantities varying from those provided for the items in the contract schedule B. Price escalation due to Inflation rate shall not be given.

#### **44. Valuation of Variations**

44.1 The basis for the valuation of variations for addition to the contract price shall be as follows in the same order of priority.

44.2 Contract unit rates for individual items shall apply to varied quantities where there is a quantity variation.

44.3 In case of other types of variations following procedure shall apply.

- If the Contract does not contain any rates or prices applicable to the varied work, the rates and prices in the Contract shall be used as per the prevailing SOR of RMC if item is not available in RMC then R & B SOR at the time of execution of the work a basis for valuation so far as may be reasonable. If this fails
- Suitable rates or prices shall be agreed upon between the Engineer and the Contractor after due consultations among the Employer, the Consulting Engineer and the Contractor. These shall be based on
- The material costs, the labour costs, the cost of use of all plant, machinery and equipment, the cost of all temporary and incidental works, the overheads and the Contractor's profit.
- The overheads shall be taken at 3 % of the sum of material costs, the labour costs, the cost of use of all plant, machinery and equipment, the cost of all temporary and incidental works.
- The Contractor's profit shall be taken at 10 % of the sum of material costs, the labour costs, the cost of use of all plant, machinery and equipment, the cost of all temporary and incidental works, the overheads.

44.4 In the event of disagreement the Engineer shall fix such rates and prices as are, in his opinion appropriate and shall notify the Contractor accordingly with a copy to the Employer.

44.5 The Engineer shall determine provisional rates and prices to enable on account payments to be included in the Interim Payment Certificates, until rates and prices are agreed as final by the Employer, the Contractor and the Consulting Engineer.

- 44.6 Deleted
- 44.7 No valuation of varied works in accordance with above clauses 43.1, 43.2 and 44 is allowed unless the Contractor gives his notice to claim or the Engineer gives his notice to vary the rates or prices to the other party (The Contractor) within 14 days of the issue of instructions to vary in accordance with clause 40.
- 44.8 The Contractor shall not be entitled to additional payment for costs, which could have been avoided by giving early warning.
- 44.9 Day works: The Engineer may, if in his opinion it is necessary or desirable, issue an instruction that any varied work shall be executed on day work basis. The Contractor shall then be paid for such varied work under the terms set out in the day work schedules included in the contract and at the rates and prices affixed to thereto by him in his bid. Unless authorized and certified on a day to day basis by the Engineer in writing, no payments shall be allowed to the Contractor.

#### **45. Cash flow forecasts**

- 45.1 The Contractor shall, within 21 days of the date of the letter of acceptance provide to the Engineer for his information a detailed cash flow estimate, in quarterly periods, of all payments to which the Contractor will be entitled under the Contract.
- 45.2 The estimates shall be revised and submitted by the Contractor every quarter of each year if need arises due to various reasons.

#### **46. Payment Certificates**

- 46.1 The contractor shall submit to the Engineer a monthly statement after the end of each calendar month in three hard copies and three soft copies on CDs each signed by the Contractors authorized Representative in such form as the Engineer may prescribe from time to time. The Monthly Statement shall state
- The amount to which the Contractor is entitled.
  - The value of the permanent works executed.
  - Other sums such as day works payments.
  - Any other sums to which the Contractor may consider himself entitled.
- 46.2 The Engineer shall check the Contractor's monthly statement within 14 days and certify for payment vide an Interim Payment Certificate the amount to be paid to the Contractor after taking into account any credit or debit for the month a)

in respect of materials for the works in the relevant amounts and b) under various conditions set forth in these General Conditions of Contract and stated in brief in the Contract Data.

- 46.3 No payment shall be recommended by the Engineer through Interim Payment Certificate until he is fully satisfied that
- The Contractor has paid the Security deposit to the Employer.
  - All premiums towards the various insurance policies taken by the contractor in accordance with these General Conditions of Contract are paid.
  - Contractor has obtained the labour licenses and PF code numbers for site staffs and workers.
- 46.4 The Engineer may by any Interim Payment Certificate or in any subsequent Interim Payment Certificate make any correction or modification in any previous Interim Payment Certificate which shall have been issued by him and shall have authority, if any work is not carried out to his satisfaction, to omit or reduce the value of such work in any Interim Payment Certificate.
- 46.5 **Statement at Completion:** No later than 3 months after the issue of the Taking Over Certificate in respect of the whole of the Works, the Contractor shall submit 3 hardcopies and 3 soft copies in the form of CDs to the Engineer of a Statement at Completion with supporting documents (such as measurements, approvals, records related to materials, test data etc.) showing in details, in the form approved by the Engineer
- The final value of all work done in accordance with the Contract up to date stated in the Taking over Certificate any further sums to which the Contractor considers himself due.
  - Any other amounts, which the Contractor considers, will become due to him under the contract to be shown in a separate statement.
  - The Engineer shall issue a Certificate of Payment after scrutiny in a similar manner as that for the Monthly Statements as described in clause 46.1 above.
- 46.6 **Final Statement:** The Contractor shall submit to the Engineer within 2 months of the issue of Defects liability Certificate pursuant to clause. 38.1b, in three hard copies and three soft copies in the form of CDs, a draft Final Statement with supporting documents (such as measurements, approvals, records related to materials, test data etc.) showing in details, in the form approved by the Engineer
- i. The value of all work done in accordance with contract including variations



ii. Any further sums which contractor considers being due to him under the contract or otherwise.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the Final Statement as agreed. If a dispute exists between the Engineer and the Contractor for any part of the draft final statement, such part shall be dealt with in accordance with the procedure laid down in clause 23 of these General Conditions of Contract. The Third Party Inspection Agency (TPI) shall deliver to the Employer an Interim Payment Certificate for the agreed parts of the draft final statement.

46.7 **Discharge:** Upon submission of the Final Statement, the Contractor shall give to the Employer with a copy to the TPI, a written discharge confirming that the total of the Final Statement represents full and final settlement of all monies due to the Contractor arising out of or in respect of the Contract. Such discharge shall become effective after.

- Payment is made against Final Payment Certificate.
- Performance security amount / bank guarantee is returned to the Contractor.

46.8 **Final Payment Certificate:** The Employer shall issue the final payment certificate to the Contractor within 28 days after receipt of the final statement and the written discharge. The certificate will state :

i) The amount which, in the opinion of the Engineer, is finally due under the Contractor or otherwise and

ii) After giving the credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled in accordance with clause 49 (Liquidated damages) of these Conditions of the Contract, the balance if any due from the Employer to the Contractor or vice versa as the case may be.

46.9 **Cessation of Employers liability:** The Employer shall not be liable to the Contractor for any matter or thing arising out of or in connection with the Contract or execution of the Works, unless the Contractor shall have included a claim in respect thereof in his Final Statement and in the Statement of Completion

**47. Payments**

**47.1** 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 TPI and Engineer

- within 28 days of the date of issue of the Certificate of bill
- within 56 days of the date of the final payment certificate
- No payment of interest shall be made to the contractor for delayed payment if any.

If an amount certified is increased in a later date certificate due to corrections in previous certificates or as a result of an award from disputes review experts, Contractor shall be paid such amount only. The Contractor shall not be paid any interest upon such delayed payment.

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

**47.2** All payments shall be made in Rajkot.

**48. Taxes and duties**

The rates are inclusive of all the prevailing taxes and duties of the Central, State and Local Governing bodies prevailing on the date of award of the contract. The Contractor will have to pay all such taxes and duties for the performance of this Contract. The contractor shall have to quote their rates including GST and other taxes and the Invoice has to be submitted accordingly, failing which, such amount will be deducted from the bill of the agency and deposited accordingly.

The contractor shall keep himself fully informed of all acts and laws of the Central & State and local Governing bodies, all orders, decrees of bodies, tribunals having any jurisdiction or authority which in any manner affect those engaged or employed and anything related to carrying out the work. All the bye-laws laid down by RMC/RUDA and any other local bodies while executing the work shall be adhered to. All taxes of local bodies shall be borne by the contractor. The contractor shall arrange to give all notices required by any authority and to pay to such authority all the fees that may have to be paid for the material, plants, equipments etc. The contractor shall also adhere to all

traffic restrictions notified by the local authorities. He shall protect and indemnify the Owner and its officials & employees against any claim or liability arising out of violations of any such laws, ordinances, orders, decree, whether by himself or by his employees or his authorized representatives. Nothing extra shall be payable on these accounts.

**48.1 Labour Welfare cess:**

As per circular No. GHR/2005/04/CWA/2004/841/M-3 dt. 3/1/05 and G.R. No.CWA/2004 1831-M(3) dt. 9/12/05 issued by G.O.G. 1 % cess tax (non-refundable) shall be deducted from every bills which shall be deposited to Govt. Labour Department for Labour welfare fund.

**49. Currencies**

All payments shall be made in Indian Rupees.

**49.1 Price adjustment**

No price adjustment is applicable for any item of work under this contract.

**50. Price Variation**

No price variation is applicable for any item of work under this contract.

**51. Retention**

51.1 The Employer shall retain from each payment against Interim Payment Certificate issued by the TPI to the Contractor 5% amount of the sum of value of work done.

This retention shall continue until the sum of amounts thus retained reaches to 5 % of the contract sum.

51.2 The retention money will not normally be due for payment until the completion of the entire work and till such period of the work has been finally accepted by the corporation and a completion certificate issued by the corporation.

**52. Liquidated Damages**

52.1 If the Contractor fails to complete the work or designated part thereof within the stipulated completion date for the work or for the part, he shall pay liquidated damages at (0.10%) zero point one zero percentage of contract price for uncompleted work per day subject to a maximum up to ten percentage of contract price or as decided by Municipal Commissioner.

52.2 The Contractor shall complete one-sixth quantum of work within one fourth period, four-tenth quantum of work within one-half period and eight-tenth quantum of work within three-fourth period, failing which, the Contractor shall

- be liable to pay liquidated damages an amount as specified above, or as decided by Municipal Commissioner.
- 52.3 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 or from any other of his obligations and liabilities under the contract.
- 52.4 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 hereof.
- 52.5 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 Completion Date (for the whole of the works 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 payments due to the Contractor. Payment of liquidated damages does not affect the Contractor's liabilities.
- 52.6 If the 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.

**53. Securities**

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

**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 the 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 When the whole of the Works have been substantially completed and have satisfactorily passed any Tests on Completion prescribed by the contract, the Contractor may give a notice to that effect to the Engineer accompanied by a written undertaking to finish with due expedition any outstanding work during the Defects Liability Period. Such notice and undertaking shall be deemed to be a request by the Contractor for the Engineer to issue a Taking over Certificate in respect of the works. The Engineer shall, within 21 days of the delivery of such a notice, either issue to the Contractor with a copy to the Employer, a Taking over Certificate, stating the date on which, in his opinion, the Works were substantially completed in accordance with the Contract, or give instructions in writing to the Contractor, specifying all the work which, in the Engineer's opinion, is required to be done by the Contractor before the issue of such certificate. The Engineer shall also notify the Contractor of any defects in the works affecting substantial completion that may appear after the instruction and before completion of the works specified therein. The Contractor shall be entitled to receive such taking over certificate within 21 days of completion, to the satisfaction of the Engineer, of the Works so specified and remedying any defects so notified.

56.2 Taking over of sections or parts:

Similarly, in accordance with the procedure set out in the sub clause 56.1, the Contractor may request and the Engineer shall issue a Taking over certificate in respect of:

56.2.1 Any section in respect of which a separate Time for Completion is provided in the Contract data,

56.2.2 Any substantial part of the permanent works, which has been both completed to the satisfaction of the TPI and Engineer, otherwise than provided for in the contract, occupied or used by the Employer, or

56.2.3 Any part of the permanent works, which the Employer has elected to occupy or use prior to completion. The Contractor shall be deemed to have undertaken to complete with due expedition any outstanding work in that part of Permanent Works during the Defects Liability Period.

**56.3 Surfaces requiring reinstatement:**

Any ground or surface requiring reinstatement at the time of issue of Taking over Certificate for the whole of the works shall be reinstated by the Contractor without any extra costs even if the Engineer has issued a Taking over Certificate in respect of section or part work wherein is included such ground or surface requiring reinstatement.

**56.4 Defects Liability:**

56.4.1 "Defects Liability Period" as stated in the Contract data means the period calculated from:

- i. The date of completion of the works certified by the Engineer in accordance with Clause 56.1 and its sub clauses of these Conditions of Contract.
- ii. The respective dates in case different dates of completion of the part works are certified by the Engineer.

56.4.2 Completion of outstanding work and remedying defects:

- a) The Contractor shall complete the outstanding work with due diligence all such work as listed by the Engineer at the time of issue of "Taking over Certificate "and also
- b) Execute all such work of amendment, reconstruction and remedying defects, shrinkages or other faults as the Engineer may, during the Defects Liability period or within 14 days of its expiration, as a result of an inspection made by or on behalf of the Engineer, prior to its expiration, instruct the Contractor to execute.

56.4.3 Costs of remedying defects: Costs of all works referred to in clause e above shall be borne by the Contractor, unless otherwise expressly stated in the contract.

**57. Claims:**

57.1 Notice of claims: Notwithstanding any other provision of the Contract, if the Contractor intends to claim any additional payment pursuant to any Clause of

these conditions or otherwise, he shall give notice of his intention to the Engineer, , within 28days after the event giving rise to the claim has first arisen.

- 57.2 Contemporary records: Upon the happening of the event referred to in sub clause 57.1 the Contractor shall keep such contemporary records as may reasonably necessary to support any claim he may subsequently wish to make. Without necessarily admitting to Employers liability, the Engineer shall, on receipt of a notice under sub clause 57.1 inspect such contemporary records and may instruct the Contractor to keep any further contemporary records as are reasonably and may be material to the claim of which notice has been given. The Contractor shall permit the Engineer to inspect all records kept pursuant to this sub clause and shall supply to him copies thereof as and when the Engineer so instructs.
- 57.3 Substantiation of claims: Within 28 days or such other reasonable time as may be agreed by the Engineer, of giving notice under sub clause 57.1 the Contractor shall send to the Engineer an account giving detailed particulars of the amount claimed and the grounds upon which the claim is based. Where the event giving rise to the claim has a continuing effect, such account shall be considered to be an interim account and the Contractor shall, at such intervals as the Engineer may reasonably require, send further interim accounts giving the accumulated amounts of the claim and any further grounds on which it is based. In cases where interim accounts are sent to the Engineer, the Contractor shall send a final account within 28 days of the end of the effects resulting from the event.
- 57.4 Failure to comply:  
If the Contractor fails to comply with any of the provisions of sub clauses 57.1, 57.2,57.3 above, in respect of any claim which he seeks to make, his entitlement to payment in respect thereof shall not exceed such amount as the Engineer or any arbitrator or arbitrators appointed pursuant to sub clause 31.1 of ITB assessing the claim considers to be verified by contemporary records (whether or not such records were brought to the notice of the Engineer as required under sub clause 57.2 and 57.3)
- 57.5 Payment of claims: The Contractor shall be entitled to have included in any interim payment certified by the Engineer pursuant to clause 57 such amount in respect of any claim as the Engineer, after due consultation with the Employer and the Contractor, may consider due to the Contractor provided that the



Contractor has supplied sufficient particulars to enable the Engineer to determine the amount due. If such particulars are insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payment in respect of such part of the claim as such particulars may substantiate to the satisfaction of the Engineer. The Engineer shall notify the Contractor of any determination made under this sub clause, with a copy to the Employer.

**58. Operating and Maintenance Manuals**

58.1 If "as built" Drawings and/or operating and maintenance manuals are required, the contractor shall supply them.

**59. Termination**

59.1 The Employer or the Contractor may terminate the Contract if the either party causes a fundamental breach of the Contract.

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

- a. The Contractor stops work for 14 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Engineer;
- b. The Engineer instructs the Contractor to delay the progress of the Works and the instruction is not withdrawn within 28 days;
- c. The Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;
- d. A payment certified by the Engineer is not paid by the Employer to the Contractor within 90 days of the date of the Engineer's certificate.
- e. 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;
- f. The Contractor does not maintain a security which is required;
- g. The Contractor has delayed the completion of works by the number of days for which the maximum amount of liquidated damages becomes payable as defined in the Contract data;
- h. If the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in the executing the Contract.

- i. 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."

- 59.3 When either party to the Contract gives notice of a breach of contract to the Engineer for a cause other than those listed above, the Engineer shall decide whether the breach is fundamental or not.
- 59.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.
- 59.5 If the Contract is terminated the Contractor shall stop work immediately, make the Site safe and secure and leave the Site as soon as reasonably possible and handover the site to the Employer including all materials and plant and equipment existing thereupon.
- 59.6 If Contractor fails to carry out the work in timely manner as mentioned in clause 52 (Liquidated damages), Rajkot Municipal Corporation may give notice in writing to the Contractor to expedite the progress of work, so that the work can be completed as per time schedule. If Contractor fails to expedite the progress of work within 14 days, Rajkot Municipal Corporation may terminate the contract and forfeit the security deposit and debar the Contractor for three years and the remaining work will be executed through other agency at the risk and cost of the Contractor.

## **60. Payment upon Termination**

- 60.1 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.

- 60.2 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 costs of protecting and securing the Works and less advance payments 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.

**61. Default of Contractor:**

- 61.1 If the Contractor enters into voluntary or involuntary bankruptcy, liquidation or dissolution or becomes insolvent, or makes an arrangement with, or assignment in favor of, his creditors, or agrees to execute the contract under a committee of inspection of his creditors, or if a receiver, administrator, trustee or liquidator appointed over any substantial part of his assets, or if, under any law or regulations relating to reorganization, arrangement or readjustment of debts, proceedings are commenced against the Contractor or resolution passed in connection with dissolution or liquidation or if any steps are taken to enforce any security interest over a substantial part of the Contractor's assets, or if any act is done, or event occurs with respect to the Contractor or his assets which, under any applicable law has a substantially similar effect to any of the foregoing acts or events, or if the Contractor has contravened the sub clause regarding assignment and subletting or has an execution levied on his goods, or if the Engineer certifies to the Employer with a copy to the Contractor, that , in his opinion, the Contractor:
- a. Has repudiated the Contract,
  - b. without reasonable excuse has failed
    - I. to commence the Works in accordance with sub clause 17.1 or
    - II. to proceed with the Works, or any section thereof, within 28 days after receiving notice pursuant to sub clause 31.3 and 31.4,

- III. to comply with a notice issued pursuant to sub clause 40 within 41 days after having received it, or an instruction issued pursuant to sub clause 38 despite previous warning from the Engineer, in writing, is otherwise persistently or flagrantly neglecting to comply with any of his obligations under the contractor,
  - IV. has contravened sub clause regarding sub-contracting, then the Employer may, after giving 14 day's notice to the Contractor, enter upon the site and the Works, and terminate the employment of the Contractor without thereby releasing the Contractor from any of his obligations or liabilities under the contract, or affecting the rights and authorities conferred on the Employer / Engineer by the Contract,, and may complete the works, or employ any other contractor to complete the Works. The Employer or such other contractor may use the Contractor's equipment, Temporary Works or materials he or they may think proper.
- 61.2 Assignment of benefit of agreement: Unless prohibited by law, the Contractor shall, if so instructed by the Engineer, within 14 days of such entry and termination referred to in clause 61.1 above assign to the Employer the benefit of any agreement for the supply of any goods or materials or services and/or for the execution of any work for the purposes of the contract, which the Contractor may have entered into.

**62. Release from Performance due to Contractor's default**

- 62.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Engineer or the Contractor the Employer 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 afterwards to which commitment was made.

62.2

**F. General Description and Scope of Work****63 Scope of work, Planning and Site Condition**

## 63.1 Location of the Site

The Rajkot Municipal Corporation has planned to **CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) UNDER PASS ON KALAWAD ROAD CROSSING AT 150' RING ROAD JUNCTION IN RAJKOT.**

The scope of work and explanatory notes given are neither complete nor exhaustive but are added to assist the contractor to understand the project. The detail scope is as described in the schedule B and specifications. However any item of work required to be carried out for proper and satisfactory completion of work with the highest standard of workmanship is deemed to be included in the scope of work whether or not it is specifically included in the schedule B.

## 63.2 Bench Mark

63.2.1 Standard Pucca RCC bench marks of required numbers shall have to be established by contractor on both the ends on each bank sides before commencement of the work or connected to the nearest GTS bench mark according to which, whole work shall be carried out. The contractor shall establish reference benchmark at intermediate suitable spots with reference to these benchmarks or as may be directed. The maintenance of all these BM, till completion shall be the responsibility of the contractor.

63.2.2 Alignments of bridge and other components have not been fixed at site by the RMC. The contractor has to establish the correct position thereof precisely on site, with respect to the co-ordinates given by RMC shown in the General Arrangement drawing and as may be indicated by the Engineer.

63.2.3 The contractor shall be solely responsible for the true and proper setting out of the alignments and for the provision of all necessary instruments, at any time during the execution of the work. In case of any error regarding location, levels, dimensions, or alignment of any part of the work, the contractor on being required to rectify such errors as may be pointed out by the Engineer, shall at his own expense do so, to the satisfaction of the Engineer. The checking of any setting out of any line or level by the Engineer or his representative shall not, in any way, relieve the contractor of his responsibilities for the correctness thereof.

The contractor shall carefully protect and preserve all benchmarks, site nails, pegs, reference pillars and other measures used in setting out of the work.

#### **64 Climatic Conditions**

It shall be deemed that the contractor has satisfied himself to the nature and location of the work, general and local conditions and particularly those pertaining to transport handling and availability and storage of materials, availability of labour, weather conditions, that he has estimated his cost accordingly and the client will bear no responsibility for the lack of such knowledge of site conditions and also consequences thereof, to the bidder. The information and the data shown in the drawings and mentioned herein and elsewhere under the contract are furnished for general information only and the client in no case will be held responsible for the strict accuracy thereof or any deductions, interpretations or conclusion drawn there from by the contractor.

The climate in this region is moderately hot. The monsoon depends upon the advent of the south -west wind but the normal rainy season commences from early June and lasts up to early October in this region. Occasionally, shower may be expected even earlier. There is generally no rain beyond October though some stray showers may be experienced. The yearly average rainfall in the area is about 550 – 1000mm.

#### **65 Availability of Labour**

Unskilled labour may be available locally and skilled labour may also be available locally or in the immediate city area for the work of this type and magnitude.

#### **66 Marketing Centers**

Nearest marketing centers for daily necessity situated near the work site.

#### **67 Housing, Water Supply and Drainage etc.**

Housing accommodation on hire is likely to be available in this area around the site. The contractor has to make his own arrangements for the housing of laborers. The land required for setting up batching plant, stacking of materials, site office will be arranged by contractor. Water Supply for drinking purposes and construction purpose at the site shall also have to be arranged by the contractor at his own cost as may be required. The water can be by drilling bore hole with prior approval of authority.

**68 Facilities**

Nearest Railway Station is Main Railway Station, Rajkot from the work site. A post office is also available at Junction Road. The nearest airport is Rajkot Airport at a distance of about 5.0 km from city area.

**69 Materials**

69.1 All materials Plant and equipment and workmanship shall be:

- a) Of the respective kinds described in the contract and in accordance with the Engineers instructions and
- b) Subjected from time to time such tests as the Engineer may require at place of manufacture, fabrication or preparation, or on the Site OR at such other place or places as may be specified in the contract or at all or any of such places.

69.2 All Contractors materials, plant, machinery and equipment shall be deemed to have been exclusively brought to site for the execution of the works and shall not be removed from site without the consent of the Engineer.

69.3 Employer shall not be liable for damage to Contractors equipment at any time unless otherwise expressly stated in the contract.

69.4 The Contractor shall not bring on the site any hired Contractors equipment unless there is an agreement for the hire thereof which contains a provision that the owner will hire such Contractors hired equipment to the Employer in the event of the termination of the contract between the Employer and the Contractor. The terms of hire in such case will be same as that between the owner and the Contractor in all respects when the contract was in force. Moreover the Employer shall be authorized to allow other Contractors to use such hired equipment without any objections from the bidder.

69.5 The costs of hire by the Employer of the Contractors hired plant and equipment as detailed in clause 69.4 above shall be properly paid by the Employer to the owner of the plant, machinery and equipment.

69.6 The provisions of the sub clauses 69.2, 69.3, 69.4 and 69.5 shall be applicable to the subcontractors appointed by the Contractor in accordance with this contract.

69.7 All the above sub clauses 69.2, 69.3, 69.4, 69.5 and 69.6 do not in any way imply approval to any kind of materials used in the works.

69.8 The coarse aggregates for concrete works shall be procured from approved quarries only (black trap chippings) confirming to IS 383 and as per MORTH. The

suitability of the same for the required quality, quantity, transport facilities for the same etc. maybe ascertained by the tenderer themselves before tendering and rates be quoted accordingly. Gravel shall not be permitted. The source of fine aggregate (Sand) should be responsibility of contractor.

69.9 All samples shall be supplied and tested by the contractor at his own cost.

69.10 The cost of all tests shall be borne by the Contractor except the tests that are required by the Engineer are clearly beyond the Contractor's obligations of proving the quality and workmanship standards of all materials, equipment, plants and Works. The Engineer shall determine the costs and time effects of such tests that are not a part of the Contractor's obligations.

69.11 The contractor will have to make his own arrangement for plants, equipments, and machinery to be used in the execution of this work well in time after award of the contract and as per work program given by him.

69.12 Contractor shall give Engineer a 24 hours notice for inspection of works or witnessing of test. The Contractor shall proceed with the works or tests in case the Engineer does not attend. Such tests shall be deemed to have been carried out in the presence of the Engineer.

The Engineer may reject such material, plant, part of the works which are defective and/ or otherwise not in accordance with the contract and notify the Contractor. The notice shall state the Engineer's objections and reasons. The Contractor shall then promptly rectify the defect or ensure that rejected materials or plant are not used in the Works and the same shall be removed from site with immediate effect. In case the Contractor wishes to retest such materials, plant or works declared defective by the Engineer, he has to bear the time and cost effects of such retests as mutually agreed with the Employer in consultation with the Engineer.

69.13 Contractor will have to pay the levies charges as amended from time to time. Random checking from approved local laboratory also shall be made as per the instruction of the Engineer and results be submitted at the contractor cost. Only screened sand shall be used. Whenever to the opinion of the Engineer the sand needs washing, the same shall be done at contractor's cost. The source of sand should be responsibility of contractor and contractor has to get approval from engineer in charge.



69.14 The contractor shall have to make his own arrangement to get the power supply from concerned electric authority. The cost of electrical charges is to be borne by contractor including for service road for traffic safety.

## **70 Labour Employment**

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

70.2 Contractor shall furnish the Engineer every week during the progress of the works, classified weekly returns of the number of the people employed on the work during the week. The report of skilled and unskilled labour shall be given in the prescribed form.

70.3 The contractor shall strictly observe all the requirements laid down in the contract labour (Regulation and Abolition) Act, 1979 and the contract labour (Regulation and Abolition) (Gujarat) Rules, 1972 and other acts as amended from time to time so far as applicable from time to time. The contractor, if directed by the Engineer shall increase or decrease the strength of the labour both skilled and unskilled required for the work. The contractor shall also furnish the following returns.

- a) A Weekly medical report showing the health of the contractor's labour camp (skilled or unskilled) and the number and the nature of their illness:
- b) A report of any accident, which may have occurred, within 24 hours of its occurrence.
- c) To maintain hygienic condition in labour camp and construction site as per the rules and regulation of authority and health department.
- d) As it is repeated in (b) above
- e) Not to import, sell give or barter alcoholic liquor or drugs.
- f) Not to import, sell give or barter arms and ammunition.

## **71 Program Through Net Work Technique**

71.1 The contractor shall furnish a complete Bar Chart considering all activities right from the award of work to mobilization at site, procurement of materials, machinery's /equipments/ labour etc. for completion of the work in all respects and get it approved from the Engineer, latest within two weeks after issue of notice to proceed with work. This shall form part of the contract agreement. This

program will be reviewed by the Engineer, in consultation with the contractor every month to assess the shortfall and to decide actions to be taken.

71.2 The contractor shall further abide by the following instruction:

a) The contractor shall cooperate fully for clarifying or evaluating schedule and also for ensuring control or monitoring the progress of the work, as per approved schedule from time to time.

b) The contractor shall Endeavour to minimize revision of the program as far as possible after the work gets into the construction.

c) The contractor shall immediately inform the Engineer whenever there is or there is likely to be, any change in his schedule.

d) In case of a schedule slippage due to the contractor's inability to perform as contracted, the contractor shall immediately take such action as may be necessary to bring back his work to schedule without additional cost to the Client, either by employing over time operations, increasing the number of shifts, capacity of equipments etc. or as directed by the Engineer.

## **72 Foreign Exchange Requirement**

It should be clearly understood that no foreign exchange sanction would be made available for either purchase of equipments, plants, machinery's, material of any kind or any other thing, required for execution of the work. It should also be clearly understood that no request for importing equipments, materials, plants, etc. that may be required in carrying out the work shall be entertained.

## **73 Relation with Public Authorities**

The contractor shall comply with all obligations arising out of legal orders and directions that may be given to him from time to time, by any local or public authorities and shall pay out of his own money, all charges becoming payable touch authorities. He shall co-ordinate his activities during execution, with all agencies including RMC, Design Consultants, construction management consultants, agencies like PGVCL( Paschal Gujarat Vim Company Limited), RMC (Rajkot Municipal Corporation), RUDA (Rajkot Urban Development Authority), Government of Gujarat, Central Government, Railway Authority, Telephone departments and their representatives without any dispute.

**74 Register to be Maintained**

## 74.1 Cement Register

A register in prescribed form, giving details regarding day to day receipts of cements procured by the contractor, consumption in work and balance available on the site, will be maintained at the work site by the contractor. This register shall invariably be signed daily by the contractor or his authorized representative in token of its correctness and shall be made available to Engineer whenever asked, for his verification of every entry made, regarding procurement by the contractor and consumption of these materials in execution.

## 74.2 Inspection Records and Registers:

Contractor/s shall maintain accurate records, plans and charts shows the dates and progress of all main operations and the Engineer shall have access to this information at all reasonable times. Records of tests made shall be handed over to the Engineer after carrying out the tests.

## 74.3 Site Order Register

The Contractor/s shall promptly acknowledge and note by signing in the register the orders given in Site Order Register by the Engineer or his representative or his superior officers and comply with them. The Contractor/s shall report the compliance to the Engineer within reasonable time so that it can be checked.

## 74.4 Steel Register

This register will record the receipts of steel items and details of reinforcement and members wherever steel is used.

## 74.5 Labour Register

This register will be maintained to show daily strength of labour in different categories employed by the Contractor/s.

## 74.6 Log Book of Events

All events are required to be chronologically logged in this book shift wise and date wise. The representative of the Engineer will sign and the contractor will have to sign. The register Performa, charts, etc. will be property of the RMC.

74.7 Any other register considered necessary by the Engineer shall be maintained at site in which the representative to the Engineer and the Contractor/s will have to sign. All registers, program, charts etc. will be the property of the RMC.

74.8 Sampling and Testing

74.8.1 Contractor shall make all arrangements for collection & transportation from site and testing of samples in sufficient quantities as required and provided in relevant IS code at the laboratory approved by the Engineer. All these will be at no extra cost to the client.

74.8.2 A register in prescribed Performa showing test results of materials and work tests will be maintained at the site of work by the contractor and every entry thereof shall invariably be signed by the contractor or his representative and also by Engineer or his authorized representative in token of its correctness.

74.9 The Contractor Shall Further Abide by the Following Instructions

74.9.1 Soon after receipt of work order awarding the contract, the Contractor for all purposes connected with the execution of work, shall immediately make his own arrangements for obtaining Electricity supply and required supply of water in such quantity and of such quality at such places on the work as may be necessary, by paying charges to the authorities supplying the same after completing all formal procedures as may be required as per the rules with them. The rates quoted in the tender are for completed items of work and shall cover cost of water and electricity as aforesaid. Water for drinking purposes for laborers etc. shall also have to be arranged by the contractor at his own cost. No cost shall be borne by client on this account. RMC shall not be responsible in any way for this purpose. However, the tenderer will be given all possible assistance in the procurement of these requirements but no assurance can be given.

74.9.2 The bidder must clearly understand that the rates quoted are for completed items of work and as such includes all costs associated with labour, materials, Wastage if any scaffoldings, plants, equipment, supervision, survey works, power, water., sales tax /income tax, and other taxes including turn over work tax, duties and any other requirements contingent upon and needed to carry out the construction. The income tax will be deducted from the running account bill as per rules.

74.9.3 No claim by the contractor for additional payment will be allowed on the ground of any misunderstanding or misapprehension in respect of technical interpretations of conditions or any such matter or otherwise on the ground of any allegation of fact that incorrect information was given to him in the tender or by any person, whether in the employment of the client or consultant or of the

failure on his part, to obtain correct information. The bidder shall not be relieved of any risks or obligations imposed upon or undertaken by him, under the contract, or any such ground or on the ground that he did not or could not foresee any matter, which may in fact, affect or have affected the execution of the work

## **75 Equipment and Accessories**

75.1 Slurry Preparation and Testing Equipment Tanks of suitable sizes and slurry pumps of suitable capacity should be used for storage, mixing and circulation of Betonies slurry at a site. A separate water pump may be used for water supply to slurry tank. Equipment for sampling the slurry from deep trenches and testing its concentrations, viscosity, pH value and hardness of ground water in which the betonies slurry and concrete are prepared, should also be used. The testing of slurry after contamination with soil or cement indicates the need of disposal or reuse as the case may be. Vibrating screens, hydro cyclones, and centrifuges for cleaning the Betonies slurry for reuse may be employed.

### **75.2 Concreting Equipment**

Concrete batching plant, shall be of requisite capacity to maintain the required progress of work. The equipment shall be capable of determining accurately by direct weighing, prescribed amount of the various ingredients viz. Cement, sand, aggregates Plasticizer and the combination of material in the mixer shall give a uniform mix within the prescribed time and discharging the mix without segregation. Equipment and its operations shall be all times to subject to approval of the Engineer.

The contractor shall provide all the equipment and any other ancillary equipment, required for checking the performance of measuring and mixing device and shall make tests as and when ordered by the Engineer to his satisfaction. The contractor shall make such adjustment, replace or replacement as may be necessary to meet the requirement of accuracy satisfaction of Engineer.

The necessary equipment shall be provided for conveying the concrete from mixer to the placing site as rapidly as practicable method. Concreting shall be done by tremmie pipes of suitable length and size and concrete pouring devices

(mechanical) should be used. The lifting arrangement for gremmie pipes should be capable of doing the work with desired speed.

#### 75.3 Lifting Devices

The mobile cranes to be used for handling, shifting and erection of precast girders should be of adequate capacity.

#### 75.4 General Guidelines

Choice of rotary, percussion, grabbing equipment, and equipment for direct or reverse mud circulation, etc, shall be made to suit the soil conditions. Vibrations and noise produced during construction should not have any damaging effect on the people and existing structures. Consideration shall be given in selection of equipment when they are required to work on a site with restricted space or head room.

#### 75.5 Compliance with statutes and regulations:

The Contractor shall comply with all statutes, regulations, laws and byelaws, ordinances of the Central and State governments and local governing bodies.

The Contractor shall keep the Employer indemnified against all penalties and liability of every kind for breach of any such statutes, ordinances and laws. The Employer shall be responsible for the permissions required for the works to proceed.

### **76 Patent rights**

The Contractor shall save harmless and indemnify the Employer from and against all claims and proceedings for or on account of infringement of any patent rights, design trademark or name or protected rights in respect of Contractors equipment, material or Plant used for or in connection with incorporation in the Works.

### **77 Royalties**

The Contractor shall pay all royalties for getting construction materials required for the Works.

### **78 Urgent Remedial work:**

If, by reason of any accident, or failure, or other event occurring to, in, or in connection with the Works, or any part thereof, either during the execution of the Works, or during defects liability period, any remedial or other work is, in the

opinion of the Engineer, urgently necessary for the safety of the Works and the Contractor is unable or unwilling at once to do such work, the Employer shall be entitled to employ and pay other persons to carry out such work as the Engineer may consider necessary. If the work or repair so done by the Employer is work which, in the opinion of the Engineer, the Contractor was liable to do at his own cost under the Contract, then all costs consequent thereon or incidental thereto shall, after due consultation with the Employer and the Contractor, be determined by the Engineer and shall be recoverable by the Employer from the Contractor, and may be deducted by the Employer from any monies due or to become due to the Contractor and the Engineer shall notify the Contractor accordingly, with a copy to the Employer. Provided that the Engineer shall, as soon after the occurrence of emergency as may be reasonably practicable, notify the Contractor thereof.

**79 Special Risks :**

79.1 The Contractor shall be under no liability whatsoever in consequence of any of the special risks referred to in sub clause 79.5 whether by way of indemnity or otherwise, for or in respect of :

79.2 Destruction or damage to work, except defective works to be removed and rectified, prior to the occurrence of the said special risks.

79.3 Destruction of or damage to property, whether of the Employer or third parties or Injury or loss of life, not caused by negligence of the contractor and even after following all the safety norms by the Contractor.

79.4 The special risks are as defined in sub clause 11.1 of these conditions. Destruction caused by a projectile, missile or bomb is also included in special risks.

79.5 The Contractor shall be entitled to payment in accordance with the Contract on account of damages covered under special risks as stated in clause 79.4 for any permanent work executed and for any material or plant so destroyed or damaged as required by the Engineer or as necessary for the completion of the works. The payment shall be for

- i. Rectifying any such destruction or damage to works
- ii Replacing or rectifying such materials or Contractor's Equipment.

And the Engineer shall determine an addition to the Contract Price in accordance to the sub clause 43 of these conditions, and shall notify the Contractor accordingly with a copy to the Employer.

The Contractor shall inform by giving notice to the Engineer with a copy to Employer, as soon as events covered by special risks occur and the cost implications of these.

79.6 The Contractor shall use his best endeavors to complete the execution of Works in the event of outbreak of war in any part of the world.

79.5 In case the Employer chooses to terminate the contract on account of the outbreak of war, the Contractor shall remove his plant and machinery from site diligently. Similar facility shall be extended to the sub contractors.

79.6 In the event of termination of contract on account of outbreak of war, the Contractor shall be entitled to payment towards the following items apart from other payments due as per conditions of contract

79.7 Sum being the amount of any expenditure reasonably incurred by the Contractor, in the expectation of completing the whole of the works, in so far as such expenditure has not been covered by any other payments.

79.8 Proportionate demobilization costs towards manpower and machinery and plant.

## **80. Force Majeure**

Neither party shall be liable to the other for any loss of damage occasioned by or arising out of acts of god, and in particulars, unprecedented Floods, volcanic eruption earth quake or other convulsion of nature, and other acts such as but not restricted to general strike, invasion, the act of foreign countries, hostilities or war like operations before or after declaration of war, rebellion, military or usurped power which prevent performance of the contract and which could not have been for seen or avoided by a prudent person.

## **81 Release from performance**

If any circumstances outside the control of both the parties arises after the issue of the Letter of Acceptance which renders it impossible or unlawful for either or both parties to fulfill his or their contractual obligations, or under the law governing the Contract the parties are released from further performance, then the parties shall be discharged



from the Contract, except as to their rights under this clause and sub clause 23 and without prejudice to the rights of either party in respect of any antecedent breach of the Contract, and the sum payable by the Employer to the Contractor in respect of the work executed shall be the same as that which would have been payable under clause 60 if the Contract had been terminated under the provisions of Clause 59.

## **82 Changes in Cost and Legislation**

There shall be no addition or deduction from the Contract Price due to changes to any National or State Statute, Ordinance, Decree, Law, Regulation or byelaw. The adjustment to Contract Price affected under various sub clauses detailed in clause 41 shall be deemed to cover such costs.

## **83. Safety aspects**

83.1 The Contractor shall take all reasonable steps to protect the environment on and off the site and avoid damage or nuisance to persons or property of the public and others arising as a consequence of his method of operation.

83.2 The Contractor shall maintain in good condition all work throughout execution, completion and defects liability period. The contractor shall be responsible for and to make good all injuries, damages and repairs, rendered necessary by fire, rain, traffic, floods or other causes

83.3 The Contractor shall be responsible for maintenance and watch and ward of the complete installation and shall also be responsible for any pilferage, theft, damage, penalty etc. in this regard. The Contractor shall indemnify the Engineer against any claim arising out of pilferage / theft, damage, penalty etc. whatsoever on this account. Security deposit for the work shall be released only after the clearance is obtained from the local authorities from whom temporary electric/ water I telephone connection have been obtained by the contractor.

83.4 The Contractor shall depute Engineers & skilled workers as required for the work. Necessary protective and safety equipment shall be provided to them by the Contractor at his own cost and used at site.

**83.5 Security & Traffic Arrangements**

In event of any restriction being imposed by the Security Staff of The Employer, Rajkot Municipal Corporation traffic or any other local governing body having control over the project, on the working or movement of labour, materials, the Contractor shall strictly follow all such restrictions or instructions issued regarding the same and nothing extra shall be payable to the Contractor on account of such restrictions or instructions. In case of loss of time on this account if any, shall have to be made up by generating additional resources etc.

General security restrictions are given as under:

- i. The movement of trucks and vehicles shall be regulated in accordance with rules and regulations as approved by competent authorities.
- ii. The Contractor shall inform in advance, if required, the truck registration numbers ownership of the trucks, names and addresses of the drivers for necessary action by the security agency.
- iii. As and when there will be security requirements, certain additional restrictions can be imposed as per the requirement of the situation.
- iv. No claim whatsoever will be entertained by the Employer on account of any restriction that can be imposed as per the requirement of the situation.

**ELECTRICAL WORK****Scope of work:**

1.1 The Contractor's scope of work covers supply, installation, commissioning and testing of the complete Electrical installation as specified in material specification and bills of quantities.

**2.0 Location:**

2.1 The works are to be carried out for **Rajkot Municipal Corporation**, a Project of **CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) UNDER PASS AT KKV ON KALAVAD ROAD AT RAJKOT CITY**. All electrical equipment and gear shall be designed for an average ambient of 45°C. with a peak of 50°C.

**3.0 Drawings, Specifications & Deviations:**

3.1 The drawings and specifications lay down minimum standards of equipment and workmanship. Should the tenderer wish to depart from the provisions of the

specifications and drawings either on account of manufacturing practice or for any other reasons, he should clearly draw attention in his tender to the proposed points of departures and submit such complete information, drawings and specifications as will enable the relative merits of the deviations to be fully appreciated. In the absence of any deviations, it will be deemed that the tenderer is fully satisfied with the intents of the specifications and drawings and their compliance with the statutory provisions and local codes.

3.2 In case of any discrepancy between the drawings and specifications or any other tender documents, the tenderer shall assume the more stringent of the two and furnish his rates accordingly.

3.3 The Contractor shall prepare fabrication and working drawings and all work shall be as per the approved working drawings. Approval of drawings does not relieve the Contractor of his responsibility to meet with the intents of the specifications. All such drawings for approval shall be in duplicate.

#### **4.0 Tools and Spare Parts:**

4.1 All the tools, tackle, scaffolding and staging require for erection and assembly of the equipment and installation covered by the contract shall be obtained and maintained by the contractor himself. All other materials such as foundation bolts, nuts etc. required for the installation of the plant shall also be supplied and included in the contract.

4.2 Tenderer should submit the spares recommended by him for two years operation of each type of equipment covered by these specifications on completion of work.

#### **5.0 Testing & Handing over:**

5.1 The contractor shall carry out tests on different equipment as specified in various sections in the presence of representatives of clients, Architects and Consulting Engineers in order to enable them to determine whether the plant, equipment and installation in general comply with the specifications.

5.2 All equipment shall be tested after carrying out necessary adjustments and balancing to establish equipment ratings and all other design conditions. At least six sets of readings shall be taken for each item tested and submitted.

5.3 The project shall be handed over after satisfactory testing along with six sets of documentation along with two sets of soft copy each consisting of :

i) Detailed equipment data as approved by the Consulting Engineers/Employer.

- ii) Manufacturer's maintenance and operating instructions.
- iii) Set of drawings, showing plant layouts, piping, ducting, cabling etc.
- iv) Approved Test reading & certificate of local authorities.
- v) List of recommended spares.

5.4 Submission of the above documentation shall form a precondition for the final acceptance of the plant and installation and final payment.

#### **6.0 Performance guarantee:**

6.1 All equipment and the entire installation shall be guaranteed to yield the specified ratings and design conditions plus/minus 3% tolerance. Any equipment found short of the specified ratings by more than the allowable tolerance as determined by the test readings shall be rejected.

#### **7.0 Defects Liability:**

7.1 All equipment and the entire installation shall be guaranteed against defective materials and workmanship for a period of 12 months reckoned after the plant is commissioned and handed over to the clients along with the 6 sets of completion documents and In case the testing of the plant is delayed for any reason, the defects liability shall extend for a minimum period of 6(six) months from the date the test readings are accepted. During the defects liability period, the contractor shall rectify, repair or replace defective parts and components free of cost except in the case of those, which are due to normal wear & tear.

#### **8.0 Statutory Inspections:**

8.1 The contractor shall be fully responsible for meeting all the statutory obligations & local inspectorate pertaining to the works carried out by them. The contractor should prepare all working drawings and obtain approval of competent authorities and also have the equipment and installation inspected and got approved. All official fees will be paid by the clients directly against demand in writing from the appropriate authority and all other expenses for submission and approval of the various and relevant statutory/bodies shall be embodied in the tender prices.

#### **9.0 General Conditions:**

9.1 The tender shall be governed by General Conditions of Contract forming Part I of this tender. Wherever conflicting, the general conditions shall prevail.

9.2 Tenderer may indicate their comments, only as deviations from the conditions stipulated herein. Wholesale submission of their own conditions and/or printed

conditions in disregard of the conditions stipulated herein shall not be binding on this contract.

#### **10.0 Safety Precautions:**

10.1 A competent and authorized Supervisor shall be on the site whenever the contractor's men are at work. The supervisor should ensure that all plant and machinery used on the site are rendered safe for working and meets with the Indian or International safety standards applicable for the use and operation of such machinery. The supervisor should also ensure that the workmen are supplied with and made to use safety appliances such as safety belts, lifelines, helmets etc. The supervisor shall not leave the work site without permission from Employer's Project Manager or his nominee.

10.2 Smoking shall not be encouraged on the site but altogether strictly prohibited in areas where combustible and inflammable goods/materials are stored or lying about.

10.3 Any hot job such as welding, soldering, gas cutting shall not be carried out without the permission of the Engineer-in-charge. Such jobs shall not be carried out where inflammable materials are stored or lying about. All electric connections shall be through adequately sized mechanically protected cables without any joints and with proper and adequate terminals. All power supplies shall be through properly rated fuses with isolating devices. No such hot jobs shall be carried out on holidays and without the presence of the Contractor's Supervisor.

10.4 It is entirely the responsibility of the Contractor to practice the principles of 'Safety First' during the entire tenure of work with adequate insurance covering injury or death to workmen, loss by theft or damage to materials and property in position or not and third party.

10.5 The contractor should clear the site of all debris every day to avoid accidents. In case this is not done, the owners may engage necessary labour to maintain the cleanliness of the premises and removal of debris, and debit all or part of the expenditure so incurred from the contractor/s.

#### **11.0 Payment to civil contractor.**

The electrical contractor will have to pay to the civil contractor for any work done on behalf of the electrical contractor like laying of pipes, filling of zaries etc.

#### **12.0 Temporary wiring**

Whenever any temporary wiring is done, it has to be done so that all precaution for safety is taken and temporary wiring shall be also done so that, it is not hazardous to

any body. Any accidents happen because of temporary or permanent installation, it will be entire responsibility of contractor for all compensation to concern parties.

Clients, architects will not be responsible for such accidents, mistake etc.

**13.0 Compilation Drawing:**

The contractor shall to submit 6 sets of as built drawings showing substation layout, single line diagrams, circuit distribution layout, conduit layout, quantity of Junction box of wires, Distribution boards, Switch boards, Circuit mains, Mains, low voltage systems layout, security systems layout etc. complete in all respect.

**G. Special Conditions of Contract****84.0 Special Conditions of Contract**

84.1 As the work is to be constructed in heavy traffic area, Employer will not be in a position to give entire stretch of work at a time. No claim shall be entertained for the same.

84.2 If any underground utility line fouls during execution, same shall be shifted by the contractor as directed by Engineer-in-charge. No claim for time extension shall be entertained for the same.

84.3 Contractor is required to use his own national / international practices of tracing out or locate underground utilities below the ground at no cost to the Employer.

84.4 No claim shall be entertained if the items stipulated in the tender shall not be executed as per site condition/ requirements.

84.5 No idle charges shall be paid to contractor if any machinery and man power remain idle and no claim shall be entertained for the same.

84.6 Municipal Commissioner reserves the rights to reduce / increase the scope of work up to any extent without assigning reason thereof and the contractor has to execute the BOQ items at his tender rate.

84.7 If any underground cables (electric, telephone, communication, etc.), Gas line foul during execution contractor shall start work at other available work front until such cables / Gas line are shifted. No claim for time extension shall be entertained for the same.

84.8 Contractor shall have his own Automatic Computerized Batch Mix Plant of min 18 m<sup>3</sup>/hr for Ready Mixed Concrete within a 10 km radius of the site. Necessary office for RMC Engineers/TPI along with Laboratory and Testing Equipment shall be provided at plant location. The Plant shall be kept under CCTV Surveillance with remote access with

an internet connection. Designated RMC officials will be provided remote access. The entire recording will have backup.

84.9 The site will be kept under CCTV Surveillance. Cameras as per requirement will be fixed at pre-decided strategic locations with remote access with an internet connection. Designated RMC officials will be provided remote access. The entire recording will have backup.

## **85 LABOUR**

- a) The Contractor shall make his own arrangements for the engagement of all staff and labour, local or other, and for their payment, housing, feeding and transport.
- b) 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.

## **86 COMPLIANCE WITH LABOUR REGULATIONS**

During continuance of the contract, the Contractor and his subcontractors shall abide at all times by all existing labour enactment and rules made there under, regulations, notifications 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 notification that may be issued under any labour law in future either by the State or Central Government or the local authority. Salient features of some of the major labour laws that are applicable to 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 there under, 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 non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules/regulations including amendments, if any, on the part of the Contractor the Engineer or any person authorized by the Engineer shall have the right to deduct



any money due to the Contractor including his amount of performance security. The Engineer or his nominee shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage 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.

#### **87 SALIENT FEATURES OF SOME MAJOR 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 at 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 @ 12%/8.33%. The benefits payable under the Act are:
  - a. Pension to family pension on retirement or death, as the case may be.
  - b. Deposit linked insurance on the death in harness of the worker.
  - c. Payment of P.F accumulation on retirement/death etc.
- d) Maternity Benefit Act 1951:- The Act provides for leave and some other benefits to workmen/ 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 labor.

- 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 Buildings, Roads, Runways are scheduled employment.
- g) Payment 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 Remuneration 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 matters of transfers, training and promotions etc.
- i) Payment 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 up to Rs. 3500/- per month shall be worked out by taking wages as Rs. 2500/- per month only. The Act does not 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 resolution 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's (Standing Orders) Act 1946:- It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States 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 same certified by the designated Authority.
- l) Trade Unions Act 1926:- The Act lays down the procedure for registration of trade union of workmen and employers. The Trade Union registered under the Act has been 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 Labor is prohibited in Building and Construction Industry.

- n) Inter-State Migrant workmen's ( Regulation of Employment & Conditions of Service ) Act 1979:-
- o) 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 establishment to which this Act becomes applicable, are required to be provided certain facilities such as housing, medical aid, travelling expenses from home upon the establishment and back, etc.
- p) 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 2% 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 work place etc. The Employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government.
- q) Factories Act 1948:- The Act lays down the procedure for approval at plans before setting up a factory, health and safety provisions, welfare provisions, working hours, annual earned 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 more persons without the aid of power engaged in manufacturing process.

### **ELECTRICAL WORK**

#### 1. General:

The following special conditions of contract shall supplement the General Conditions of Contract, whenever there is a conflict, the provision herein shall prevail over those in the general conditions of contract.

- |    |                                    |   |                     |
|----|------------------------------------|---|---------------------|
| 2. | Amount of Bid Security EM          | : | As specified in GCC |
| 3. | Performance Bank Guarantee         | : | As specified in GCC |
| 4. | Period for Completion of the Works | : | As specified in GCC |
| 5. | Equipment & Machinery on Work Site |   |                     |

The contractor will be required to provide and maintain in working order power driven machines like welding, drilling machine, zarrri cutters, meggar, multimeter, continuity tester etc. till the completion of work.

6. The quantity for measurement will be actual quantity used in electrification:
- I) The contractor shall bear all incidental charges for the storage and safe custody of the materials at site at his own responsibility.
  - II) The contractor shall make arrangement at the site of works for safe custody of materials to protect from damage by rain, dampness, fire, theft etc.
  - III) In case any materials get damaged the contractor shall replace the same at his own cost.
  - IV) The contractor shall furnish to Engineer-in-Charge sufficiently in advance a statement showing his requirements of quantities of materials to be supplied by Owner if any and the time when he will require the same.
  - V) A day to day account of the material supplied by Owner/Contractor shall be maintained by the contractor in the agreed proforma.
7. Application codes for Specification of Electrical works shall be as per that in Material Specification and as specified in Applicable Standards.

**8. Clearance of site on completion.**

On completion of the works, the contractor shall clear away and remove from the site, surplus materials, rubbish and temporary works of every kind and leave the whole site and works clean and in workman like condition to the satisfaction of Owner at his own cost. If the contractor fails to clear the site within 15 days after virtual completion/ submission of final bill whichever is earlier, it shall forfeit all his claims and the owner may get the site cleared at contractor's cost.

**9. Scope of work**

Supply, Installing, Testing and commissioning of all kind of electrical work during the contract period as instructed by Client/Architect/Consultant with same quoted rate.

Preparing necessary drawing submitting to authorities, getting their approval / sanction and final certificate to energize the sub-station equipment's. Filling the necessary application to supply co. following up and getting the supply filling the necessary test report to the supply co. inclusive. All official / statutory fees shall be paid by clients on submission of documentary proof.

Contractor is responsible for maintaining the power factor as per rules of supply co. Cost will be debited to the contractor in case of any penalty due to low power factor by Supply Company. No credit shall be passed on to contractor if any given by Supply Company for better power factor.

- 10 Engineer In charge will provide operative instructions on regular basis related to project during contract execution period, which are not covered in this tender document. Contractor and his staff at site shall comply all these instructions.
- 11 Client's approval will be final in all concerned matters.
- 12 All correspondences between contractor and architect will be through client.
- 13 No extra payment shall be made for all above requirements.

#### **14 Minimum Criteria for selecting Electrical contractor.**

1. The Electrical contractor must be licensed Electrical contractor.
2. The Electrical contractor must have available all kind of necessary equipments at site.
3. The Electrical contractor must have completed following kind of jobs under one project head in last 3 years.
  - SITC M.V.Cabling.
  - SITC of all M.V. Switch gear panels made by CPRI approved panel vendor.
  - SITC of external lighting like poles, cables, cable trenches etc,
4. The Electrical contractor should get approval prior to appoint any sub agencies for specialized jobs. Client /Consultant/Architect have right to reject any contractor at any stage of project.
5. It is presumed that all insurance formalities & workman's compensation policy will be carry of.
6. The contractor will have to provide:
  - Minimum one senior Electrical site engineer B.E. with more then 10 years experience.

- Minimum one junior Electrical site engineer D.E.E. with more than 5 years experience.
  - All wiring person must be a supervisor level grade.
7. Emphasis will be given to the contractor venders who had already completed similar kind & Magnitude projects of similar type of renowned client / Architect.

**SECTION - II**  
**CONTRACT DATA**

**Section - III:Contract Data**

1. **Name of Work: CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) UNDER PASS ON KALAWAD ROAD CROSSING AT 150' RING ROAD JUNCTION IN RAJKOT**
2. The Employer is Rajkot Municipal Corporation  
Address: The City Engineer, Room No 9, Rajkot Municipal Corporation, West zone office, Behind Big Bazaar, 150ft Ring Road Rajkot-360001.
3. Name of authorized Representative of Employer: The Municipal Commissioner, Rajkot or his representative deputed by him.
4. The Design Consultant is:  
**DELFI Consulting Engineers (I) Pvt.Ltd**  
Address: 101 2<sup>nd</sup> floor, Shanay 1  
Opp. Shivalik Plaza,  
IIM ATIRA ROAD, Ahmedabad – 380 006  
Phone: 079-40076864.  
Email: info@delfengineersindia.com
5. Defect Liability Period: 2 Years after issue of completion certificate or otherwise stated in particular item.
6. The Start Date shall be the date of notice to proceed with the works.
7. The Completion Period for the whole of the Works shall be 15(Fifteen Months)calendar months (including monsoon period) after the start date.
8. The Site is located in Rajkot City.
9. The following document also form part of the Contract:
  1. Invitation for Bids
  2. Instruction to Bidders
  3. Qualification Information and other forms
  4. The final accepted bid of the bidder after modifications, changes, additions and alterations after mutual agreement with Employer.
  5. General Conditions of Contract
  6. Contract Data
  7. Technical Specifications
  8. Form of bid



9. Schedule B
10. Drawings
11. Documents furnished by bidder
12. Pre bid Clarification and Amendments
13. The law which applies to the Contract is the law of Union of India
14. The language of the contract document is English
15. Subcontracting is allowed only with prior permission from Engineer / Employer.
16. The Schedule of Other Contractors : Nil
17. The Schedule of Key Personnel As specified.
18. The minimum insurance cover for physical property, injury and death is Rs. 5 lacs per occurrence with the number of occurrences limited to four. After each occurrence, contractor will pay additional premium necessary to make insurance valid for four occurrences always, up to expiry of defect liability period.
19. The Site Possession Date shall be the immediate next day on award of work
20. Appointing Authority for the Dispute Review Expert - The Municipal Commissioner, Rajkot Municipal Corporation
21. The period for submission of the programme for approval of Engineer shall be 15 days from the issue of Letter of Acceptance.
22. The period between programme updates shall be 1 Month.
23. The amount to be withheld for late submission of an updated programme shall be Rs. 1, 00,000. (Rupees One Lacs)
24. The following events shall not be compensated on any account: Contractor should make its own assessment for the following aspects before bidding.
  - (i) Substantially adverse ground conditions encountered during the course of execution of work not provided for in the bidding document.
  - (ii) Removal of underground utilities
  - (iii) Significant change in classification of soil requiring additional mobilization by the contractor, e.g. ordinary soil to rock excavation,
  - (iv) Removal of unsuitable material like marsh, debris dumps, etc not caused by the contractor
  - (v) Artesian conditions
  - (vi) Seepage, erosion, landslide
  - (vii) Presence of historical, archaeological or religious structures, monuments interfering with the works

- (viii) Restriction of access to ground imposed by civil, judicial, or military authority
- (ix) Suitable arrangement for diversion of traffic.
- 25. The currency of the Contract is Indian Rupees.
- 26. Retention Money @ 5% of value of work done) will be deducted from each RA bill. It will be released as mentioned in tender.
- 27. Amount of Liquidated damages for delay in completion of works  
If the Contractor fails to complete the work or designated part thereof within the stipulated completion date for the work or for the part, he shall pay liquidated damages at (0.10%) zero point one zero percentage of contract price for uncompleted work per day subject to a maximum up to ten percentage of contract price or as decided by Municipal Commissioner.

The Securities shall be for the following minimum amounts equivalent as a percentage of the Contract Price: Performance Security for 5 per cent of contract price. Additional sums (to be decided after evaluation of the bid) as additional security in terms ITB Clause 30.0.)

- 28. The standard form of Performance Security acceptable to the Employer shall be an unconditional Bank Guarantee or DD of Nationalized OR schedule bank (except cooperative bank) in an approved format by the Employer.

**SECTION - IV**  
**WORK PLAN**  
**&**  
**TECHNICAL SPECIFICATIONS**

**SECTION – IV: WORK PLAN AND TECHNICAL SPECIFICATIONS****Table of Clauses****A. Project Feature and Work Planning**

1.0 Location of site

2.0 Scope of Work

**B. Specifications**

3.0 Technical Specifications

4.0 General Specifications

**A – PROJECT FEATURES AND WORK PLANNING****1.0 Location of the Site**

The Rajkot Municipal Corporation has planned for **CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) UNDER PASS ON KALAWAD ROAD CROSSING AT 150' RING ROAD JUNCTION IN RAJKOT**

**1.1 Scope of Work**

Main component of the Underpass are as under;

- i) Estimated cost of work –Rs. 24,57,72,000/-
- ii) Sub-structure – RCC Twin-Cell Box
- iii) Approaches –RCC Retaining Wall on open foundation
- iv) Service road Development on both sides
- v) Electrification works for Underpass & service Road
- vi) Pump & Sump Arrangement for StormWater Drainage Works
- vii) Utility Shifting Works

**1.2 Work Planning**

The tender drawing shows the schematic layout and details of the proposed Underpass along with service road.

Twin-Cell Box is proposed for the Underpass at KKV Circle. Approaches on retaining wall on open foundation are proposed on both side of the box.

The field investigation i.e. Survey and Geotechnical investigation (as & if required in addition to the supplied data) for preparing or confirming the design of open foundation shall be carried out.

- (a) Marking out of alignment of the proposed underpass.
- (b) Provide isolation / barricading to the construction area. Prepare Diversion route
- (c) Start the execution work as per the approved work schedule and as directed by the Engineer in charge.

**1.3 Special Precautions to be taken regarding existing Flyover Bridge Structure & traffic**

- i) During Construction of underpass box, the contractor has to take special precaution not to damage existing ROB's 45.00m Span's Pier Foundation & there shall be no settlement of pier Foundation.
  - a. 60.0m length twin-cell box shall be casted with open cut in rocky strata.
  - b. 60.0m length of twin-cell box shall be casted in suitable segment length as required for junction vehicular traffic movement.
  - c. For central 30.0m length of twin-cell box, excavation up to Founding RL of Box shall be done with strict control so that founding strata below existing obligatory span pier's foundation shall not be disturbed /settled.
  - d. Box-Cutting width for twin-cell box shall be only 600mm wide from outer face of wall. With necessary shoring support arrangement to excavate vertical line of rocky strata.
- ii) During Construction of Retaining walls, Special Precaution shall be taken for Service road vehicular movement.
  - a. Box-Cutting width for retaining wall shall be only 900mm wide from outer face of the stem-wall with necessary shoring support arrangement to excavate vertical line of rocky strata.
- iii) Special precautions to safely divert the traffic with smooth movement of continuous traffic should be taken up before commencing the work. Safety precaution shall be taking up as required and direct by Engineer-in-charge particularly at cross road junctions.
- iv) In addition to the normal barricading the diversion sign boards and signs showing directions etc are required to be provided, Contractor shall have to cater for following special safety measures.
  - a. Blinking electric warning red colored lights to warn the vehicular traffic of the obstruction on the road during construction activities.
  - b. Strong barricading/fencing of approved design to keep pedestrians segregated from foundation, construction equipment, material, etc.
  - c. Translucent reflectors, metallic or glass as directed by Engineer-in-Charge.
  - d. All schemes of providing safety measures shall be got approved from the Engineer-in- Charge and the concerned traffic controlling authorities.
  - e. It is essential that the contractor visits the site before submitting his offer to make him fully acquainted with the situation and to plan his activities accordingly. No subsequent claims on this account will be entertained.

**1.4 Space required for casting, stacking etc**

The contractor is advised to study the problems of stacking, storing, casting, working space, etc. Their construction methods, especially for following items should be carefully planned and shown in the methodology.

- a. Storing, stacking of materials like aggregates, steel, cement, shuttering scaffolding materials, dismantled material, etc.
- b. Planning of the equipments for batching plant, placement concreting, etc.
- c. Movement of trucks, transit mixture, cars, etc.
- d. Location of the site office store etc.
- e. Casting/Fabrication yard as required.
- f. Coordinating work activities with ongoing work.

**1.5 Concrete Mix Design**

Contractor should study all the possibilities of achieving the desired results for the concrete mixes proposed for the project. The contractor should collect the coarse and fine aggregates of the best quality. The cement used for this type of concrete should be got tested periodically and should not be more than 3 months old. The contractor may study the possibility should of adding the necessary plasticizers and ad-mixtures to achieve this strength with desired workability and finishes without affecting durability and damaging the reinforcement and high tensile steel. The cost for any plasticizer admixtures shall be borne by contractor.

**1.6 Design of sub-structure and foundation in Approaches**

The design of substructure and the foundations has been based on the soil investigation data. The design is however, tentative to the extent that this information may be at variance with the actual foundation conditions met during construction. Necessary changes would be made in the design of foundation & substructure for the change data. The variation in the superstructure, sub-structure and foundations will not vitiate the contract and the work will be carried out at quoted rates according to the details furnished to the contractor during execution of the work. The contractor has to confirm the strata, SBC, etc. mentioned in the execution drawing by the required tests and if any changes are found, the same shall be brought to the notice of the Engineer in charge. The necessary actions required for the same shall be carried out in consultation with the Engineer in Charge/design consultant. No extra payment shall be made for the same. The arrangement for box and approach portion shown is tentative and may be changed if any underground services are encountered and is fouling with the foundation. The diversion of any services required to be done will be done separately. The contractor will be required to provide temporary supports during the period of construction to the services before

and after diversion as directed by the Engineer-in-charge. It shall be deemed to be part of the contract and no extra payment shall be made for the same.

### 1.7 Setting out Works

The contractor shall be responsible for the true and proper setting out of the works and for the correctness of the positions, levels, dimensions and alignment of all parts of the works and for the provisions of all necessary instruments and appliances and labour in connection therewith. If at any time during the progress of works any error appears or arises in the positions, levels, dimensions or alignment of any part of the works, the contractor is required to rectify the same at his own expenses to the satisfaction of the Engineer-in-Charge. The checking of any setting out or of any lines and levels by the Engineer-in-Charge or his representative shall not in any way relieve the contractor of his responsibility for correctness thereof and the contractor shall carefully protect, preserve and maintain all bench marks, site rails, pegs etc. used in setting out the works. The costs of providing, preserving, protecting and maintaining the site rails, pegs, barricades benchmark etc. shall be deemed to be included in the rate quoted for various items in the schedule B and no separate payment will be made for the same.

The contractor shall incorporate into the structure the fixtures for lighting, drainage, road markers, signals etc. as may be given to him by the Engineer-in Charge, without claiming any extra cost.

**1.8** All permanent and temporary works shall conform to the latest specifications of Codes of Indian Road Congress, Specifications of Road & Bridge works by Ministry of Road Transport and Highways, IS Standards and any other relevant codes and prevailing sound Engineering practices as mentioned in the contract documents or approved by the competent authority as applicable.

### 1.9 Drawings

It is very much necessary for the contractor to submit and get approved the detailed work plan/schedule. The detailed submission of the drawings shall be done only after these details. The drawings shall be issued to the contractor as and when necessary keeping in view that the construction schedule of the project is not disturbed.

The bar bending schedule and shop drawings for structural steel work shall be prepared by the contractor and got approved from the Engineer-in-charge before planning of work, fabrication, cutting or assembling. All the dimensions shown on the tender drawings are tentative and subject to variation during execution. Contractor cannot claim for any variation/change in the dimensions shown in the tender drawings during execution.

## B. SPECIFICATION

**1.0 PREAMBLE:**

The 'Technical Specifications' contained hereunder shall be read in conjunction with the other bidding stipulations.

**2.0 TECHNICAL SPECIFICATIONS:**

The Technical Specifications in accordance with which the entire work described herein after shall be constructed and completed by the Contractor shall comprise of the followings:

1. The work specifications are described in the following clauses. However, wherever required, in opinion of the Engineer-in-Charge, reference shall be made to the General Technical Specifications given in the 'SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (FIFTH REVISION)' or latest version', as corrected in the original issued by the Ministry of Road Transport & Highways (MORTH), Government of India (GOI) and published by the Indian Roads Congress (IRC), New Delhi.
2. In the absence of any definite provisions on any particular issue in the aforesaid specifications, reference may be made to the latest codes and specifications of IRC and BIS in that order. Where even these are silent, the construction and completion of the works shall conform to good engineering practice as approved by the Engineer-in-Charge and in case of any dispute arising out of the interpretation of the above, the decision of the Engineer-in-Charge shall be final and binding on the contractor.



**GENERAL SPECIFICATION**

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**SECTION: B-1:EARTH WORK IN TRENCH, EXCAVATION AND BACK FILLING****B.1.1 Scope**

This specification covers the general requirements of earth work in excavation for foundations, pipe trench, form work etc. in different materials, filling in areas as shown in drawing, back filling around foundations trenches, conveyance and disposal of surplus soils or stacking them properly including any lead. As shown on the drawings and/or as directed by the Engineer-in-Charge and all operations covered within the intent and purpose of this specification. The scope also includes public utilities, such as cables, drains, service pipes water mains etc. However, for more details reference shall be made to the section no. 200, 300 and 1500 of MORT&H specifications.

**B.1.2 Applicable Codes**

The following Indian Standard codes, unless specified otherwise elsewhere in the documents prepared by the client or the consultant, in relation to the project under consideration, shall be applicable. In all cases, the latest revision of the codes shall be referred to.

1. IS 783 - Code of practice for laying of concrete pipes
2. IS 1200 - Method of measurement of building
3. IS 3764 - Safety code for excavation
4. IS 3385 - Code of practice for measurement of Civil Engineering works
5. IS 2720 - Methods of test for soils

Part – I - Preparation of dry soil samples for various tests.

Part –II - Determination of water content

Part –IV - Grain size analysis

Part –V - Determination of liquid and plastic limit

Part–VII -Determination of water content dry density relation using light compensation.

Part – IX - Determination of dry density – moisture content relation by constant weight of soil method

Part – XIV - Determination of density index (relative density) of cohesion less soils

Part – XXVIII - Determination of dry density of soils in place, by the sand replacement method

Part – XXXIII - Determination of the density in place by ring and water replacement method

Part – XXXIV - Determination of density of soil in place rubber balloon method

Part – XXXVIII - Compaction control test (Hilf Method).

### B.1.3 Definitions

The following terms shall have the meanings hereby assigned to them

- **Top Soil** – Surface material including turf, suitable for use in soiling areas to be grassed or cultivated.
- **Excavation** – Excavation in open cut down to levels required as per approved drawings or otherwise as being the general levels after completion of excavation.

#### B.1.3.1 Drawings

Engineer-in-Charge will furnish drawings, wherever, in his opinion, such drawings are required to show areas to be excavated or filled, grade level, sequences and priorities etc. The contractor shall strictly follow such drawings.

### B.1.4 General

- B.1.4.1** Contractor shall furnish all tools, plants, instruments, qualified supervision personnel, labour, quality materials and consumables etc., anything and everything necessary, whether or not such items are specifically stated here for completion of the allotted job in accordance with drawings, specification and requirements related to the project as deemed fit by the Engineer-in-Charge. Contractor shall also be obliged to carry out any temporary work as directed by the Engineer-in-Charge, related to the project or safety to human beings in the project site.
- B.1.4.2** Contractor shall carry out the survey of the site before excavation and properly establish line and levels for various works such as earthwork excavation for grading, basement, foundations, plinth filling, roads, drains, cable trenches, pipelines etc. Such survey shall be carried out by taking accurate cross sections of the area perpendicular to established reference / grid lines at 8m intervals or closer, as determined by the Engineer-in-Charge, based on the ground profile. These shall be checked by the Engineer-in-Charge and recorded properly thereafter.
- B.1.4.3** The excavation shall be carried out to correct lines and levels. This shall also include, wherever required, or as directed by the Engineer-in-Charge, provision of proper shoring to maintain walls of the excavations, furnishing, erecting and maintaining substantial barricades around the excavated areas, fitted with warning lamps blinking at night ensuring safety.
- B.1.4.4** The rates quoted shall also include dumping of excavated materials in regular heaps, bunds, rip rap with regular slopes as directed by the Engineer-in-Charge, within the lead specified and leveling the same so as to provide natural drainage. Rock / soil excavated shall be stacked properly as directed by the Engineer-in-Charge. As a rule, softer materials shall be laid along the center of heaps formed by harder and more weather resisting materials forming casing on the sides and the top. Rock shall be stacked separately.
- B.1.4.5** The rates quoted shall include carriage, staking properly, spreading the excavated material within a lead of 3km for backfilling the trenches with the selected excavated materials, as directed by the Engineer-in-Charge.
- B.1.5 Site Clearance**  
The area to be excavated or filled up shall be cleared of fences, trees, plants, logs, stumps, bush, vegetation, rubbish, slush etc. and other objectionable matter. If any roots or stumps of trees are met during excavation, they shall also be removed. The material so removed shall be burnt or disposed off as directed by the Engineer-in-Charge. Where earth fill is intended, the area shall be stripped of all loose/soft patches and top soil containing objectionable matter/materials shall be removed before fill commences.
- B.1.6 Precious objects, relics, objects of antiquity etc.**  
All gold, silver, crude oil, minerals, archaeological and other findings of importance, trees cut or other materials of any description and all precious stones, coins, treasures, relics, antiquities

and other similar things which may be found in or upon the site shall be the property of Client and Contractor shall duly preserve the same to the satisfaction of Owner and from time to time deliver the same to such person or persons as Owner may from time to time authorize or appoint to receive the same.

**B.1.7 Classification**

**B.1.7.1** All materials to be excavated shall be classified by Engineer, into one of the following classes and shall be paid for at the rate tendered for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of Engineer regarding the classification of the material shall be final and binding on Contractor and not be a subject matter of any appeal or arbitration.

**B.1.7.2** Any earthwork will be classified under any of the following categories:

**B.1.7.2.1 Soil**

This shall comprise topsoil, turf, sand, silt, loam, clay, mud, peat, black cotton soil, soft shale or loose murrum, a mixture of this and similar material which yields to the ordinary application of peak, spade and/or shovel, rake or other ordinary digging implement. Removal of gravel or any other nodular material having dimension in any one direction not exceeding 75mm occurring in such strata shall be deemed to be covered under this category.

**B.1.7.2.2 Ordinary rock (not requiring blasting)**

This shall include:

- I. Rock types such as laterites, shales and conglomerates, varieties of limestone and sandstone etc., which may be quarried or split with crow bars, also including any rock which in dry state may be hard, requiring blasting but which when wet, becomes soft and manageable by means other than blasting.
- II. Macadam surfaces such as water bound and bitumen/tar bound; soling of roads, paths etc. and hard core; compact murrum and stabilized soil requiring grafting tool or pick or both and shovel, closely applied; gravel and cobble stone having maximum dimension in any one direction between 75 and 300mm.
- III. Lime concrete, stone masonry in lime mortar and brick work in lime/cement mortar below ground level, reinforced cement concrete which may be broken up with crow bars or picks and stone masonry in cement mortar below ground level, and
- IV. Boulders which do not require blasting having maximum dimension in any direction of more than 300mm, found lying loose on the surface or embedded in ricer bed, soil, talus, slope wash and terrace material or dissimilar origin.

**B.1.7.2.3 Hard rock (requiring blasting)**

This shall include:

- I. Any rock or cement concrete for the excavation of which the use of mechanical plant and/or blasting is required.
- II. Reinforced cement concrete (reinforcement cut through but not separated from the concrete) below ground level, and
- III. Boulders requiring blasting.

**B.1.7.2.4 Hard rock (blasting prohibited)**

Hard rock requiring blasting as described under B1.7.2.3 but where blasting is prohibited for any reason and excavation has to be carried out by chiseling, wedging or any other agreed method.

**B.1.7.2.5 Marshy soil**

This shall include soils like soft clays and peats excavated below the original ground level of marshes and swamps and soils excavated from other areas requiring continuous pumping or bailing out of water.

**B.1.8 Excavation**

B.1.8.1 All excavation work shall be carried out by mechanical equipment's unless, in the opinion of Engineer, the work involved and time schedule permit manual work.

B.1.8.2 Excavation for permanent work shall be taken out of such widths, lengths, depths and profiles as are shown on the drawings or such other lines and grades as may be specified by Engineer. Rough excavation shall be carried out to a depth 150 mm above the final level. The balance shall be excavated with special care. Soft pockets shall be removed ever below the final level and extra excavation filled up a directed by Engineer. The final excavation if so instructed by Engineer should be carried out just prior to laying the mud-mat.

B.1.8.3 Contractor may, for facility of work or similar other reasons, excavate, and also backfill later, if so approved by Engineer, at his own cost outside the lines shown on the drawings or directed by Engineer. Should any excavation be taken below the specified elevations, Contractor shall fill it up, with concrete of the same class as in the foundation resting thereon, up to the required elevation. No extra shall be claimed by Contractor on this account.

B.1.8.4 All excavation shall be done to the minimum dimensions as required for safety and working facility. Prior approval of Engineer shall be obtained by Contractor in each individual case, for the method he proposes to adopt for the excavation, including dimensions, side slopes, dewatering, disposal etc. This approval, however, shall not in any way relieve Contractor of his responsibility for any consequent loss or damage. The excavation must be carried out in the most expeditious and efficient manner. Side slopes shall be as steep as will stand safely for the actual soil conditions encountered. Every precaution shall be taken to prevent slips. Should slips occur, the slipped material shall be removed and the slope dressed to a modified stable slope. Removal of the slipped earth will not be paid for if the slips are due to the negligence of Contractor.

B.1.8.5 Excavation shall be carried out with such tools, tackles and equipment as described here in before. Blasting or other methods may be resorted to in the case of hard rock; however not without the specific permission of Engineer.

B.1.8.6 Engineer may also direct that in some extreme case, the rock may be excavated by heating and sudden quenching for splitting the rock. Fire-wood shall be used for burning.

**B.1.9 Stripping loose rock**

B.1.9.1 All loose boulders, semidetached rocks (along with earthy stuff which might move therewith) not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Engineer, to fall or otherwise endanger the workmen, equipment, or the work, etc. shall be stripped off and removed away from the area of the excavation. The method used shall be such as not to shatter or render unstable or unsafe the portion which was originally sound and safe.

B.1.9.2 Any material not requiring removal as contemplated in the work, but which, in the opinion of Engineer, is likely to become loose or unstable later, shall also be promptly and satisfactorily removed as directed by Engineer. The cost of such stripping will be paid for at the unit rates accepted for the class of materials in question.

**B.1.10 Fill, back filling and site grading**

**B.1.10.1 General**

B.1.10.1.1 all fill material will be subject to Engineer's approval. If any material is rejected by Engineer, contractor shall remove the same forthwith from the site at no extra cost to the owner. Surplus fill material shall be deposited / disposed off as directed by Engineer after the fill work is completed up to a distance of 10 Km.

B.1.10.1.2 No earth fill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with as directed by Engineer.

**B.1.10.2 Material**

B.1.10.2.1 To the extent available, selected surplus soils from excavated materials shall be used as backfill. Fill material shall be free from clods, salts, sulphates, organic or other foreign material. All clods of earth shall be broken or removed. Where excavated material is mostly rock, the bounders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murrum or earth fill up the voids and the mixture used for filling.

B.1.10.3 If any selected fill material is required to be borrowed, Contractor shall make arrangements for bringing such material from outside borrow pits. The material and source shall be subject to prior approval of Engineer. The approved borrow pit area shall be cleared of all bushes, roots of trees, plants, rubbish etc, top soil containing salts / sulphate and other foreign material shall be removed. The materials so removed shall be burnt or disposed off as

directed by Engineer. Contractor shall make necessary access to borrow areas and maintain the same, if such access road does not exist, at his cost.

B.1.10.4 Filling in pits and trenches around foundations of structures, walls etc.

B.1.10.4.1 As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches etc. shall be cleaned of all debris, and filled with earth in layers not exceeding 20 cm, each layer being watered, rammed and properly consolidated, before the succeeding one is laid.

Each layer shall be consolidated to the satisfaction of Engineer. Earth shall be crammed with approved mechanical compaction machines if instructed. Usually no manual compaction shall be allowed unless Engineer is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to proper profile as directed by Engineer or indicated on the drawing.

B1.10.5 Plinth filling

B.1.10.5.1 Plinth filling shall be carried out with approved material as described herein before in layers not exceeding 20 cm, watered and compacted with mechanical compaction machines. If required engineer may however permit manual compaction by hand tampers in case he is satisfied that mechanical compaction is not possible. When filling reaches the finished level, the surface shall be flooded with water, unless otherwise directed for at least 24 hours, allowed to dry and then the surface again compacted as specified above settlements at a later stage. The finished level of the filling shall be trimmed to the level / slope specified.

B.1.10.5.2 Where specified in the schedule of works, compaction of the plinth fill shall be carried out by roller in case of compaction of granular materials such as sands and gravel, vibratory rollers shall be used. A smaller weight roller may be used only if permitted by Engineer. As rolling proceeds, water sprinkling shall be done to assist consolidation. Water shall not be sprinkled in case of sandy fill.

B.1.10.5.3 The thickness of each unconsolidated fill layer can in this case be up to a maximum of 200 mm. Engineer will determine the thickness of the layers in which fill has to be consolidated depending on the fill material and equipment used. Rolling shall commence from the outer edge and progress towards the centre and continue until compaction is to the satisfaction of Engineer, but in no case less than 10 passes of the roller will be accepted for each layer. The compacted surface shall be properly shaped, trimmed and consolidated to an even and uniform gradient. All soft spots shall be excavated and filled and consolidated. At some locations / areas if may not be possible to use rollers because of space restrictions etc. Contractor shall then be permitted to use pneumatic tampers; rammers etc. and he shall ensure proper compaction.

B.1.10.6 Sand filling in plinth and other places

B.1.10.6.1 At places backfilling shall be carried out with local sand if directed by Engineer. The sand used shall be clean, medium grained and free from impurities. The filled in sand shall be kept flooded with water for 24 hours to ensure maximum consolidation. Any temporary work required to contain sand under flooded condition shall be to contractor's account. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floor or other structures on sand fill shall not be started until Engineer has inspected and approved the fill.

#### B.1.10.7 Filling in Trenches

B.1.10.7.1 Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed. The backfilling material shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the pipes.

B.1.10.7.2 Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the centerline of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the centerline of the pipe shall also be done with selected earth by hand compaction or other approved means in layers not exceeding 20 cm.

B.1.10.7.3 In case of excavation of trenches in rock, the filling up to a level 30 cm above the top of the pipe shall be done with fine materials, such as earth, murrum etc. The filling up of the level of the centerline of the pipe shall be done by hand compaction in layers not exceeding 20 cm. Also the filling above the centerline of the pipe shall be done by hand compaction or approved means in layers not exceeding 20 cm. The filling from a level 30 cm. above the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 20 cm mixed with fine material as available to fill up the voids.

B.1.10.7.4 Filling of the trenches shall be carried simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

#### B.1.11 General Site grading

B.1.11.1 Site grading shall be carried out as indicated in the drawings and as directed by Engineer. Excavation shall be carried out as specified in the specification. Filling and compaction shall be carried out as specified under Clause B.1.10 and elsewhere unless otherwise indicated below.

B.1.11.2 If no compaction is called for, the fill may be deposited to the full height in one operation and leveled. If the fill has to be compacted, it shall be placed in layers not exceeding 200 mm and leveled uniformly and compacted as indicated in Clause 10.0 before the next layer is deposited.



- B.1.11.3 To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by Contractor at his cost.
- B.1.11.4 Field compaction test shall be carried out at different stages of filling and also after the entire height has been completed. This shall hold good for embankments as well.
- B.1.11.5 Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, Contractor shall remove the affected material and make good the slip at his cost.
- B.1.11.6 The fill shall be carried out to such dimensions and levels as indicated on the drawings after the stipulated compaction. The fill will be considered as incomplete if the desired compaction has not been obtained.
- B.1.11.7 If specifically permitted by Engineer, compaction can be obtained by allowing loaded trucks conveying fill or other material to ply over the fill area. Even if such a method is permitted, it will be for contractor of demonstrate that the desired / specified compaction has been obtained. In order that the fill may be reasonably uniform throughout, the material should be dumped in place in approximately uniform layers. Traffic over the fill shall then be so routed to compact the area uniformly throughout.
- B.1.11.8 If so specified, the rock as obtained from excavation may be used for filling and leveling to indicate grades without further breaking. In such an event, filling layers should not exceed 50 cms approximately. After rock filling the void in the rocks shall be filled with finer materials such as earth, broken stone etc. and the area flooded so that the finer materials fill up the voids. Care shall be taken to ensure that the finer fill material does not get washed out. Over the layer so filled, a 100 mm thick mixed layer of broken materials and earth shall be laid and consolidation carried out by a 12 tone roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken up.

**B.1.12 Fill density**

- B.1.12.1 The compaction, only where so called for, in the schedule of quantities / items shall comply with the specified (Standard Proctor / modified Proctor) density at moisture content differing not more than 4 percent from the optimum moisture content. Contractor shall demonstrate adequately at his cost, by field and laboratory tests that the specified density has been obtained.

**B.1.13 Lead**

- B.1.13.1 Lead for deposition / disposal of excavated material shall be as specified in the respective item of work. For the purpose of measurement of lead, the area to be excavated or filled or area on which excavated material is to be deposited / disposed off shall be divided into suitable blocks and for each of the blocks, the distance between centerlines shall be taken as the lead which shall be measured by the shortest straight line route taken by Contractor. No extra compensation is admissible on the grounds that the

lead including that for borrowed material had to be transported over marshy or 'katcha' land / route.

**B.1.14 Measurement and payment**

B.1.14.1 All excavation shall be measured net. Dimensions for purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, tanks, rafts or other foundations / structures to be built, multiplied by the mean depth from the surface of the ground in accordance with the drawings. Contractor may make such allowance in his rates to provide for excavation in side slopes keeping in mind the nature of the soil and safety of excavation. Reasonable working space, beyond concrete dimensions and shuttering where considered necessary in the opinion of Engineer will be allowed in excavation and considered for payment. However, if concreting is proposed against the excavated sides, no such over – excavation will be permitted. In such cases over-excavation shall be made good by Contractor with concrete of the same class as in the foundations at his cost.

B.1.14.2 Unless otherwise specified, the unit rates quoted for excavation in different types of material shall also account for a basic lead of 100 meters for disposal as specified or directed. Only leads beyond the basic lead of 100 meters will be considered as extra lead and paid for at the rates quoted in the schedules.

B.1.14.3 Backfilling as per specifications the sides of foundations of columns, footings, structures, walls, tanks, rafts, trenches etc. with excavated material will not be paid for separately. It shall be clearly understood that the rate quoted for excavation including backfilling shall include stacking of excavated material as directed, excavation / packing of selected stacked material, conveying it to the place of final backfill, compensation etc. as specified. As a rule material to be backfield shall stacked temporarily within the basic lead of 100 meters unless otherwise directed by the Engineer. If Engineer directs / permits a lead of over 100 meters for such material, the conveyance of the material for the extra distance over the basic lead of 100 meters for backfilling will be paid for.

B.1.14.4 Payment for fill inside trenches, plinth of similar filling with selected excavated material will be made for only compaction as specified / directed. Cost of all other operations shall be deemed to have been covered in the rate quoted for excavation. Payment for this work will be made based on measurement of trench dimensions filled. The plinth ground levels shall be surveyed before hand for this purpose. If no compaction is specified / desired, such filling will not be separately paid for. In such an event, the fill shall be leveled / finished to the profile as directed at no extra cost.

B.1.14.5 Backfilling with borrowed earth will be paid for at rates quoted. The quoted rate shall include all operations such as clearing, excavation, lead and transport, fill, compaction etc. as specified. Actual quantity of consolidated filling or actual quantity of excavation in the

borrow pits (less such top soil which has been excavated and not used for filling) whichever is less shall be measured and paid for in cubic meters. The lead, lift etc. shall be as indicated in the schedule of quantities.

B.1.14.6 Actual quantities of consolidated sand filling shall be measured and paid in cubic meters.

## **SECTION: B-2: DEWATERING**

### **B.2.1 Scope**

B.2.1.1 This specification covers the general requirements of dewatering excavations in general. However for more details reference shall be taken from section no. 300 of MORTH specifications.

### **B.2.2 General**

B.2.2.1 All excavations shall be kept free of water. Grading in the vicinity of excavations shall be controlled to prevent surface water running into excavated areas. Contractor shall remove by pumping or other means approved by Engineer any water inclusive of rain water and subsoil water accumulated in excavation and keep all excavations dewatered until the foundation work is completed and backfilled. Sumps made for dewatering must be kept clear of the excavations / trenches required for further work. Method of pumping shall be approved by Engineer but any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction.

B.2.2.2 When there is a continuous inflow of water and quantum of water to be handled is considered in the opinion of Engineer, as large, well point system – single stage or multistage, shall be adopted. Contractor shall submit to Engineer his scheme of well point system including the stages, the spacing, number and diameter of well points, heads etc. and the number, capacity and location of pumps of approval. Unless separately provided for in the schedule of prices the cost of dewatering shall be included in the item rate for excavation.

B.2.2.3 Where cofferdams are required, these shall be carried to adequate depths and heights, be safely designed and constructed and be made as water tight as is necessary for facilitating construction to be carried out inside them. The interior dimensions of the cofferdams shall be such as to give sufficient clearance for the construction and inspection and to permit installations of pumping equipments, etc., inside the enclosed area.

### **B.2.3 MEASUREMENT**

Dewatering is deemed to have been included in the unit rates quoted for excavation. No extra payment will be made against dewatering and excavation in wet soil condition.

## **SECTION: B-3: RAIN WATER DRAINAGE**

**B.3.1 SCOPE**

B.3.1.1 This section covers the drainage of rain water in excavated areas. However for more details reference shall be taken from section no. 300 of MORTH specifications.

**B.3.2 GENERAL**

B.3.2.1 Grading in the vicinity of excavation shall be such as to exclude rain / surface water draining into excavated areas. Excavation shall be kept clean of rain and such water as the Contractor may be using for his work by suitably pumping out the same at no extra cost to the owner. The scheme for pumping and discharge of such water shall be approved by the Engineer.

**SECTION: B-4 : SITE FILLING****B.4.1 Scope**

B.4.1.1 Apart from any other work / purpose for which this specification may be made applicable by Engineer, this shall generally govern work involving filling site / plant over the entire area / most of the area to raise the general grade level to the desired elevation. This work shall be carried out as per applicable clauses "Earthwork in Grading, Excavation and Backfilling" particularly clauses B.1.10 & B.1.11. However for more details reference shall be taken from section no. 300 of MORTH specifications.

**B.4.2 Fill Material****B.4.2.1 General**

B.4.2.1.1 All fill material whether such material is brought from outside borrow areas or excavation within the site, will be subject to Engineer's approval. Notwithstanding any approval given to the fill material or borrow areas from which fill material is proposed to be brought, Engineer / Owner reserves the right to reject such material which in his opinion either does not meet the specification requirements or is unsuitable for the purpose for which it is intended.

**B.4.2.2 Borrow Areas**

B.4.2.2.1 It shall be Contractor's responsibility to locate suitable borrow areas for borrowing fill material. Such areas will be inspected by Engineer and approved before Contractor makes arrangements to borrow the fill material. The top soil which may contain vegetation, rubbish, slush etc. shall not be used. If demanded by Engineer. Contractor shall arrange to have trial pits of specified dimensions and numbers dug at locations specified, for Engineer to examine the nature and type of material likely to be obtained from the borrow area.

**B.4.2.3 Lead, Lift and Transportation**

B.4.2.3.1 Unless separately provided, for, all lead, lift and transportation required for bringing in the fill material from borrow areas or from excavation from within the site shall be included in the Contractor's quote unit rates.

**B.4.2.4 Quality**

B.4.2.4.1 The borrowed soil shall be generally granular, and non-cohesive. It shall consist of sand, silty sand, murrum, ordinary soil, gravel and shingle. Dredged material, free from clayey deposit, will be accepted. Fill material shall also be free from sulphates, salts, organic, foreign and other harmful or objectionable materials. Any material rejected by Engineer shall be removed from the site immediately.

#### **B.4.3 Access road**

B.4.3.1 Roads, whether of temporary or other nature, required to be constructed for access and for movement of man, materials, Equipments, transport vehicles, vehicles carrying fill material etc. to or over borrow areas and/or to or over areas on which fill has to be deposited shall be constructed by Contractor at his cost. Such costs shall be deemed to have been included in the unit rates quoted by Contractor. Such access roads shall be maintained in good condition during all seasons to ensure completion of work according to time schedule.

B.4.4.1 Site clearing before filling shall be carried out as specified in the enclosed specification. Earthwork in Grading, Excavation and backfilling.

#### **B.4.4 Clearing**

B.4.4.1 Site clearing before filling shall be carried out as specified in the sections B.1.5, and B.1.10.4 above.

#### **B.4.5 Filling**

##### **B.4.5.1 Backfill**

B.4.5.1.1 Backfill shall be deposited to bring the grade level to desired elevation after compaction of fill.

B.4.5.1.2 Back fill shall be compacted, where so specified, by 12 tone rollers as indicated in Clause B.5.5.2.3 below. The fill material shall be compacted to the specified density, where so specified.

B.4.5.1.3 If the density of fill use of rollers for compaction is not specified. Contractor shall ensure necessary compaction by the passage of trucks, carrying the fill material over the deposited fill in such a way that the entire fill area is covered. These will reasonably compact the sand fill will be accepted by Engineer. However, Contractor shall ensure that every layer is thus compacted before the succeeding layers are deposited. Each layer shall not exceed 200 mm in thickness.

B.4.5.1.4 Compaction of back fill by flooring the area shall be carried out where so specified. In this case, Contractor should ensure that the fill material is not washed away. This work shall be carried out as directed by Engineer.

##### **B.4.5.2 Soil Fill**

B.4.5.2.1 Approval soil fill consisting of ordinary soil, murrum, soil containing gravel, shingle etc. shall be deposited in layers not exceeding 200 mm. Contractor should ensure that all clods of earth are broken down to a size not larger than 100 mm.

B.4.5.2.2 Where density of fill or use of rollers is not specified, the fill shall be carried out as specified in Clause B.5.5.1.3 above.

B.4.5.2.3 Where the fill material has to be compacted by use of rollers procedure as specified in Clause B.1.10.5.2 of specification for "Earthwork in Grading, Excavation and Backfilling".

B.4.5.2.4 Where specified, the required density of fill shall be obtained by proper compaction.

#### **B.4.6 Measurement**

B.4.6.1 The rate for this item includes in the relevant item of excavation and no extra payment will be made.

### **SECTION: B-5 : CONCRETE WORKS**

#### **B.5.1 Scope**

B.5.1.1 This Specification covers the general requirements for concrete using on-site production facilities including requirements in regard to the quality, handling, storage of ingredients, proportioning, batching, mixing, transporting, placing, curing, protecting, repairing, finishing and testing of concrete; form work; requirements in regard to the quality, storage, bending and fixing of reinforcement; grouting as well as mode of measurement and payment for complete works.

B.5.1.2 It shall be very clearly understood that the specifications given herein are brief and do not cover minute details. However, all work shall have to be carried out in accordance with the relevant standards and codes of practices or in their absence in accordance with the best accepted current engineering practices or as directed by Engineer from time to time. The decision of Engineer as regards the specification to be adopted and their interpretation and the mode of execution of work shall be final and binding on Contractor and no claim whatsoever will be entertained on this account.

B.5.1.3 However for more details reference shall be taken from section no. 1000 and 1700 of MORTH specifications.

#### **B.5.2 Applicable codes and specifications**

B.5.2.1 The following specifications, standards and codes, including all official amendments / revisions and other specifications and codes referred to therein, should be considered a part of this specification. In all cases the latest issue / edition / revision shall apply. In case of discrepancy between this specification and those referred to herein below or other specifications forming a part of this bid document, this specification shall govern.

##### **B.5.2.2 Code for Materials**

1. IS: 269 - Specification for 33 grade ordinary Portland cement
2. IS: 455 - Specification for Portland slag cement

3. IS: 1489(Part 1 & 2)- Specification for Portland pozzolana cement
4. IS: 8112 - Specification for 43 grade ordinary Portland cement.
5. IS: 12330 - Specification for sulphate resisting Portland cement
6. IS: 383 - Specification for coarse and fine aggregates from natural sources for concrete.
7. IS: 432(Part 1& 2)- Specification for mild steel and medium tensile steel bars and hard drawn steel wires for concrete reinforcement.
8. IS: 1786 - Specification for high strength deformed steel bars and wires for concrete reinforcement.
9. IS: 1566 - Specification for hard drawn steel wire fabric for concrete reinforcement.
10. IS: 9103 - Specification for admixtures for concrete.
11. IS: 2645 - Specification for admixtures for concrete.
12. IS: 4990 - Specification for integral cement water proofing compounds.
13. IS: 12269 - Specification for 53 Grade Ordinary Portland Cement

#### B.5.2.3 Code for Material Testing

1. IS: 4031 (Parts 1 to 15) - Methods of physical tests for hydraulic cement.
2. IS: 4032 - Methods of chemical analysis of hydraulic cement.
3. IS: 650 - Specifications for standard sand for testing of cement.
4. IS: 2430 - Methods for sampling of aggregates for concrete.
5. IS: 2386 (Parts 1 to 8) - Methods of test for aggregates for concrete.
6. IS: 3025 - Methods of sampling and test (physical and chemical) water used in industry.
7. IS: 6925 - Methods of test for determination of water soluble chlorides in concrete admixtures.

#### B.5.2.4 Code for Materials Storage

1. IS: 4082 - Recommendations on stacking and storing of construction materials at site.

#### B.5.2.5 Code for Concrete Mix Design

1. IS: 10262 - Recommended guidelines for concrete mix design.
2. SP : 23 (S&T) - Handbook on Concrete Mixes.

#### B.5.2.6 Code for Concrete Testing

1. IS: 1199 - Method of sampling and analysis of concrete.
2. IS: 516 - Method of test for strength of concrete
3. IS: 9013 - Method of making, curing and determining compressive strength of accelerated cured concrete test specimens.

4. IS: 8142 - Method of test for determining setting time of concrete by penetration resistance.
5. IS: 9284 - Method of test for abrasion resistance of concrete.
6. IS: 2770 - Methods of testing bond in reinforced concrete.

#### B.5.2.7 Code for Equipment

1. IS: 1791 - Specification for batch type concrete mixers.
2. IS: 2438 - Specification for roller pan mixer.
3. IS: 4925 - Specification for concrete batching and mixing plant.
4. IS: 5892 - Specification for concrete transit mixer and agitator.
5. IS: 7242 - Specification for concrete spreaders.
6. IS: 2505 - General Requirements for concrete vibrators : Immersion type.
7. IS: 2506 - General Requirements for screed board concrete vibrators.
8. IS: 2514 - Specification for concrete vibrating tables.
9. IS: 3366 - Specification for pan vibrators.
10. IS: 4656 - Specification for form vibrators for concrete.
11. IS: 11993 - Code of practice for use of screed board concrete vibrators12 IS: 7251 – Specification for concrete finishers.
13. IS: 2722 - Specification for portable swing weigh batchers for concrete (single and double bucket type).
14. IS: 2750 - Specification for steel scaffoldings.

#### B.5.2.8 Codes of Practice

1. IS: 456 - Code of practice for plain and reinforced concrete.
2. IS: 457 - Code of practice for general construction of plain and reinforced concrete for dams and other massive structures.
3. IS: 3370 (Parts 1 to 4 ) – Code of Practice for concrete structures for storage of liquids.
4. IS: 3935 - Code of practice for composite construction.

#### B.5.2.9 Code for Construction safety

1. IS: 3696(Parts I and III) - Safety code for scaffolds and ladders.
2. IS: 7969 - Safety code for handling and storage of building materials.
3. IS: 8989 - Safety code for erection of concrete framed structures.

#### B.5.2.10 Code for Measurement

1. IS: 1200 (Part 1 to 28) – Method of measurement of building & engineering works
2. IS: 3385 – Code of practice for measurement of Civil Engineering works.

### B.5.3 General

B.5.3.1 Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and



Engineer's approval obtained, prior to starting of concrete work. This shall, however, not relieve Contractor of any of his responsibilities. All materials which does not conform to this specification shall be rejected.

B.5.3.2 Materials should be selected so that they can satisfy the design requirements of strength, serviceability, safety, durability and finish with due regards to the functional requirements and the environmental conditions to which the structure will be subjected. Materials complying with codes / standards shall generally be used, other materials may be used after approval of the Engineer and after establishing their performance suitability based on previous data, experience or tests.

#### **B.5.4 Materials**

##### B.5.4.1 Cement

B.5.4.1.1 Unless otherwise specified or called for by the Engineer, cement shall be **Ordinary Portland Cement Conforming** to IS specified above.

B.5.4.1.2 Where Portland pozzolana or slag cement are used, it shall be ensured that consistency of quality is maintained, there will be no adverse interactions between the materials and the finish specified is not marred.

B.5.4.1.3 Only one type of cement shall be used in any one mix. The source of supply, type or brand of cement within the same structure or portion thereof shall not be changed without approval from Engineer.

B.5.4.1.4 Cement which is not used within 90 days from its date of manufacture shall be tested at a laboratory approved by Engineer and until the results of such tests are found satisfactory, it shall not be used in any work.

##### B.5.4.2 Aggregates (General)

###### B.5.4.2.1 General

B.5.4.2.1.1 "Aggregate" in general designates both fine and coarse inert materials used in the manufacture of concrete (vide IS 456 & IS 383) and conforming to tests as per IS 2386 (Part I to VI).

B.5.4.2.1.2 "Coarse Aggregate" is aggregate most of which is retained when passed through on 4.75 mm BIS sieve.

B.5.4.2.1.3 All fine and coarse aggregates proposed for use in the works shall be subject to the Engineer-in-Charge's approval and after specific materials have been accepted, the source of supply of such materials shall not be changed without prior approval of the Engineer-in-charge.

B.5.4.2.1.4 Aggregates shall consist of natural sand, stone (crushed or uncrushed) from a source known to produce satisfactory aggregate for concrete and shall be chemically inert, non-flaky, strong, hard, and durable against weathering or limited porosity and free from deleterious materials that may cause corrosion of the reinforcement or may impair the

strength and or durability of concrete. The grading of aggregates shall be such as to produce a dense concrete of specified strength and consistency that will work readily into position without segregation and shall be based on the "mix design" and preliminary tests on concrete specified later.

The aggregates shall be brought from the source as mentioned in Volume-I Clause C.1.39.

#### B.5.4.2.2 Sampling and testing

B.5.4.2.2.1 Samples of the aggregates for mixed design and determination of suitability shall be taken under the supervision of the Engineer-in-charge and delivered to the laboratory, well in advance of the scheduled placing of concrete. Records of tests, which have been made on proposed aggregates and on concrete made from this source of aggregates, shall be furnished to Engineer-in-charge in advance of the work, for use in determining aggregate suitability. The costs of all such tests, sampling etc. shall be borne by the contractor.

#### B.5.4.2.3 Storage of aggregates

#### B.5.4.2.4 Specific Gravity

B.5.4.2.4.1 Aggregates having a specific gravity below 2.4 (saturated surface dry basis) shall not be used.

#### B.5.4.3 Fine Aggregate

B.5.4.3.1 Fine aggregate shall consist of natural or crushed sand conforming to IS 383 conforming to tests as per IS 2386 part I to IV. The sand shall be clean, sharp, hard, strong and durable and shall be free from dust, vegetable substances, adherent coating, clay, alkali, organic matter, mica, salt or other deleterious substances, which can be injurious to the setting qualities / strength/ durability of concrete.

B.5.4.3.2 Screening and Washing: Sand shall be prepared for use by such screening or washing, or both, as necessary, to remove all objectionable foreign matter while separating the sand grains to the required size fraction.

B.5.4.3.3 Foreign Material limitations: The percentage deleterious substances in sand delivered to the mixer shall not exceed the following:

Sr. No.	Foreign Material	Percentage by weight	
		Uncrushed	Crushed
1	Material finer than 75 micron IS sieve	3.0	15.0
2	Shale	1.0	---
3	Coal and Lignite	1.0	1.0
4	Clay Lumps	1.0	1.0

B.5.4.3.4 Gradation: Unless otherwise directed or approved by the Engineer-in-charge, the grading of sand shall be within the limits indicated hereunder.

IS: Sieve Designation	Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV
10 mm	100	100	100	100
4.75 mm	99 – 100	90 – 100	90 – 100	95 – 100
2.36 mm	60 – 95	75 – 100	85 – 100	95 – 100
1.18 mm	30 – 70	55 – 90	75 – 100	90 – 100
600 microns	15 – 34	35 – 59	60 – 79	80 – 100

IS: Sieve Designation	Grading Zone-I	Grading Zone-II	Grading Zone-III	Grading Zone-IV
300 microns	5 – 20	8 – 30	12 – 40	15 – 50
150 microns	0 – 10	0 – 10	0 – 10	0 – 15

B.5.4.3.4.1 Where the grading falls outside the limits of any particular grading zone of sieves, other than 600 microns IS sieve, by total amount not exceeding 5%, it shall be regarded as falling within that grading zone. This tolerance shall not be applied to percentage passing the 600 micron IS sieve or to percentage passing any other sieve on the coarser limit of grading zone I or the finer limit of grading zone IV. Fine aggregates conforming to grading zone IV shall not be used. Mix designs and preliminary tests shall show its suitability for producing concrete of specified strength and workability.

#### B.5.4.3.5 Fineness Modulus

The sand shall have a fineness modulus of not less than 2.2 or more than 4.2. The fineness modulus is determined by adding the cumulative percentages retained on the following IS sieve sizes (4.75 mm, 2.35 mm, 1.18 mm, 600 microns and 150 microns) and dividing the sum by 100.

#### B.5.4.4 Coarse Aggregate

B.5.4.4.1 Coarse aggregate for concrete, except as noted above, shall conform to IS 383 and IS 2386. This shall consist of crushed stone and shall be clean and free from elongated, flaky or laminated pieces, adhering coatings, clay lumps, coal residue, clinkers, slag, alkali, mica, organic matter or other deleterious matter.

B.5.4.4.2 Screening and Washing: Crushed rock shall be screened and or washed for the removal of dirt or dust coating, if so requested by the Engineer-in-charge.

#### B.5.4.4.3 Grading

B.5.4.4.3.1 Coarse aggregate shall be either in single size or graded, in both cases the grading shall be within the following limits:

IS Sieve Size	Percentage passing for single sized aggregate of normal size					Percentage passing for graded aggregate of normal size			
	40	20	16	12.5	10	40	20	16	12.5

	mm	mm	mm	mm	mm	mm	mm	mm	mm
63	100	--	--	--	--	--	--	--	--
40	85-100	100	--	--	--	95-100	100	--	--
20	0-20	85-100	100	--	--	30-70	95-100	100	100
16	--	--	85-100	100	--	--	--	90-100	--
12.5	--	--	--	85-100	100	--	--	--	90-100
10	0 5	0-20	0-30	0-45	85-100	10-35	25-55	30-70	40-85
4.75	--	0-5	0-5	0-10	0-20	0-5	0-10	0-10	0-10
2.36	--	--	--	--	0-5	--	--	--	--

B.5.4.4.3.2 The pieces shall be angular in shape and shall have granular or crystalline surfaces. Friable, flaky and laminated pieces, mica and shale, if present, shall be only within tolerance limits which will not affect adversely the strength and or durability of concrete. The maximum size of coarse aggregate shall be 40 mm for M7.5 and M10 and 20 mm for M15 to M20 concrete, or as directed by the Engineer-in-charge or specified otherwise.

The maximum size of coarse aggregate shall be the maximum size specified above but in no case greater than  $\frac{1}{4}$ th of the minimum thickness of the member, provided that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of the form. For plain concrete the maximum size of aggregate shall be of 40 mm. for heavily reinforced concrete members, the nominal maximum size of the aggregate shall be 5 mm less than the minimum clear distance between the reinforcing main bars or 5 mm less than the minimum cover reinforcement whichever is smaller.

#### B.5.4.4.4 Foreign material limitations

B.5.4.4.4.1 The percentage of deleterious materials in the aggregate delivered to the mixer shall not exceed the following:

Sr. No.	Foreign Material	Percentage by weight	
		Uncrushed	Crushed
1	Material finer than 75 micron IS sieve	3.0	3.0
2	Coal and Lignite	1.0	1.0
3	Clay Lumps	1.0	1.0
4	Soft fragments	3.0	---

#### B.5.4.5 Water

B.5.4.5.1 Water used for both mixing and curing shall conform to IS: 456. Potable water is generally satisfactory. Water containing any excess of acid, alkali, sugar or salt shall not be used.

#### B.5.4.6 Reinforcement

B.5.4.6.1 Reinforcement bars shall conform to IS: 432, IS: 226 or IS: 1786 and the welded wire fabric to IS: 1566 as shown or specified on the drawings.

B.5.4.6.2 All reinforcement shall be clean, free from pitting, oil, grease, paint, loose mill scales, rust, dirty dust or any other substance that will destroy or reduce bond.

B.5.4.6.3 If permitted by Engineer, welding of reinforcement shall be done in accordance with IS ; 2751 or IS: 9417 as applicable.

B.5.4.7 Admixtures

B.5.4.7.1 Accelerating, retarding, water-reducing and air entraining admixtures shall conform to IS: 9103 and integral water proofing admixtures to IS: 2645.

B.5.4.7.2 Admixtures may be used in concrete as per manufacturer's instructions only with the approval of Engineer based upon evidence that with the passage of time neither the compressive strength nor its durability is reduced. An admixture's suitability and effectiveness shall be verified by trial mixes with the other material used in the works. If two or more admixtures are to be used simultaneously in the same concrete mix, their interaction shall be checked and trial mixes done to ensure their compatibility. There should also be no increase in risk of corrosion of the reinforcement or other embedment.

B.5.4.7.3 Calcium chloride shall not be used for accelerating set of the cement for any concrete containing reinforcement or embedded steel parts. When calcium chloride is permitted such as in mass concrete works, it shall be dissolved in water and added to the mixing water by an amount not exceeding 1.5 percent of the weight of the cement in each batch of concrete. The designed concrete mix shall be corrected accordingly.

B.5.4.8 Wastage

B.5.4.8.1 No wastage allowance for cement and steel shall be considered and paid for

### **B.5.5 SAMPLES AND TESTS**

B.5.5.1 All materials used for the works shall be tested before use.

B.5.5.2 Manufacturer's test certificate shall be furnished, for each batch of cement / steel and when directed by Engineer samples shall also be got tested by the Contractor in a laboratory approved by Engineer at no extra cost to Client. However, where/material is supplied by Client, all testing charges shall be borne by Client; but transportation of material samples to the laboratory shall have to be done by Contractor at no extra cost.

B.5.5.3 Sampling and testing shall be as per IS: 2386 under the supervision of Engineer. The cost of all tests, sampling etc. shall be borne by Contractor.

B.5.5.4 Water to be used shall be tested to comply with requirement of IS: 456.

B.5.5.5 Contractor shall furnish manufacturer's test certificates and technical literature for the admixture proposed to be used. If directed the admixture shall be got tested and approved laboratory at no extra cost.

### **B.5.6 STORING OF MATERIALS**

B.5.6.1 All material shall be stored in a manner so as to prevent its deterioration and contamination which would preclude its use in the works. Requirements of IS: 4082 shall be complied with.

B.5.6.2 Contractor will have to make his own arrangements for the storage of adequate quantity of cement even if cement is supplied by Client. Cost of such rejected cement, where cement is supplied by Client, shall be recovered at issue rate or open market rate whichever is higher. Cement bags shall be stored in dry weatherproof shed with a raised floor, well away from the outer walls and insulated from the floor to avoid moisture from ground. Not more than 15 bags shall be stacked in any tier. Storage arrangement shall be approved by Engineer. Storage under tarpaulins shall not be permitted. Each consignment of cement shall be stored separately and consumed in its order or receipt.

B.5.6.3 Each size of coarse and fine aggregates shall be stacked separately and shall be protected from leaves and contamination with foreign material. The stacks shall be on hard, clean, free draining bases, draining away from the concrete mixing area.

B.5.6.4 Contractor shall make his own arrangements for storing water at site in tanks to prevent contamination.

B.5.6.5 The reinforcement shall be stacked on top of timber sleepers to avoid contact with ground / water. Each type and size shall be stacked separately.

## **B.5.7 CONCRETE**

### **B.5.7.1 General**

Concrete grade shall be as designated on drawings. In concrete grade M15, M20, M25 etc. the number represents the specified characteristic compressive strength of 150 mm cube at 28 days, expressed in N/sq.mm as per IS: 456. Concrete in the works shall be "**Design Mix Concrete**" or "**Normal Mix Concrete**". All concrete works of **grade M5, M7.5 and M10 shall be Nominal whereas all other grades, M15 and above, shall be Design Mix Concrete.**

### **B.5.7.2 Design Mix Concrete**

#### **B.5.7.2.1 Mix Design and Testing**

B.5.7.2.1.1 For Design Mix Concrete, the mix shall be designed according to IS: 10262 and SP: 23 to provide the grade of concrete having the required workability and characteristics strength not less than appropriate values given in IS: 456. The design mix shall in addition be such that it is cohesive and does not segregate and should result in dense and durable concrete and also capable of giving the finish as specified. For water retaining structures, the mix shall also result in water-tight concrete. The Contractor shall exercise great care while designing the concrete mix and executing the works to achieve the desired result.

B.5.7.2.1.2 Unless otherwise specifically mentioned, the minimum cement content for Design Mix Concrete shall be as given below.

Grade of Concrete

Minimum Cement Content in

	Kg/Cu.m of concrete
M15	290
M20	360
M25	380
M30	410
M35	425

The minimum cement content stipulated above shall be adopted irrespective of whether the Contractor achieves the desired strength with less quantity of cement. The Contractor's quoted rates for concrete shall provide for the above eventually and nothing extra shall become payable to the Contractor in this account. Even in the case where the quantity of cement required is higher than that specified above to achieve desired strength based on an approved mix design, nothing extra shall become payable to the Contractor.

B.5.7.2.1.3 It shall be Contractor's sole responsibility to carry out the mix designs at his own cost. He shall furnish to Engineer at least 30 days before concreting operations, a statement of proportions proposed to be used for the various concrete mixes and the strength results obtained. The strength requirements of the concrete mixes ascertained on 150 mm cubes as per IS: 516 shall comply with the requirements of IS: 456.

Grade of concrete	Minimum compressive strength(N/Sq.mm at 7 days)	Specified Compressive strength(N/Sq.mm at 28 days)
M 15	10.0	15.0
M 20	13.5	20.0
M 25	17.0	25.0
M 30	20.0	30.0
M 35	23.5	35.0
M 40	27.0	40.0
M 45	30.0	45.0

B.5.7.2.1.4 A range of slumps, which shall generally be used for various types of construction unless otherwise instructed by the Engineer is given below :

Structure / Member	Slump in millimeters	
	Maximum	Minimum
Reinforced foundation walls and footings	75	25
Plain footings, caissons and substructure walls	75	25
T.G. and massive compressor foundations	50	25
Slabs, beams and reinforced walls	100	25
Pumps and miscellaneous equipment foundations	75	25

Building columns	100	25
Pavements	50	25
Heavy mass construction	50	25

#### **B.5.7.2.2 Batching and Mixing of Concrete**

B.5.7.2.2.1 Proportions of aggregates and cement, as decided by the concrete mix design, shall be by weight. These proportions shall be maintained during subsequent concrete batching by means of weigh batchers capable of controlling the weights within one percent of the desired value.

B.5.7.2.2.2 Amount of water added shall be such as to produce dense concrete of required consistency, specified strength and satisfactory workability and shall be so adjusted to account for moisture content in the aggregates. Water cement ratio specified shall be maintained. Each time the work stops, the mixer shall be cleaned out, and while recommencing, the first batch shall have 10% additional cement to allow for sticking in the drum.

B.5.7.2.2.3 Arrangement should be made by Contractor to have the cubes tested in an approved laboratory or in field at his own expense, with prior consent of Engineer. Sampling and testing of strength and workability of concrete shall be as per IS:1199, IS: 516 and IS: 456.

#### **B.5.7.3 Nominal Mix Concrete**

##### **B.5.7.3.1 Mix Design and Testing**

B.5.7.3.1.1 Mix design and preliminary tests are not necessary for Nominal mix Concrete. However works tests shall be carried out as per IS: 456. Proportions for Nominal Mix Concrete and **water / cement ratio may** be adopted as per Table 3 of IS: 456. However it will be Contractor's sole responsibility to adopt appropriate nominal mix proportions to yield the specified strength.

##### **B.5.7.3.2 Batching and Mixing Concrete**

B.5.7.3.2.1 Based on the adopted nominal mixes, aggregates and cement shall be measured by weight.

#### **B.5.8 FORM WORK**

B.5.8.1 Form work shall be all inclusive and shall consist of but not limited to shores, bracings, sides of footings, walls, beams and columns, bottom of slabs etc. including ties, anchors, hangers, inserts, false work, wedges etc.

B.5.8.2 The design and engineering of the formwork as well as its construction shall be the responsibility of Contractor. However, if so desired by Engineer the drawings and calculations for the design of the formwork shall be submitted to Engineer for approval.

B.5.8.3 Formwork shall be designed to fulfill the following requirements:



- a) Sufficiently rigid and tight to prevent loss of grout or mortar from the concrete at all stages and appropriate to the methods of placing and compacting.
  - b) Made of suitable materials.
  - c) Capable of providing concrete of the correct shape and surface finish within the specified tolerance limits.
  - d) Capable of withstanding without deflection the worst combination of self weight, reinforcement and concrete weight, all loads and dynamic effects arising from construction and compacting activities, wind and weather forces.
  - e) Capable of easily striking without shock, disturbance or damage to the concrete.
  - f) Soffit forms capable of imparting a camber if required.
  - g) Soffit forms and supports capable of being left in position if required.
    - h) Capable of being cleaned and / or coated if necessary immediately prior to casting the concrete; design temporary openings where necessary for these purposes and to facilitate the preparation of construction joints.
- B.5.8.4 The formwork may be of timber, plywood, steel, plastic or concrete depending upon the type of finish specified. Sliding forms and slip form may be used with the approval of Engineer. Timber for formwork shall be well seasoned, free from sap, shakes, loose knots, work holes, warps and other surface defects. Joints between formwork and formwork and between formwork and structures shall be sufficiently tight to prevent loss of slurry from concrete, using seals if necessary.
- B.5.8.5 The faces of formwork coming in contact with concrete shall be cleaned and two coats of approved mould oil applied before fixing reinforcement. All rubbish, particularly chippings, shavings, sawdust, wire pieces dust etc. shall be removed from the interior of the forms before the concrete is placed. Where directed, cleaning of forms shall be done by blasting with a jet of compressed air at no extra cost.
- B.5.8.6 Forms intended for reuse shall be treated with care. Forms that have deteriorated shall not be used. Before reuse, all forms shall be thoroughly scraped, cleaned, nails removed, holes suitably plugged, joints repaired and warped lumber replaced to the satisfaction of Engineer. The Contractor shall equip himself with enough shuttering to allow for wastage so as to complete the job in time.
- B.5.8.7 Permanent formwork shall be checked for its durability and capability with adjoining concrete before it is used in the structure. It shall be properly anchored to the concrete.
- B.5.8.8 Wire ties passing through beams, columns and walls shall not be allowed. In their place bolts passing through sleeves shall be used. Formwork spacers left in situ shall not impair the desired appearance or durability of the structure by causing spalling, rust staining or allowing the passage of moisture.

- B.5.8.9 For liquid retaining structures sleeves shall not be provided for through bolts or shall through bolts be removed if provided. The bolts, in the latter case, shall be cut at 25 mm depth from the surface and the hole made good by cement mortar of the same proportion as the concrete just after striking the formwork.
- B.5.8.10 Where specified or shown on drawings, all corners and angles exposed in the finished structure shall have chamfers or fillets of 20 mm x 20 mm size
- B.5.8.11 Forms for substructure may be omitted when, in the opinion of Engineer, the open excavation is firm enough (in hard non-porous soils) to act as a form. Such excavations shall be slightly larger, as directed by Engineer, than that required as per drawing to compensate for irregularities in excavation.
- B.5.8.12 The Contractor shall provide adequate props carried down to a firm bearing without overloading any of the structures.
- B.5.8.13 The shuttering for beams and slabs shall be so erected that the side shuttering of beams can be removed without disturbing the bottom shuttering. If the shuttering for column is erected for the full height of the column, one side shall be built up in sections as placing of concrete proceeds or windows left for placing concrete from the side limit the drop of concrete to 1.0 m or as directed by Engineer. The Contractor shall temporarily and securely fix items to be cast in (embedment's / inserts) in a manner that will not hinder the striking of forms or permit loss of grout.
- B.5.8.14 Formwork showing excessive distortion, during any stage of construction, shall be repositioned and strengthened. Placed concrete affected by faulty form work, shall be entirely removed and formwork corrected prior to placement of new concrete at the cost of the Contractor.
- B.5.8.15 The striking time for formwork shall be determined based on following requirements:
- a) Development of adequate concrete strength;
  - b) Permissible deflection at time of striking form work;
  - c) Curing procedure employed – its efficiency and effectiveness;
  - d) Subsequent surface treatment to be done;
  - e) Prevention of thermal cracking at re-entrant angles;
  - f) Ambient temperature; and
  - g) Aggressiveness of the environment (unless immediate adequate steps are taken to prevent damage to the concrete).
- B.5.8.16 Under normal circumstances (generally where temperatures are above 20 Deg. C) forms may be struck after expiry of the time period given in IS: 456, unless directed otherwise by Engineer. For Portland pozzolona / slag cement the stripping time shall be suitably modified as directed by the Engineer. It is the Contractor's responsibility to ensure that forms are not struck until the concrete has developed sufficient strength to support itself, does not

undergo excessive deformation and resist surface damage and any stressed arising during the construction period.

**B.5.9 Reinforcement Workmanship**

B.5.9.1 Reinforcing bars supplied bent or in coils shall be straightened cold without damage at no extra cost. No bending shall be done when ambient temperature is below 5 Deg. C. Local warming may be permitted if steel is kept below 100 Deg. C.

B.5.9.2 All bars shall be accurately bent gradually and according to the sizes and shapes shown on the drawings / schedules or as directed by Engineer.

B.5.9.3 Re-bending or straightening incorrectly bent bars shall not be done without approval of Engineer.

B.5.9.4 Reinforcement shall be accurately fixed and maintained firmly in the correct position by the use of blocks, spacers, chairs, binding wire etc. to prevent displacement during placing and compaction of concrete. The tied in place reinforcement shall be approved by Engineer prior to concrete placement. Spacers shall be of such materials and designs as will be durable, not lead to corrosion of the reinforcement and not cause spalling of the concrete cover.

B.5.9.5 Binding wire shall be 16 gauge soft annealed wire. Ends of the binding wire shall be bent away from the concrete surface and in no case encroach into the concrete cover.

B.5.9.6 Substitution of reinforcement, laps / splices not shown on drawing shall be subject to Engineer's approval.

**B.5.10 Tolerances**

B.5.10.1 Tolerance for formed and concrete dimensions shall be as per IS: 456 unless specified otherwise.

B.5.10.2 Tolerances specified for horizontal or vertical building lines or footings shall not be construed to permit encroachment beyond the legal boundaries.

**B.5.11 Preparation prior to concrete placement**

B.5.11.1 Before concrete is actually placed in position, the inside of the formwork shall be cleaned and mould oil applied, inserts and reinforcement shall be correctly positioned and securely held, necessary openings, pockets etc. provided.

B.5.11.2 All arrangements formwork, equipment and proposed procedure, shall be approved by Engineer. The Contractor shall maintain separate Pour Card for each pour as per the format enclosed and shall produce before commencement of concreting to Engineer-in-charge.

**B.5.12 Transporting, placing and compacting concrete**

B.5.12.1 Concrete shall be transported from the mixing plant to the formwork with minimum time lapse by methods that shall maintain the required workability and will prevent segregation, loss of any ingredients or ingress of foreign matter or water.

B.5.12.2 In all cases concrete shall be deposited as nearly as practicable directly in its final position.

To avoid segregation concrete shall not be re-handled or caused to flow. For locations where direct placement is not possible and in narrow forms, Contractor shall provide suitable drops and 'Elephant Trunks'. Concrete shall not be dropped from a height of more than 1.0 m as stipulated in clause B.5.8.13.

B.5.12.3 Concrete shall not be placed in flowing water. Under water, concrete shall be placed in position by tremies or by pipeline from the mixer and shall never be allowed to fall freely through the water.

B.5.12.4 while placing concrete the Contractor shall proceed as specified below and also ensure the following:

- a) Continuously between construction joints and predetermined abutments.
- b) Without disturbance to forms or reinforcement.
- c) Without disturbance to pipes, ducts, fixings and the like to be cast in; ensure that such items are securely fixed. Ensure that concrete cannot enter open ends of pipes and conduits etc.
- d) Without dropping in a manner that could cause segregation or shock.
- e) In deep pours only when the concrete and formwork designed for this purpose and by using suitable chutes or pipes.
- f) Do not place if the workability is such that full compaction cannot be achieved.
- g) Without disturbing the unsupported sides of excavations; prevent contamination of concrete with earth. Provide sheeting if necessary. In supported excavations, withdraw the lining progressively as concrete is placed.
- h) If placed directly onto hardcore or any other porous material, dampen the surface to reduce loss of water from the concrete.
- i) Ensure that there is no damage or displacement to sheet membranes. j) Record the time and location of placing structural concrete.

B.5.12.5 Concrete shall normally be compacted in its final position within thirty minutes of leaving the mixer. Concrete shall be compacted during placing with approved vibrating equipment without causing segregation until it forms a solid mass free from voids thoroughly worked around reinforcement and embedded fixtures and into all corners of the formwork. Immersion vibrators shall be inserted vertically at points not more than 450 mm apart and withdrawn slowly till air bubbles cease to come to surface, leaving no voids. When placing concrete in layers advancing horizontally, care shall be taken to ensure adequate vibration, blending and melding of the concrete between successive layers. Vibrators shall not be allowed to come in contact with reinforcement, formwork and finished surfaces after start of initial set. Over vibration shall be avoided.

B.5.12.6 Concrete may be conveyed and placed by mechanically operated equipment after getting the complete procedure approved by Engineer. The slump shall be held to the

minimum necessary for conveying concrete by this method. When concrete is to be pumped concrete mix shall be specially designed to suit pumping. Care shall be taken to avoid stoppages in work once pumping has started.

B.5.12.7 Except when placing with slip forms, each placement of concrete in multiple lift work, shall be allowed to set for at least 24 hours after the final set of concrete before the start of subsequent placement. Placing shall stop when concrete reaches the top of the opening in walls or bottom surface of slab, in slab and beam construction, and it shall be resumed before concrete takes initial set but not until it has had time to settle as determined by Engineer. Concrete shall be protected against damage until final acceptance.

#### **B.5.13 Mass concrete works**

B.5.13.1 Sequence of pouring for mass concrete works shall be as approved by Engineer.

The Contractor shall exercise great care to prevent shrinkage cracks and shall monitor the temperature of the placed concrete if directed.

#### **B.5.14 Curing**

B.5.14.1 Curing and protection shall start immediately after the compaction of the concrete to protect it from:

- (a) Premature drying out, particularly by solar radiation and wind; (b) leaching out by rain and flowing water;
- (c) Rapid cooling during the first few days after placing; (d) high internal thermal gradients;
- (e) Low temperature of frost;
- (f) Vibration and impact which may disrupt the concrete and interfere with its bond to the reinforcement.

B.5.14.2 All concrete, unless directed otherwise by Engineer, shall be cured by use of continuous sprays or ponded water or continuously saturated coverings of sacking, canvas, hessian or other absorbent material for the period of complete hydration with a minimum of 7 days. The quality of curing water shall be the same as that used for mixing.

B.5.14.3 Where a curing membrane is directed to be used by the Engineer, the same shall be of a non-wax base and shall not impair the concrete finish in any manner. The curing compound to be used shall be got approved from the Engineer before use and shall be applied with spraying equipment capable of a smooth, even textured coat.

B.5.14.4 Curing may also be done by covering the surface with an impermeable material such as polyethylene, which shall be well sealed and fastened.

B.5.14.5 Extra precautions shall be exercised in curing concrete during cold and hot weather.

#### **B.5.15 Construction joints and keys**

B.5.15.1 Construction joints will be as shown on the drawing or as approved by Engineer.

Concrete shall be placed without interruption until completion of work between construction joints. If stopping of concreting becomes unavoidable anywhere, a properly formed construction joint shall be made with the approved of Engineer.

B.5.15.2 Dowels for concrete work, not likely to be taken up in the near future, shall be coated with cement slurry and encased in lean concrete as indicated on the drawings or as directed by Engineer.

B.5.15.3 Before resuming concreting on a surface which has hardened all laitance and loose stone shall be thoroughly removed by wire brushing / hacking and surface washed with high pressure water jet and treated with thin layer of cement slurry for vertical joints and a 15 mm thick layer of cement sand mortar for horizontal layers, the ratio of cement and sand being the same as in the concrete mix.

B.5.15.4 When concreting is to be resumed on a surface which has not fully hardened, all laitance shall be removed by wire brushing, the surface wetted, free water removed and a coat of cement slurry applied. On this a layer of concrete not exceeding 150 mm thickness shall be placed and well rammed against the old work. Thereafter work shall proceed in the normal way.

#### **B.5.16 Foundation bedding**

B.5.16.1 All earth surfaces upon which or against which concrete is to be placed, shall be well compacted and free from standing water, mud or debris. Soft or spongy area shall be cleaned out and back filled with either soil cement mixture, lean concrete or clean sand compacted as directed by Engineer. The surfaces of absorptive soils shall be moistened.

B.5.16.2 Concrete shall not be deposited on large sloping rock surfaces. The rock shall be cut to form rough steps or benches by picking, barring or wedging. The rock surface shall be kept wet for 2 to 4 hours before concreting.

#### **B.5.17 Finishing of concrete surfaces**

##### **B.5.17.1 General**

Immediately after the removal of forms, all exposed bars or bolts passing through the reinforced cement concrete member and used for shuttering or any other purpose shall be cut inside the reinforced cement concrete member to a depth of at least 25 mm below the surface of the concrete and the resulting holes be closed by cement mortar. All fins caused by form joints shall be broken. All cavities produced by the removal of form ties, all holes and depressions, honeycomb spots, broken edges or corners and all other defects shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry a consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been filled/ pointed shall be kept moist for period of twenty-four

hours. Any repair and rectification of defective work is to be undertaken and carried out as directed by the Engineer-in-charge and the cost is to be borne by the contractor.

If rock pockets/ honeycombs, in the opinion of the Engineer-in-charge, are of such an extent or character as to affect 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 affected portion of the structure.

All construction and expansion joints in the completed work shall be left carefully tooled and free from any mortar and concrete. Expansion joint filler shall be left exposed for its full length with clean and true edges.

Curing of the surface shall be continued for a period of 21 days.

#### B.5.17.2 Classes of Finishing

The surface finish for formed and unformed surfaces are classified and defined as below. Surface irregularities permitted for the various classes of finishes are termed either "abrupt" or "gradual". Fins or offsets caused by displaced or misplaced form sheeting, lining or form sections, by loose knots in form timber or by otherwise defective form timber are considered abrupt irregularities. All other cases are described as gradual irregularities. Gradual irregularities will be measured with a template consisting of a straight edge for plane surfaces or its equivalent for curved surfaces. The length of template for testing gradual irregularities on formed surfaces shall be 1.5 m in length, the permissible gradual irregularities being measured over this length of the template. Special surfaces, finishes and treatments falling outside the classes described here but defined elsewhere by the Engineer-in-charge shall also form part of these specifications.

Finish F1, F2 and F3 shall describe formed surfaces.

Finish U1, U2 and U3 shall describe unformed surfaces.

##### B.5.17.2.1 Class F1 Finish

This class of finish shall apply to all formed surfaces for which class F2 or F3 is not specified. It shall generally be formed by sawn timber formwork so constructed that there shall be no loss of material from the concrete during placement and compaction. After hardening, the concrete shall be in the position required and shall have the shape and dimensions called for in the drawings. Any abrupt irregularities shall not exceed 8 mm and gradual irregularities shall not exceed 16mm. All fins and drifts in excess of the above limits shall be made good by chipping and grinding if required by the Engineer-in-charge. Small blemishes caused by entrapped air or water may be expected but the surface shall be free from voids, honeycombing or other large blemishes. Class F1 finish shall be generally specified for all surfaces buried in ground or not visible during service or for surfaces that are to receive further rendering treatment such as plastering etc. Unless otherwise specified in the schedule B the surface finish shall be understood to be Class F1.

## B.5.17.2.2 Class F2 Finish

Class F2 finish shall be obtained by the use of properly designed forms, either close jointed wrought timber forms or with forms having plywood or steel sheet lining. The abrupt irregularities shall not exceed 5 mm and gradual irregularities shall be less than 8mm. Small blemishes caused by entrapped air or water may be permitted but the surface shall be generally free from honeycombing, voids and large blemishes. Surface irregularities in excess of those stipulated shall be removed by chipping or rubbing with abrasive stone.

## B.5.17.2.3 Class F3 Finish

Class F3 finish shall be formed by specially designed close jointed rigid forms having lining of high quality form plywood. The surface irregularities shall be limited to nil for abrupt irregularities and 3 mm for gradual irregularities. Class F3 finish may be obtained from class F2 finish by carefully removing all abrupt irregularities including fins and projections by rubbing/grinding. If steel forms are used they shall be subjected to Engineer-in-charge's approval.

In addition, finish F3 shall include filling air holes with mortar and treatment of the entire surface with sack rubbed finish. It shall also include clean up of loose and adhering debris. For a sack rubbed finish, the surface shall be prepared within two days after of removal of the forms. The surface shall be wetted and allowed to dry slightly before mortar is applied by sack rubbing. The mortar used shall consist of one part cement to one and one half parts by volume of fine (IS No. 16 mesh) sand. Only sufficient mixing water to give the mortar a workable consistency shall be used. The mortar shall then be rubbed over the surface with a fine burlap or linen cloth so as to fill the surface voids. The mortar in the voids shall be allowed to stiffen and solidify after which the whole surface shall be wiped clean with clean burlap such that all air holes etc. are filled and the entire surface presents a uniform appearance without air holes, irregularities etc.

## B.5.17.2.4 Class U1 Finish

This is the screened finish used on surfaces over which other finishes such as wearing coats etc. are to be placed. It is also the first step in the formation of U2 and U3 finishes. The finishing operation consists of leveling and screening the concrete to produce an even and uniform surface so that the gradual irregularities are not greater than 6 mm. Surplus concrete should be removed immediately after consolidation by striking it off with a sawing motion of a straight edge or template across a wooden or metal strip that has been set as guide. Unless the drawings specify a horizontal surface or show the slope required, the tops of narrow surfaces, such as stair treads, walls, curbs and parapets shall be sloped approximately 10 mm per 300 mm width. Surfaces to be covered with concrete topping, terrazzo and similar surfaces shall be smooth and leveled to produce even surfaces, irregularities not exceeding 6 mm.

## B.5.17.2.5 Class U2 Finish



This is a floated finish used on all outdoor unformed surfaces not prominently exposed to view such as tops of piers etc. The floating may be done by hand or power driven equipment. It should not however be started until some stiffening has taken place in the surface concrete and the moisture film or "shine" has disappeared. The floating should work the concrete no more than is necessary to produce a surface that is free from screed marks. All joints and edges should be finished with edging tools. It shall include the repair of gradual irregularities exceeding 6 mm. All abrupt irregularities shall also be repaired unless a roughened texture is specified.

#### B.5.17.2.6 Class U3 Finish

This is a trovelled finish used on all surfaces exposed to view at close quarters such as tops of parapets and kerbs etc. Steel trovelling should not be started after the moisture film and "shine" have completely disappeared from the floated surface and the concrete has hardened enough to prevent an excess of fine material and water from being worked to the surface. Excessive trovelling, especially if started too soon, tends to produce crazing and lack of durability. Too long a delay will result in a surface too hard for proper finishing. Steel trovelling should be performed with a firm pressure that will flatten and smooth the sandy surface left by floating. Trovelling should produce a dense, uniform surface free of blemishes, ripples and trovel marks. It shall include the repair of all abrupt irregularities and the repair of gradual irregularities exceeding 6 mm. It shall also include finishing the joints and the edges of concrete with edging tools.

#### **B.5.18 Repair and replacement of unsatisfactory concrete**

B.5.18.1 Immediately after the shuttering is removed, all the defective areas such as honeycombed surfaces, rough patches, holes left by form bolts etc. shall be brought to the notice of Engineer who may permit patching of the defective areas or reject the concrete work.

B.5.18.2 All through holes for shuttering shall be filled for full depth and neatly plugged flush with surface.

B.5.18.3 Rejected concrete shall be removed and replaced by Contractor at no additional cost to Client.

B.5.18.4 For patching of defective areas all loose materials shall be removed and the surface shall be prepared as directed by the Engineer.

B.5.18.5 bonding between hardened and fresh concrete shall be done either by placing cement mortar or by applying epoxy. The decision of the Engineer as to the method of repairs to be adopted shall be final and binding on the Contractor and no extra claim shall be entertained on this account. The surface shall be saturated with water for 24 hours before patching is done with 1:5 cement sand mortar. The use of epoxy for bonding fresh concrete shall be carried out as directed by Engineer.

#### **B.5.19 Vacuum dewatering of slabs**

B.5.19.1 where specified floor slabs, either on grade or suspended, shall be finished by vacuum dewatering including all operations such as poker vibration, surface vibration, vacuum processing, floating and toweling as per equipment manufacturers recommendation. The equipment to be used shall be subject to Engineer's approval.

**B.5.20 Hot weather requirements**

B.5.20.1 Concreting during hot weathers shall be carried out as per IS: 7861 (Part – I)

B.5.20.2 Adequate provisions shall be made to lower concrete temperatures which shall not exceed 40 Deg. C at the time of placement of fresh concrete.

B.5.20.3 Where directed by Engineer, Contractor shall spray non-wax based curing compound of unformed concrete surfaces at no extra costs.

**B.5.21 Cold weather requirements**

B.5.21.1 Concreting during cold weather shall be carried out as per IS: 7861 (Part-II).

B.5.21.2 The ambient temperature during placement and upto final set shall not fall below 5 Deg. C. Approved antifreeze / accelerating additives shall be used where directed.

B.5.21.3 For major and large scale concreting works the temperature of concrete at times of mixing and placing, the thermal conductivity of the formwork and its insulation and stripping period shall be closely monitored.

**B.5.22 Liquid retaining structures**

B.5.22.1 The Contractor shall take special care of concrete for liquid retaining structures, underground structures and those others specifically called for to guarantee the finish and water tightness.

B.5.22.2 The minimum level of surface finish for liquid retaining structures shall be type F2. All such structures shall be hydro-tested.

B.5.22.3 The Contractor shall include in his price of hydro-testing of structure, all arrangements for testing such as temporary bulk heads, pressure gauges, pumps, pipelines etc.

B.5.22.4 Any temporary arrangements that may have to be made to ensure stability of the structures shall also be considered to have been taken into account while quoting the rates.

B.5.22.5 Any leakage that may occur during the hydro-test or subsequently during the defects liability period or the period for which the structure is guaranteed shall be effectively stopped either by cement / epoxy pressure grouting, guniting or such other methods as may be approved by the Engineer. All such rectification of the Client/Engineer shall be done at no extra cost to the Client.

**B.5.23 Testing concrete structures for leakage**

B.5.23.1 Hydro-static test for water tightness shall be done at full storage by Engineer, as described below:

B.5.23.1.1 In case of structures whose external faces are exposed, such as elevated tanks, the requirements of the test shall be deemed to be satisfied if the external faces show no sign of leakage or sweating and remain completely dry during the period of observation of seven days after allowing a seven day period for absorption after filling with water.

B.5.23.1.2 In the case of structures whose external faces are submerged and are not accessible for inspection, such as underground tanks, the structures shall be filled with water and after the expiry of seven days after the filling, the level of the surface of the water shall be recorded. The level of water shall be recorded again at subsequent intervals of 24 hrs. over a period of seven days. Backfilling shall be withheld till the tanks are tested. The total drop in surface level over a period for seven day shall be taken as an indication of the water tightness of the structure. The Engineer shall decide on the actual permissible nature of this drop in the surface level, taking into account weather the structures are open or closed and the corresponding effect it has on evaporation losses. Unless specified otherwise, a structure whose top is covered shall be deemed to be water tight if the total drop in the surface level over a period of seven days does not exceed 40 mm.

B.5.23.1.3 Each compartment / segment of the structure shall be tested individually and then all together.

B.5.23.2 For structures such as pipes, tunnels etc. the hydro-static test shall be carried out by filling with water, after curing as specified, and subjecting to the specified test pressure for specified period. If during this period the loss of water does not exceed the equivalent of the specified rate, the structure shall be considered to have successfully passed the test.

#### **B.5.24 OPTIONAL TESTS**

B.5.24.1 If Engineer feels that the materials i.e. cement, sand coarse aggregates, reinforcement and water are not in accordance with the specifications or if specified concrete strengths are not obtained, he may order tests to be carried out on these materials in laboratory, to be approved by the Engineer, as per relevant IS Codes. Client shall pay only for the testing of material supplied by the Client, otherwise Contractor shall have to pay for the tests. Transporting of all material to the laboratory shall however be done by the Contractor at no extra cost to Client.

B.5.24.2 In the event of any work being suspected of faulty material or workmanship requiring its removal or if the works cubes do not give the stipulated strengths Engineer reserves the right to order the Contractor to take out cores and conduct tests on them or do ultrasonic testing or load testing of structure, etc. All these tests shall be carried out by Contractor at no extra cost to the Client. Alternatively Engineer also reserves the right to ask the Contractor to dismantle and re-do such unacceptable work at the cost of Contractor.

B.5.24.3 If the structure is certified by Engineer as having failed, the cost of the test and subsequent dismantling/reconstruction shall be done by contractor.

B.5.24.4 The quoted unit rates / prices of concrete shall be deemed to provide for all tests mentioned above.

#### **B.5.25 GROUTING**

B.5.25.1 Grout shall be provided as specified on the drawings. The proportion of standard Grout shall be such as to produce a flow able mixture consistent with minimum water content and shrinkage. Surface to be grouted shall be thoroughly roughened and cleaned. All structural steel elements to be grouted shall be cleaned of oil, grease, dirt etc. The use of hot, strong caustic solution for this purpose will be permitted. Prior to grouting, the hardened concrete shall be saturated with water and just before grouting water in all pockets shall be removed. Grouting once started shall be done quickly and continuously. Variation in grout mixes and procedures shall be permitted if approved by ENGINEER. The grout proportions shall be limited as follows:

	<b>Use</b>	<b>Grout Thickness</b>	<b>Mix Proportions</b>	<b>W/C Ratio (max.)</b>
a)	Fluid mix	Under 25 mm	One part Portland cement to one part sand	0.44
b)	General mix	25 mm and over but less than 50 mm	One part Portland cement to 2 part sand.	0.53
c)	Stiff mix	50 mm and over	One part Portland cement to 3 part sand	0.53

#### **B.5.25.2 Non Shrink Grout**

B.5.25.2.1 Non-shrink grout where called for in the Schedule of Quantities or specified on the drawings shall be provided in strict accordance with the manufacturer's instructions/ specifications on the drawings.

#### **B.5.26 Inspection**

B.5.26.1 All materials, workmanship and finished construction shall be subject to continuous inspection and approval of Engineer. Materials rejected by Engineer shall be expressly removed from site and shall be replaced by Contractor immediately at no extra cost to Client.

#### **B.5.27 Clean-Up**

B.5.27.1 Upon the completion of concrete work, all forms, equipment, construction tools, protective coverings and any debris, scraps of wood etc. resulting from the work shall be removed and the premises left clean.

#### **B.5.28 Acceptance Criteria**

B.5.28.1 Any concrete work shall satisfy the requirements given below individually and collectively for it to be acceptable.

- a) Properties of constituent materials;
- c) Specified mix proportions;
- e) Maximum free-water / cement ratio;
- g) Temperature of fresh concrete;
- i) Cover to embedded steel;
- k) Tolerances in dimensions;
- m) Durability;
- o) Special requirements such as:
  - i) Water tightness;
  - ii) Resistance to aggressive chemicals
  - iii) Resistance to freezing and thawing
  - iv) Very high strength
  - v) Improved fire resistance
  - vi) Wear resistance
  - vii) Resistance to early thermal cracking
- b) Characteristic compressive strength;
- d) Minimum cement content;
- f) Workability;
- h) Density of fully compacted concrete;
- j) Curing;
- l) Tolerances in levels;
- n) Surface finishes;

B.5.28.2 The Engineer's decision as to the acceptability or otherwise of any concrete work shall be final and binding of the Contractor.

B.5.28.3 For work not accepted, the Engineer may review and decide whether remedial measures are feasible so as to render the work acceptable. The Engineer shall in that case direct the Contractor to undertake and execute the remedial measures. These shall be expeditiously and effectively implemented by the Contractor. Nothing extra shall become payable to the Contractor. Nothing extra shall become payable to the Contractor by the Client for executing the remedial measures.

**B.5.29 Mode of measurement and payment**

B.5.29.1 The unit rate for concrete work under various categories shall be all inclusive and no claims for extra payment on account of such items as leaving holes, embedding inserts, etc. shall be entertained unless separately provided for in the schedule of quantities. No extra claim shall also be entertained due to change in the number, position and / or dimensions of holes, slots or openings, sleeves, inserts or on account of any increased lift, lead of scaffolding etc. All these factors should be taking into consideration while quoting the unit rates. Unless provided for in the Schedule of Quantities the rates shall also include fixing insets in all concrete work, whenever required.

B.5.29.2 Payments for concrete will be made on the basis of unit rates quoted for the respective items in the Schedule of Quantities. No deduction in the concrete quantity will be made for reinforcements, inserts etc. and opening less than 0.100 of a sq.m in areas where concrete is measured in sq.m and 0.010 cu.m where concrete is measured in cu.m. Where no such deduction for concrete is made, payment for shuttering work provided for such holes,

pockets, etc. will not be made. Similarly the unit rates for concrete work shall be inclusive or exclusive of shuttering as provided for in the Schedule of Quantities.

B.5.29.3 Payment for beams will be made for the quantity based on the depth being reckoned from the underside of the slabs and length measured as the clear distance between supports. Payment for columns shall be made for the quantity based on height reckoned upto the underside of slab / beams.

B.5.29.4 The unit rate for precast concrete members shall include formwork, mouldings, finishing, hoisting and setting in position including setting mortar, provision of lifting arrangement etc. complete. Reinforcement and inserts shall be measured and paid for separately under respective item rates.

B.5.29.5 Only the actual quantity of steel embedded in concrete including laps as shown on drawings or as approved by Engineer shall be measured and paid for, irrespective of the level or height at which the work is done. The unit rates for reinforcement shall include lap chairs, spacer bars etc.

B.5.29.6 Where the formwork is paid for separately, it shall be very clearly understood that payment for formwork is inclusive of formwork, shuttering, shoring, propping scaffolding etc. complete. Only the net area of concrete formed (shuttered) shall be measured for payment.

#### CONCRETE POUR CARD

Client : \_\_\_\_\_ Date : \_\_\_\_\_  
 Project : \_\_\_\_\_ Structure : \_\_\_\_\_  
 Contractor : \_\_\_\_\_ Max. Aggregate size slump : mm/ mm/ Drg. NO. : Start/  
 Completion Time : \_\_\_\_\_  
 Concrete Grade : \_\_\_\_\_ Mixing Time : \_\_\_\_\_

Sr.	Item	Contractor's Rep. Signature	Engineer's Signature	Remarks
1	Centre lines Checked			
2	Form work and Staging checked for Accuracy, Strength & finish			
3	Reinforcement Checked			
4	Cover to Reinforcement Checked			
5	Verified test certificate for cement / steel	Yes / No	Yes / No	
6	Adequacy of Materials / Equipment	Yes / No	Yes / No	
7	Embedded Parts checked (Location and Plumb)	Civil		
		Mechanical		
		Electrical		

**Pour Authorized site Engineer**

8	Soffit(S) and pour top ( T ) levels checked before ( B ) and after (A) from removal (Only of Beams of over 1 M. span & Important structures link T.G etc.)	S(B) S(A)	T(B) T(A)	
9	Construction joint location & time (If not as per Drawing)			
10	Cement Consumption in Kgs.			
11	Numbers of cubes and identification mark			
12	Test cube results (7 Days / 28 Days)			
13	Concrete Condition on Form Removal	<b>Very Good/ Good / Fair / Poor</b>		

Engineer-in-charge

Contractor

Notes:

1. Each item to be checked & signed by the respective engineers.
2. Item 8 to 13 ( Both inclusive ) to be filled by only engineers of the client.
3. Each pour to have separate cards in triplicate one each for client & site
4. Under remarks indicate deviations from drawings & specifications congestion in reinforcement if any unusual occurrences such as failure of equipment sinking of supports / props, heavy rain affecting reasonable. Poor compaction improper curing other deficiencies observations etc.

**SECTION: B-7 Deleted****SECTION: B-7 STRUCTURAL STEEL**

All structural steel shall be comply with the requirements of IS 226-1961 and structural steel work IS 1915-1962 specifications for structural steel appropriate for bridge work. However for more details reference shall be taken from section no. 1000, 1600 and 1900 of MORTH specifications.

**B.7.1 Steel for Pins and Rollers**

Rolled steel pins and rollers, shall comply with requirements of the specifications appropriate for the work. Steel casting for casting steel pins shall conform to grade 1 or 3 of IS 1030-1956 specifications for steel casting (for general engineering purposes as appropriate).

**B.7.2 Bolts and Nuts**

Mild steel for bolts and nuts when tested shall comply with IS 1608-1960 and shall have tensile strength of not less than 2500 Kg/cm<sup>2</sup>. Plain washers shall be made of steel.

**B.7.3 Welding Electrode**

Mild steel electrodes shall comply with requirements of IS 814-1957 specification for covered electrodes for metal arc welding of mild steel.

**B.7.4 Workmanship**

All work shall be in accordance with the drawings and shall satisfy IS specification No. 1915-1961. Care shall be taken to ensure that all parts in assembly fit accurately together. Notes or specifications on the drawings supplied by the Engineer-in-Charge/consulting Engineer, are to be constructed as superseding or cancelling any clause of this specifications with which they conflict. On all drawings dimensions shown in figures shall be acted in preference to measurement by scale.

**B.7.5 Straightening**

All structural steel members and parts shall have straight edges. All straightening shaping and leveling etc. shall be done by pressure only and not by hammering. All joggles and knees shall be formed by pressure and where practicable in making these, the metal shall not be cut and welded.

**B.7.6 Cutting**

All structural steel parts where required shall be sheared, cropped sawn or flame cut and ground accurately to the required dimensions and shape.

**B.7.7 Bolts Holes**

The diameter of bolts holes B shall be 1.5 to 2.0 mm. larger than the nominal diameter of bolt. All holes for bolts shall be drilled unless permitted by Engineer-in-Charge for punching the holes. Care shall be taken; such as surrounding material is not deformed or damaged in case of punching the hole is allowed.

**B.7.8 Welding**

Welding of steel conforming to relevant IS specifications shall be in accordance with general requirements of metal arc welding. In addition to general requirement, the following care shall be taken:-

- (a) The welding shall be positioned for downward welding wherever practicable.
- (b) The welding current shall conform with respect of voltage and ampere to the recommendations of the manufacturers of the electrode being used. The arc length, voltage and ampere shall be suited to the thickness of material, type of groove and other circumstances of the work.
- (c) The surface to be welded and surrounding material for a distance of at least 155 mm shall be free from scale, dirt, grease, paint, heavy rust or other surface deposit.
- (d) Members to be welded shall be held in correct position by holes, clamps, wedges, jigs or other suitable devices or by tack welding until welding has been completed, such fastening as may be used shall be adequate to ensure safety. Suitable allowance shall be made for warpage and shrinkage.



(e) Tack welds located where the final welds will later be made shall be subject to the same quality requirements as final welds. Defective and broken tack welds shall be removed before final welding.

(f) Fusion faces shall be made or cut by shearing, chipping, machining or by gas cutting.

(g) Exposed faces of welds shall be made reasonably smooth and regular so as to conform as closely as practicable to design requirements and shall not be of less than the required cross section.

(h) Finished welds and adjacent parts shall be protected with clean boiled linseed oil after all slag has been removed.

### **B.7.9 Safety Precautions**

B.7.9.1 (a) Operators of welding and cutting equipment shall be protected from the rays of the arc flame gloves and by helmet, hand shields, or goggles equipped with suitable filter lenses.

(b) Closed space shall be ventilated properly while welding is being done therein.

(c) Welders should be provided with such staging as will enable them to perform the welding operation. For site welding shelter should be provided to protect welders and the parts to be welded from the weather.

B.7.9.2 The Constructor shall employ a competent welding supervisor to ensure that the standard of workmanship and the quality of materials comply with requirements laid in this specification.

B.7.9.3 The Constructor shall provide free access to the representative of Engineer-in-Charge/Consulting Engineer to the work being carried out at all reasonable times and facilities shall be provided so that during the course of welding he may be able to inspect any layer of weld metal. He shall be at liberty to reject any material that does not conform to the terms of the specifications and to require any defective welds to be cut out and welded. The representative of the Engineer-in-Charge/Consulting Engineer shall be notified in advance of any welding operations.

B.7.9.4 Inspection and testing of welds shall be done as laid down in IS 822 and IS 11017.

B.7.9.5 No welder shall be employed in any position except those who are fully qualified to welding. Qualification for welders shall be as laid down in IS 812.

### **B.7.10 Joints**

All steel work intended to be bolted together must be in contact over the whole surface. Joints which have to take compressive stress and the ends of all stiffeners shall meet truly over the whole of the butting surface.

### **B.7.11 Assembling**

All members shall be so arranged that they can be accurately assembled, without being unduly packed, strained or forced into position and when built shall be true and free from twist kinks, buckles or open joints between component pieces. Work shall be kept properly bolted together and no drifting shall be allowed except for the purpose of drawing

assembled sections together in accuracy's in matching of holes may be corrected. But drifting to enlarge holes is prohibited. Failure in any of the above respect will involve the rejection of defective members.

#### **B.7.12 Mode of Measurement and Payment**

B.7.12.1 Measurement of this item shall be as per IS 1200(Part VIII) - 1974 or as per its latest revision so far as applicable.

B.7.12.2 The contract rate shall be suitable for unit of one metric tone of structural steel.

### **SECTION: B-8: REINFORCEMENT**

#### **B.8.1 Specification for TMT steel bars reinforcement**

##### **B.8.1.1 Scope of work**

The scope of work consists of providing and laying HYSD TMT Fe500 reinforcement for RCC works of various components of the structure. This may be ISI Mark TMT Steel reinforcement confirming to IS: 1786 by primary manufacturers only shall be allowed only for this project. This includes cuttings, bending, binding, placing, with all equipment and labour required for the work as directed by the Engineer-in-Charge and all operations covered within the intent and purpose of the specification. However for more details reference shall be taken from section no. 1000, 1600 and 1900 of MORTH specifications.

##### **B.8.1.2 Bending of Reinforcement**

Reinforcing steel shall conform accurately to the dimensions shown on relevant drawings and conforming to the relevant IS codes (latest revision) Bars shall be bent cold to the specified shape and dimensions or as directed by the Engineer in Charge using a proper bar bender, operated by hand or power to attain proper radii of bends. Bars shall not be bent or straightened in a manner that will cause injury to the material. Bars bent during transport or handling shall be straightened before being used on work; they shall not be heated to facilitate bending. The bending of the TMT bars shall be carried out as per the following :

Sr. No.	Operation	Size	TMT bars
1	Bend	Upto 22 mm dia.	3d
		Over 22 mm dia.	4d
2	Rebend	Upto 10 mm dia.	4d
		Over 10 mm dia.	5d

##### **B.8.1.3 Placing of Reinforcement**

All reinforcing bars shall be accurately placed in the 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 conforming to IS: 280 and by using stays blocks or metal chairs,

spacer, metal hangers, supporting wires or other approved devices at sufficiently close intervals. Bars will not be allowed to sag between supports nor displaced during concreting or any other operation over the work. All devices used for positioning shall be of non-corrodible material. Wooden and metal supports will not extend to the surface of concrete, except where shown on the drawings, Placing bars on layers of freshly laid concrete as the work progresses for adjusting bar spacing will not be allowed. Pieces of broken stone, brick or 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 protect reinforcement from corrosion, concrete cover shall be provided as indicated on the drawings. All bars protruding from concrete to which other bars are to be spliced and which are likely to be exposed for an indefinite period shall be protected by a thick coat of neat cement grout.

In the case of columns and walls, vertical bars shall be kept in normal position with timber templates having slots accurately cut in for bar position. Such templates shall be removed after the concreting has progressed up to a level just below them.

Bars crossing each other, where required, shall be secured by binding wire (annealed) of size not less than 1 mm and conforming to IS: 280 in such a manner that they do not slip over each other at the time of fixing and concreting. As far as possible, bars of full length shall be used. In case this is not possible, overlapping of bars shall be done as directed by the Engineer in Charge. When practicable, overlapping bars shall not touch each other, but be kept apart by 25 mm or 1 1/4 times the maximum size of the coarse aggregates whichever is greater, by concrete between them. Where this is not feasible, overlapping bars shall be bound with annealed steel wire, not less than 1mm thickness twisted tight in eight shapes around the lapped bars. The overlaps shall be staggered for different bars and located at fixed locations only along the span where neither shear nor bending moment is maximum.

#### **B.8.1.4 Welding of Bars**

Welding of TMT bars can be permitted if specified on the drawings, joints of reinforcement bars shall be butt welded so as to transmit their full strength. Welded joints shall preferably be located at points where 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 33 per cent of the rods are welded. No pre-warming or post heat treatment is necessary. Interpose temperature should be limited to 200°C with low heat input and equivalent strength low hydrogen type electrode. Suitable means shall be provided for holding the bars securely in position during welding. It must be ensured that no voids are left in welding and when

welding, is done in 2 or 3 stages, previous surface shall be cleaned properly. Ends of the bars shall be cleaned of all loose scale, rust, Grease, paint and other foreign matter before welding. Only competent welders shall be employed on the work.

Welded pieces of reinforcement shall be tested. Specimens shall be taken from the actual site and their number and frequency of tests shall be as directed by Engineer in Charge.

The TMT bars shall be tested for any or all of the following tests as directed by the Engineer-in-charge.

- (1) Alternate immersion test
- (2) Salt spray test
- (3) Atmospheric exposure test
- (4) Sulphur dioxide test
- (5) Potential dynamic test

#### **B.8.1.5 Measurements for payment**

Reinforcement shall be measured in lengths separately for different diameters as actually used in the work including overlaps/ From the length so measured the weight of reinforcements shall be calculated in tones as per IS: 1732 lengths shall include hooks at ends, wastage, avoidable overlaps, couplis and welded joints, spaced bars and annealed steel wire for binding shall not be measured and cost of these items shall be deemed to be included in the rates for reinforcement.

#### **B.8.1.5 Rate**

Rate for reinforcement shall include cost of all steel including procurement, cost of bending, placing, binding and fixing in position as shown on the drawings and as directed by the Engineer in charge. It shall also include cost of all devices for keeping reinforcement in approved position, cost of jointing as per approved method, and all wastage, overlaps and spacer bars.

### **SECTION: B-9 : SUB-STRUCTURE**

#### **B.9.1 Scope**

The work shall cover furnishing and providing of masonry or reinforced concrete sub-structure in accordance with the drawings and as per specifications or as directed by the engineer. However for more details reference shall be taken from section no. 1000, 1700 and 2200 of MORTH specifications.

#### **B.9.1 Materials**

Materials shall conform to section B-5, B-6, B-7 and B-8 of these specifications.

#### **B.9.2 Piers And Abutments**

In case of concrete piers the number of, horizontal construction joints shall be kept minimum. Construction joints shall be avoided in splash zones unless specifically permitted by the

engineer and provided they are treated in accordance with special provisions. No vertical construction joint shall be provided. The work shall conform strictly to the drawings or as directed by the engineer. In case of tall piers and abutments, use of slip form shall be preferred.

The surface of the foundation shall be scrapped with wire brush and all loose materials removed. In case of reinforcing bars projecting from foundations are coated with cement slurry, the same shall be removed by tapping, hammering or wire brushing. Care shall be taken to remove all loose materials around reinforcements. Just before commencing masonry or concrete work, the surface shall be thoroughly wetted.

The surface finish shall be smooth, except the earth face of the abutments which shall be rough finished.

In case of abutments likely to experience considerable movement on account of backfill of approaches and settlement of foundations, the construction of abutment shall be followed by filling up of embankment in layers to the full height to allow for the anticipated movement during construction period before casting of super structure.

#### **B.9.3 Pier cap and abutment cap**

The locations and levels of pier cap/abutment cap/pedestals and bolts for fixing bearings shall be checked carefully to ensure alignment in accordance with the drawings of the bridge.

The surface of cap shall be finished smooth and shall have a slope for draining of water as shown on the drawings or as directed by the engineer. For short span slab bridges with continuous support on pier caps, the surface shall be cast horizontal. The top surface of the pedestal on which bearings are to be placed shall also be cast horizontal.

The surface on which elastomeric bearings are to be placed shall be wood float finished to a level plane which shall not vary more than 1.5mm from straight edge placed in any direction across the area. The surface on which other bearings (steel bearings, pot bearings) are to be placed shall be cast about 25mm below the bottom level of bearings and as indicated on the drawings.

#### **B.9.4 Dirt / Ballast wall, Return wall and Wing wall**

For gravity type masonry and concrete return and wing wall, the surface of foundation shall be prepared in the same manner as prescribed for construction of abutment. No horizontal construction joint shall be provided. If shown on the drawing or directed by the engineer, vertical construction joint may be provided. Vertical expansion gap of 20 mm shall be provided in return wall / wing wall at every 10 meter intervals or as directed by the engineer.

The finish of the surface on the earth side shall be rough while the front face shall be smooth finished.

#### **B.9.5 Tests and standards of acceptance**

The materials shall be tested in accordance with these specifications and shall meet the standard criteria.

The work shall conform to these specifications and shall meet the standards of acceptance.

#### **B.9.6 Measurement for payment**

Masonry and concrete in sub-structure shall be measured in cubic meters in accordance with relevant sections of these specifications, based on the quantities ordered or as shown on the drawing.

Steel in sub-structure shall be measured in tones in accordance with relevant sections of these specifications, based on the quantities ordered or as shown on the drawing.

#### **B.9.7 Rate**

The contract unit rates for masonry, concrete and reinforcement shall include all works as given in respective sections of these specifications and cover all incidental items for furnishing and providing substructure as mentioned in this section.

#### **SECTION: B-10 Deleted**

#### **SECTION: B-11 Deleted**

#### **SECTION: B-12 FILTER MEDIA BEHIND ABUTMENT & RETURNS**

##### **B.12.1 SCOPE**

Well graded pebbles or metal of 40 mm. to 63 mm. size shall be used. The grading tolerances of metal or pebbles should be as under.

<b>Sr.</b>	<b>No. of size range</b>	<b>Sieve designation</b>	<b>Percentage by weight passing through the sieve</b>
1.	63 mm. To 40 mm.	90 mm.	100-50
		63 mm.	85 -100
		50 mm.	35-70
		40 mm.	00 -15
		20 mm.	00 - 05

The size shall be 40 mm. to 63 mm. Wherein tolerance limit for oversize shall be up to 15% and that for lower size should be up to 15% & below 20 mm. it shall be tightly placed to a thickness not less allowable up to 5%, the filter material than 600 mm. & provided over the entire surface behind abutments wings or return walls to the full height.

##### **B.12.2 MATERIALS**

Materials shall be first stacked in boxes of 2 m. x 1.5 m. x 0.5 m. size on fairly level ground and measured.

##### **B.12.3 MEASUREMENTS**

The measurement for payment shall be made on cubic meter basis.

**B.12.4 PAYMENT**

The unit rate includes to the cost of materials, scaffolding, labour & tools to complete the work.

**SECTION : B-13 : WEEP HOLES**

**B.13.1** Providing weep holes in abutment and returns using 100 mm. dia. PVC pipes and C.I. grating including cutting, fixing, the pipe in required slope. Weep holes with the backing of filter material shall be provided in abutments and returns as per detailed drawings, the quality of the PVC. pipe 100mm dia. and C. I. Grating shall be as per I. S. standards and the same shall have to be got approved from the Engineer in charge before using the same. The work shall be carried out to the full satisfaction of the Engineer-in-charge.

**B.13.2 MEASUREMENT**

Measurements shall be given on number of weep holes provided.

**B.13.3 PAYMENT**

The rate includes all materials, labors, equipment and plants etc. required for executing this item.

**SECTION : B-14 : G. I. WATER SPOUT****B.14.1 SCOPE**

Material for the water spout shall be as mentioned in the item and shall be got approved from the Engineer-in-charge.

**B.14.2 MATERIAL & ASSEMBLY**

Water spout shall be 100mm internal dia. G. I. grating shall be provided at the entry and shall be fixed in the recess so as to be flush with the road surface. The quality and size of the grating shall be got approved from the Engineer-in-charge. The water spouts shall project at least 10cm. outside the concrete and shall be rigidly fixed in it. The grating and G. I. pipes shall be painted with two coats of anticorrosive black bitumen paint.

**B.14.3 MEASUREMENT**

Measurement shall be per number of water spout fixed.

**B.14.4 PAYMENT**

Unit rate includes cost of all materials, labour and tools to complete the work.

**SECTION: B-15: WEARING COAT**

**B.15.1** Wearing coat shall not be laid monolithic with the deck. The thickness of wearing coat shall be 75mm the minimum grade of concrete shall be M 30 with water cement ratio as 0.4.

Curing of wearing coat earlier than what is generally required may be resorted to, so as to avoid formation of shrinkage cracks in hot weather. All carriageways and footpath surfaces shall have non-skid characteristics. The cross slope in the carriageway shall be kept as 2 percent. Cross camber shall be achieved by variation in thickness of wearing coat.

**B.15.2 MEASUREMENT**

Cement concrete wearing coat shall be measured in cubic meters. Asphaltic concrete wearing coat shall be measured in square meters.

**B.15.3 RATE**

The contract unit rate for wearing coat shall include the cost of all labour, material, tools and plant and other cost necessary for completion of the work.

**SECTION: B-16: P.V.C. and G.I. pipe****B.16.1 General**

The G.I. pipe used shall conform to IS: 1239. The PVC pipe used shall be of 75mm and 100 mm diameter and as per detail given in the drawings.

**SECTION: B-17: EPOXY COATINGS**

**B.17.1** Prime coat to be used shall conform to the specifications of primers approved by the engineer. Primer shall be applied to the blast cleaned surface before any deterioration of the surface is visible. All coats shall be compatible with each other. The under coat and finishing coat shall be from same manufacturer. Typical guidelines for the epoxy based paints are as given below:

- I) Surface preparation: Remove oil/grease by use of petroleum hydrocarbon solution (IS:1745) and grit blasting to near white metal surface.
- II) Paint System: 2 coats of epoxy zinc phosphate primer = 60 microns; Total 2 coats = 100 microns

**B.17.2 Methods of application:**

The methods of application of all paint coatings shall be in accordance with the manufacturer's written recommendation and shall be as approved by the engineer. Spray paintings may be permitted provided it will not cause inconvenience to the public and is appropriate to the type of structure being coated. Areas hard to gain access to for painting and areas shaded for spray application shall be coated first by brushing. Oil based red lead primers must be applied by brush only, taking care to work into all corners and crevices. The primer, intermediate and finishing coats shall all be applied so as to provide smooth coatings of uniform thickness. Wrinkled or blistered coatings or coatings with pin holes, sags, lumps or other blemishes shall not be accepted. Where the engineer so directs, the coating shall be removed by abrasive blast cleaning and replaced at the contractor's expense.

**B.17.3 Measurements for payment:**



The measurements of coatings shall be in sq.m. based on the area on which coating is applied. No addition shall be made for the weight of protective coating.

**B.17.4 Rate**

The contract unit rate shall include the cost of all materials, labour, tools and other costs necessary for completion of work.

**SECTION: B-18: DELETED****SECTION: B-19: ROADWORK BETWEEN RETURN WALLS FOR EARTH WORK****B.19.1 FOR EARTH WORK****Description:-**

These specifications shall apply to the construction of embankment shoulders and miscellaneous back fills the approved material obtained either from excavation for road construction or brought from outside by the contractor. All embankments shall be constructed in accordance with the requirements of the specifications and in conformity with the lines grades and cross section shown on the drawings or as directed by the Engineer.

**Materials:-****Physical requirements:-**

The materials used in the embankment shall be earth murrum, gravel, and admixture of those of any other material approved by the Engineer. Such materials shall be free of logs, slums roots, rubbish or any other gradient likely to deteriorate or affect the stability of the embankment. The work shall be so planned and executed that the best available materials are saved for the top portion of the embankment. The sizes of the coarse materials in the mix of earth shall ordinarily not exceed 75 mm. However, the Engineer may at his discretion permit the use of material coarser than this also if he is satisfied that the same will not present any difficulty as regards the cement of fill material and its completion to the specification requirements.

Ordinarily, only the materials satisfying the density requirements given in Table shall be employed for embankment construction. The Engineer may however, change these requirements as his discretion taking into account the availability of materials for construction and other relevant factors.

Density requirements of embankment materials Type of work	Minimum laboratory dry density in gm / sc. When tested as per IS 2720 (Part VII)
Top 0.5 mt. of the embankment below the sub-grade level and shoulders (where earth shoulder are specified)	Not less than 1.65
Embankment's up to 3.0 meter height	Not less than 1.44

Embankment exceeding 3.0 meter height or any height subject to long period	Not less than 1.52
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Note: The soaked CBR value of the embankment shall not be less than 4.

#### **Construction Operation:-**

After the site has been cleared, the work shall be set out. The limits of the embankment shall be marked by fixing matter pegs on both sides at regular intervals as guides before commencing the earth work. To ensure their safety, it is desirable to fix the pegs about 0.5 meters back from the actual limits of the fill and to paint them in distinctive color. All cases the original ground shall be compacted by rolling as directed by the Engineer, when the height of the embankment is less than 0.5 m and the original ground does not already have a relative compaction of at least 95% the same shall be loosened to a depth of 2.5 watered and compacted in layers not exceeding 250 mm in loose thickness to the maximum dry density of the material, determined in accordance with IS 2720 Part VII However before relaying and compacting the loosed material the surface below this level shall be compacted as directed by the Engineer. Where so directed by the Engineer, any unsuitable materials occurring in the embankment foundation shall be removed and replaced until the foundation for embankment have been inspected by the Engineer, found satisfactory and approved.

#### **Spreading Material in layers and bringing to appropriate moisture content**

The embankment material shall be spread uniformly over the entire width of the embankment in layers not exceeding 250 mm in loose thickness successive layers of embankment shall not be placed until the layer under construction has been thoroughly compacted to the requirements set down herein under.

Moisture content of the materials shall be checked at the source of supply and if found less than specified for compaction the same shall be made good either at the source or after spreading the soil in loose thickness for compaction in latter case water shall be sprinkled directly from hose line or from water tank mounted on a truck and flooding shall not be permitted under any circumstances.

If the material delivered to the road is too wet, it shall be dried, by serration and exposure to the sun, till the moisture content is acceptable for compaction should circumstances arise. Where owing to wet weather, the moisture content cannot be reduced the required amount by the above procedure, work on compaction shall be suspended, moisture content of each layer of soil shall be adjusted (making due allowances for evaporation losses) so that at the time of compaction, it is on the range of 10%: 2% below above the optimum moisture content. After adding the required amount of water, soil shall be processed by means of narrow, rotary mixer or as otherwise until the layer is uniformly wet. Clods of had lumps of earth shall be broken to have maximum size of 150 mm

when being placed in the lower layers of the embankment and a maximum size of 60 mm when being placed in the top 0.5 meter portion of the embankment below the sub grade.

**Compaction:**

Each layer of the material shall be thoroughly compacted by using a power roller of not less than 10 Ton or any other approved plant rolling after compaction shall be not less than 95% of the maximum laboratory dry density as per IS: 2720 (Part VII) Subsequent layers shall be placed only after the finished layer has been tested according to the clause and accepted by the Engineer.

When density measurement reveals any soft areas in the embankment further compaction shall be carried out as directed by the engineer. If in spite of this specified compaction is not achieved, the material in the soft areas shall be removed and replaced and approved materials compacted to the density requirement and to satisfaction of the Engineer. The surface of the embankment shall at all times during construction be maintained at such a cross fall as will shed water and prevents flooding.

**Rolling:**

A power roller shall as a rule, be not less than 10 tones but if any still heavier rollers are required on the works, the contractors shall have to bring them as may be directed by the Engineer. In case of trenches not more than 8' in width, a earth master of any other similar equipment manually or machine operated shall be invariability employed.

Rolling shall progress from edges to the centre of the road in strips paralleled to the centre line of the road. Rolling shall be done by lapping uniformly each proceeding rear wheel track by at least one half width of the track. On super elevations rolling shall be started at inner edge and shall progress towards outer edge.

During and after rolling the surface shall be checked for graded chamber. Rolling shall be started, worked or stopped without jerks. Rolling shall not normally be done is length less than 100 m.

On completion of day's work the roller shall be made to stand on the side width of the road and shall be guarded by a watchman. A red lantern shall be hung on the roller at night to as to be visible from both sides of the road.

**B.19.2 SUPPLYING OF COARE CLEAR N SHARP SAND**

1. The materials for the purpose shall be of approved quality. Any material, which is found inferior, shall be rejected and the contractor shall move such rejected materials from the site at his own cost. The Executive Engineer or his authorized agent shall approve the materials.
2. River or nala or sea sand required for the work shall be clear, sound, properly, graded, free from organic materials silt clay etc. and shall be got approved by the Engineer-in-charge. The sand shall be obtained and brought from the source approved by the Engineer-in-charge. The sand shall be well graded

The payment shall be made on Cubic meter basis.

3. Stacking shall be done by filling in the standard steel boxes of 2 m x 1.5 m x 0.5 m size which shall be supplied by the department if available on rent. Otherwise contractor shall make his own arrangement. No deduction for voids shall be made from the grade measurements. Where any doubt exists as to whether the quantity of stacks of murrum in an hectometer is not confirming with the cubic content of the standard pharas (2 x 1.5 x 0.5 m) the same shall be got corrected by the contractor if so ordered by the Engineer-in-charge for which no extra payment shall be claimed by the contractor. If the quantity of murrum in any stack in a particular hectometer is found to be less than the standard measurements viz. 1.5 cmt. The entire collection in the hectometer shall be paid on the basis of the quantity so found. Regular stacks shall be done by the Contractor on a fairly level ground. Stacking of the murrum shall be done in a manner as directed by the Engineer-in-charge.
4. For road work completed stacking of murrum shall be done by the Contractor on a fairly level ground. Stacking of the murrum shall be done in a manner as directed by the Engineer-in-charge.
5. For road work completed stacking of murrum as per requirement shall be carried out in 2 K.M. lengths before spreading. The collection shall always, be commenced at one end of the K.M. and be carried continuously toward the other end unless the Engineer- in-charge shall direct otherwise.
6. The payment shall be made on cubic meter basis without deduction for voids. The contractor shall maintain all stacks in regular and proper size till the whole materials are collected, measured and finally accepted by the Department. The spreading of materials shall not be allowed till the materials are fully stacked and completed kilometer wise.
7. The rate includes cost of collection, conveyance to the site with all lead and lift and filling the boxes including all labor, tools, equipment and other incidental expenses.
8. The rates quoted are inclusive of all such tools, duties, fees, royalties, taxes etc.
9. The measurements shall be taken on cubic meter basis.

#### **B.19.3 SUPPLY OF GRADED HAND BROKEN STONE AGGREGATE**

1. The stone for rubble soling, to be supplied from the approved quarry by the contractor and shall be of good quality and of size 63 mm to 170 mm as directed by the Engineer-in-charge.
2. The stone shall be quarried and shall be sound, angular, durable and free from flaws and decay and shall be approved by the Engineer – in – charge.
3. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height and not less than 1.0 mt. The stack shall be measured in volume.
4. The material shall be stacked in such a way that there shall be minimum voids.

5. The measurement of stack at the place shall be taken in volume and no deduction for voids shall be made.
6. The rate includes quarrying blasting, hand breaking collection transporting, to the site.
7. Inferior quality of material brought on site shall be immediately removed from the site without any extra cost.
8. The rate shall be paid on cubic meter basis.
9. The rubble or spouls shall be spread after measurement is recorded and orders are obtained from the Engineer – in –charge.
10. The rubble spouts shall be screened for any rubbish dust or grass. Rubbles or spouls then shall be laid 5" (127 mm) to required grade and camber as directed by Engineer.

**B.19.4 LABOUR CHARGES FOR SPREADING THE SPOULS 127 MM THICK LAYER**

1. This item relates to labour work of soling item. The rubbles and asphalt metal stacked within 30 mt. lead from the trench should be used. The rubbles shall be sorted out from stacks. Extra earth, debris, shall be removed and the rubbles shall be placed in position over the earth level formed to give a suitable soling formation by packing voids or hollow space is left. If required the missing quantity of rubble will be provided on the after all the excavation rubbles and asphalt metal are used. The soling shall be filled by selected earth to fill, interlock the small cavities between the soling, and the whole soling shall be made a compact, solid and continues level which shall not be made a compact, solid and continuous level which shall not be disturbed while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any are formed shall be packed again by the same process.
2. The measurement will be on square meter basis of the actual area of soling surface prepared. The contractor shall have to prepare the surface true in accordance to camber gradient of the road. If any extra depth of soling is required in the process that will not be paid for separately.

**B.19.5 SUPPLY OF GRADED MACHINE CUT STONE AGGREGATE**

1. The stone for metaling shall be supplied by the contractor, shall be of good quality black trap metal of size 40 mm to 65 mm.
2. The stone shall be quarried and shall be sound angular, durable and free from flaws and decay and shall be approved by Engineer in charge.
3. The stone shall be stacked on near and uniform ground at road sides stack shall be of height not less 1.0 mt. The stack shall be uniform and without any depression and not uneven in height length and breadth.
4. The material shall be stacked such as there shall be minimum voids.

5. The measurement of stacks at the place where directed and no deduction for voids shall be made.
6. The rate includes machining out quarrying blasting, breaking, collecting, transporting to the road site etc.
7. Inferior quality of the material brought to site shall be removed immediately without any extra cost.
8. The rate shall be paid on cubic meter basis.
9. The black trap metal shall be spread after measurement is recorded and orders are obtained from the Engineer in charge

**B.19.6 LABOUR WORK FOR SPREADING THE METAL 100 MM THICKNESS**

1. The metal shall be screened of any rubbish, dust or grass. Then metal shall be laid uniformly up to 100 mm thick layer, to the required grade and camber as directed by the Engineer – in – charge.
2. Laying of metal shall be started after the consolidating soling layer is prepared perfectly to the proper line level and grade and camber.
3. Where camber of soling is found doubtful it shall be corrected prior to spreading metal.
4. Metal filled on the basket shall be spread evenly if required number of layer as directed.
5. Metal shall be spread in proper grade and camber by using camber boards etc. so as to ensure the correct surface. The surface shall be checked at every 15 mts by means of template and string for correctness of the camber.
6. The consolidation of metal shall be done by the contractor with a minimum 8 to 10 T roller. The contractor provides required number of labour and drive at the time of rolling to rectify the undulation that might have occurred during rolling.
7. The contractors shall carry out grouting of the above said 100 mm thick metalling coat. Including all equipment and materials required shall be brought on site by the contractor as directed.
8. Applying bitumen: Bitumen of appropriate grade penetration of approved brand heated to a temperature of 325 degree F. and shall be applied hot by means of a sprayer uniformly over the surface at the rate of 250 Kg. / 100 Sq.mt. upto the entire satisfaction of Engineer – in – charge.
9. Binding the surface: Immediately following the application of bitumen and while it is still hot key aggregate of 12.5 mm (1/2") size and approved quality shall be evenly spread out at rate of 0.0125 cum. per sq. mt. After spreading the chipping the whole area shall be rolled over thoroughly with a 8 T to 10 T roller. It is important that the rolling should be done while the bitumen is still soft and it should be continued until the road sets and there is no settlement under the roller.

10. Protection of pavement: During the period between the initial compaction of coarse aggregate and compaction of the seal coat the surface coarse shall be protected from all traffic other than essential to its constructions.
11. All above operation shall be carried by the contractor using his equipments and material including fuel or wood required for burning etc. and as directed up to the entire satisfaction of Engineer - in - charge.
12. The mode of payment for this item shall be on square meter basis.

### **B.19.7 GRANULAR SUB-BASE**

#### **B.19.7.1 Scope**

This work shall consist of laying and compacting well-graded material on prepared sub-grade in accordance with the requirements of these specifications. The material shall be laid in one or more layers as sub-base or lower sub-base and upper sub-base as necessary according to lines, grades and cross sections shown on the drawings.

#### **B.19.7.2 Materials**

The material to be used for the work shall be natural sand, murrum, gravel, crushed stone or combination thereof depending upon the grading required. Material like crushed slag, crushed concrete, brick metal and kankar may be allowed only with specific approval of the engineer. The material shall be free from organic or other deleterious constituents and conform to one of the three grading given in table 1 below.

#### **B.19.7.3 Physical requirements:**

The material shall have 10 percent fines value of 50 KN or more (for sample in soaked condition) when tested in compliance with BS: 812 (Part 111)). The water absorption value of coarse aggregate shall be determined as per IS: 2386 (Part 3); if this value is greater than 2 percentage, the soundness test shall be carried out on the material delivered to site as per IS: 383. For grading II and III materials, the CBR shall be determined at the density and moisture content likely to be developed in equilibrium conditions which shall be taken as being the density relating to a uniform air voids content of 5 percent.

**Table :1 Grading for Close graded granular Sub-base Materials.**

IS sieve	Percent by weight passing the IS sieve		
Designation	Grading I	Grading II	Grading III
75.0 mm	100	--	--
53.0 mm	80-100	100	--
26.5 mm	55-90	70-100	100
9.50 mm	35-65	50-80	65-95
4.75 mm	25-55	40-65	50-80

2.36 mm	20-40	30-50	40-65
0.425 mm	10-25	15-25	20-35
0.075 mm	3-10	3-10	3-10
CBR value (minimum)	30	25	20

**Table: 2 Grading for coarse graded granular sub-base materials.**

IS sieve	Percent by weight passing the IS sieve		
	Grading I	Grading II	Grading III
Designation			
75.0 mm	100	--	--
53.0 mm		100	
26.5 mm	55-75	50-80	100
9.50 mm			
4.75 mm	10-30	15-35	25-45
2.36 mm			
0.425 mm			
0.075 mm	<10	<10	<10
CBR value (minimum)	30	25	20

Note: The material passing 425 micron (0.425 mm) sieve for all the three grading when tested according to IS: 2720 (Part 5) shall have liquid limit and plasticity Index not more than 25 and 6 percent respectively.

**B.19.7.4 Strength of sub-base**

It shall be ensured prior to actual execution that the material to be used in the sub-base satisfies the requirements of CBR and other physical requirements when compacted and finished. When directed by the Engineer, this shall be verified by performing CBR tests in the laboratory as required on specimens remolded at field dry density and moisture content and any other tests for the "quality" of materials, as may be necessary.

**B.19.7.5 Construction Operations**

B.19.7.5.1 Preparation of sub grade : Immediately prior to the laying of sub-base, the sub grade already finished to Clause B.15 as applicable shall be prepared by removing all vegetation and other extraneous matter, lightly sprinkled with water if necessary and rolled with two passes of 80 -100 KN smooth wheeled roller.

B.19.7.5.2 Spreading and compacting: The sub-base material of grading specified in the Contract shall be spread on the prepared sub-grade with the help of a motor grader of adequate capacity, its blade having hydraulic controls suitable for initial adjustment and for



maintaining the required slope and grade during the operation or other- means as approved by the Engineer.

When the sub-base material consists of combination of materials mentioned in Clause B.19.7.5.1, mixing shall be done mechanically by the mix-in-place method.

Manual mixing shall be permitted only where the width of laying is not adequate for mechanical operations, as in small-sized jobs. The equipment used for mix-in-place construction shall be a rotavator or similar approved equipment capable of mixing the material to the desired degree. If so desired by the Engineer, trial runs with the equipment shall be carried out to establish its suitability for the work.

Moisture content of the loose material shall be checked in accordance with IS:2720 (Part 2) and suitably adjusted by sprinkling additional water from a truck mounted or trailer mounted water tank and suitable for applying water uniformly and at controlled quantities to variable widths of surface or other means approved by the Engineer so that, at the time of compaction, it is from 1 per cent above to 2 per cent below the optimum moisture content corresponding to IS:2720 (Part 8). While adding water, due allowance shall be made for evaporation losses. After water has been added, the material shall be processed by mechanical or other approved means like disc harrows, rotavators until the layer is uniformly wet.

Immediately thereafter, rolling shall start. If the thickness of the compacted layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 KN weight may be used. For a compacted single layer upto 225 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 KN static weight with plain drum or pad foot-drum or heavy pneumatic tyred roller of minimum 200 to 300 KN weight having a minimum tyre pressure of 0.7 MN/m<sup>2</sup> or equivalent capacity roller capable of achieving the required compaction. Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional cross-fall and super-elevation and shall commence at the edges and progress towards the centre for portions having crossfall on both sides.

Each pass of the roller shall uniformly overlap not less than one-third of the track made in the preceding pass. During rolling, the grade and cross-fall (camber) shall be checked and any high spots or depressions, which become apparent, corrected by removing or adding fresh material. The speed of the roller shall not exceed 5 km per hour.

Rolling shall be continued till the density achieved is at least 98 per cent of the maximum dry density for the material determined as per IS: 2720 (Part 8). The surface of any layer of material on completion of compaction shall be well closed, free from movement under compaction equipment and from compaction planes, ridges, cracks or loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of layer and re-compacted.

**B.19.7.6 Surface Finish and Quality Control of Work**

The surface finish of construction shall conform to the lines, grades, cross sections and dimensions shown on the drawings or as indicated by the engineer.

**B.19.7.7 Arrangements for Traffic**

During the period of construction, arrangement of traffic shall be maintained in accordance with Clause 112 of M.O.R.T.&H. specifications.

**B.19.7.8 Measurements for Payment**

Granular sub-base shall be measured as finished work in position in cubic meters.

The protection of edges of granular sub-base extended over the full formation as shown in the drawing shall be considered incidental to the work of providing granular sub-base and as such no extra payment shall be made for the same.

**B.19.7.9 Rate**

The Contract unit rate for granular sub-base shall be payment in full for carrying out the required operations including full compensation for:

- (i). Making arrangement for traffic to clause 112 of M.O.R.T. & H. specification except for initial treatment to verges, shoulders and construction of diversions;
- (ii). Furnishing all material to be incorporated in the work including all royalties, fees, rents where necessary and all leads and lifts;
- (iii). All labour, tools, equipment and incidentals to complete the work to the Specifications;
- (iv). Carrying out the work in part widths of road where directed; and
- (v). Carrying out the required tests for quality control.

**B.19.8 WET MIX MACADAM SUB-BASE/BASE****B.19.8.1 Scope**

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared sub-grade/sub-base/base or existing pavement as the case may be in accordance with the requirements of these specifications. The material shall be laid in one or more layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be increased to 200 mm upon approval of the Engineer.

**B.19.8.2 Materials****B.19.8.2.1 Aggregates**

**B.19.8.2.2 Physical requirements:** Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 percent by weight of the gravel/shingle pieces retained on 4.75 mm

sieve shall have at least two fractured faces. The aggregates shall conform to the physical requirements set forth in Table below.

**Physical requirements of coarse aggregates for wet mix macadam for Sub-base/ Base Courses**

Test	Test method	Requirements
Los Angeles abrasion value	IS 2386 (Part-4)	40 percent (Max.)
Or Aggregate impact value	IS 5640	30 percent (Max.)
Combined flakiness and elongation indices (Total)	IS 2386 (Part-1)	30 percent (Max.)

Aggregate may satisfy requirements of either of the two tests.

To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is weight of Elongated particles divided by total non-flaky particles. The value of flakiness index and elongation index so found are added up.

If the water absorption value of the coarse aggregate is greater than 2 percent, the soundness test shall be carried out on the material delivered to site as per IS: 2386 (Part-5).

B.19.8.2.3 Grading requirements: The aggregates shall conform to the grading given in Table below.

**Grading Requirements of Aggregates for wet mix macadam**

IS sieve Designation	Percent by weight passing the IS sieve
53.00 mm	100
45.00 mm	95-100
26.50 mm	---
22.40 mm	60-80
11.20 mm	40-60
4.75 mm	25-40
2.36 mm	15-30
600.00 mm	8-22
75.00 mm	0-8

Materials finer than 425 micron shall have Plasticity index (PT) not exceeding 6

The final gradation approved within these limits shall be well graded from coarse to fine and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa.

**B.19.8.3 Construction Operations**

B.19.8.3.1 Preparation of base: Clause 404.3.1 of M.O.R.T. & H specifications shall apply.

B.19.8.3.2 Provision of lateral confinement of aggregates: While constructing wet mix macadam, arrangement shall be made for the lateral confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer and following the sequence of operations described in Clause 407.4.1 of M.O.R.T.&H specifications.

B.19.8.3.3 Preparation of mix : Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled addition of water and forced/positive mixing arrangement like pugmill or pan type mixer of concrete batching plant. For small quantity of wet mix work, the Engineer may permit the mixing to be done in concrete mixers. Optimum moisture for mixing shall be determined in accordance with IS:2720 (Part-8) after replacing the aggregate fraction retained on 22.4 mm sieve with material of 4.75 mm to 22.4 mm size. While adding water, due allowance should be made for evaporation losses. However, at the time of compaction, water in the wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.

B.19.8.3.4 Spreading of mix: Immediately after mixing, the aggregates shall be spread uniformly and evenly upon the prepared sub-grade/sub-base/base in required quantities. In no case should these be dumped in heaps directly on the area where these are to be laid nor shall their hauling over a partly completed stretch be permitted.

The mix may be spread either by a paver finisher or motor grader. For portions where mechanical means cannot be used, manual means as approved by the Engineer shall be used. The motor grader shall be capable of spreading the material uniformly all over the surface. Its blade shall have hydraulic control suitable for initial adjustments and maintaining the same so as to achieve the specified slope and grade.

The paver finisher shall be self-propelled, having the following features:

- (i) Loading hoppers and suitable distribution mechanism.
- (ii) The Screed shall have tamping and vibrating arrangement for initial compaction to the layer as it is spread without rutting or otherwise marring the surface profile.
- (iii) The paver shall be equipped with necessary control mechanism so as to ensure that the finished surface is free from surface blemishes.

The surface of the aggregate shall be carefully checked with templates and all high or low spots remedied by removing or adding aggregate as may be required. The layer may be tested by depth blocks during construction. No segregation of larger and finer particles should be allowed. The aggregates as spread should be of uniform gradation with no pockets of fine materials.

B.19.8.3.5 Compaction: After the mix has been laid to the required thickness, grades and cross-fall/camber the same shall be uniformly compacted, to the full depth with suitable roller. If

the thickness of single compacted layer does not exceed 100 mm, a smooth wheel roller of 80 to 100 KN weight may be used. For a compacted single layer upto 200mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 KN or equivalent capacity roller. The speed of the roller shall not exceed 5km/h.

In portions having unidirectional cross fall/ super elevation, rolling shall commence from the lower edge and progress gradually towards the upper edge. There after roller should progress parallel to the center line of the road, uniformly overlapping each preceding track by at least one third width until the entire surface has been rolled. Alternate trips of the roller shall be terminated in stops at least 1 m away from any preceding stop.

In portions in camber, rolling should begin at the edge with the roller running forward and backward until the edges have been firmly compacted. The roller shall then progress gradually towards the center parallel to the center line of the road uniformly overlapping each of the preceding track by at least one-third width until the entire surface has been rolled.

Any displacement occurring as a result of reversing of the direction of a roller or from any other cause shall be corrected at once as specified and/or removed and made good.

Along forms, kerbs, walls or other places not accessible to the roller, the mixture shall be thoroughly compacted with mechanical tampers or a plate compactor. Skin patching of an area without scarifying the surface to permit proper bonding of the added material shall not be permitted.

Rolling should not be done when the sub grade is soft or yielding or when it causes a wave-like motion in the sub-base/base course or sub grade. If irregularities develop during rolling which exceed 12 mm when tested with a 3 meter straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and cross-fall. In no case should use of unmixed material be permitted to make up the depressions.

Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material as determined by the method outlined in IS: 2720 (Part-8).

After completion, the surface of any finished layer shall be well closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material. All loose, segregated or otherwise defective areas shall be made good to the full thickness of the layer and recompacted.

B.19.8.3.6. Setting and drying: After final compaction of wet mix macadam course, the road shall be allowed to dry for 24 hours.

B.19.8.4 Opening to Traffic: Preferably no vehicular traffic of any kind should be allowed on the finished wet mix macadam surface till it has dried and the wearing course laid.

B.19.8.5 Surface Finish and Quality control of work

B.19.8.5.1 Surface evenness: The surface finish of construction shall conform to the requirements of clause 902 of M.O.R.T.& H specifications.

B.19.8.5.2 Quality control: Control on the quality of materials and works shall be exercised by the Engineer in accordance with section 900 of M.O.R.T.&H specifications.

**B.19.8.6 Rectification of Surface Irregularity**

Where the surface irregularity of the wet mix macadam course exceeds the permissible tolerance or where the course is otherwise defective due to sub-grade soil getting mixed with the aggregates, the full thickness of the layer shall be scarified over the affected area reshaped with added premixed material or removed and replaced with fresh premixed material as applicable and recompacted in accordance with clause 406.3 of MORTH specifications. The area treated in the aforesaid manner shall be less than 5m long and 2m wide. In no case shall depressions be filled up with unmixed and ungraded material or fines.

**B.19.8.7 Arrangement for Traffic**

During the period of construction, arrangement of traffic shall be done as per Clause 112 of MORTH specifications.

B.19.8.8 Measurement for Payment: wet mix macadam shall be measured as finished work in position in cubic meters.

B.19.8.9 Rate: The contract unit rate for wet mix macadam shall be payment in full for carrying out the required operations including full compression for all components.

**B.19.9 TACKCOAT**

B.19.9.1 Scope: this work shall consist of the application of a single coat of low viscosity liquid bituminous material to an existing bituminous road surface preparatory to the superimposition of a bituminous mix, when specified in the contract or instructed by the engineer.

**B.19.9.2 Material:**

B.19.9.2.1 Binder: the binder used for tack coat shall be bitumen emulsion complying IS: 8887 of a type and grade as specified in the Contract or as directed by the Engineer. The use of cutback bitumen as per IS 217 shall be restricted only for sites at sub-zero temperatures or for emergency applications as directed by the Engineer.

**B.19.9.3 Weather and Seasonal Limitations**

Bituminous material shall not be applied to a wet surface or during a dust storm or when the weather is foggy, rainy or windy or when the temperature in the shade is less than 10°C. Where the tack coat consists of emulsion, the surface shall be slightly damp, but not wet. Where the tack coat is of cutback bitumen, the surface shall be dry.

**B.19.9.4 Construction**

B.19.9.4.1 Equipment: The tack coat distributor shall be a self propelled or towed bitumen pressure sprayer, equipped for spraying the material uniformly at a specified rate. Hand spraying of small areas, inaccessible to the distributor, or in narrow strips, shall be sprayed with a pressure hand sprayer, or as directed by the Engineer.

B.19.9.4.2 Preparation of base: The surface on which the tack coat is to be applied shall be clean and free from dust, dirt, and any extraneous material, and be otherwise prepared in accordance with the requirements of Clauses 501.8 and 902 of MORTH specifications as appropriate. Immediately before the application of the tack coat, the surface shall be swept clean with a mechanical broom, and high pressure air jet, or by other means as directed by the Engineer.

B.19.9.4.3 Application or tack coat: The application of tack coat shall be at the rate specified in the Contract, and shall be applied uniformly. If rate of application of Tack Coat is not specified in the contract then it shall be at the rate specified in Table below.

#### Rate of application of Tack Coat

Type of surface	Quantity of liquid bituminous material in Kg per sq. m. area
i). Normal bituminous surfaces	0.20 to 0.25
ii). Dry and hungry bituminous surfaces	0.25 to 0.30
iii). Granular surfaces treated with primer	0.25 to 0.30
iv). Non bituminous surfaces	
a) Granular base(not primed)	0.35 to 0.40
b) Cement concrete pavement	0.30 to 0.35

The normal range of spraying temperature for a bituminous emulsion shall be 20°C to 70°C and for a cutback, 50°C to 80°C if RC-70/MC-70 is used. Where a geosynthetic is proposed for use, The provisions of Clauses 703.3.2 and 703-4.4 of MORTH specifications shall apply. The method of application of the tack coat will depend on the type of equipment to be used, size of nozzles, pressure at the spray bar and speed of forward movement. The Contractor shall demonstrate at a spraying trial, that the equipment and method to be used is capable of producing a uniform spray, within the tolerances specified.

Where the material to receive an overlay is a freshly laid bituminous layer that has not been subjected to traffic or contaminated by dust, a tack coat is no mandatory where the overlay is completed within two days.

**B.19.9.5 Curing of tack coat:** The tack coat shall be left to cure until all the volatiles have evaporated before any subsequent construction is started. No plant or vehicles shall be allowed on the tack coat other than those essential for the construction.

**B.19.9.6 Quality Control of Work**

For control of the quality of materials supplied and the works carried out, the relevant provisions of Section 900 of MORTH specifications shall apply.

**B.19.9.7 Arrangements for Traffic**

During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112 of MORTH specifications.

**B.19.9.8 Measurement for Payment**

Tack coat shall be measured in terms of surface area of application in square meters.

**B.19.9.9 Rate**

The contract unit rate for tack coat shall be payment in full for carrying out the required operations including for all components listed in Clause 401.8 (i) to (v) of MORTH specifications and as applicable to the work specified in these Specifications. The rate shall cover the provision of tack coat at 0.2 kg per square meter, with the provision that the variance in actual quantity of bitumen used will be assessed and the payment adjusted accordingly.

**B.19.10 DENSE GRADED BITUMINOUS MACADAM**

**B.19.10.1 Scope**

This clause specifies the construction of Dense Graded Bituminous Macadam, (DBM), for use mainly, but not exclusively, in base/binder and profile corrective courses. DBM is also intended for use as road base material. This work shall consist of construction in a single or multiple layers of DBM on a previously prepared base or sub-base. The thickness of a single layer shall be 50mm to 100mm.

**B.19.10.2 Materials -**

**B.19.10.2.1 Bitumen:** The bitumen shall be paving bitumen of Penetration Grade complying with Indian Standard Specifications for "Paving Bitumen" IS: 73, and of the penetration indicated in Table 3 for dense bitumen macadam, or this bitumen as modified by one of the methods specified in Clause 521 of MORTH specifications, or as otherwise specified in the contract. Guidance on the selection of an appropriate grade of bitumen is given in The Manual for Construction and Supervision of Bituminous works.

**B.19.10.2.2 Coarse aggregates:** The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm sieve. They shall be clean, hard, durable, of cubical shape, free from dust and soft or friable matter, organic in other deleterious



substances. Where the Contractor's selected source of aggregate have poor affinity for bitumen, as a condition for the approval of that source, the bitumen shall be treated with an approved anti-stripping agent, as per the manufacturer's recommendations, without additional payment. Before approval of the source, the aggregates shall be tested for stripping. The aggregates shall satisfy the physical requirements specified in **Table 1**, for dense bituminous macadam.

Where crushed gravel is proposed for use as aggregate, not less than 90% by weight of the crushed material retained on the 4.75 mm sieve shall have at least two fractured faces.

**B.19.10.2.3 Fine aggregates:** Fine aggregates shall consist of crushed or naturally occurring mineral material, or a combination of the two passing the 2.36mm sieve and retained on the 75 micron sieve. They shall be clean, hard, durable, dry and free from dust, and soft or friable matter, organic or other deleterious matter. The fine aggregate shall have a sand equivalent value of not less than 50 when tested in accordance with the requirement of IS: 2720 (Part 37).

The plasticity index of the fraction passing the 0.425 mm sieve shall not exceed 4. When tested in accordance with IS: 2720 (Part 5)

**TABLE 1. Physical requirements for coarse aggregate for dense graded bituminous macadam**

Property	Test	Specification
Cleanliness (dust)	Grain size analysis	Max 5% passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index (combined)	Max 30%
Strength*	Losangeles abrasion value	Max 35%
	Aggregate impact value	Max 27%
Durability	Soundness	
	Sodium sulphate	Max 12%
	Magnesium sulphate	Max 18%
Water Absorption	Water absorption	Max 2%
Stripping	Coating and stripping of bitumen aggregate mixtures	Minimum retained coating 95%
Water sensitivity**	Retained tensile strength	Max 80%

Notes: 1. IS: 2386 Part 1

5. IS: 2386 Part 5

2. IS: 2386 Part 1

6. IS: 2386 Part 3

(The elongation test to be done only on non-flaky aggregates in the sample)

3. IS: 2386 Part 4\*

7. IS: 6241

4. IS: 2386 Part 4\*

8. AASHTO T283\*\*

\*Aggregate may satisfy requirements of either of these two tests.

\*\* The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%.

B.19.10.2.4 Filler: Filler shall consist of finely divided mineral matter such as rock dust, hydrated lime or cement approved by the Engineer.

The filler shall be graded within the limits indicated in Table 2.

**Table 2. Grading requirements for mineral filler**

IS Sieve(mm)	Cumulative per cent passing by weight of total aggregate
0.6	100
0.3	95-100
0.075	85-100

The filler shall be free from organic impurities and have a Plasticity Index not greater than 4. The Plasticity Index requirement shall not apply if filler is cement or lime. When the coarse aggregate is gravel, 2 percent by weight of total aggregate, shall be Portland cement or hydrated lime and the percentage of fine aggregate reduced accordingly. Cement or hydrated lime is not required when the limestone aggregate is used. Where the aggregates fail to meet the requirements of the water sensitivity test in Table 1, then 2 percent by total weight of aggregate, of hydrated lime shall be added without additional cost.

B.19.10.2.5 Aggregate grading and binder content: When tested in accordance with IS:2386 Part 1 (wet sieving method), the combined grading of the coarse and fine aggregates and added filler for the particular mixture shall fall within the limits shown in Table 3, for dense bituminous macadam grading 1 or 2 as specified in the contract. The type and quantity of bitumen, and appropriate thickness, are also indicated for each mixture type.

**Table 3. Composition of Dense graded bituminous macadam pavement thickness**

Grading	1	2
Nominal Aggregate size	40 mm	25 mm
Layer thickness	80-100 mm	50-75 mm
IS sieve (mm)	Cumulative % by weight of total aggregate passing	
45	100	
37.5	95-100	100
26.5	63-93	90-100
19	-	71-95
13.2	55-75	56-80

9.5	-	-
4.75	38-54	38-54
2.36	28-42	28-42
1.18	-	-
0.6	-	-
0.3	7-21	7-21
0.15	-	-
0.075	2-8	2-8
Bitumen content % by mass of total mix	Min 4.0	Min 4.5
Bitumen grade (pen)	65 or 90	65 or 90

Notes: 1. The combined aggregate grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.

2. Determined by the Marshall method.

### B.19.10.3 Mixture Design

B.19.10.3.1 Requirement for the mixture: Apart from conformity with the grading and quality requirements for individual ingredients, the mixture shall meet the requirements set out in Table 4.

**TABLE 4. REQUIREMENTS FOR DENSE GRADED BITUMINOUS MACADAM**

Minimum stability	9.0
Minimum flow (mm)	2
Maximum flow (mm)	4
Compaction level (Number of blows)	75 blows on each of the two faces of the specimen
Percent air voids	3-6
Percent voids in mineral aggregate (VMA)	See table 5 below
Percent voids filled with bitumen (VFB)	5-75

The requirements for minimum per cent voids in mineral aggregate (VMA) are set out in Table 5.

**Table 5. Minimum percent voids in mineral Aggregate (VMA)**

Nominal maximum particle size (mm)	Minimum VMA, Percent related to design air voids, percent		
	3.0	4.0	5.0
9.5	14.0	15.0	16.0
12.5	13.0	14.0	15.0

19.0	12.0	13.0	14.0
25.0	11.0	12.0	13.0
37.5	10.0	11.0	12.0

**Notes:** 1. The nominal maximum particle size is one size larger than the first sieve to retain more than 10 per cent.

2. Interpolate minimum voids in the mineral aggregate (VMA) for design air voids values between those listed.

B.19.10.3.2 Binder content: The binder content shall be optimized to achieve the requirements of the mixture set out in Table 4 and the traffic volume specified in the contract. The Marshall method for determining the optimum binder content shall be adopted as described in The Asphalt Institute Manual MS-2. replacing the aggregates retained on the 26.5 mm sieve by the aggregates passing the 26.5 mm sieve and retained on the 22.4 mm sieve, where approved by the Engineer.

Where 40 mm dense bituminous macadam mixture is specified the modified Marshall method described in MS-2 shall be used. This method requires modified equipment and procedures; particularly the minimum stability values in Table 4 shall be multiplied by 2.25, and the minimum flow shall be 3 mm

B.19.10.3.3 Job mix formula: The Contractor shall inform the Engineer in writing, at least 20 days before the start of the work, of the job mix formula proposed for use in the works, and shall give the following details:

- (i) Source and location of all materials;
- (ii) Proportions of all materials expressed as follows where each is applicable:
  - (a) Binder type and percentage by weight of total mixture;
  - (b) Coarse aggregate/Fine aggregate/Mineral filler as percentage by weight of total aggregate including mineral filler;
- (iii) A single definite percentage passing each sieve for the mixed aggregate.
- (iv) The individual grading of the individual aggregate fractions, and the proportions of each in the combined grading.
- (v) The result of tests enumerated in Table 4 as obtained by the contractor.
- (vi) Where the mixer is a batch mixer, the individual weight of each type of aggregate and binder per batch,
- (vii) Test results of physical characteristics of aggregates to be used;
- (viii) Mixing temperature and compacting temperature.

While establishing the job mix formula, the contractor shall ensure that it is based on a correct and truly representative sample of the materials that will actually be used in the work and that the

mixture and its different ingredients satisfy the physical and strength requirements of these specifications.

Approval of the job mix formula shall be based on independent testing by the Engineer for which samples of all ingredients of the mix shall be furnished by the Contractor as required by the Engineer. The approved job mix formula shall remain effective unless and until a revised Job Mix Formula is approved. Should a change in the source of materials be proposed, a new job mix formula shall be forwarded to the Engineer for approval before the placing of the material.

B.19.10.3.4. Plant trials - permissible variation in job mix formula: Once the laboratory job mix formula is approved, the Contractor shall carry out plant trials at the mixer to establish that the plant can be set up to produce a uniform mix conforming to the approved job mix formula. The permissible variations of the individual percentages of the various ingredients in the actual mix from the job mix formula to be used shall be within the limits as specified in Table 6. These variations are intended to apply to individual specimens taken for quality control tests in accordance with Section 900 of MORTH specifications.

**TABLE 6. PERMISSIBLE VARIATIONS FROM THE JOB MIX FORMULA**

Description	Permissible variation	
	Base/binder course	Wearing course
Aggregate passing 19 mm sieve or larger	± 8%	± 7%
Aggregate passing 13.2 mm, 9.5 mm	± 7%	± 6%
Aggregate passing 4.75 mm	± 6%	± 5%
Aggregate passing 2.36 mm, 1.18 mm, 0.6 mm	± 5%	± 4%
Aggregate passing 0.3 mm, 0.15 mm	± 4%	± 3%
Aggregate passing 0.75 mm	± 2%	± 1.5%
Binder content	± 0.3%	± 0.3%
Mixing temperature	± 10°C	± 10°C

Once the plant trials have demonstrated the capability of the plant, and the trials are approved, the laying operation may commence. Over the period of the first month of production for laying on the works, the Engineer shall require additional testing of the product to establish the reliability and consistency of the plant.

B.19.10.3.5 Laying Trials: Once the plant trials have been successfully completed and approved, the Contractor shall carry out laying trials, to demonstrate that the proposed mix can be

successfully laid, and compacted all in accordance with Clause 501 of MORTH specifications. The laying trial shall be earned out on a suitable area which is not to form part of the works, unless specifically approved in writing, by the Engineer. The area of the laying trials shall be a minimum of 100 sq.m. of construction similar to that of the project road, and it shall be in all respects, particularly compaction, the same as the project construction, on which the bituminous material is to be laid.

The Contractor shall previously inform the Engineer of the proposed method for laying and compacting the material. The plant trials shall then establish if the proposed laying plant, compaction plant, and methodology is capable of producing satisfactory results. The density of the finished paving layer shall be determined by taking cores, no sooner than 24 hours after laying, or by other approved method.

Once the laying trials have been approved, the same plant and methodology shall be applied to the laying of the material on the project, and no variation of either shall be acceptable, unless approved in writing by the Engineer, who may at his discretion require further laying trials.

#### B.19.10.4 Construction Operations

B.19.10.4.1 Weather aid seasonal limitations: The provisions of Clause 501.5.1 of MORTH specifications shall apply.

B.19.10.4.2 Preparation of base: The base on which Dense Graded Bituminous Material is to be laid shall be prepared in accordance with Clause 501 and 902 of MORTH specifications as appropriate, or as directed by the Engineer. The surface shall be thoroughly swept clean by a mechanical broom, and the dust removed by compressed air. In locations where mechanical broom cannot access, other approved methods shall be used as directed by the Engineer.

B.19.10.4.3 Geosynthetics: Where Gsosynthetics are specified in the Contract this shall be in accordance with the requirements stated in Clause 70.3 of MORTH specifications.

B.19.10.4.4 Stress absorbing layer: Where a stress absorbing layer is specified in the Contract, this shall be applied in accordance with the requirements of Clause 522 of MORTH specifications.

B.19.10.4.5 Prime coat: Where the material on which the dense bituminous macadam is to be laid is other than a bitumen bound layer, a prime coat shall be applied, as specified, in accordance with the provisions of Clause 502 of MORTH specifications, or as directed by the Engineer.

B.19.10.4.6 Tack coat: Where the material on which the dense bituminous macadam is to be placed is a bitumen bound surface, a tack coat sha11 be applied as specified, in accordance with the provisions of Clause 503 of MORTH specifications or as directed by the Engineer.

B.19.10.4.7 Mixing and transportation of the mixture: The provisions as specified in Clauses 501.3 and 501.4 of MORTH specifications shall apply.

- B.19.10.4.8 Spreading: The provisions of Clauses 501.5.3 and 501.5.4. of MORTH specifications shall apply.
- B.19.10.4.9 Rolling: The general provisions of Clauses 501.6 and 501.7 of MORTH specifications shall apply, as modified by the approved laying trials. The compaction process shall be carried out by the same plant, and using (lie same method, as approved in the laying trials, which may be varied only with the express approval of the Engineer in writing.
- B.19.10.5 Opening to Traffic: The newly laid surface shall not be open to traffic for at least 24 hrs after laying and completion of compaction, without the express approval of the Engineer in writing.
- B.19.10.6 Surface Finish and Quality Control of Work: The surface finish of the completed construction shall conform to the requirements, of Clause 902. All materials and workmanship shall comply with the provisions set out in Section 900 of MORTH Specification.
- B.19.10.7 Arrangements for Traffic: During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112 of MORTH specifications.
- B.19.10.8 Measurement for Payment: Dense Graded Bituminous Materials shall be measured as finished work either in cubic meters, tons or by the square meter at a specified thickness as detailed on the Contract drawings, or documents, or as directed by the Engineer.
- B.19.10.9 Rate: The contract unit rate for Dense Graded Bituminous Macadam shall be payment in full for carrying out the all required operations as specified, and shall include, but not necessarily limited lo all components listed in Clause 501.8.8.2 (i) to (xi) of MORTH specifications. The rate shall include the provision of bitumen, at 4.25 per cent by weight of the total mixture.
- The variance in actual percentage of bitumen used will be assessed and the payment adjusted, up or down, accordingly.

### **B.19.11 SEMI-DENSE BITUMINOUS CONCRETE**

#### **B.19.11.1 Scope**

This clause specifies the construction of Semi dense Bituminous Concrete, for use in wearing/binder and profile corrective courses. This work shall consist of construction in a single or multiple layers of semi dense bituminous concrete on a previously prepared bituminous bound surface. A single layer shall be 25mm to 100mm in thickness.

#### **B.19.11.2 Materials**

- B.19.11.2.1 Bitumen: The bitumen shall be paving bitumen of penetration grade complying with Indian Standard Specification for Paving Bitumen, IS: 73 and of the penetration indicated in Table 8, for semi dense bituminous concrete, or this bitumen as modified by one of the methods specified in Clause 521, or as otherwise specified in the contract. Guidance on

the selection of an appropriate grade of bitumen is given in the Manual for Construction and Supervision of Bituminous works.

B.19.11.2.2 Coarse aggregates: The coarse aggregates shall be generally as specified in Clause 507.2.2 of MORTH specifications except that the aggregates shall satisfy the physical requirements of Table 7.

B.19.11.2.3 Fine aggregates: The fine aggregates shall be all as specified in Clause 507.2.3 of MORTH specifications.

B.19.11.2.4 Filler: Filler shall be generally as specified in Clause 507.2.4 of MORTH specifications, where the aggregates fail to meet the requirements of the water sensitivity test in Table 7 then 2 percent by total weight of aggregate, of hydrated lime shall be added without additional cost.

B.19.11.2.5 Aggregate grading and binder content: When tested in accordance with IS:2386 Part I (Wet sieving method), the combined grading of the coarse and fine aggregates and added filler shall fall within the limits shown in Table 8 for grading 1 or 2 as specified in the Contract.

### B.19.11.3 Mixture Design:

B.19.11.3.1 Requirements for the mixture: Apart from conformity with the grading and quality requirements for individual ingredients the mixture shall meet the requirements set out in Table 9.

**TABLE 7. Physical requirements for coarse aggregate for Semi dense bituminous concrete pavement layers**

Property	Test	Specification
Cleanliness (dust)	Grain size analysis	Max 5% passing 0.075mm sieve
Particle shape	Flakiness and Elongation Index (combined)	Max 30%
Strength*	Los-angeles abrasion value Aggregate impact value	Max 35% Max 27%
Durability	Soundness Sodium sulphate Magnesium sulphate	 Max 12% Max 18%
Water Absorption	Water absorption	Max 2%
Stripping	Coating and stripping of bitumen aggregate mixtures	Minimum retained coating 95%
Water sensitivity**	Retained tensile strength	Max 80%

Notes:1. IS: 2386 Part 1

5. IS: 2386 Part 5

2. IS: 2386 Part 1

6. IS: 2386 Part 3



(the elongation test to be done only on non-flaky aggregates in the sample)

3. IS: 2386 Part 4\*

7. IS: 6241

4. IS: 2386 Part 4\*

8. AASHTO T283\*\*

\*Aggregate may satisfy requirements of either of these two tests.

\*\* The water sensitivity test is only required if the minimum retained coating in the stripping test is less than 95%.

The requirements for minimum per cent voids in mineral aggregate (VMA) are set out in Table 5.

B.19.11.3.2 Binder content: The binder content shall be optimized to achieve the requirements of the mixture set out in Table 9 and the traffic volume as specified in the contract. The Marshall method for determining the optimum binder content shall be adopted as described in the Asphalt Institute Manual MS-2, replacing the aggregates retained on the 26.5mm sieve and retained on the 22.4mm sieve, where approved by the Engineer.

**Table 8. Composition of Semi Dense bituminous concrete pavement layers**

Grading	1	2
Nominal Aggregate size	13 mm	10 mm
Layer thickness	35-40 mm	25-30 mm
IS sieve (mm)	Cumulative % by weight of total aggregate passing	
45		
37.5		
26.5		
19	100	
13.2	90-100	100
9.5	70-90	90-100
4.75	35-51	35-51
2.36	24-39	24-39
1.18	15-30	15-30
0.6	-	-
0.3	9-19	9-19
0.15	-	-
0.075	3-8	3-8
Bitumen content % by mass of total mix	Min 4.5	Min 5.0
Bitumen grade (pen)	65*	65*

Notes: 1. The combined aggregate grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.

2. Determined by the Marshall method.

\* Only in exceptional circumstances, 80/100 penetration grade may be used, as approved by the engineer.

**TABLE 9.REQUIREMENTS FOR SEMI DENSE BITUMINOUS PAVEMENT LAYERS.**

Minimum stability(kN at 60°C)	8.2
Minimum flow (mm)	2
Maximum flow (mm)	4
Compaction level (Number of blows)	75 blows on each of the two faces of the specimen
Percent air voids	3-5
Percent voids in mineral aggregate (VMA)	See table 5
Percent voids filled with bitumen (VFB)	65-78

B.19.11.3.3 Job mix formula: The procedure for formulating the job mix formula shall be generally as specified in Clause 507.3.3 of MORTH specifications said the results of test enumerated in Table 9 as obtained by the contractors.

B.19.11.3.4 Plant trials: Permissible variation in Job mix formula: The requirements for plant trials shall be all as specified in Clause 507.3.4 of MORTH specifications and permissible limits for variation as shown m Table 6.

B.19.11.3.5 Laying trials: The requirements for laying trials shall be all as specified in Clause 507.3.5 of MORTH specifications.

#### **B.19.11.4 Construction Operations**

B.19.11.4.1 Weather and seasonal limitations: The provisions of Clause 501.5.1 of MORTH specifications shall apply.

B.19.11.4.2 Preparation or base: The surface on which the Semi Dense Bituminous material is to be laid shall be prepared in accordance with Clauses 501 and 902 of MORTH specifications as appropriate, or as directed by the Engineer. The surface shall be thoroughly swept clean by mechanical broom and dust removed by compressed air. In locations where a mechanical broom cannot access, other approved methods shall be used as directed by the Engineer.

B.19.11.4.3 Geosynthetics: Where Geosynthetics are specified in the contract this shall be in accordance with the requirements stated in Clause 70.3 of MORTH specifications.

B.19.11.4.4 Stress absorbing layer: Where a stress absorbing layer is specified in the contract, this shall be applied in accordance with the requirements of Clause 522 of MORTH specifications.

- B.19.11.4.5 Tack coat: Where specified in the Contract, or otherwise required by the Engineer, a tack coat shall be applied in accordance with the requirements of Clause 503 of MORTH specifications.
- B.19.11.4.6 Mixing and transportation of the mixture: The provisions as specified in Clauses 501.3 and 501.4 of MORTH specifications shall apply.
- B.19.11.4.7 Spreading: The general provisions of Clauses 501.5.3 and 501.5.4 of MORTH specifications shall apply.
- B.19.11.4.8 Rolling: The general provisions of Clauses 501.6 and 501.7 of MORTH specifications shall apply, as modified by the approved laying trials, The compaction process shall be carried out by the same plant, and using the same method, as approved in the laying trials, which may be varied only with the express approval of the Engineer in writing.
- B.19.11.5 Opening to Traffic: The newly laid surface shall not be open to traffic for at least 24 hours after laying and the completion of compaction, without the express approval of the Engineer in writing.
- B.19.11.6 Surface Finish and Quality Control: The surface finish of the completed construction shall conform to the requirements of Clause 902 of MORTH specifications. All materials and workmanship shall comply with the provisions set out in Section 900 of MORTH specifications.
- B.19.11.7 Arrangements for Traffic: During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112 of MORTH specifications.
- B.19.11.8 Measurement for Payment: The measurement shall be all as specified in Clause 507.8 of MORTH specifications.
- B.19.11.9 Rate: The contract unit rate shall be all as specified in Clause 507.9 of MORTH specifications except that the rate shall include the provision of bitumen at 4.75 per cent, by weight of total mixture. The variance in actual percentage of bitumen used will be assessed and the payment adjusted up or down, accordingly.

**SECTION : B-20 : TRAFFIC SIGNS****B.20.1 General**

The color, configuration, size and location of all traffic signs for highways other than Expressways shall be in accordance with the Code of Practice for Road Signs, IRC: 67 or as shown on the drawings.

For Expressways, the size of the signs, letters and their placement shall be as specified in the Contract drawings and relevant Specifications. In the absence of any details or for any missing details, the signs shall be provided as directed by the Engineer.

The signs shall be either reflectorised or non-reflectorised as shown on the drawings or as directed by the Engineer. When they are of reflectorised type, they shall be of retro-reflectorised

type and made of encapsulated lens type reflective sheeting vide Clause 801.3 of MORTH specifications fixed over aluminum sheeting as per these Specifications. In general, cautionary and mandatory signs shall be fabricated through process of screen printing. In regard to informatory signs with inscriptions, either the message could be printed over the reflective sheeting, or cut letters of non-reflective black sheeting used for the purpose which must be bonded well on the base sheeting as directed by the Engineer

## **SECTION : B-21 : ADDITIONAL SPECIFICATIONS**

### **B.21.1 Marking of center line of bridge alignment along longitudinal axis and giving out foundation layout with theodolite levels including providing necessary masonry reference pillars, establishing bench mark etc. as directed.**

1. The contractor shall be responsible for the true and proper setting out of the works and for the correctness of the positions, levels, dimensions and alignments of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection therewith. If at any time during the progress of the works any error may appear or arise in the positions, levels and dimensions of alignment of any part of the works, the contractor is required to rectify at his own cost, such errors to the satisfaction of the Engineer-in-charge. The checking of any setting out of any line or level by the Engineer or his representative shall not relieve in any way the contractor of his responsibility for the correctness thereof and the contractor shall carefully protect and preserve all bench marks, site rails, pegs and other things used in the setting out works.
2. The work under this item comprises of establishing a set of bench marks, permanent theodolite stations, centre line pillars etc. and includes all materials, tools, equipment, labour etc. for performing all the functions necessary and ancillary thereto at commencement and during the progress of work till the physical completion of all the times of the work in question.
3. The centre line of the bridge, piers and abutments and open foundations shall be established by theodolite and the center line marks shall be engraved on smoothly finished masonry or concrete pillars of such dimensions as are constructed at such intervals and places as approved and directed by the Engineer-in-charge. Prior approval of the Engineer-in-charge as to the positions, number, dimensions and design of such theodolite stations to be established shall be obtained.
4. The contractor shall also establish a series of interconnected permanent bench marks with reference to the standard bench marks in the vicinity. Suitable concrete or masonry pillars for permanent bench marks shall be constructed and maintained properly with necessary records of their values throughout the period of construction till final measurements as recorded for the works accepted. He shall also keep proper record of all such permanent bench marks established denoting therein their correct values. The above work of establishing all such bench

marks shall be carried out by the experienced staff of the contractor with the help of precision instruments suitable for the type of work and properly checked for the accuracy and for permanent adjustment before the commencement of the work and at frequent intervals during the progress of work. All such marks established by the contractor shall be subject to the check and approved by the Engineer-in-charge or his representative and any variation noticed in the work as a result of improper establishment or maintenance of such bench marks shall be made good at the Contractor's risk and cost. For the purpose of payment of this item all bench marks, central line pillars, theodolite stations positions of piers, abutments etc. established by the contractor for proper execution of all the foundations and various components of the bridge structure shall be considered as a job work and shall be paid at the lump sum rate tendered for the item on completion of the whole work. The tendered rate shall include all materials, tools, equipment labour etc. for performing all functions described above and all other necessary and ancillary works thereto.

**B.21.2 Dismantling of the part of existing structure including removing and stacking the Dismantled material as and where directed.**

**(a) Dismantling of brick masonry**

**(b) Dismantling of RCC work**

1. The scope of work shall consist of dismantling portions of the existing brick masonry/ R. C. C. work of any structure in railway limit. Dismantling and removal operations shall be carried out with such equipment and in such a manner so as not to disturb the railway traffic moving on the running railway line.
2. All materials obtained from the dismantling of existing structure shall be the property of the Client unless otherwise specified. Materials having any salvage value shall be transported including all lifts and lead to RMC, stores and placed in neat stacks of like materials as directed by the Engineer-in-charge of work.
3. Materials which in the opinion of the Engineer cannot be used or auctioned, shall be disposed of as directed by Engineer with all lifts and leads.
4. The work shall be measured in Cubic meter.
5. The rates shall be inclusive of all labour, tools, equipment, safeguards and incidentals necessary to complete the work. This shall also include excavation and back filling where necessary to the required compaction and for handling, salvaging, piling and disposing of the dismantled materials within all lifts and leads.

**B.21.3 Special Precautions to be taken regarding traffic**

Special precautions to safely divert the traffic with smooth movement of continuous traffic should be taking up before commencing the work. Safety precaution shall be taking up as required and direct by Engineer-in-charge particularly at cross road junctions.

For diversion of traffic during construction of suitable structure is proposed as the structure is passing through private and however if land is not available and diversion structure is not constructed payment for the same shall not be made however for ease of traffic suitably barricading / diversion shall be provided by bidder at low cost without any extra cost.

In addition to the normal barricading the diversion sign boards and signs showing directions etc are required to be provided. Contractor shall have to cater for following special safety measures.

- a) Blinking electric warning red colored lights to warn the vehicular traffic of the obstruction on the road during construction activities.
- b) Strong barricading/fencing of approved design to keep pedestrians segregated from foundation, superstructure equipment, material, etc.
- c) Translucent reflectors, metallic or glass as directed by Engineer-in-Charge.

All schemes of providing safety measures shall be got approved from the Engineer-in-Charge and the concerned traffic controlling authorities.

It is essential that the contractor visits the site before submitting his offer to make himself fully acquainted with the situation and to plan his activities accordingly. No subsequent claims on this account will be entertained.

### 3.0 GENERAL SPECIFICATIONS

- 1) The details of reinforcement of RCC work shall be as per design and instructions of Authority and his order will be considered final.
- 2) Authority and his order will be considered final.
- 3) The contractor shall have to maintain account of steel, cement and other materials that may be brought by him on site. The account shall be regularly maintained and kept open for inspection by Authority.
- 4) The Contractor shall remain responsible for workmen's compensation if any, when such case occurs, the contractor shall arrange for red lamps at night and fencing and pagi and shall be responsible for any damage of life and lime or property if any happen, during the execution of work. In case of dispute for unseen or overlooked items, the decision of Authority shall be final. The Contractor shall have to give site clean of all rubbish on completion of work and hand over the bridge with final finishing of the work as directed. All the rejected materials shall be removed from site within 24 hours by contractor at his risk and cost.
- 5) For mixing mortar either for masonry or for plaster or for any other purpose contractor shall have to prepare trough of bigger size and mix the mortar in required proportion. In no case he shall be allowed to mix the mortar either on floor or any finished surfaces.

- 6) The Contractor shall have to make his own arrangement for water required for the work and shall pay the water charges as per rules.
- 7) If any extra item crops up during the progress of work the same shall be carried out by the contractor and he shall be paid at the rate fixed by Authority as per the rate analysis based on current market rates.
- 8) If in the interest of the RMC or site conditions it is necessary to change either any site or the design of the proposed work the contractor shall carry out the same at his quoted rates, without charging any extra and he will be paid at the rates quoted by him and no claim for extra charges made will be entertained.
- 9) The RCC and other specified work shall not be done on Sunday and holiday except in emergency or when technical requirements are such that continuity of work should be maintained and that too will be with prior permission of the competent authority.
- 10) Cement and Steel will not be supplied by the RMC. The Contractors have to make their own arrangements for procurement of indigenous Portland cement or imported portland cement and M.S. Round Bars including Steel for Steel Girder the entire work. The contractors shall have to give necessary test certificates as per relevant I.S Code before using the same in the work
- 11) Contractor will be fully responsible for compliance of the various provisions under Contract Labour Act, 1970 and the Rules framed there under.
- 12) As per circular No. MGR 2176(96), 2418 (ii) dt. 31.8.77 issued by the Government of Gujarat contractors are requested to procure their quarry materials required for construction work through legal sources i.e. only from the quarry lease holders permit holders or middle man who satisfies the contractor as to the legality of the source of purchase by him of these materials.
- 13) All defective works are liable to be demolished, rebuilt and defective materials replaced by the contractor at his own cost. In the event of such works being accepted by carrying out repairs etc as specified by the Engineer in charge, the cost of repairs will be borne by the contractor and will be paid for the works actually carried out by him at reduced rates of the tendered rates, as may be considered reasonable by the Engineer in charge in the preparation of final or on account bills.

## ITEM – WISE TECHNICAL SPECIFICATION

FOR DETAILED SPECIFICATION OF SCHEDULE-B, MOST OF THE ITEMS ARE COVERED FROM MORT&H SPECIFICATION FOR ROAD AND BRIDGE WORKS (FIFTH REVISION) 2013. FOR ANY SPECIFICATION NOT FOUND IN THIS BOOK, KINDLY REFER THE BELOW MENTIONED SPECIFICATIONS IN DETAILS. IF ANY AMBIGUITY FOUND REPORT TO ENGINEER IN CHARGE FOR FURTHER WORK.

READY REFERENCE ITEM DESCRIPTION AND SPECIFICATION NO. AS PER BELOW MENTIONED TABLE:

Sr N o.	Item of work	MORT&H specification No.
1	Providing flood gauge marks on substructure as per design including painting complete.	As per Detailed Specification
2	Marking out the center line of the Bridge and various other component structures and complete lining out and leveling with total station, levels, including constructing necessary masonry pillars for lines and levels and establishing necessary bench marks etc. complete as directed. Note : The item includes multiple markings required throughout the project duration.	As per Detailed Specification
3	Felling trees of the girth (measured at a height of 1 m above ground (level), Including cutting of trunks and branches, removing the roots and stacking of serviceable material and disposal of unserviceable material. Beyond 60cm girth upto & including 120cm girth.	Cl. No. 201, Pg. no. 37
4	Removal of Telephone / Electric Poles and Lines (Removal of telephone / Electric poles including excavation and dismantling of foundation concrete and lines under the supervision of concerned department, disposal with all lifts and up to a lead of 1000 metres and stacking the serviceable and unserviceable material separately)	As per Detailed Specification
5	Dismantling of existing structures like Footpath, Pavers, Kerb and other structure comprising of masonry, cement concrete, steelwork, including tools, plants and scaffolding wherever necessary, sorting the dismantled material, disposal of unserviceable material and stacking the serviceable material with all lifts and leads & as directed by engineer in charge.	Cl. No. 202, Pg. no. 39
6	Dismantling of Flexible Pavements (Dismantling of flexible pavements and disposal of dismantled materials up to a lead as directed by Engineer-in-Charge, stacking serviceable and unserviceable materials separately)	Cl. No. 202, Pg. no. 39



7	Excavation for foundation in sand, gravel, clay, soft soils and murrum etc. Including shoring, strutting dewatering as necessary and disposing & reuse of the excavated stuff behind retaining walls as directed by Engineer in Charge. (A) Depth upto 3.0 m	Cl. No. 304, Pg. no. 59
8	Excavation in large boulders and soft rock by chisseling including shoring, strutting and dewatering as necessary and disposing of the excavated stuff as directed by Engineer in Charge. (B) Depth from 2.0 m to 5.0m	Cl. No. 304, Pg. no. 59
9	Excavation in hard rock by dry-wet blasting and chiselling (B) prohibited Blasting work, including dewatering preparing foundation base by proper benching and stepping and disposing of the excavated stuff as directed by Engineer in Charge. (C) Depth from 5.0 m to 10.5m	Cl. No. 304, Pg. no. 59
10	Carting of excavated material such as murrum, earth,kapachi, gravel, brickbats, kankar, debris, sand, dismantled material, including loading, unloading, stacking etc.complete at non objectional place as directed by engineer in charge.	As per Detailed Specification
11	Providing & filling in foundation with ordinary cement concrete M 20 mix including formwork vibrating ramming & curing complete.	As per Detailed Specification
12	Providing and casting in-situ controlled cement concrete of M35 grade for RCC work for Box Top slab with 20/40mm down coarse aggregate of the required size for any depth including dewatering, scaffolding centring, shuttering, mixing, placing in position, consolidating with mechanical vibrators, curing, deshuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary as per specification and drawing. any honeycombing/ undulation found shall be rectify to match F3 class finish. Note:- Rates in items shall include cost of providing grooves, chamfers, moulding, cut-out etc. in formwork. The work will include placing in position of necessary fixtures, sleeves for various purposes, etc. complete as per drawings, specifications and as directed by the Engineer in charge.	Cl. No. 1700,2200 Pg. no. 535,669
13	Providing and casting in-situ controlled cement concrete of M35 grade for RCC work for Box Bottom slab with 20/40mm down coarse aggregate of the required size for any depth including dewatering, scaffolding centring, shuttering, mixing, placing in position, consolidating with mechanical vibrators, curing, deshuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary as per specification and drawing.	Cl. No. 200,1700,2100, 2200 Pg. no. 37,535,663,669
14	Providing and casting in-situ controlled cement concrete of M35 grade for RCC work for Box Side Walls with 20/40mm down coarse aggregate of the required size for any depth including dewatering, scaffolding centring, shuttering, mixing, placing in position, consolidating with mechanical vibrators, curing, deshuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary as per specification and drawing, with including cost of finishing equivalent to F3 type exposed concrete and form mark. The rate shall also include preparation of construction joints as per specifications and provide approved wire mesh/weld mesh at	Cl. No. 1700,2200 Pg. no. 535,669

	<p>such location as approved by the Engineer-in-charge or as shown in drawings.</p> <p>Any honeycombing/ undulation found shall be rectify to match F3 class finish. Note:- Rates in items shall include cost of providing grooves, chamfers, moulding, cut-out etc. in formwork. The work will include placing in position of necessary fixtures, sleeves for various purposes, etc. complete as per drawings, specifications and as directed by the Engineer in charge.</p>	
15	<p>Providing and casting in-situ controlled cement concrete of M35 grade for RCC work for retaining walls foundations with 20/40mm down coarse aggregate of the required size for any depth including dewatering, scaffolding centring, shuttering, mixing, placing in position, consolidating with mechanical vibrators, curing, deshuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary as per specification and drawing.</p>	<p>Cl. No. 200, 2100, Pg. no. 37, 663</p>
16	<p>Providing and casting in situ controlled cement M35 for RCC work in retaining wall stem as per drawing including centering shuttering scaffolding where necessary laying vibrating curing and finishing complete.</p> <p>The rate is inclusive of all materials, including necessary mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, deshuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools &amp; plants, machineries, as required, with including cost of finishing equivalent to F3 type exposed concrete and form mark.</p> <p>Any honeycombing/ undulation found shall be rectify to match F3 class finish. Note:- Rates in items shall include cost of providing grooves, chamfers, moulding, cut-out etc. in formwork. The work will include placing in position of necessary fixtures, sleeves for various purposes, etc. complete as per drawings, specifications and as directed by the Engineer in charge.</p>	<p>Cl. No. 2200, Pg. no. 669</p>
17	<p>Providing and laying filter media 600mm thick as directed at the back of abutments, returns and wing walls as per detailed specifications.</p>	<p>Cl. No. 2504, Pg. no. 709</p>
18	<p>Providing and laying of the excavated earth at the back of retaining wall as directed by Engineer - in-charge and as per the detailed specifications.</p>	<p>Cl. No. 304.3.7, Pg. no. 61</p>
19	<p>Providing and casting in -situ controlled cement concrete of M 40 grade for RCC crash Barrier with 20 mm down coarse aggregate of the required size including formwork, shuttering, placing in position, consolidation with mechanical vibrators curing finishing, deshuttering carefully, marking good the damages, fixing embedment, inserts, pockets, wherever necessary as directed and as per drawing with F3 type exposed concrete finish and formwork as directed by Engineer - in - charge, etc. complete as per specification.</p> <p>Note : The reinforcement for Crash barrier and MS pipe railing above it are calculated separately.</p>	<p>Cl. No. 2703.3, Pg. no. 752</p>

20	Providing and casting in-situ controlled cement concrete of M-30 grade with minimum cement content 420kg/cum as per IS-456-2000, reinforcement cement concrete with 20mm downgraded crushed stone aggregates of required size in super structure for approach slab including required formwork, shuttering and supporting arrangement (excluding cost of reinforcement) and transporting concrete from batching plant by transit mixture placing it in position, compacting with needle vibrator including curing with all labour, material, machinery all lead, lift etc. complete as per drawing and technical specification of MORTH & as directed by Engineer Incharge.	Cl. No. 2704, Pg. no. 754
21	Providing and placing in position High Yield Strength Deformed (HYSD) bars reinforcement (TMT Fe 500D grade) conforming to IS 1786 of all categories for foundation of pier, abutment & retaining wall including cutting, bending, hooking and tying with 18 gauge mild steel binding wires, supporting in position to ensure lines and levels during concreting, maintaining proper cover / spacing etc. complete as per specification and detailed drawing.	Cl.No. 1600,2200 Pg. no. 527,669
	For Box	
	For Retaining Wall Foundation	
	For Retaining Wall (Stem)	
	Approach Slab	
	Wearing Coat	
	Kerb & Median	
	Collection Sump & Pump Room	
22	Road marking with hot applied thermoplastic compound with reflectorising glass beads on road surface providing and laying hot applied thermoplastic compound 2.5 CM thick including reflectorising glass bends @ 250 gms /sq mt area thickness of surface applied glassbend as per IRC..35 the finished surface to be level uniform and free from streaks and holes.	Cl. No. 803.4, Pg. no. 338
23	Make out acrylic strene acrylonitrile or high impact polystyrene fitted with molded of methacrylate (MMC) reflector cube corners reflection design filled with tightly adhering potting compound as per ASTM D 788 size 11.5 x 7.0 x 1.6 cms or 10 x 10 x 1.75 cms provided with bitumenous adhesive in sufficient quality with each unit for fixing . no nail shall allow for fixing . Reflection on both side, min reflection on both side, min reflective area 12.90 sq cms on each face . coefficient of lamination as per specification and compressive strength 13 tonnes at 23 degree centigrade (B) double side lenses.	Cl. No. 804, Pg. no. 353
24	Providing and applying two coats of 100% Acrylic breathable, Anti-carbonation, Waterproof, Heat insulating, decorative external coating "SUNEXT 8" or equivalent of approved shade after applying a primer coat of same material. Acrylic paint shall be spray/brush/roller applied and shall conform to the following properties. Carbon dioxide diffusion equivalent air layer thickness (DIN EN	As per Detailed Specification

	1062-6) > 100 m.; Carbon dioxide diffusion resistance coefficient (DIN EN1062-6) >105; Elongation of cured film shall be as per ASTM D 2370/98 > 400%; Chloride Ion Diffusion (ASTM C 1202) = Zero Penetration; Adhesion to concrete (ASTM D 4541) > 2 N/mm <sup>2</sup> ; Solar Reflective Index (ASTM E 1980-11, EN 673:2011, EN 410:2011) > 104. The inter-coat gap to be 24 hours. The rate shall include complete treatment mentioned above.	
25	Providing Weep holes in RCC abutment, Return wall and retaining wall with 100 mm dia PVC pipe with geotextile and decorative grating, extending through the full width of the structure with slope of 1V:20H etc. complete as per drawing and technical specification.	Cl. No. 2706, Pg. no. 755
26	Providing Pylon consist of cast-in-situ concrete of M30 grade exposed finish as per drawing and as directed by engineer incharge. Rate includes providing required shuttering and form work but excluding stone slab & carving. (Reinforcement shall be paid in respective item.)	As per Detailed Specification
27	Providing and fixing marble slab including transporting, engraving and painting all complete. (ii) Size 60cm x 60cm x 4cm	As per Detailed Specification
28	Providing and casting in situ reinforced cement concrete M30 grade controlled cement concrete in median kerb & footpath kerb using 6mm to 20mm machine crushed well graded stone aggregate, sand of approved quality, OPC 53 grade cement with contractor's own concrete mix design as approved by client etc complete as per specification The rate is inclusive of all materials, including necessary mixing in fully automatic batch mix plant, transportation, curing, vibrating, placing in position, shuttering, formwork, deshuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead & lift with contractors labour, tools & plants machinaries, as required with F3 type exposed concrete finish and form mark.	Cl. No. 1500, 1700 & 2704 Pg. no. 519,535 & 754
29	Providing and fixing pre-cast concrete kerb stone of gray cement based concrete block 30cm length,30cm height and 15cm thick of M250 grade concret as per approved design and including excavation for fixing in proper line and level,filling the joint with C:M 1:3 (1cement:3fine sand) etc complete.	As per Detailed Specification
30	Providing and fabricating MS pipe railing on Crash Barrier with NB80 medium class MS pipe, anchor bars, MS plate, MS flat etc. as per drawing including providing and 3 coats of epoxy painting(1 coat of primer and 2 coats of paint as per manufacture's specification) of approved brand and manufacture to give an even shade of two or more coat as directed by Engineer-in charge. Addition to that anticorrosive paint must be applied before any paint as directed by Engineer - in -charge . Item complete as per specification and drawing.	Cl. No. 2705, Pg. no. 754
31	Providing Vertical Joints - Pre-moulded bituminous filler joints as per drawings.(A) 12mm	Cl. No. 2604, Pg. no. 725
32	Fabricating, supply and erecting in position Standard Structural steel sections conforming to IS 2062 for railing or other works using ISMB, ISA, ISMC, MS plate, flat, squarebars, pipe, square pipe ,etc. including welding, cutting, wastage, etc. complete.	Cl. No. 1900, Pg. no. 585

33	Box cutting the road surface to proper slope and chamber for making a base for road work including removing the excavated stuff and depositing on the road side slope as directed up to 50m lead.	As per Detailed Specification
34	Earth work for embankment for SUBGRADE with CBR 5 % including breaking clods, dressing with all lead and lift and including watering, rolling and consolidation of subgrade in layers at O.M.C. to required dry density, including filling the depressing, which occurs during the process using power roller of 8 tonne to 10 tonne all as per specification. (E)From borrow area 3km lead.	Cl. No. 305,900, Pg. no. 63,415
35	Construction of Granular Sub Base (GSB) by providing coarse graded material of grading-II, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per MORTH specification.	Cl. No. 401, Pg. no. 109
36	Providing, laying, spreading and compacting graded stone aggregate to Wet Mix Macadam (WMM) specification including premixing the material with water at OMC in mechanical mix plant carriage of mixed material by tipper to site, laying in uniform layers with paver in sub base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.	Cl. No. 406, Pg. no. 131
37	Providing and applying PRIMER COAT with bitumen emulsion using emulsion pressure distributor at the rate of 0.75 kg/sqm on prepared surface of granular base including clearing of road surface using mechanical brooms.	Cl. No. 502, Pg. no. 166
38	Providing & laying DENSE GRADED BITUMINOUS MACADAM with batch type Drum Mix Plant (DMP) using crushed aggregates of specified grading, premix with bitumen grade 60/70 , bituminous binder @ 5.0 per cent by weight of total mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction complete,including providing & laying tack coat 2.5kg /10sqm all as per MORTH specification.	Cl. No. 504, Pg. no. 170
39	Providing & laying BITUMINOUS CONCRETE with batch type Drum Mix Plant (DMP) using crushed aggregates of specified grading, premix with bitumen grade 60/70 bituminous binder @ 5.5 per cent by weight of total mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction complete, all as per MORTH specification.	Cl. No. 507, Pg. no. 188

40	Providing and casting in-situ controlled cement concrete of M35 grade for RCC work in wearing coat with 20 / 40 mm down coarse aggregate of the required size including, centring, shuttering, scaffolding, ramming, laying, placing in position, consolidating with mechanical vibrators, curing, finishing, deshuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary as directed and as per drawing with F3 type exposed concrete finish and form mark as directed by Engineer-in-charge, etc. complete as per specification.	Cl. No. 2702, Pg. no. 751
41	Supplying & fixing road sign board of MS plates and angle iron including painting , lattering , etc. complete including fixing in CC 1:4:8 with necessary excavation etc complete as per IRC Type A) Non reflective type.	Cl. No. 801, Pg. no. 325
42	Providing and fixing sing boards made out of 2mm aluminium sheet; size 80 x 60cms. rectangle as per the design of IRC-67-1977 pre treated with phospheting process & acid teching; coated with one coat of epoxyprimer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest MOST Specifications; 3.1m long stand postand frame fabricated from suitable sizeiron angle of 35 x 35 x 3mm75x75x6mm as required; painted with best qualityepoxy coatings in black and whitebends. the details of symbol for eachboard shall details of symbol for eachboard shall be as per the instruction ofengineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x45 x 60cms. for each leg. including excavation curing tec. complete under the supervision of engineer in charge.	Cl. No. 801, Pg. no. 325
43	Providing and fixing sing boards made out of 2mm aluminium sheet; size 60cms. diameter circle as per the design of IRC-67-1977 pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest MOST Specifications; 3.1m long stand post and frame fabricated from suitable size iron angle of 35 x 35 x 3mm 75x75x6mm as required; painted with best quality epoxy coatings in black and white bends. the details of symbol for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.	Cl. No. 801, Pg. no. 325
44	Providing and fixing sing boards made out of 2mm aluminium sheet; size 244 x 122cms. rectangle as as per the design of IRC-67-1977 pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest MOST Specifications; Letters and numerals should be as per IRC-30-1968, 3.1m long (2 nos) stand post and frame fabricated from suitable size iron angle of 50 x 50 x 5mm 75x75x6mm as required; painted with best quality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60cms. for each leg. including excavation curing	Cl. No. 801, Pg. no. 325

	etc. complete under the supervision of engineer in charge.	
45	Providing and fixing sing boards made out of 2mm aluminium sheet; size 180 x 120cms. rectangle as as per the design of IRC-67-1977 pre treated with phospheting process & acid etching; coated with one coat of epoxy primer and two coats of best quality epoxy paint; reflectorised with retro reflective sheeting as per latest MOST Specifications; Letters and numerals should be as per IRC-30-1968, 3.1m long (2 nos) stand post and frame fabricated from suitable size iron angle of 50 x 50 x 5mm 75 x 75 x 6mm as required; painted with best quality epoxy coatings in black and white bends. the details of symbol or inscription / numerals for each board shall be as per the instruction of engineer in charge. The fixing at site shall be in 1:2:4 CC block of size 45 x 45 x 60cms. for each leg. including excavation curing etc. complete under the supervision of engineer in charge.	Cl. No. 801, Pg. no. 325
46	Providing & fixing sign board made out of 2mm aluminium sheet, size 30cms diameter circle, pretreated with phospheting process and acid etching, painted with one coat of epoxy primer and two coats of best quality epoxy paint reflectorised with retro reflective sheeting as per latest M.O.S.T. specifications (As per attached draiwng)	Cl. No. 801, Pg. no. 325
47	Paver Block -Supply & Fixing of 60mm M-30 Grade cement concrete rubber mold paving inter locking paving block (Grey colour) as per ISI mark after beding of Bhogavo sand in line and CC on the edge in proportion of 1:2:4 with curing etc. complete. The work of the paving blocks shall be executed in line and level by skilled mason of flooring work only. It should be laid in such a way that the no cutting of the paver block to be necessary. If cutting of paver block shall be required, than cut by machine only and laying to be done by skilled flooring mason. The Finished surface of the Paver Block shall have Coarse Sand Texture Finish. Paver blocks shall be compacted and shall be re-laid if necessary. Actual laid area shall be measured and paid without any wastage.	Cl. No. 1405, Pg. no. 509
48	Providing and filling sand beneath footpath slab as directed.	Cl. No. 305, Sub Cl. No. 305.4.2-305.4.4, Pg. no. 72
49	Providing and casting in -situ controlled cement concrete of M 30 grade for RCC Collection Sump with 20 mm down coarse aggregate of the required size including formwork, shuttering, placing in position, consolidation with mechanical vibrators curing finishing, deshuttering carefully, marking good the damages, fixing embedment, inserts, pockets, wherever necessary as directed and as per drawing with F3 type exposed concrete finish and formwork as directed by Engineer - in - charge, etc. complete as per specification.	Cl. No. 1700,200,2300 Pg. no. 535,669,675
50	15mm thick Plaster Finishing wall with water proofing cement paint of on wall surfaces (Two coats) to give an approved brand and manufacture and of required shape even shade after thoroughly brushing the surface to remove all dirt and remains of loose powered materials.	Cl. No. 1300, Pg. no. 501

51	Providing & fabricating Metal grating for Collection Sump along with frame assembly.	Cl. No. 1900, Pg. no. 585
52	Providing and fixing rubber speed breakers (with polyurethane binder) of size 500mm x 350mm x 50mm lining with 8 no of cat eyes per piece including intermediate and end members as per manufacturer's specifications or supplier's specifications and as directed by engineer in charge. Weight of speed breaker approximate 15 kg/Rmt and weight capacity 20 Tons with high impact resistance and brutal weather condition. Speed breaker shall be fixed with grout (min 8 holes for fixing per piece) and as per manufacturer's specification. Sample shall be approved by engineer in charge.	As per Detailed Specification
53	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 -fine sand)(A) Modular	As per Detailed Specification
54	Providing 15mm thick cement plaster in single coat on Rough (Similar) side of single or half brick walls for interior plastering upto floor two level and finished even and smooth in (ii) Cement mortar 1:4 (1-cement :4-sand)	Cl. No. 1300, Pg. no. 501
55	Providing and laying controlled cement concrete M25 and curing complete excluding the cost of formwork and reinforcement for reinforced concrete work in (C) Slabs,landing,shelves,Balconies, Lintels,Beams, Girders and Cantilever upto floor two level.	Cl. No. 1700,200,2300 Pg. no. 535,669,675
56	Providing and laying in position FE 500/500D TMT bar reinforcement including cutting, bending, hooking and tying complete as per detailed drawings for the following.	Cl. No. 1600,2200 Pg. no. 527,669
57	Providing and fixing 35 mm thick shutters for Doors, windows and clear storey windows including anodised alluminium butt hinges with necessary screws. (A) Indian Teak Wood (ii) Fully Glazed.	As per Detailed Specification
58	Providing and laying White Stone Bela masonry block in course for substructure with stone of approved quality and exposed finish in Cement Mortar 1:5 (1-Cement :5- course sand) including packing the joints etc. complete as per design and drawing of Design Consultant and as directed by Engineer-in-Charge.	Cl. No. 1405 Pg. no. 509
59	Pointing on coursed stone masonry with cement mortar 1:3 (1-cement : 3-course sand) (B) Ruled pointing as per design and drawing of Design Consultant and as directed by Engineer-in-Charge	Cl. No. 1406 Pg. no. 515
60	Providing and fixing 1.20 Metre high fencing with 2.0 Metre long M.S. Angle posts 40mm x 40 mm x6 mm and oil painting 3 coats fixed at 2.5 Mt,C/c. with five Horizontan lines and two diagonals of galvanised steel barbed wire weighting 9.38 Kg. per 100 Metre, strained and fixed to posts with G.I.staples including fixing the postsin ground with 0.5 M x 0.5.M x 0.5 M. block in C.C1:5:10 etc complete.	Cl. No. 808, Pg. no. 358
61	Providing aluminium sheeting for concealing the cables as directed by Engineer-in-Charge and as required.	Cl. No. 1900, Pg. no. 585
62	Providing water stops serrated with central bulb (225mm wide, 8 - 11 mm thick) as per direction of engineer.	As per Detailed Specification



63	<p>Providing &amp; Laying of underground ducts for carrying of optical fibres, BSNL lines, etc. as directed by Engineer-in-Charge. AC pressure pipe with ISI-1592_2003 mark and manufacturing by MAZZA process of CLASS-15. with all type of taxes, transportation, loading -unloading and insurance and Third Party Inspection (TPI). Supply to Central Store (Eng.) or any site in RMC limit. Length of pipe must be as per IS-1592_2003. (A) 300 mm Dia.</p>	
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**Item No. 1**

**Providing flood gauge marks on substructure as per design including painting complete.**

1. The width of the flood gauge shall be 60 cm and will have caneri yellow background colour. The flood gauge marking will be in 10 cm. thick strips of alternative black and white colour. The width of the strip shall be as under :-
  - (a) At every 10 cm. 15cm. width
  - (b) At every 1/2 m. 25 cm, width in black
  - (c) At every metre 35 cm. width in white

The lettering shall be in black color and of 10 cm. height. The lettering shall show every metre and 1/2 m. level. The lettering shall show levels based on either GST B.M. or Arbitrary B.M. as furnished by Engineering-in-charge.

2. All the painting work shall be done in 3 coats. The paint shall be of approved make.
3. The measurement for payment shall be on running meter basis measured vertically in height.
4. The unit rate includes the cost of materials, labour, painting, equipment if any to complete the work.

**Item No. 2**

**Marking out the center line of the Bridge and various other component structures and complete lining out and leveling with total station, levels, including constructing necessary masonry pillars for lines and levels and establishing necessary bench marks etc. complete as directed.**

**Note : The item includes multiple markings required throughout the project duration.**

The Center line axis of the Six lane bridge is to be done for bridge and also for approaches / retaining walls in both ends shall be surveyed along their lengths. Center line pegs for six lane bridge, ramps including foundation pegs at each location and at suitable distance of 3.0 m c/c along the approach on each side shall be fixed.

All deviation angles of the central line axis for the six lane bridge including tangent distances shall bedemarcated with pegs fixed in to the ground.

The rate on Lump sum basis shall include all equipments, survey instruments, necessary survey party, supply and fixing of pegs including, fixing of pillars for intermediate stations labour, materials required incompleting the job as required, as per direction of Engineer-in-charge.

**The rate shall be paid on lump sum basis.**

**Item No. 4**

**Removal of Telephone / Electric Poles and Lines (Removal of telephone / Electric poles including excavation and dismantling of foundation concrete and lines under the**

**supervision of concerned department, disposal with all lifts and up to a lead of 1000 metres and stacking the serviceable and unserviceable material separately)**

1. The relevant specifications for removal of electric poles and lines as per mentioned in item.
2. The rate includes excavation and dismantling of foundation concrete and lines under the supervision of concerned department, stacking of all serviceable material to RMC store and disposal of debris.
3. The measurement shall be in Nos. basis of poles.

#### **Item No. 10**

**Carting of excavated material such as murrum, earth, kapachi, gravel, brickbats, kankar, debris, sand, dismantled material, including loading, unloading, stacking etc. complete at non objectional place as directed by engineer in charge.**

##### **1.0 General:**

- I. The distance for lead shall be as per the item description.
- II. All the excavated material shall be the property of the client. Where the excavated material is directed to be used in the construction of the works for general grading, plinth filling or embankments, the operations shall be arranged in such a manner that the capacity for cutting, haulage and compaction are nearly the same.
- III. All hard materials such as hard murrum, rubble etc. not intended for filling in foundations, plinth or embankments shall be stacked neatly for future use as directed by the Engineer. The contractor on his own risk shall dispose of unsuitable or surplus materials not intended for use in part of the works or for reuse outside the work site.
- IV. The rates quoted shall also include for dumping of excavated materials in regular heaps, bunds, riprap with regular slopes within the lead specified and levelling. As a rule, all softer material shall be laid along the centre of the heaps, the harder and more weather resisting materials forming the casing on the sides and the top. Excavated soft rock or hard rock shall be stacked separately.

##### **2.0 Workmanship:**

- I. The surplus excavated earth shall be disposed off as and when directed by the Architect or Engineer-in-charge. In case the excavated earth is to be stacked inside the plot, the location of the stack shall be directed by the architect or engineer in charge. If earth is to be disposed outside the plot, non-objectionable site shall be selected by the contractor.

- II. The disposal of the stuff includes loading the earth in vehicle, conveyance to the specified site, unloading, spreading and compacting with required capacity of roller the same beyond the initial lead.
- III. The Contractor should contact the Engineer-In-Charge before disposing the material.

### **3.0 Mode of measurements and payment:**

- I. The actual measurements of the disposed earth shall be calculated by taking actual levels of the original ground before start of the work after site clearance and after compaction of the fill as specified. Quantity of the earth so computed shall be reduced by 10% in case of consolidated fills, 5% in case of consolidation is done by heavy equipment. No deduction will be done in case of consolidation heavy mechanical machinery at optimum moisture content.
- II. The quantity of the earth worked out for interim payment by taking lorry measurements; have to be reduced by 20%.
- III. The rate includes for spreading, dressing etc. complete at the specified site and shall be for a unit of one cum.
- IV. The Final quantity of the transported earth shall be worked out after overall reconciliation of excavation, filling and disposing of the earth for whole site.
- V. The mode of payment shall be in per cum. basis.

### **Item No. 11**

#### **Providing & filling in foundation with ordinary cement concrete M 20 mix including formwork vibrating ramming & curing complete.**

Ordinary cement concrete of specified Grade shall be carried out in accordance with the following specification.

1. In case of ordinary concrete, mix is not required to be designed by preliminary tests and proportions of cement, fine aggregates and coarse aggregates are specified by volume as given in table below for different grades of concrete designated as ordinary M. 100, M. 150, M.200 and M.250.
2. In the designation of a concrete mix, letter "M" refers to the mix and the number the specified 28 days works cube compressive strength of that mix on 150 mm. cubes expressed in kg/cm<sup>2</sup>.
3. The ordinary concrete mix shall generally be specified by volume. For cement which normally comes in bags and is used by weight, volume shall be worked out taking 50 kg. of cement as 0.035 cubic meter in volume. While measuring aggregate by volume, shaking,

ramming or hammering shall not be done. Proportioning of sand shall be as per its dry volume. In case it is dump, allowance for "bulking" shall be made as per IS : 2386 (Part-III).

4. Ingredients required for ordinary concrete containing one 50 Kg. bag of cement of different proportions of mix shall be as given in Table below.

TABLE

Grade of Concrete	Mix By Volume	Total Quantity of dry aggregates by volume per 50 Kg. of cement, to be taken as sum of the individual volumes of fine and coarse aggregates max	Proportion of fine aggregate to coarse aggregate	Quantity of water per 50 kg. of cement max.
1	2	3	4	5
(1 Cubic meter = 1000 Litres)				
Ordinary	Litres			Litres
M.100	1:3:6	300	General 1:2 for fine aggregate to coarse aggregate by volume but subject to a upper limit of 1:1. ½ & a lower limit of 1:3	34
M.150	1:2:4	220		32
M.200	1:1.1/2:3	160		30
M.250	1:1:2	100		27

**NOTE-** The proportions of the aggregates shall be adjusted from upper limit to lower limit progressively as the grading of the fine aggregates becomes finer & the maximum size of coarse aggregate becomes larger.

**Example-** For an average grading of fine aggregate (that is Zone II of IS : 383-1963) the proportions shall be 1: 1 1/2, 1:2 and 1:3 for maximum size of aggregates 10 mm, 20 mm. and 40 mm. respectively (after carrying out sieve analysis).

**Note-2** A mix leaner than M.100 (1:3:6) may be used for non- structural parts, if provided in the contract. In such case grading of aggregates shall be by volume. Other requirements for mixing, placing & curing shall be the same.

5. Following shall be the maximum nominal size of coarse aggregate for the different items of work:

Sr. No.	Item of Construction	Maximum nominal size of Coarse aggregate
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(i)	R.C.C. well curb. R.C.C. well staining and R.C.C. Piles	40 mm
(ii)	R.C.C. well steining	63 mm
(iii)	Well cap or pile cap; solid type piers, abutment and wing-walls, and their pier caps	40 mm
(iv)	R.C.C. works in cross girders deck slab, wearing coats, kerb, light posts, blast walls, approach slab etc. and hollow type piers, abutments, wing-walls and their pier caps	20 mm
(v)	R.C.C. bearings.	20 mm
(vi)	For any other item of construction not covered by items (i) to (v)	As specified on the drawing or as desired by the Engineer-In-charge in case it is not specified on drawing.

6. For heavily reinforced concrete members as in the case of ribs of main beams nominal maximum size of aggregate shall usually be restricted to 5 mm. less than the minimum lateral clear distance between the main bars or 5 mm. less than the minimum cover to the reinforcement, whichever is the smaller.
7. Fine aggregate shall be clean, hard, coarse sand. It shall be free from dust and such other substances. The sand be got approved by the Engineer-in-charge.
8. All materials shall be stored as to prevent their deterioration or intrusion of their quality and fitness for the work. Any material which has deteriorated or has been damaged or is otherwise considered defective by the Engineer-in-charge shall not be used in the works.
9. Cement shall be stored above the ground level in perfectly dry and water tight sheds. Wherever bulk storage containers are used, their capacity should be sufficient to cater to the requirements at site and should be cleaned at least once every 3 to 4 months. The aggregate shall be stored in such a way as to prevent admixture of foreign materials. Different size of fine or coarse aggregate shall be stored in separate stock-piles sufficiently away from the each other to prevent intermixing the materials.
10. The water for mixing shall be potable water to satisfaction of the Engineer-in-charge. The quantity of water shall be just sufficient to produce a dense concrete of required workability for the job.
11. For all work concrete shall be mixed in a mechanical mixer which along with other accessories shall be kept in first class working condition and so maintained throughout

the construction. 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 show complete coating of mortar containing its proportionate amount of cement. In no case shall the mixing be done for less than 2 minutes after all ingredients have been put into the mixer.

12. When hand mixing is permitted by the Engineer-in-charge for small jobs or for certain other reasons. It shall be done on a smooth watertight platform large enough to allow efficient turning over of the ingredients of concrete before and after adding water. Mixing platform shall be so arranged that no foreign material shall get mixed with concrete nor does the mixing water flow out. Cement in required number of bags shall be placed in a uniform layer on top of the measured quantity of fine and coarse aggregate, which shall also be spread in a 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 of uniform colour. Enough 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 per cent above that specified.
13. 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 be the Engineer-in-charge, the first batch of concrete from the mixer 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.
14. The method of transporting and placing concrete shall be approved by the Engineer-in-charge. Concrete shall be so transported and placed that no contamination, segregation or loss of its constituent material takes place. All form work and reinforcement contained in it 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.
15. If concreting is not started within 24 hours of the approval being given, it shall have to be obtained again from the Engineer-in-charge. Concreting being given, it shall proceed continuously over the area between construction joints. Fresh concrete shall not be placed against concrete which has been in position for more than 30 minutes unless a proper construction joint is formed. Concrete shall be compacted in its final position within 30 minutes of its discharge from the mixer unless carried in properly design agitators, operating continuously, when this time shall be within 2 hours of the addition of cement to the mix and within 30 minutes of its discharge from the agitator. Except where otherwise agreed to be the Engineer-in-charge, concrete shall be deposited in horizontal layers to a compacted depth of no more than 0.45 meter when internal vibrators are used and not exceeding 0.30 meter in all other cases.

16. Unless otherwise agreed to by the Engineer-in-charge concrete shall not be dropped into place from a height exceeding 2 meters. When trucking or chutes are used they shall be kept clean 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 laitance shall be removed by scrubbing the well 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.
17. 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 event of break downs.
18. Immediately after compaction, concrete shall be protected against harmful effects of weather, including rain, running water, shocks, vibration, traffic, rapid temperature changes, frost and driving out process. It shall be covered with wet sacking, hessian or other similar absorbent material approved by the Engineer-in-charge 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 the foundation concrete may be started after 48 hours of its laying but the curing of concrete shall be continued for a minimum period of 14 days. Form work shall include all temporary or permanent forms required for forming the concrete, together with all temporary construction required for their support. Form work shall however be divided into following two distinct categories :-

- (1) Shuttering i.e., form work required for forming the concrete.
- (2) Scaffolding i.e., form-work required for supporting shuttering.

Forms for shuttering shall be constructed only in metal suitably lined. Forms for scaffolding shall be constructed of metal or timber. Both shuttering and scaffolding shall be of substantial-rigid construction and shuttering shall be true to shape and dimensions shown on the drawings. All bolts and rivets shall be counter-sunk and well ground to provide a smooth, plane surface.

19. Forms shall be mortar-tight and shall be made sufficiently rigid by the use of ties and bracings to prevent any displacement or sagging between supports, They shall be strong enough to withstand all pressure, ramming and vibration, without deflection from the prescribe lines occurring during and after placing the concrete. Screw jacks or hard wood wedges where required shall be provided to make up any settlement in the



formwork either before or during the placing of concrete. Suitable camber shall be provided in horizontal members of structure, especially in long spans to counteract the effects of any fixed as to provide for such camber. Forms shall be so constructed as to be removable in sections in the desired sequence, without damaging the surface of concrete or disturbing other sections. Unless otherwise specified or directed, chamfers or fillets of sizes 25 mm x 25 mm shall be provided at all angles of formwork to avoid sharp corners.

20. The inside surfaces of shuttering shall, except in the case of permanent form work or where otherwise agreed to by the Engineer-in-charge, be coated with an approved material to prevent adhesion of concrete to the form work. Release agents shall be applied strictly in accordance with the manufacturer's instructions and shall not be allowed to come into contact with any reinforcement or pre-stressing tendons and anchorages. Different release agents shall not be used in form work for concrete which will be visible in the finished works.
21. Special measures shall be taken to ensure that the form work does not hinder the shrinkage of concrete because without these cracking could occur before formwork is removed. Wherever applicable arrangements must be made to ensure that the form work does not restrain the shortening and hogging of the beams or slabs during tensioning of the tendon's. The form work should take due account of the calculated amount of positive or negative camber so as to ensure the correct final shape of the structures having regard to the deformation of a false work, scaffolding or propping and the instantaneous or deferred deformation due to various causes affecting pre-stressed structures. Where there are re-entrant angles in the concrete sections the form work should be removed, at those sections as soon as possible after the concrete has set in order to avoid cracking due to shrinkage of concrete. Formwork shall be tight enough to prevent any appreciable loss of cement during vibrations; suitable tolerances should be provided in the formwork. Immediately before concreting all forms shall be thoroughly cleaned. Contractor shall give the Engineer-in-charge due notice before pouring 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 safety of men, machinery, materials and for results obtained.
22. The Engineer-in-charge shall be informed in advance by the contractor of his intention to strike any formwork. While fixing the time for removal of formwork, 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. Where field operations are controlled by strength tests of concrete, the removal of the load-supporting or soffit forms may commence when concrete has attained strength equal to at least twice the stress to which the concrete will be subjected at the time of striking props including the effect of any further addition of loads. When field operations are not controlled by strength tests of concrete the vertical forms of beams, columns and walls may be removed after 2 days. The props of slabs and beams may be removed after 14

and 21 days respectively. All formwork shall be removed without causing any damage to the concrete. 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 ties 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 reuse the formwork, it shall be cleaned and made good to the satisfaction, of the Engineer-in-charge.

23. Immediately after the removal of forms, all exposed bars or bolts passing through the Cement concrete member and used for shuttering or any other purpose shall be cut inside the cement concrete member to a depth of atleast 25 mm. 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 ties and all other holes and depressions, honey comb spots, broken edges or corners and other defects, shall be thoroughly cleaned, saturated with water and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry as consistency as is possible to use. Considerable pressure shall be applied in filling and pointing to ensure thorough filling in all voids. Surfaces which have been pointed shall be kept moist for a period of twenty four hours. If rock pockets/honeycombs, in the opinion of the Engineer-in-charge are of such an extent or character as to affect 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 the structure affected.

24. In the case of reinforced concrete work workability shall be such that the concrete surrounds and properly grips all reinforcement. The degree of consistency, which shall depend upon the nature of work and methods of vibration of concrete shall be determined by regular slump tests. Following slump shall be adopted for different types of works.

Type of Work		Slumps	
		Slump where vibrator is used	Slump where vibrator is not used
1	Mass concrete in RCC foundations, footings and retaining walls.	10 mm to 25 mm	80 mm
2	Beams, slabs and columns simply reinforced.	25mm to 40 mm	100 to 120 mm
3	Thin R.C.C. section or congested steel.	40 mm to 50 mm	125 to 150 mm

25. Works strength tests shall be made in accordance with IS : 516. Each test shall be conducted on ten specimens, five of which shall be tested at seven days and the remaining five at 28 days. The samples of concrete shall be taken on each day of concreting and cubes shall be made at the rate of one for every 5 cubic meter of concrete or a part thereof. However, if concreting done in a day is less than 15 cubic meter, the minimum number of cubes can be reduced to 6 with the specific permission of the Engineer-in-charge. Similar works tests shall be carried out whenever the quality and grading of materials is changed irrespective of the quantity of concrete poured. The number of specimens may be suitably increased as deemed necessary by the Engineer-in-charge when procedure of tests given above reveal a poor quality of concrete and in other special cases.

26. The average strength of the group of cubes cast for each day shall not be less than the specified works cube-strength. 20 per cent of the cubes cast for each day may have values less than the specified strength, provided the lowest value is not less than 85 per cent of the specified strength.

27. R.C.C. work shall have exposed concrete surface. Centering design and its erection shall be approved by the Engineer-in-charge. One carpenter with helper will invariably be kept present throughout the period of concreting. Movement of labour and other persons shall be totally prohibited over 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, kapchi or metal pieces shall not be used for this purpose. Concreting of important structural members shall always be done in the presence and under the supervision of departmental person not below the rank of Asstt. Engineer/Addl. Asstt. Engineer, Overseer or as instructed by the Engineer-in-charge. After removal of form work checks that concrete produced is of good quality. Plastering shall not be allowed to the exposed faces of concrete.

28. In reinforced concrete the volume occupied by reinforcement shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab.

29. All necessary labour, materials, equipment, etc., for sampling, preparing test cubes, curing etc., shall be provided by the Contractor. Testing of the materials and concrete may be arranged by the Engineer-in-charge in an approved laboratory at the cost of the contractor.

**30. The payment will be made on cumt. basis of the finished work.**

31. The unit rate for concrete shall include the cost of all materials, labour, tools and plant required for mixing, placing in position, vibrating and compacting finishing as per directions of the Engineer-in-charge, curing and all other incidental expenses for producing concrete of specified strength to complete the structure or its components as shown on the

drawings and according to these specifications. The rate shall also include the cost of making/fixing and removing of all centers and forms required for the work.

**Item No. 24**

**Providing and applying two coats of 100% Acrylic breathable, Anti-carbonation, Waterproof, Heat insulating, decorative external coating "SUNEXT 8" or equivalent of approved shade after applying a primer coat of same material. Acrylic paint shall be spray/brush/roller applied and shall conform to the following properties. Carbon dioxide diffusion equivalent air layer thickness (DIN EN 1062-6) > 100 m.; Carbon dioxide diffusion resistance coefficient (DIN EN1062-6) >105; Elongation of cured film shall be as per ASTM D 2370/98 > 400%; Chloride Ion Diffusion (ASTM C 1202) = Zero Penetration; Adhesion to concrete (ASTM D 4541) > 2 N/mm<sup>2</sup>; Solar Reflective Index (ASTM E 1980-11, EN 673:2011, EN 410:2011) > 104.**

**The inter-coat gap to be 24 hours. The rate shall include complete treatment mentioned above.**

Acrylic paint shall be spray/brush/roller applied and shall conform to the following properties.

1. Carbon dioxide diffusion equivalent air layer thickness (DIN EN 1062-6) > 100 m
2. Carbon dioxide diffusion resistance coefficient (DIN EN1062-6) >105;
3. Elongation of cured film shall be as per ASTM D 2370/98 > 400%;
4. Chloride Ion Diffusion (ASTM C 1202) = Zero Penetration;
5. Adhesion to concrete (ASTM D 4541) > 2 N/mm<sup>2</sup>;
6. Solar Reflective Index (ASTM E 1980-11, EN 673:2011, EN 410:2011) > 104.
7. The intercoat gap to be 24 hours.

**Item No. 26**

**Providing Pylon consist of cast-in-situ concrete of M30 grade exposed finish as per drawing and as directed by engineer incharge. Rate includes providing required shuttering and form work but excluding stone slab & carving. (Reinforcement shall be paid in respective item.)**

1. The relevant specifications for Pylon cast-in-situ concrete of M30 grade shall be as per MORT&H fifth revision specifications.
2. The measurement shall be in Nos. basis.
3. The rate includes providing required shuttering and formwork but excluding stone slab & carving. (Reinforcement shall be paid in respective item.)

**Item No. 27**

**Providing and fixing marble slab including transporting, engraving and painting all complete. (ii) Size 60cm x 60cm x 40mm**

1. Marble plate shall be white and of approved quality and shall be of size as mentioned in the item. Lettering shall be done by V-shape engraving and shall be filled with black paint of approved quality, lettering shall be done as directed by the Engineer-in-charge. The Marble plate shall be fixed in neat cement at a place as directed by the Engineer-in-charge. Cement shall conform to relevant IS Specification.
2. Measurement shall be per number of marble plate fixed.
3. Unit rates includes cost of all material labour and tools to complete the work

**Item No. 29**

**Providing and fixing pre-cast concrete kerb stone of gray cement based concrete block 30cm length,30cm height and 15cm thick of M250 grade concret as per approved design and including excavation for fixing in proper line and level, filling the joint with C:M 1:3 (1cement:3fine sand) etc complete.**

1. The specification shall be followed as per the item description and as directed by engineer in charge
2. The mode of payment shall be in per Rmt. basis.

**Item No. 33**

**Box cutting the road surface to proper slope and chamber for making a base for road work including removing the excavated stuff and depositing on the road side slope as directed up to 50m lead .**

1. This work shall consist of excavation, removal and satisfactory disposal of all materials necessary for the construction of widening carriageway in accordance with requirements of these specifications and the lines, grades and cross sections shown in the drawings or as indicated by the Engineer.
2. After the site has been cleared the limits of excavation/ box cutting the road surface shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer.
3. Box cutting shall be carried out in conformity with the directions laid here in under and in a manner approved by the Engineer. The work shall be so done that the suitable materials available from box cutting/ excavation are satisfactorily utilized as directed.
4. The contractor shall not excavate outside the limits of box cutting. Subject to the permitted tolerances, any excess depth/ width excavated beyond the specified levels/ dimensions on the drawings shall be made good at the cost of the contractor with suitable material of characteristics similar to that removed and compacted as directed.
5. Cutting shall be done in proper grade & camber as per measurements given. Care must be taken that all slopes are evenly and truly dressed. Cutting shall be done to the exact depth required and shall be as per formation level in proper grade and the camber. If extra depth of cutting is done due to negligence of contractor the

same shall be refilled with approved quality of materials duly consolidated to the satisfaction of the Engineer-in-charge (without extra cost).

6. The bottom level of box cutting i.e. sub grade shall be watered and well compacted with vibratory roller at OMC to the desired density as directed by the Engineer in charge. Rolling and compaction shall be deemed to be incidental to the work and no extra cost shall be paid for compaction of box cutting base surface.
7. The stuff received from the cutting shall be used for filling and correcting side slopes of bank and earthwork for embankment as directed by the Engineer in charge with all lead and lift.
8. The measurement of box cutting shall be taken on level basis & level shall be taken at 30 mt. interval. Volume shall be computed in cubic meters by average area method.
9. The payment shall be made on Cmt. basis.
10. The rate includes cost of all labour, machineries required, cost of carting and spreading the cutting stuff with all lead and lift and leveling the dumping ground/ embankment, rolling and consolidation of subgrade level etc. complete.

**Item No. 52**

**Providing and fixing rubber speed breakers (with polyurethane binder) of size 500mm x 350mm x 50mm lining with 8 no of cat eyes per piece including intermediate and end members as per manufacturer's specifications or supplier's specifications and as directed by engineer in charge. Weight of speed breaker approximate 15 kg/Rmt and weight capacity 20 Tons with high impact resistance and brutal weather condition. Speed breaker shall be fixed with grout (min 8 holes for fixing per piece) and as per manufacturer's specification. Sample shall be approved by engineer in charge.**

Rubber speed breaker shall be of approved make, size and pattern. Installation of speed breaker shall

be inclusive of intermediate and end piece with cat eyes as per description. Weight of speed breaker is approximate 15 Kg/Rmt and weight capacity 20 Tons with high impact resistance and brutal weather condition. Speed breaker shall be fixed with grout (min 8 holes for fixing per piece) and as per manufacturer's specification. Sample shall be approved by engineer in charge.

**The Measurement of the item shall be in Rmt basis.**

**Item No. 53**

**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 -fine sand)(A) Modular.**

GULLY TRAP

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 traps 100 mm. x 100 mm. size P. type.

**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.

**Workmanship:**

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 specification of item 4.0.0 of earth work.

**Fixing:**

The gully trap shall be fixed over cement concrete 1 : 5 : 10 (1 cement : 5 sand : 10 graded brick bats 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.

**Brick masonry chamber:**

After fixing and testing gully and branch drain, a brick masonry 300 x 300 mm. inside with bricks in C. M. 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 upto 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.

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 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.

**Mode of measurements & payment:**

The rate includes cost of all labour, materials, tools and plant etc. required for satisfactory completion of this item as described above.

The rate shall be for cu.m basis.

**Item No. 57**

**Providing and fixing 35 mm thick shutters for Doors, windows and clear storey windows including anodised aluminium butt hinges with necessary screws. (A) Indian Teak Wood (ii) Fully Glazed.**

1. The measurement shall be in Sq.m. basis.
2. The mode of payment shall be in per Sq.m. basis.

**Item No. 62**

**Providing water stops serrated with central bulb (225mm wide, 8 - 11 mm thick) as per direction of engineer.**

1. The measurement shall be in Rmt. basis.
2. The mode of payment shall be in per Rmt. basis.



## **ELECTRIFICATION WORKS ITEM SPECIFICATION**

### **1.0 Panels Section Feeder Pillar**

#### **1.1 Panels\_Section Feeder Pillar**

Supplying, unloading at site, shifting to site, assembling, leveling, grouting, erecting, Testing, & Commissioning double compartmentalized Double door type section feeder pillar with IP 55 protection & should be powder coated fabricated from 10 Gauge CRCA sheet & folded channel totally enclosed cubical type with pad lock arrangement. The successful tenderer will have to prepare general arrangement with dimensions & get it approved through Architect/Consultant. All civil work including RCC platform for section pillar should be in scope of Electrical contractor complete in all respect as per detail drawing and directed by engineer incharge.

#### **1) Material:**

MV switch gear & power panel shall conform E-1.

#### **2) Workmanship:**

- 1) Main bus bar should be electrolytic tinned copper type.
- 2) All internal wiring and all connection shall be with copper wires and strips as required. Use copper flexible wire for below 100 Amps and copper strips for 100 Amps and above ratings.
- 3) All component, frame etc shall be earthed. A common internal earth bar with two separate earthing leads to be provided.
- 4) Painting or powder coating to be done on all sheet metal works as required.
- 5) Panel should have MS base frame for floor mounting unless otherwise specified.
- 6) The board should be front operated and extensible type.
- 7) Compression type brass glands and crimping lugs for incomer and outgoing ends.
- 8) All ammeters to be provided with C.T.s and selector switch and voltmeter with selector switch and control fuses.
- 9) Panel components shall be as specified.
- 10) The design and location of all panels to be approved by the architect / consultant before fabrication and Installment.
- 11) All panels should be dust and vermin proof.
- 12) All panels should be fabricated out of 14 gauge sheet, the door should be made from

14 gauges (2 mm) and the other parts should be made from 14 gauge sheet metal  
**(Applicable for Metallic Panels).**

- 13) All meters should be digital type with communication port only unless and otherwise specified.
- 14) The metering on main panels shall be LOAD MANAGER with communication port unless and otherwise specified.
- 15) All the Switches used should be capable of withstanding the AC23 duty for motor operation. The Switches should have quick make quick break. The contacts should be silver plated double break type.
- 16) The board should withstand the system prospective fault current.
- 17) Engraved plastic labels shall be provided indicating the feeder details, capacity, cable size and load in KW and danger signs.
- 18) The entire panel board should be with adequate height width & depth as per relevant prevailing I.S. code and Installation include foundation bolts of suitable size as per requirement.
- 19) 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 is in 'ON' position & switch cannot be 'ON' when the door is in open position.

**3) Mode of measurement:**

The rate shall be for one unit of panel complete in all manners.

## **2.0 CABLE TRENCH**

**2.1 Making trench in soft soil of suitable width of 90 cms deep for laying cable or locating the fault all over the run and backfilling the same and making the surface as normal ground.**

**1 Material:**

All the tools and tackels required for the excavation shall be provided by the contractor. Cable markers shall be provided.

**2 Workmanship:**

Excavation shall be done as per the route specified in the plan of the consultant. Also the depth as specified in the item shall be strictly maintained. Cable markers shall be installed at length specified in the item.

**3 Mode of measurement:**

The item shall be paid in cubic Mtr. And the measurement shall be certified by the

engineer in charge from the Clients side. Depth of the excavation shall be measured from average ground level given in drawing

**2.2 Covering of cable with second class bricks or cement tiles laid cover the cable crosswise & also on both sides with covering of 7.5 Cms. layer of sand above & below cable (16 bricks per meter).**

**1 Material:**

All the tools and tackles required for the spreading fine sand and back filling shall be provided by the contractor. Bricks of 2nd class or higher quality shall be used.

**2 Workmanship**

Bricks shall be laid on all the three sides of the cable as per the drawing of the consultant. Proper thickness for the fine sand as specified in the item shall be strictly maintained. After back filling proper leveling shall be done and lumps of soil should not be visible. The trench should give a leveled look.

**3 Mode of measurement:**

The item shall be paid in running Mtr. and the measurement shall be certified by the engineer in charge from the Clients side.

## **LT CABLING**

**Providing and erecting XLPE(IS:7098)(I)-88 ISI armoured cable multistrand Copper conductor for 1.1 KV. to be laid on wall with necessary clamps or in existing trench / pipe at road crossing or floor of following size of cables.**

**1) Material**

Shall be confirm to E- 3,

**2) Workmanship**

Installation

**A)** 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 Architect/Consultant 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.

**B)** Cables, running indoors shall be laid on walls, ceiling, inside shafts or trenches. Single cables laid shall be laid in GI/PVC pipe and not to fix on wall slab directly or drawn through GI / PVC pipes fixed on wall or ceiling and supported at not more than 500 mm. Where number of cables is run, necessary perforated cable trays shall be provided wherever shown. Perforated trays shall be mild steel or Aluminum as specified in the schedule of work

and supported on mild steel frame work as shown on drawings or as approved. Cables laid in built-up trenches shall be on steel supports. Plastic / Aluminum identification tags shall be provided at every 30 m. All cables laid shall be properly dressed and at least 50 mm space shall be kept between the cables.

**C)** 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.

**D)** In the case of cables buried directly in ground, the cable route shall be parallel or perpendicular to roadways, walls etc. 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 brick 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 20 meters and at all loop points.

**E)** The general arrangement of cable laying is shown on drawings. 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. cable termination for conductors up to 4 sq.mm. may be insertion type and all higher sizes shall have tinned copper compression 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 armoring shall be earthed at both ends.

**F)** In case of cables entering the buildings. It would be done duly only through pipes. The pipes shall be laid in slant position, so that no rain water 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 of water light.

**G)** Cables shall be provided with stainless steel/Aluminum cable identification tags at a maximum distance of 10m.

**H)** All cables to be laid should be properly dress and at least 50 mm space should be kept between the cables.

**Testing:**

A) MV cables shall be tested upon installation with a 500 V Meggar and the following readings established:

- 1) Continuity on all phases.
- 2) Insulation Resistance.
  - (a) Between conductors.
  - (b) All conductors and ground.

All test readings shall be recorded and shall form part of the completion documentation.

**3) Mode of measurement**

The cable shall be measured in per mt. Basis and the rates shall include,

- 1) Cables and clamps
- 2) Installation, Commissioning and testing.

Cable length shall be certified by engineer in charge from Client's / PMC side.

**4.0 LT Cable glands & LT Cable Lugs**

**4.1 Providing and, fixing heavy duty flange type brass cable gland with rubber ring for PVC insulated armoured cable complete with without tails, insulating tape etc for following size of cables.:**

**1) Material**

Should conform to E - 4.

**2) Workmanship**

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.

**3) Mode of measurement**

Rate shall be considered for 1 nos of joint complete.

**4.2 LT Cable Lugs Same as It. No. 4.1 but without Gland**

**1) Material**

Should conform to E - 4.

**2) Workmanship**

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.

**3) Mode of measurement**

Rate shall be considered for 1 no of joint complete but without Gland.

## 5.0 Fabrication

5.1 **Supplying , fabricating and installation of various sizes junction boxes For Under space Light Fixture /clamps/hangers for light fixtures etc. made out of 14 gauge sheet/Angle/Flat/rod/ channel/box section etc with all necessary accessories like bend, junction boxes, coupler, supporting clamps, elbows, hardware, anchor fasteners etc All the necessary fabrication required will be included in the scope of contractor. Scope also includes two coat of primer and two coat of painting of each items on all the sides complete in all respect.**

### 1) Material

Should be 'got it approved' from client engineer / site in-charge before executing.

### 2) Workmanship

As per the drawings provide by architect / consultants / as per the instruction of site in-charge. Finish should be given up to satisfying level of client / architect / consultants to each fabricated item.

### 3) Mode of measurement

Rate shall be considered per Kilogram of fabrication item complete.

## 6.0 EARTHING

6.1 **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 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.**

(c) For Electrical Installation covering Transformer Neutrals, Lightning arrester Earthing, A.C.Plant & Sensitive Computer System(like Automation, SCADA) i.e independent Earthing in normal soil.

**Length of Pipe : 3.00 mtrs**

**Back filling Compound :2 nos Bags of 25 Kg.**

### 1) Material

Shall be as per E – 6.

### 2) Workmanship

A) 50 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. (Not required for Electrode type earthing)

B) Top of the pipe shall be provided with G.I. funnel and screen for watering the earth \ ground through the pipe. (Not required for Electrode type earthing)

C) 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. (Not required for Electrode type earthing)

D) 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.

E) 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.

F) The earth conductors ( Strips / Wires copper/ Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Mild Steel Zinc Passivated screws \ bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

G) 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.

H) Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.

I) The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

J) The connection between strip and plate shall be through stainless steel bolts and washers.

Following tests shall be carried out:

A) The following earth resistance values shall be measured with an approved earth meggar and recorded.

- 1) Each earthing station
- 2) Earthing system as a whole
- 3) Earth continuity conductor

B) Earth conductor resistance for each earthed equipment shall be measured which shall not exceed 3 Ohm in each case.

C) Measurements of earth resistance shall be carried out before earth connections are made between the earth and the object to be earthed.

D) All tests shall be carried out in presence of the Site Engineer.

### 3) Mode of measurement

Rate shall be considered for one unit of pit complete in all manners.

## 6.2 Earth wire/strips:

Providing and erecting required size HOT deep Galvanised iron strip for earthing of H.T. , OCB/ ACB/ Transformer LT panel board, Motors etc. using proper clamp.

a) Fixing accessories.

b) Corrosion protection of buried conductors with bituminous coating and covered with PVC tapes.

### 1) Material

Copper strips of sizes specified in the BOQ. The strips shall not be corroded.

### 2) Workmanship

Copper strips shall be laid along with the cables and mains as instructed by the consultant and along the path of the cable. The strips shall be terminated at both the ends properly via brazing SS nut and bolts with double washer screws and nuts as instructed by the consultant. Strips shall not be bend to and extent that they go brittle.

### 3) Mode of measurement

The rate shall be considered on meter basis and the quantity shall be certified by the engineer in charge from Clients side.

## 7.0 MISCELLANEOUS

7.1 Providing & laying ISI marked Rigid PVC pipe having 6Kg / cm<sup>2</sup> (Class-3) to be erected at road crossing on or floor as directed for laying of cable. The pipes as following size of dia & weight per 6 mtr.

### 1) Material:

#### Rigid and Flexible conduits:

A) All conduits shall be rigid PVC having minimum wall thickness of medium gauge 1.6 to 1.8 approved by F.I.A. & I.S.I. All rigid pipe and its accessories shall be of suitable material complying with IS: 3419-1989 and IS: 9537 (Part 5) 2000 for flexible conduits.



The conduits shall be circular in cross-section and designated by their nominal outside diameter. Minimum thickness of walls shall be as follows:

- a) Up to 38 mm. diameter - minimum 1.8 mm. wall thickness.
- b) Above 40 mm. diameter - minimum 2.2 mm. wall thickness.

The maximum number of PVC insulated copper conductor cables of 650/1100V grade conforming to IS: 694-1990 that can be drawn in one conduit of various sizes shall be as specified.

B) 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.

**Accessories:**

A) 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.

**2) Workmanship**

As per item no 7.1

**3) Mode of measurement**

The rate shall be for 1 mtr of PVC pipe complete with all required accessories.

**Providing & laying. R.C.C. Hume pipe for cable to be laid 90 cms. below ground across the road crossing or on floor with necessary material in an approved manner and making the ground as per original.**

**1 Material**

RCC Hume pipe should be of NP2 class

**2 Workmanship**

Including excavation of trenches, laying the pipe as per layout and drawing, filling the joints with stiff mixture of cement mortar (1:1) and jute, curing, testing the pipe and re-filling the trenches etc. complete as directed.

**3 Mode of measurement**

The rate shall be for 1 mtr of RCC pipe

Follow Up with supply co. for getting supply to various Section Pillar. The scope also covers laying of L.T. cable from Section Pillar to company's cut-out. This also covers to obtain any permission required for road crossing from any authority (if required), Filling the necessary application to supply co., following up and getting the supply filling the necessary test report to the supply co. All official fees shall be paid by client on presentation of documentary proof and all other out of pocket expenses shall be of contractor.

**1) Material**

Not Applicable

**2) Workmanship**

As directed by engineer in-charge /Consultant.

**3) Mode of measurement :**

Shall be measured on lump sum basis.

**8.0 EXTERNAL LIGHTING**

**General Note:** The Sampling should be required for Lighting on SITE. The samples required to be approved by the relative authorities of the client before further execution of the same stretch. The type of lighting fixtures will be finalized based on the same results along with its aesthetical suitability on the FLYOVER/ROAD. **No extra cost** shall be paid for the process to the contractor; it is the responsibility of contractor to co-ordinate with all the required concerns & vendors for sampling & takes the approval of the same from the authorities of client & architects.

**Poles**

**Providing and fixing approved make Octagonal poles. Made from CR sheet steel. The pole should be made as per IS. and shall be coated with hot dip galvanizing as per IS 2629/4759. with required base plate suitable suspend local wind speed to be erected on existing foundation.**

**(E) 7 Mtr. Long 70 mm Top X 135 mm bottom dia, 3 mm thickness**

**1) Material**

Shall conform E - 8.

**2) Workmanship**

The pole shall be installed as shown in the drawing and shall be checked for proper earthing (Not required for Non-metallic poles). Wiring sequence shall as per the design given by the consultant.

**3) Mode of measurement**

The rate shall be for one pole complete in all manners.

**Supplying, erecting, connecting, testing and commissioning of following type  
Decorative LED Light Fixture with all necessary Hardware, Internal Wiring with control gear /  
Driver etc. all required accessories Complete in all respect.**

**1) Material**

As per E-8

**2) Workmanship**

As per item no E-8

**3) Mode of measurement**

The rate shall be for one no of light fixture with Lamp & control gear complete.

**ELECTRICAL MATERIAL SPECIFICATION****E – 1 Panels\_Section Feeder Pillar****1.1 Scope:**

The scope covers supply, installation, testing and commissioning of power panels, incorporating circuit breakers, fuse units, busbars, interconnections, earthing etc., meeting the requirements shown in equipment schedule and the drawings.

**1.2 Standards:**

AS PER SCHEDULE OF INDIAN STANDARD ATTACHED WITH THE DOCUMENT

The PCCs & MCCs shall comply with the latest edition of relevant Indian standards and Indian Electricity rules and regulations. The following Indian Standards shall be complied with:

IS: 4237	:	General requirements for switch gear and control gear for voltage not exceeding 1000 v.
IS: 375	:	Switchgear bus-bars, main connection and auxiliary wiring, marking and arrangement.
IS: 2147	:	Degree of protection provided by enclosures for low voltage switch gear and control gear.
IS: 8197	:	Terminal marking for electrical measuring instrument and their accessories.
IS: 2557	:	Danger notice plates.
IS: 2516	:	Specification for AC circuit breaker.
IS: 1818	:	Specification for AC isolator and earthing switch.
IS: 3072	:	Code of practice for installation and maintenance of switchgear.
IS: 8623	:	Specification for factory built as symbolize of switch gear and control gear for voltage up to and including 1000v. A.C.& 1200 v. D.C.
IS: 8828	:	Miniature Circuit Breaker.
IS: 2516	:	Air circuit breaker.
IS: 4064	:	Fuse switch and switch fuse unit.
IS: 9224	:	HRC fuse unit.
IS: 2705	:	Current transformer.
IS: 3155	:	Voltage transformer.
IS: 3231	:	Electrical relay for protection.
IS: 1248	:	indicating instrument.
IS: 722	:	Integrating instrument.
IS: 6875	:	Control switches & push buttons.
IS: 2959	:	Auxiliary contactor.
IS: 1822	:	AC motor starters of voltage not exceeding 1000V.

**1.3 TYPE OF M.V. SWITCH GEAR:**

1.3.1 All the PCC's / PDB's / MCC's shall be metal clad, totally enclosed, rigid, floor / wall mounted, air - insulation, cubical type suitable for operation on three phase / single phase, 415 / 230 volts, 50 Hz. neutral effectively / Non effectively grounded at transformer and short circuit level not less than 30 MVA at 415 volts.

1.3.2 The PCC's / MCC's shall be designed to withstand and heaviest condition at site, with minimum expected ambient temperature of 45 degree celsius, 80 percent humidity and dusty weather.

1.3.3 Should confirm to Indian Electricity Act and rules. (as amended up to ate) & approval of FIA. of India.

**1.4 STRUCTURE:**

- 1.4.1 The PCCs, MCCs & PDBs shall be metal clad enclosed and be fabricated out of high quality CRCA sheet, suitable for indoor installation having dead front operated and floor mounting type.
- 1.4.2 All CRCA sheet steel used in the construction of PCCs / MCCs / PDBs shall be 2 mm thick and shall be folded and braced as necessary to be provided a rigid support for all components. Joints of any kind in sheet shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal
- 1.4.3 The PCCs / MCCs / PDBs shall be totally enclosed, completely dust and vermin proof and degree of protection being no less than IP-51 to IS 2147. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be fully gasket with foam rubber and / or rubber strips and shall be lockable.
- 1.4.4 All panels and covers shall be properly fitted and secured with the frame, and holes in the panel correctly positioned. Fixing screw shall enter into holes taped into an adequate thickness of metal or provided with bolts and nuts. Self threading screws shall not be used in the construction of PCCs / MCCs / PDBs.
- 1.4.5 A base channel of 75 mm x 75 mm x 5 mm thick shall be provided at the bottom.
- 1.4.6 PCCs / MCCs /PDBs shall arranged in multi-tier formation. The PCCs / MCCs / PDBs shall be of adequate size with a provision of 20 percent spare space to accommodate possible future additional switch gear. The size of the PCCs / MCCs / PDBs shall be designed in such a way that the internal space is sufficient for hot air movement, and the electrical component does not attain temperature more than 40 degree celsius. If necessary openings shall provided for natural ventilation, but the said openings shall be screened with fine weld mesh.
- 1.4.7 Knockout holes of appropriate size and number shall be provided in the PCCs / MCCs/ PDBs in conformity with number, and size of incoming and outgoing conduits / cables.
- 1.4.8 Alternatively the PCCs / MCCs / PDBs shall provided with removable sheet plates at top and bottom to drill holes for cable / conduit entry at site.
- 1.4.9 The PCCs / MCCs / PDBs shall be designed to facilitate easy inspection, maintenance and repair.
- 1.4.10 The PCCs / MCCs / PDBs shall be sufficiently rugged in design and shall support the equipment without distortion under normal and short circuit condition, they shall be suitable braced for short circuit duty.

**1.5 PROTECTION CLASS:**

All the indoor PCCs / MCCs / PDBs shall have protection class as IS.

**1.6 PAINTING:**

All sheet steel work shall undergo a process of decreasing pickling in acid, cold rinsing, phosphating, pesivating and then sprayed with a high corrosion resistant primer. The primer shall be backed in an oven. The finishing treatment shall be by application. Three coats of synthetic enamel paint of approved colour shall be applied by spray and stoves in dust free atmosphere or the panel shall be powder coated.

#### 1.7 CIRCUIT COMPARTMENT :

1.7.1 Each circuit breaker and switch fuse units shall be housed in separate compartments and shall be enclosed on all sides. Sheet steel hinged lockable door shall be duly inter locked with the breaker / switch fuse units in ON and OFF position. Safety interlocks shall be from being drawn out when the breaker is in ON position.

1.7.2 The door shall not form as integral part of the drawout position of the circuit breaker. All instruments and indicating lamp shall be mounted on the compartment door. Sheet steel barriers shall be provided between the tires in a vertical section.

#### 1.8 INSTRUMENT COMPARTMENT

Separate and adequate compartment shall provided for accommodating instruments, indicating lamp, control contactors, relays and control fuses etc. These components shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, switch fuse units, busbars and connections.

#### 1.9 BUSBARS

1.9.1 The busbar shall be air insulated and made high quality, high conductivity, high strength copper and as per relevant IS code. The busbar shall of three phases and neutral system with separate neutral and earth bar. the busbar and interconnection between busbar and various components shall be of high conductivity, hard drawn, electrolytic copper. the busbar shall be of rectangular cross section designed to withstand full load current for phase busbar and full rated current for neutral busbar and shall be extensible type on either side. The busbar shall be rated for the frame size of the main incoming breaker but in any case not less than 200 amp capacity. The busbar shall have uniform cross section throughout the length.

1.9.2 The busbar and interconnection shall be insulated with heat shrinkable PVC sleeves and be colour coded in red, Yellow, Blue and Black to identify the three phases and neutral of the system. The busbar shall be supported on unbreakable, non hygroscopic DMC insulated supports at sufficientevely close interval to prevent busbar sag and shall effectively withstand electromagnetic stresses in the event of short circuit capacity of 50 KA RMS symmetrical for one second and a peak short circuit withstand of 105 KA minimum.

1.9.3 The busbar shall be housed in a separate compartment. The busbar shall be isolated with 3 mm thick bakalite sheet to avoid any accidental contact. The busbar shall be arranged such that minimum clearance between the busbar are maintained as per below.

Between phases : 27 mm min.

Between phases and neutral : 25 mm min.

Between phases and earth	:	25 mm min.
Between neutral and earth	:	23 mm min.

1.9.4 All busbar connection shall be done by drilling holes in busbars and connecting by chromium plated brass bolt and nuts. Additional cross section of busbar shall be provided in all PCCs / MCCs / PDBs to cover-up the holes drilled in the busbars. Spring and flat washers shall be used for tightening the bolts.

1.9.5 All connection between busbar and circuit breaker / switches and between circuit breaker/ switches and cable terminals shall be through solid copper strips of proper size to carry full rated current. These strips shall be insulated with insulating strips.

#### 1.10 ELECTRICAL POWER & CONTROL WIRING CONNECTION

- a) Terminal for both incoming and outgoing cable shall be suitable for 1100 volts grade, aluminum/copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solder less sockets for the cable size as indicated on the appended drawing for the PCCs, MCCs, PDBs.
- b) Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.
- c) Both control and power terminals shall properly be shrouded.
- d) 10% spare terminal shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block so that not more than one outgoing wire connected per terminal.
- e) Terminal strip for power and control shall preferably be separated from each other by suitable barriers of enclosures.
- f) Wiring inside the module for power, control protection and instrument etc. shall be done with use of 660/1100 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 sq mm cross section area. For current transformer circuits, 2.5 sq mm copper conductor wire shall be used. Other control wiring shall be done with 1.5 sq mm copper conductor wires. Wires for connections to the door shall be flexible. All conductors shall be crimped with solder less sockets at the ends before connections are made to the terminals.
- i) Control power for the motor starter module shall be taken from the respective module switchgear outgoing from R phase and Neutral. Control wiring shall have control fuse (HRC type).
- j) Particular care shall be taken to ensure that the layout of wiring neat and orderly. Identification ferrules shall be filled to all the wire termination for ease of identification and to facilitate and testing.
- k) "CUPAL" washers shall be used for all copper and aluminum connections.
- k) Final wiring diagram of the PCC, MCC, PDB power and control circuit with ferrules number shall be submitted along with the PCC/MCC/PDB as one of the documents.

#### 1.11 TERMINALS

The outgoing terminals and neural link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformer for instrument metering shall be mounted on the disconnecting type terminal blocks. No direct connection of incoming and outgoing cables to internal components connection of the distribution board is permitted, only one conductor may be connected in one terminal.

#### **1.12 WIREWAYS**

A horizontal PVC wire way with screwed covers shall provided at the top to take interconnecting control wiring between different vertical sections.

#### **1.13 CABLE COMPARTMENT**

Cable compartment of adequate size shall be provided in the PCCs, MCCs, PDBS for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate support shall be provided in the cable compartment shall be brought out to terminal blocks in the cable compartment.

#### **1.14 EARTHING**

- a) Copper earth busbar of 25 mm x 3 mm shall be provided in the PCCs, MCCs, PDBS for the entire length of panel. The frame work of the PCCs, MCCs, PDBs shall be connected to this earth busbar. Provisions shall be made for connection from earth busbar to the main earthing bar coming from the earth pit on both sides of the PCCs, MCCs, PDBs.
- b) The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar. The armour shall be properly connected with earthing clamp and the clamp shall be ultimately bounded with the earth bar.

#### **1.15 LABELS**

Engraved PVC labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.

#### **1.16 NAME PLATE**

- a) A name plate with panel designation in bold letter shall be fixed at top of the central in panel. A separate name plate giving feeder giving feeder details shall be provided for each feeder module door.
- b) Inside the feeder compartment, the electrical component, equipments, accessories like switchgear, contactor, lamp, relays etc. shall suitably be identified by providing stickers.
- c) Engraved name plates shall preferably be of 3 ply, (red-white-red or black-white-black) lamicol sheet. However black engraved perplex sheet name plates shall also be applicable. Engraving shall be done with square groove cutters.
- d) Name plate shall be fastened by counter sunk screws and not by adhesives.

#### **1.17 DANGER NOTICE PLATE**

- a) The danger plate shall be affixed in a permanent manner on operating side of the panel.



- b) The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.
- c) The danger notice plate in general shall meet to requirements of local inspecting authorities.
- d) Overall dimension of the danger notice plate shall be 200 mm wide and 150 mm high. The danger notice plate shall be made from minimum 1.6 mm thick mild steel sheet and after due pretreatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.
- e) The letter, the figure, the conventional skull and bones shall etc. shall be positioned on the plate as per recommendations of IS : 2551-1982.
- f) The said letter, the figure and the sign of skull and bones be painted in single red colour as per IS : 5-1978.
- g) The danger plate shall have rounded corners. Locations of fixing holes for the plate shall be decided to suit design of the panel.
- h) The danger notice plate, if possible, be of ISI certification mark.

#### **1.18 INTERNAL COMPONENTS**

- a) The PCC / MCC / PDB shall be equipped complete with all type of required number of air circuit breakers, switch fuse unit, contactor, relays, fuses, meters, instruments, indicating lamps, push buttons, equipment, fittings, busbar, cable boxes, cable glands etc. and all the necessary internal connections /wiring as required and as indicated on relevant drawings. Components necessary for proper complete functioning of the PCC / MCC / PDB but not indicated on the drawings shall be supplied and installed on the PCC / MCC / PDB.
- b) All part of the PCC / MCC / PDB carrying current including the components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the acceptable values of the relevant specifications at any part of the PCC / MCC / PDB.
- c) All units of the same rating and specifications shall be fully interchangeable.

#### **1.19 INSPECTIONS**

Each equipment should inspect and witness by client & consultant.

- a) The PCC / MCC / PDB shall be inspected and checked as per inspection manual of the PCC / MCC / PDB manufacturer.
- b) Various electrical components and accessories of the PCC / MCC / PDB shall be checked as per drawing for the respective PCC / MCC / PDB.
- c) The PCC / MCC / PDB shall be checked for rigid mounting, earthing connections, proper rating and size of components, internal wiring, etc.
- d) All mechanical fasteners and electrical connections shall be checked and tightened before installation.

- e) Type test certificates for all ACB for similar rating shall be submitted.
- f) Test:
  - a) Prior to dispatch of the PCC / MCC / PDB following tests shall be carried out.
  - b) Mechanical endurance test shall carried out by closing and opening of all the ACB's, MCB's switches etc.
  - c) Over voltage and Insulation resistance test shall be carried out between phases and between phase to earth bus, keeping the isolating switch in ON position. Similar test shall be carried out keeping the isolating switch in closed position.
  - D) All the interlocks, controls and tripping mechanism of the switch gears shall be tested for their proper functioning.

**1.20 COMPONENTS:****A) GENERAL**

- a) The type, size, and rating of the components shall be as indicated on the relevant drawings.
- b) While selection of the capacity of the components resulting from the prevailing conditions like room temperature shall be allowed for the Thermal and magnetic trip rating shall be compensated for the ambient temperature.
- c) The rating indicated on the drawings are rating anticipated at prevailing site condition.

**B) FUSE SWITCH UNITS:**

The fuse switches unit shall be 3 pole double break type suitable for load break duty (AC 23), quick make and break action. Separate neutral link shall be provided with hinged doors duly interlocked with operating mechanism so as to prevent opening of the door when the switch is in "ON" position and also prevent closing of the switch when the door is not properly secured. 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 proper size of the cables. High Rupturing capacity (HRC) fuse links shall be provided with switch fuse units and shall be in accordance with IS : 2208-1962 and having rupturing capacity of not less than 35 MVA 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.

**C) MINIATURE CIRCUIT BREAKER**

Miniature circuit breakers shall be quick make and break and break type conform with British standard BS : 3871 (Part-I) 1965 and IS :8825 (1996). The housing of MCBs shall be heat resistant and having the high impact strength. The fault current of MCBs shall not be less than 10000 amps, 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.

The circuit breaker dollies shall be of trip free pattern to prevent closing the breaker on a fault current.

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 3 as for over current and short circuit protection. The over load or short circuit devices shall have a common trip bar in the case of DP and TPN miniature circuit breakers. All the MCB's shall be tested and certified as per Indian Standard, prior to Installation.

**D) FUSE**

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. Backup fuse rating for each motor / equipment. HRC fuses shall be of English Electric make or approved equal.

**F) MOULDED CASE CIRCUIT BREAKER**

The MCCB shall be air break type and having quick make quick break with trip free operating mechanism.

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 busbar 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 appended drawings.

**G) CONTACTORS:**

The contactor shall meet with the requirements of IS : 2959 and BS : 775.

The contactors shall have minimum making and breaking capacity in accordance with utilization category AC 3 and shall be suitable for minimum class II intermittent duty.

If the contactor forms part of a distribution board then a separate enclosure is not required, but the installation of the contactor shall be such that it is not possible to make an accidental contact with live parts.

**H) LOAD MANAGER:**

The load manager should meet the following requirement unless and otherwise specified in the bill of material or drawings.

**KWH METER:** Digital KWH meter 96 x 96 x 80 mm size Acc Class 1.0 suitable for true RMS reading having reverse LED. Optically isolated pulse output having pulse with 500 ms and pulse amplitude 12 volts.

**Load Manager (For Main Incoming) :** The load manager should be 192 x 144 mm size having facility to read voltage current harmonics power parameters. It should contain real time clock. The meter should be field programmable and to generate high / low profile for all power parameters with date & time, also able to store previous period integrated data. The meter should have RS 485 port for networking purpose. All the programming should be pass word protected.

**Load Manager (For Outgoing) :** Load manager facility to measure A, V, Hz, PF, kW, KWH with RS 485 port for networking. The meter should be totally field programmable and having a password protection. Size should be 96 x 96 mm.

**I) CURRENT TRANSFORMER**

Where ammeters are called for, CT's shall provided for current measuring. Each phase shall be provided with separate CT of class I accuracy and suitable VA burden for operation of associated metering and controls. Current transformer shall be in accordance with IS : 2705 - 1964 as amended up to date.

**J) PUSH BUTTON:**

The push button unit shall comprise of the contact element, a fixing holder, and push button actuator. The push button shall be momentary contact type. The contacts shall be of silver alloy and rated at 10 Amps continuous current rating. The actuator shall be of stranded type and colour as per its usage for ON, OFF and Trip.

**K) INDICATING LAMP:**

Indicating Lamp shall be transformer operated low voltage rated and shall supplied complete with translucent covers to diffuse the lamp light.

Colour shade for the indicating lamps shall be as below :

ON indicating lamp	:	Red
OFF indicating lamp	:	Green
TRIP indicating lamp	:	Amber

PHASE indicating lamp : Red, Yellow, Blue.

#### **E – 3, 4 LT CABLING AND TERMINATION**

##### **1.1 Scope:**

The scope consists of Supply, laying, testing and commissioning of L.T. XLPE Cable and its termination.

##### **1.2 Standards:**

AS PER SCHEDULE OF INDIAN STANDARDS; ATTACHED IN THE DOCUMENT

##### **1.3 Cables:**

- A) LV POWER CABLES will be 1100 Volts grade single / multicore standard aluminum conductor extruded XPLE insulated with extruded PVC inner sheath outer sheath made of FRLS PVC compound conforming to IS-7098 part-1. Single core will be used for DC application. Cables in buried insulation shall be armoured type. Armoured cable should be provided with galvanized steel wire or strip armouring.
- B) Control cables will be 1100 Volts grade multicore minimum 2.5 sqmm cross section standard copper conductor minimum 7 strands PVC insulated inner extruded sheathed and other sheath made of extruded FRLS PVC compound conforming to IS-1554 part-1.
- Cables in buried insulation shall be armoured type.
- C) All cables shall be new without any kind or visible damage. The manufacturers name, insulating material, conductor size and voltage class shall be marked on the surface of the cable at every 600 mm centers.

##### **1.4 Cable joints and termination:**

###### **A) Connectors :**

Cable terminations shall be made with copper/Aluminium Heavy duty long neck copper crimping lugs only 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. All cable lugs should be long neck type only.

###### **B) Cable Glands :**

Cable glands shall be of heavy duty brass compression / whether proof type as specified. Generally single compression type cable glands shall be used for indoor protected locations and double compression type shall be used for outdoor locations. Glands for classified hazardous areas shall be CMRI approved.

###### **C) Ferrules :**

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.8

**D) Cable joints :**

Kit type joint shall be done and filled with insulating compound. The joint should be of 1.1 KV grade insulation.

**E – 6 EARTHING**

**1.1 Scope of Work:**

The scope of work shall cover supply, laying, installation, connecting, testing and commissioning of:

- 1.1.1 copper/galvanized/aluminium/chemical or Electrode type Earthing station.
- 1.1.2 Earthing G.I./Aluminum/copper strips from earthing station to equi-potential bar.
- 1.1.3 Earthing G.I./ Aluminum/ copper strips/ wires from equi-potential bar to lay feeder mains and circuit to connect power panels, DBs, switchboards etc.
- 1.1.4 Bonding of Non-current carrying parts, and metallic parts of the electrical installation.
- 1.1.5 Provide inter connection between all earth pits of same type.

**1.2 STANDARDS**

1.2.1 The following standards and rules shall be applicable:

- 1) IS: 3043 - 1966 Code of practice for Earthing.
- 2) Indian Electricity Act and Rules

1.2.2 All codes and standards mean the latest. Where not specified otherwise the installation shall generally follow the Indian Standard Code of Practice or the British Standard Codes of Practice in absence of Indian standard.

**1.3 GENERAL**

All the non-current carrying metal parts of the electrical installation and mechanical equipments shall be earthed properly. The metal conduits, trucking, cables armoured and sheath, electric panels boards, lighting fixtures, ceiling and exhaust fan and all other parts made of metal shall be bonded together and connected by means of specified earthing system.

An earth continuity conductor shall be installed with all the feeders and circuits and shall be connected from the earth bar of the panel boards, to the conduit system, earth stud of the switch box, lighting fixture, earth pin of the socket outlets and to any metallic wall plates used. All the enclosures of motors shall be also connected to the earthing system.

**1.4 TYPE OF EARTHING STATION****1.4.1 ELECTRODE / CHEMICAL TYPE EARTHING STATIONS:**

- 1.4.1.1 The substation earthing and equipment earthing shall be as per earthing scheduled in BOQ & Drawing.
- 1.4.1.2 The earthing station shall be as shown on the drawing.
- 1.4.1.3 The earth resistance shall be maintained with suitable soil treatment as per IS: 3043.
- 1.4.1.4 The resistance of each earth station should not exceed the limit specified in IS: 3043.
- 1.4.1.5 The earthing grid and the earthing conductors shall be of copper strip of size as mentioned on the drawing.
- 1.4.1.6 The block masonry chamber with Cast Iron hinged cover shall be provided for housing the termination block as shown in the drawing.
- 1.4.1.7 The hardware and other consumable for earthing installation shall be of copper/brass, as per details shown in the drawing.

**1.5 INSTALLATION AND CONNECTION:**

- 1.5.1 The plate \ pipe electrode, as far as practicable, shall be buried below permanent moisture level but in no case not less than 2.5 M below finished ground level.
- 1.5.2 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.
- 1.5.3 The plate electrode shall be installed vertically and shall be surrounded with 150 mm. thick layers of Charcoal dust and Salt mixture.
- 1.5.4 G.I. pipe for watering shall run from top edge of the plate \ pipe electrode to the mid level of block masonry chamber.
- 1.5.5 Top of the pipe shall be provided with G.I. funnel and screen for watering the earth \ ground through the pipe.
- 1.5.6 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.
- 1.5.7 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.
- 1.5.8 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.
- 1.5.9 The earth conductors ( Strips / Wires copper/ Hot dip G.I.) inside the building shall properly be clamped / supported on the wall with Galvanized Iron clamps and Mild Steel Zinc

Passivated screws \ bolts. The conductors outside the building shall be laid at least 600 mm. below the finished ground level.

- 1.5.10 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.
- 1.5.11 Over lapping of earth conductors during straight through in joints, where required, shall be of minimum 75mm. long.
- 1.5.12 The earth conductors shall be in one length between the earthing grid and the equipment to be earthed.

#### **1.6 EARTH LEADS AND CONNECTIONS:**

- 1.6.1 Earth lead shall be bare copper or galvanized steel as specified with sizes shown on drawings. Copper lead shall have a phosphor content of not over 0.15 %. Galvanized steel buried in the ground shall be protected with bitumen and Hessian wrap or polytene faced Hessian and bitumen coating. At road crossing necessary Hume pipes shall be laid. Earth lead run on surface of wall or ceiling shall be fixed on saddles so that strip is at least 8 mm away from the wall surface.
- 1.6.2 The complete earthing system shall be mechanically and electrically bonded to provide an independent return path to the earth source.

#### **E-8 External Lighting**

##### **1.1 Scope:**

- 1.1.1 The scope of work covers the supply, installation and testing of lighting poles with required foundation as per drawing complete in all respect, weather proof light fixtures, wiring to the fixtures, cable laying, earthing as specified and shown on drawings.

##### **1.2 Standards:**

As per Applicable standard

##### **1.3 Light Fixtures:**

- 1.3.1 The light fixture construction shall be of suitable IP rating as specified in BOQ shall be of die cast aluminium with a separate compartment for integral ballast equipment. The reflector shall be anodized polished aluminium. The glass refractor shall be heat resistant.
- 1.3.2 Lamp holder shall be of porcelain and shall comprise of a terminal block of no 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.
- 1.3.3 The Lamp & Laminar shall generally follow the specification under section 'LIGHT FIXTURES'.



#### 1.4 Lighting Poles: Lighting Poles for street lights

**Design** The Octagonal Poles shall be designed to withstand the maximum wind speed as per IS 875. The top loading i.e. area and the weight of fixtures are to be considered to calculate maximum deflection of the pole and the same shall meet the requirement of BSEN 40-3:2000, pr EN-40-3-3.

**Pole Shaft** The pole shaft shall have octagonal cross section and shall be continuously tapered with single longitudinal welding. There shall not be any circumferential welding. The welding of pole shaft shall be done by Submerged Arc Welding (SAW) process.

All octagonal pole shafts shall be provided with the rigid flange plate of suitable thickness with provision for fixing foundation bolts. This base plate shall be fillet welded to the pole shaft at two locations i.e. from inside and outside. The welding shall be done as per qualified MMAW process approved by Third Party Inspection agency.

**opening for cable entry:** Pole should have appropriate size holes for cable entry.

**Material** Octagonal Poles HT Steel Conforming to grade S355JO. Base Plate Fe 410 conforming to IS 226 / IS 2062 Foundation Bolts EN.8 grade

**Welding** The welding shall be carried out conforming to approved procedures duly qualified by third party inspection agency. The welders shall also be qualified for welding the octagonal shafts.

**Pole sections** The Octagonal Poles shall be in single section . There shall not be any circumferential weld joint.

**Galvanization** The poles shall be hot dip galvanised as per IS 2629 / IS 2633 / IS 4759 standards with average coating thickness of 70 micron. The galvanizing shall be done in single dipping.

**Fixing Type** The Octagonal Poles shall be bolted on a pre-cast foundation with a set of foundation bolts for greater rigidity.

**Manufacturing** The pole manufacturing & galvanizing unit shall be ISO 9001: 2000 & ISO 14001 certified to ensure consistent quality & environmental protection.

**Pole Testing Facility** The manufacturing unit shall have in-house pole testing facility for validation of structural design data. The pole testing facility shall conform to BS EN 40-3-2-2000 part 3-2.

#### 1.5 Cable laying:

1.5.1 Cabling shall be generally as specified in the section 'CABLING'.

1.5.2 Cables shall be terminated in a 4 to 6 way terminal block inside the pole or attached therewith as shown on drawings.

1.5.3 Cable route shall be as shown on the drawings or the contractor shall mark out the route and lay the cables only upon approval of the route.

**1.6 Earthing:**

1.6.1 All street lights fixtures and poles shall be earthed as specified under section 'EARTHING' or as per site condition.

**1.7 Mode of Measurement:**

1.7.1 Each light fitting with lamp, control gear, earthing etc. shall be considered as one unit for measurement and payment.

1.7.2 Each lighting pole, concrete coping, base plate earthing etc. shall be considered as one unit for measurement and payment.

1.7.3 All cabling work shall be measured on the basis of unit length and the cost shall include, cost of cable, cable termination in junction boxes or pole terminal box etc.

## SPECIAL CONDITION FOR TESTING

**(CONTRACTOR TO READ THIS CAREFULLY)****1.0 SCOPE :**

If required contractor should have to take all necessary testing/ random testing of equipments and component prior to supply as per the guidelines / rules / sampling method etc. of IS at manufacturing works or other standard lab in presence of Client's representative & consultant as witness testing. Any deviation in parameters which is not as per IS is not accepted and client reserve the rights to reject the same at any stage of the project.

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**APPLICABLE STANDARDS**

<b>Sr. No.</b>	<b>IS No.</b>	<b>Description</b>
1)	IS: 2026-1977 &1981 -1994	: Power transformers fittings.
2)	IS 3639-1966	: Fittings and acc. For P.T.
3)	IS10028-Part III 1981	: Installation of Transformer.
4)	IS: 13118-1991	: Specification for High voltage AC circuit breakers.
5)	IS: 335-1993	: Insulating oil for Transformers & switch gear.
6)	IS: 2705-1992	: CT for measuring and protection.
7)	IS: 3156-1992	: Voltage (Potential) Transformers.
8)	IS: 3156-1992	: Voltage Transformer.
9)	IS: 8623-Part II	: Bus-bar arrangement and marking
10)	IS: 2099-1986	: Bushing
11)	IS: 5621-1980	: Large Hollow Porcelains Insulator
12)	IS: 2544-1973	: Insulators greater than 1000V
13)	IS: 2629-1985 IS: 2633-1986	: Hot Dip Galvanizing
14)	IS: 3842-1967	: Relays for AC system
15)	IS: 1248-2003	: Meters (measuring).
16)	IS: 10118-1982	: Installation of Switch gears.
17)	IS: 692-1994	: HV Cable Paper Insulated Lead Sheathed Cables for Rated Voltage up to and Including 33 kV Specification.
18)	IS: 1255 -1983	: Installation of HV cables and jointing.
19)	IS: 3043-198	: Code of practice for earthing.

- 20) IS: 13947-Part III : HD Air breaker, Switch gears  
-1993 and fuses for Voltage not exceeding 1000 Volts.
- 21) IS: 13703-Part IV : Selection, installation and maintenance -1993  
of fuses up to 650 Volts.
- 22) IS: 13947-Part I : General requirements for switch gear and  
-1993 control gear for voltage not exceeding 1000 Volts.
- 23) IS: 13947-Part III : Air-break isolators for Voltage not  
-1993 exceeding 1000 Volts.
- 24) IS:8623-1993 : Factory built assemblies of switch gears and control gears for voltage up to and including 1000 Volts A.C. and 1200 Volts D.C.
- 25) IS: 11353-1985 : Marking and arrangement of switch gear bus bars main connectors and auxiliary wiring.
- 26) IS: 13947 PART-1 : Cubical Boards
- 27) IS: 8084-1976 : Insulated Bus bar rating.
- 28) IS: 2675-1983 : Enclosed distribution fuse boards and cut-outs for Voltage not exceeding 1000 Volts.
- 29) IS: 8828-1995 : Miniature Circuit Breaker.
- 30) IS: 9926-1981 : Fuse wire used in rewirable type electric fuses up to 650 Volts.
- 31) IS: 1554-Part I : PVC insulated electric cables  
-1988 Heavy duty.
- 32) IS: 3961-Part II & IV : Recommended current rating  
-1967 for cables.
- 33) IS: 8130-1984 : Copper conductor in insulated cables and cores.
- 34) IS: 8130-1984 : Conductor for insulated electric cables and flexible cords.

- 35) IS: 3975-1999 : Low Carbon Galvanized Steel Wires, Formed Wires and Tapes for Armouring of Cables - Specification
- 36) IS: 5831-1984 : PVC insulation and sheath of electric cables.
- 37) IS: 8130-1984 : Aluminum conductor for insulated cables.
- 38) IS: 11955-1987 : Recommended current rating for Cable.
- 39) IS: 732-1989 : Code of practice for electrical wiring installation system Voltage not exceeding 650 Volts.
- 40) IS: 1646-1997 : Code of practice for fire safety of Buildings (general) electrical installation.
- 41) IS: 9537-1981 : Rigid steel conduits for electrical wiring.
- 42) IS: 2667-1988 : Fittings for rigid steel conduits for electrical wiring.
- 43) IS: 3480-1966 : Flexible steel conduit for electrical wiring.
- 44) IS: 3837-1976 : Accessories for rigid steel conduits for electrical wiring.
- 45) IS: 694-1990 : PVC insulated cables (wires).
- 46) IS: 9537-Part III : Installation of Rigid non-metallic  
-1983 conduits for electrical wiring.
- 47) IS: 6946-1973 : Flexible (playable) non-metallic conduits for electrical installation.
- 48) IS: 1293-2005 : Plugs and sockets up to 250V.
- 49) IS: 8130-1984 : Conductors for insulated electrical cables and flexible codes.
- 50) IS: 9537-1980 : Specification for conduit for electrical installation.
- 51) IS: 3419-1988 : Accessories for non-metallic conduits for electrical wiring.
- 52) IS: 3854-1997 : Switches.
- 53) IS: 6538-1971 : Plugs.
- 54) IS: 13585-Part I : Shunt Capacitors for power

	-1998		systems up to 650V.
55)	IS: 1370	:	Low voltage fuse and links up to 1000 volts.
56)	IS: 1913-1978	:	General and safety requirement for lighting fittings.
57)	IS: 1944-1981	:	Code of practice for lighting public thorough fares.
58)	IS: 3528-1966	:	Waterproof electric lighting fittings.
59)	IS: 3553-1966	:	Water tight electric lighting fitting.
60)	IS: 1239-Part I	:	Mild Steel tubular and other
	-2004		wrought steel pipe fitting.
61)	IS: 10322-Part V	:	Luminaries for street light.
	-1987		
62)	IS: 13703-Part III	:	HRC fuses having rupturing
	-1993		capacity voltage up to 1000V.
63)	IS: 2312-1967	:	Exhaust Fan.
64)	IS: 374-1979	:	Class I Ceiling Fan.
65)	IS: 7098 (Part I, II, III)	:	XLPE armoured Cables up to
	-1988		1000V.

**NOTE:** All codes and standards means the latest where not specified otherwise the installation shall generally follow the Indian Standard codes of practice or relevant British Standard Codes of Practice in the absence of corresponding Indian Standards.

**PLEASE FOLLOW:**

- a. Indian Electricity Act of 1910 and rules issued there under revised up to date.
- b. Regulations for electrical equipment in building issued by The Bombay Regional Council of insurance Association of India.

**LIST OF APPROVED MAKE / MANUFACTURER**

- |                                  |   |   |
|----------------------------------|---|---|
| 1) Rigid PVC Conduit             | : | ISI & FIA approved & manufactured from virgin material. Precision, Nihir.Vraj   |
| 2) Accessories for conduit       | : | Same make as of pipe  |
| 3) Flexible Copper Wires         | : | FRLS type: Finolex, Polycab, Primecab.  |
| 4) Switch fuse Units             | : | L&T, Siemens, Schneider   |
| 60 Amps - AC 23 duty             |   |   |
| 5) HRC Fuses                     | : | Schneider MG, Siemens, L&T.   |
| 6) MCCB/MCB/ELMCB                | : | Legrand (Lexic),Schneider MG, L&T, Hager.   |
| 7) PVC tape                      | : | Steel grip, Anchor  |
| 8) LT Cables                     | : | Finolex, Primecab, CCI, Avo cab   |
| 9) Branched Cable downstream :   |   | Finolex, Primecab, CCI, Avo cab.  |
| From 35 sqmm.                    |   |   |
| 10) Glands                       | : | Compression type, Heavy duty and deep threading with rubber ring and double washers. (Sample to be approved) HMI, Comet |
| 11) Cable Lugs                   | : | Dowels, 3-D   |
| 12) Industrial Plug-socket       | : | Legrand, Indoasian  |
| 13) Connectors                   | : | Elmex, Connectwel   |
| 14) M.S. Conduit ISI             | : | BEC, Steel Craft, AKG   |
| 15) Meter                        |   |   |
| (DIGITAL ENERGY METERS)          | : | Secure, L&T, ElMeasure, HPL   |
| 16) Light Fixture                | : | Phillips, Lighting Technologies, Keslec, Ligman, Neri (Sample to be approved)   |
| 17) Panel Fabricators (Metallic) | : | CPRI approved vendors only  |
| 18) Load Manager                 |   |   |
| Power meter/MFM                  | : | Conzerv, L&T, ElMeasure, HPL  |
| 19) Anchor Fasters               | : | Hilti or equivalent   |



20) Meters (V, A, PF etc)	:	AE, RISHABH, EIMeasure, HPL
21) Timer	:	Theban (Indoasian), Legrand, Schneider
22) LT CT	:	KAPPA/ AE / Pragati
23) DWC Pipes	:	Rex, Dutron, equi
24) Electrode type Earthing	:	LPI, OBO
25) Water Tight JB	:	Hensel, Spealsberg
26) Street light Pole	:	Bajaj, Surya, Crompton

**Special Notes:**

- The successful tenderer will have to supply the makes from above in consultation with the Client / Architect / Consultant without any extra cost.
- The tenderer should have to submit considered makes from the above list along with the tender with covering letter of separate letter enclosure. However, the final decision for accepting make specified by tenderer would be of client / Architect / Consultants.
- As far as possible, the successful tenderer will have to place order directly to the manufacturer OR it's authorized dealer.
- The Client/Architect/Consultants have right to check the challans of supplier.
- The MCB and MCB DBs must be of same make.
- Make of components required to be used by contractor to complete the installation, if not mentioned any where, shall be required to GOT IT APPROVED by Client/Architect/Consultant before installation in writing manner.
- Within a week of work order, the contractor shall submit the sample of each item / component of above mentioned approved make for the approval of the Client/Architect/Consultant.

## **PLUMBING WORKS SPECIFICATIONS**

### **1. GENERAL INSTRUCTIONS**

#### **1.1. GENERAL INSTRUCTIONS**

The detailed specifications given hereinafter are for the items of works described in the schedule of quantities attached herein, and shall be guidance for proper execution of work to the required standards. It may also be noted that the specifications are of generalized nature and these shall be read in conjunction with the description of item in schedule of quantities and drawings. The work also includes all minor details of construction which are obviously and fairly intended and which may not have been referred to in these documents but are essential for the entire completion in accordance with standard Engineering practice.

Unless specifically otherwise mentioned, all the applicable codes and standards published by the Indian Standard Institution and all other standards which may be published by them before the date of receipt of tenders, shall govern in all respects of design, workmanship, quality and properties of materials and methods of testing, method of measurements etc. Wherever any reference to any Indian Standard Specification occurs in the documents relating to this contract, the same shall be inclusive of all amendments issued there to or revisions thereof, if any, up to the date of receipt of tenders. In case there is no I.S.I. specification for the particular work, such work shall be carried out in accordance with the instructions in all respects, and requirements of the Engineer-in-Charge. The work shall be carried out in a manner complying in all respects with the requirements of relevant bye-laws of the Municipal Committee/ Municipal Corporation/ Development Authority/ Improvement Trust etc. under the jurisdiction of which the work is to be executed or as directed by the Engineer-in-Charge and, unless otherwise mentioned, nothing extra shall be paid on this account.

Samples of various materials, fittings etc. proposed to be incorporated in the work shall be submitted by the contractor for approval of the Engineer-in-charge before order for bulk supply is placed.

The contractor shall take instructions from the Engineer-in-Charge regarding collection and stacking of materials in any place. No excavated earth or building materials shall be stacked on areas where other buildings, roads, services, compound walls etc. are to be constructed.

The contractor shall maintain in perfect condition all works executed till the completion of the entire work allotted to him. Where phased delivery is contemplated, this provision shall apply to each phase.

The contractor shall give a performance test of the entire installation(s) as per standard specifications before the work is finally accepted and nothing extra whatsoever shall be payable to the contractor for the test.

The contractor shall clear the site thoroughly of all debris, surplus excavated materials and rubbish etc. left out of his work and dress the site around the building to the satisfaction of the Engineer-in-Charge before the work is considered as complete.

The Chief Engineer, DCSE, DAE, shall be the sole deciding authority as to the meaning; interpretations and implications for various provisions of the specifications and his decision in writing shall be final and binding on all concerned.

In case any difference or discrepancy between the specifications and the description in the schedule of quantities, the schedule of quantities shall take precedence. In case of any difference or discrepancy between specifications and drawing, the specifications shall take precedence. In case any difference or discrepancy between the specifications for civil works and specification for Public Health Engineering works, specifications for civil works shall take precedence.

#### **1.1.1 APPROVAL**

The materials for P.H. Engineering works which are to be supplied by the contractor shall conform to the relevant IS specifications and on the latest approved list of Mumbai Municipal Corporation/ Local bodies if any, and shall be approved by the Engineer-in-Charge prior to installation of fixture and the approved samples shall be maintained at site till the completion of work. The approved makes of main items are, however specified in the list of approved makes of materials here in before.

#### **1.1.2 PRECAUTIONS**

While carrying out pipe line work in case the contractor encounters any interference with other services such as cables, conduits etc, he shall take sufficient precautions in order to

prevent any damage to them. If any damage occurs, it shall be rectified to its original condition at his own cost to the satisfaction of the officers concerned with such services.

The contractor shall ensure that all inserts, pipe lines embedded in structural members or sleeves are placed in position in co-ordination with civil work.

All public health engineering services shall be handed over to Engineer-in-charge complete in all respects on completion of the work. Incomplete work will not be taken over. Any loss or damage to these services due to any reasons by anybody whatsoever before handing over will be at contractor's risk and cost. Any damage to any structural/finishing work done during the testing or rectification shall be made good by the contractor at his own cost and risk.

### **1.1.3 COST TO BE COVERED**

The rates quoted by the tendered under this contract shall cover the cost of all the following elements.

### **1.1.4 MISCELLANEOUS WORK**

The contractor carrying out the construction work shall take effective measures to carefully open out all existing channels, culverts, bridges, pipelines, conduits, water courses, sewer, drains, electrical cables, transmission lines and their supports and all works buried or otherwise where such services have to be interfered with the purpose of the construction of the works. He shall provide and arrange all necessary temporary supports and diversions if necessary across/under/even through along sides of the trenches and all other parts of construction work for all such channels, culverts, bridges, pipe lines, conduits.

### **1.1.5 CLEARANCE FOR ROADS AND FOOT PATHS**

The contractor shall arrange to carry out all works with least interference practicable with public footpath and vehicular traffic and with existing waste water or storm water drainage arrangements and provide all necessary road barriers, fences, notices, lights, gangways, access crossings, diversions for traffic, temporary drains, dewatering channels, chutes pumping or water lifting arrangements and all other facilities for the proper execution of the

works to the approval and satisfaction in all respects of the Engineer-in-Charge. Any work carried out by the contractor in this connection shall be deemed as temporary works incidental to the construction work.

**1.1.6 LOCATION**

The rates quoted by the tendered under this contract shall be applicable for the work at all levels and locations.

**1.1.7 DEWATERING**

The rates quoted by the tendered under this contract shall include bailing or pumping out all the water which may accumulate during the progress of the work either through seepage, springs, rain or any other cause.

**1.1.8 WATER SUPPLY MAIN**

The cost includes for transport charges and testing charges prescribed by the municipal Corporation. Water mains thus laid shall be tested to a pressure as specified in the schedule and specifications. Contractor has to get the pipe line laid hydraulically tested by the Municipal Authorities. Contractor has to bear the Municipal hydraulic testing charges.

**1.1.9 FORMALITIES WITH STATUTORY BODIES**

The work shall be carried out in a manner complying in all respects with requirement of relevant bye-laws of the Municipal Committee/ Municipal Corporation/ Development Authority/ Improvement Trust under the jurisdiction of which the work is to be executed or as directed by the Engineer-in- Charge and, unless otherwise mentioned, nothing extra shall be paid on this account. The contractor has to satisfy all the requirement of fire brigade, drainage and hydraulic engineering department of Municipal Corporation.

**Note:** In case a separate item is included in the schedule of quantities, contractor shall engage a licensed P.H. Engineer/ licensed plumber and obtain all the above certificates from Municipal Corporation. The Department shall authorize the contractor to deal with BMC on behalf of the Department.

**1.2. LIST OF INDIAN STANDARDS**

The following IS codes shall be referred in execution of PH Engineering works.

IS CODE	SUBJECT
IS: 456	Code of practice for Plain & Reinforced concrete.
IS: 458	Specifications for Concrete Pipes.
IS: 783	Code of practice for laying concrete pipes.
IS: 784	Pre-stressed concrete pipes.
IS: 1200 (Pt. 16)	Method of measurements for Laying of water and sewer lines including appurtenant items.
IS: 1239 (Pt I & II)	Specifications for Mild steel tubes
IS: 1726	Cast iron manhole covers and Frames.
IS: 2527	Code of practice for fixing rain water gutters and down pipes for roof drainage.
IS: 3597	Method of test for concrete pipes.
IS: 4038	Foot valves for water works purposes.
IS: 4111 (Pt. I to V)	Code of practice for ancillary structures in sewage system.
IS: 4111 (Pt. I)	Manholes
IS: 4736	Specification for hot -dip zinc coating on mild steel tubes.
IS: 4854 (Pt. I to III)	Glossary terms for valves and their parts
IS: 5312 (Pt. I)	Swing check type reflux (non-return) valves
IS: 5312 (Pt. II)	Reflux (non-return) valves - single door pattern
IS: 5455	Cast iron steps for manholes

IS: 5961	Specifications for Cast Iron grating for drainage purposes
IS: 7740	Code of Practice for road gullies
IS: 8835	Guidelineforplanninganddesignofsurfacedrains.
IS: 9338	SpecificationsforCastIronscrewdownstopvalvesandstop&checkvalves forwaterworkspurposes
IS: 12592	Precast concrete frame & cover (SFRC frame & cover)



## **2. TECHNICAL SPECIFICATIONS**

### **2.1. EARTH WORK AND BACKFILL**

#### **2.1.1.SCOPE OF WORK**

The scope of work covered under this specifications pertains to excavation of foundations, trenches, pits and over areas, in all sorts of soils, soft and hard rock, correct to dimensions given in the drawing including shoring, protections of existing underground utilities if any, such as water lines, electric cables etc., dewatering and shoring if necessary, stacking the useful materials as directed within the lead specified, refilling around the foundation and into the plinth with selected useful excavated earth and disposing off the surplus earth/materials within specified lead and finishing the surface to proper levels, slopes and camber etc. all complete.

#### **2.1.2.SITE CLEARANCE**

Before the earth work is started the area coming under cutting and filling shall be cleared of all obstructions, loose stones, shrubs, rank vegetation, grass, brush-wood, trees and saplings of girth up to 30 cm. measured at a height of one meter above ground and rubbish removed up to a distance of 150 meters outside the periphery of the area under clearance. The roots of trees shall be removed to a minimum depth of 60 cm. below ground level, or a minimum of 30 cm. below formation level whichever is lower, and the hollows filled up with earth, leveled and rammed. This work is deemed to be included in the earth work items and no separate payment will be admissible for the work.

The trees of girth above 30 cm. measured at a height of one meter above ground, shall only be cut after permission of the Engineer-in-charge is obtained in writing. The roots shall also be removed as described in the preceding sub-Para. Payment for cutting and removing roots of such trees shall be made separately. Any material obtained from the site will be the property of the Department and the useful materials as decided by the Engineer- in-charge will be conveyed and properly stacked as directed within the lead specified.

#### **2.1.3.SETTING OUT AND MAKING PROFILES**

Masonry or concrete pillars will be erected at suitable points in the area to serve as bench marks for the execution of the work. These bench marks shall be connected with G. T. S. or

any other permanent bench mark approved by the Engineer-in-charge. Necessary profiles with pegs, bamboos and strings or Burjis shall be made to show the correct formation levels before the work is started. The contractor shall supply labor and materials for setting out and making profiles and Burjis for the work at his own cost and the same shall be maintained during the excavation work. The Department will show grid Co-ordinate or other reference points. It shall be the responsibility of the contractor to set out centre lines correctly with reference to the drawings and install substantial reference marks. Checking of such alignment by the Department will not absolve the contractor from his responsibility to execute the work strictly in accordance with the drawings.

#### 2.1.4.EARTHWORK

The contractor shall notify the Engineer-in-charge before starting excavation and before the ground is disturbed, to enable him to take existing levels for the purpose of measurements. The ground levels shall be taken at 5 to 15 meters intervals in uniformly sloping ground and at closer distance where local mounts, pits or undulations are met with, as directed by the Engineer-in-charge. The ground levels shall be recorded in field books and plotted on plans, which shall be signed by the Contractor and the Engineer-in-charge, before the earth work is actually started. The labor required for taking levels, shall be supplied by the Contractor at his own cost. The Contractor shall perform excavation in all types of soils, murrum, soft and hard rock, boulders etc. in foundation, over areas and in trenches to widths, lines, levels, grades and curves as shown in the drawing or lesser widths, lines and levels as directed by the Engineer-in-charge and as per items in the schedule of quantities.

2.1.4.1. The item in the schedule of quantities shall specify the excavation in trenches for this purpose, the excavation in trenches for foundations and for pipes, cables etc. not exceeding 1.5 meter in width and for chambers, manhole, shafts, wells, cesspits and the like not exceeding 10 sqm. on plan and to any depth shall be described as Excavation in trenches for foundation, drains, pipes and cables and returning the excavated material to fill the trenches after pipes, cables etc, are laid and their joints tested and passed and disposal of surplus excavated material up to 50 m lead.

2.1.4.2. Excavation exceeding 1.5 meter in width as well as 10 sqm. On plan (excluding trenches for pipes, cables etc.) and exceeding 30 cm in depth shall be described as Excavation over areas.

**2.1.5.CLASSIFICATION OF EARTH WORK**

The earth work shall be classified under the following main categories and measured separately for each category.

1. All types of soils, murrum, boulders.
2. Soft rock.
3. Hard rock.

**2.1.5.1. ALL TYPES OF SOILS, MURRUM, BOULD**

This includes earth, murrum, top deposits of agricultural soil, reclaimed soil, clay, sand or any combination thereof and soft and hard murrum, shingle etc. which is loose enough to be removed with spades, shovel and pick axes. Boulders not more than 0.03 cum. in volume found during the course of excavation shall also fall under this classification.

**2.1.5.2. EXCAVATION IN SOFT ROCK**

This shall include all materials which are rock or hard conglomerate, all decomposed weathered rock, highly fissured rock, old masonry, boulders bigger than 0.03 cum. in volume but not bigger than 0.5 cum. and other varieties of soft rock which can be removed only with pick axes, crow bars, wedges and hammers with some difficulty. The mere fact that the contractor resorts to blasting and/or wedging and chiseling for reasons of his own, shall not mean the rock is classifiable as hard rock.

**2.1.5.3. EXCAVATION IN HARD ROCK**

This includes all rock other than soft rock mentioned in Para 2.1.5.1 b viz. soft rock, occurring in masses, boulders having approximate volume more than 0.5 cum. Plain or reinforced cement concrete, which can best be removed by blasting or chiseling and wedging where blasting cannot be permitted owing to any restriction at site.

**2.1.5.3.1. EXCAVATION IN HARD ROCK BY BLASTING**

Where blasting is permitted the excavation in rock shall be done by means of blasting. No heavy blasting will be permitted and only controlled/muffled blasting will be permitted at the discretion of the Engineer-in-Charge. The Contractor shall be governed by the relevant statutory laws, rules and regulations on explosives, pertaining to the acquisition, transport,

storage, handling and use of explosive which shall be rigidly followed and shall obtain him all necessary materials and equipment for blasting. Blasting shall be executed through a licensed blaster with prior permission from police authorities. Prior to blasting sufficient notice shall be given to concern parties to avoid danger to people, materials and nearby structures. All the damages caused by careless blasting if any shall be made good by the contractor at his own expenses.

#### **2.1.5.3.2. EXCAVATION IN HARD ROCK BY CHISELLING AND WEDGING**

Where blasting is not permitted and if the Engineer-in-Charge so desires, the excavation shall be done by chiseling and wedging or any other agreed method.

**NOTE:** All the excavated hard rock obtained shall be stacked properly and neatly within the specified lead by the contractor as directed by the Engineer-in-Charge.

#### **2.1.6.EXCAVATION**

The excavation under all classifications in areas in trenches or in pits shall be carried out systematically. Cutting shall be done from top to bottom and no under-pining or undercutting will be allowed. The bottom and sides of excavation shall be dressed to proper level, slopes, steps, camber etc. by removing high spots, and ramming thoroughly as directed by the Engineer-in-charge.

All the excavation shall be carried out strictly to the dimensions given in the drawing. The width shall generally be of the width of mud mat concrete and depth as shown in drawing or as directed by the Engineer-in- Charge, according to availability of the desired bearing capacity of soil below. Any excavation if taken below the specified depths and levels, the contractor shall at his own cost fill up such overcut to the specified level with cement concrete 1:4:8 in case of excavation in all types of soils and with cement concrete 1:2:4 in case of excavation in soft and hard rock.

After the excavation is completed, the contractor shall notify the Engineer-in-Charge to that effect and no further work shall be taken up until the Engineer-in-Charge has approved the depth and dimensions and also the nature of foundation materials. Levels and measurements shall also be recorded prior to taking up any further work.

**2.1.6.1. SIZES OF TRENCH FOR EXCAVATION FOR PIPE LINE :**

Where the width of trench is not specified the following shall apply.

1. Up to 1.0 meter deep shall be arrived at by adding 25 cm to the external diameter of pipe (not socket/collar) cable, conduit etc where a pipe is laid on concrete bed/cushioning layer, the authorized width shall be the external diameter of the pipe (not socket/collar) plus 25 cm or the width of concrete bed/cushioning layer whichever is more.
2. For depths exceeding one meter, an allowance of 5 cm per meter of depth for each side of the trench shall be added to the authorized width (that is external diameter of pipe plus 25 cm) for excavation. This allowance shall apply to the entire depth of the trench. In firm soils up to a depth of 2 meters from the bottom. For depths greater than 2 meters, the excavation profiles shall be widened by allowing steps of 50 cm on either side after every two meters from bottom.
3. Where more than one pipe, cable, conduit etc. are laid, the diameter shall be reckoned as the horizontal distance from outside to outside of the outermost pipes, cable, conduit etc.
4. Where the soil is soft, loose or slushy, width of trench shall be suitably increased or side sloped or the soil shored-up as directed by the Engineer-In-Charge. It shall be the responsibility of the contractor to take complete instructions in writing from the Engineer-In-charge regarding increase in the width of trench, sloping or shoring to be done for excavation in soft, loose or slushy soils.

**2.1.6.2. SIZES OF TRENCH FOR EXCAVATION FOR CHAMBERS, MANHOLES, SHAFTS, WELLS, CESSPITS:**

Authorized working space shall be special in each case. Where authorized working space is not so specified the following shall apply:

600 mm measured from the external face of substructure/walls (including protective measures like water proof plaster, tile cladding etc. if any) at lowest level, where extra working space is required.

**2.1.7.SHORING**

Unless separately provided for in the schedule of quantities, the quoted rate for excavation shall include excavation of slopes to prevent falling in soil by providing and/or fixing, maintaining and removing of shoring, bracing etc. The contractor would be responsible for the design of shoring for proper retaining of sides of trenches, pits etc. with due consideration to the traffic, superimposed loads etc. Shoring shall be of sufficient strength to resist the

pressure and ensure safety from slips and to prevent damage to work and property and injury to persons. It shall be removed as directed after items for which it is required are completed. Should the slips occur, the slipped material shall be removed and slope dressed to a modified stable slope? Removal of the slipped earth will not be measured for payment.

#### **2.1.8.DEWATERING**

Unless specifically provided for as a separate item in the schedule of quantities, rate shall also include bailing or pumping out all water which may accumulate in the excavation during the progress of further works such as mud mat concrete, R.C. footings, shuttering etc. either due to seepage, springs, rain or any other cause and diverting surface flow by bunds or other means. Care shall be taken to ensure that the water discharged sufficiently away from the foundations to keep it free from nuisance to other works in the neighborhood.

#### **2.1.9.DISPOSAL OF EXCAVATED MATERIALS**

##### **2.1.9.1. ANTIQUITES**

Any finds of archaeological interest such as relics of antiquity, coins, fossils or other articles of value shall be delivered to the Engineer-in-Charge and shall be the property of the Government.

##### **2.1.9.2. USEFUL MATERIALS**

Any material obtained from the excavation which in the opinion of the Engineer-in- Charge is useful, shall be stacked separately in regular stacks as directed by the Engineer-in-Charge and shall be the property of the Government.

No material excavated from foundation trenches of whatever kind they may be are to be placed even temporarily nearer than about 3 m. from the outer edge of excavation. Discretion of the Engineer-in-Charge in such cases is final. All materials excavated will remain the property of the Department. Rate for excavation includes sorting out of the useful materials and stacking them separately as directed within the specific lead.

Materials suitable and useful for refilling or other use shall be stacked in convenient place but not in such a way as to obstruct free movement of materials, workers and vehicles or encroach on the area required for constructional purposes. It shall be used to the extent

required to completely backfill the structure to original ground level or other elevation shown on the plan or as directed by the Engineer-in-Charge. Materials not useful in anyway shall be disposed off, leveled and compacted as directed by the Engineer-in-charge within a specified lead. The site shall be left clean of all debris and leveled on completion.

#### **2.1.10. REFILLING IN SIDES OF CHAMBERS, DRAINS ETC.**

The back filling shall be done after the concrete or masonry has fully set and shall be done in such a way as not to cause under-thrust on any part of the structure. Where suitable excavated material is to be used for back filling, it shall be brought from the place where it was temporarily deposited and shall be used in refilling. The scope of work for back filling/ filling in sides of chambers and other areas shall include filling for all the excavation covered under the contract. Surplus earth available from the excavation, if required, shall be used for refilling/ filling for filling the trenches for pipes cables buildings also within the specified lead mentioned in the item.

All timber shoring and form work left in the trenches, pits, floors etc. shall be removed after their necessity ceases and trash of any sort shall be cleared out from the excavation. All the space between foundation masonry or concrete and the sides of excavation shall be refilled to the original surface with approved materials in layers not exceeding 200 mm. in thickness, watered and well consolidated by means of rammers to at least 90% of the consolidation obtainable at optimum moisture content (Proctor density). Flooding with water for consolidation will not be allowed. Areas inaccessible to mechanical equipment such as areas adjacent to walls and columns etc. shall be tamped by hand rammer or by hand held power rammers to the required density. The backfill shall be uniform in character and free from large lumps, stones, shingle or boulder not larger than 80 mm. in any direction, salt and clods, organic or other foreign materials which might rot. The refilling in plinth and under floors shall be done in similar way in layers not exceeding 200 mm. thick and shall be well consolidated by means of mechanical or hand operated rammers as specified to achieve the required density.

Test to establish proper consolidation as required will be carried out by the Department at rates specified. Two tests per 50 sqm. Will be taken to ascertain the proper consolidation. The cost of tests carried out will be recovered from the contractor's bill.

**2.1.11. REFILLING IN TRENCHES FOR PIPES, CABLES ETC.**

Filling in trenches shall be commenced soon after the joints of pipes, cables; conduits etc. have been tested and passed. The space around the pipes, cables, conduits etc. shall be cleared of all debris, brick bats etc. Where the trenches are excavated in hard/soft soil, the filling shall be done with earth on the sides and top of pipes in layers not exceeding 20 cm in depth. Each layer shall be watered, rammed and consolidated. All clods and lumps of earth exceeding 8 cm in any direction shall be watered, rammed and consolidated. All clods and lumps of earth exceeding 8 cm in any direction shall be broken or removed before the excavated earth is used for filling. In case of excavation of trenches in ordinary/hard rock, the filling up to a depth of 30 cm above the crown of pipe, cable, conduits etc. shall be done with fine material like earth, murrum or pulverized/decomposed rock according to the availability at site. The remaining filling shall be done with boulders of size not exceeding 15 cm mixed with fine material like decomposed rock, murrum or earth as available to fill up the voids, watered, rammed and consolidated in layers not exceeding 30 cm. Excavated material containing deleterious material, salt peter earth etc. shall not be used for filling. Ramming shall be done with iron rammers where feasible and with blunt ends of crow bars where rammers cannot be used, Special care shall be taken to ensure that no damage is caused to the pipes, cables, conduits etc. laid in the trenches.

**2.1.12. LEAD & LIFT****2.1.12.1. LEAD**

The lead for disposal/deposition of excavated materials shall be as specified in the respective item of work. For the purpose of measurements of lead, the area to be excavated or filled or area on which excavated material is to be deposited/ disposed off shall be divided in suitable blocks and for each of the block, the distance between centre lines shall be taken as the lead which shall be measured by the shortest straight line route on the plan and not the actual route adopted.

**2.1.12.2. LIFT**

Lift shall be measured from ground level. Excavation up to 1.5 m depth below ground level and depositing excavated material on the ground shall be included in the item of earthwork for various kinds of soil. Extra lift shall be measured in unit of 1.5 m or part thereof. Obvious lift shall only be measured; that is lifts inherent in the lead due to ground slope shall not be



measured except for lead up to 250 m. All excavation shall be measured in successive stages of 1.5 m stating the commencing level. This shall not apply to cases where no lift is involved as in hill side cutting.

### 2.1.13. MODE OF MEASUREMENTS

2.1.13.1. All excavation in areas having depth more than 30 cm. pits, trenches etc. Shall be measured net. The dimensions for the purpose of payment shall be reckoned on the horizontal area of the excavation at the base for foundations of the walls, columns, footings, rafts or other foundations, multiplied by the mean depth from the surface of ground determined by levels. Excavation for side slopes will not be paid for. Excavation in areas having depths less than 30 cms. Shall be measured as surface excavation on square meter basis, mentioning the average depth of excavation.

Reasonable working space beyond concrete dimension required for waterproofing and shuttering where considered necessary in the opinion of Engineer-in Charge will be allowed in execution and considered for payment for underground water tank, sump, septic tank etc.

2.1.13.2. Wherever direct measurements of rock excavation are not possible, volume of rock be calculated on the basis of length, breadth and depth of stacks made at site. The net volume shall be worked out by reducing it by 50%, taking the voids into consideration as 50%. Similarly to arrive at net quantity to be paid in the case of soil, reduction @ 20% of corresponding stack/truck measurements shall be made.

2.1.13.3. The rate for excavation shall include carting and disposing and leveling the excavated materials within the specified lead. The rate shall also be inclusive of cost of all tools, plants, explosives, shoring, dewatering at various stages, labor, materials etc. to complete all the operations specified.

2.1.13.4. The backfilling and consolidation in sides of foundation and in plinth with excavated material will not be paid for separately. The rate quoted for excavation shall be deemed to have been included the cost of stacking of excavated materials, conveying within the specified lead, picking of selected stacked materials, conveying it to the place of final backfill, compaction to the required proctor density etc.

2.1.13.5. Payment for filling and consolidation inside the trenches, sides of foundations, plinth etc. with selected materials brought by the contractor other than the excavated material, shall be paid for separately as per the rates in schedule of quantities which includes cost of such materials/ excavation, royalty, its conveyance within the specified lead, watering, consolidating, dressing etc. Actual quantity of consolidated filling shall be measured and paid in cubic meters up to two places of decimal.

2.1.13.6. The rate quoted in cum. for items of excavation is deemed to include the necessary additional quantity of excavation involved beyond the plan dimensions of the work which may be necessary to be carried out for carrying out the work in an engineering manner, decided upon by the contractor. Therefore no extra payment will be made for any excavation done other than the required quantity as per the plan dimension indicated in the drawings.

2.1.13.7. Measurements for excavation over areas shall be determined by levels or by "Dead men" or both at the discretion of the Engineer-in-Charge. If however the Engineer-in-Charge decides on measurement by levels, levels of site shall be jointly taken and recorded by the Engineer-in-Charge or his representatives and the contractor, before commencement of the work and after completion of the work and the quantity of work done shall be computed based on these levels. The volume of earth work shall be computed based on "Simpson's formula" or any other approved method at the discretion of the Engineer-in-Charge.

#### **2.1.14. MODE OF PAYMENT**

The contract rate shall be for unit cubic meter of earth work.

### **2.2. PLAIN CEMENT CONCRETE**

#### **2.2.1. GENERAL**

The specification covers the requirement of ordinary Cement Concrete of the specified proportion to be used for various concrete items.

**2.2.2.MATERIAL**

The material requirement for particular item shall be as per IS 456

**2.2.3.CEMENT**

Cement shall be OPC/PPC cement conforming to IS 269 & IS 1489 respectively. Cement shall be stored in dry god owns or sheds use of PPC slag cement as approved by the Engineer In-charge, out of construction with damp ground on a 0.6M height platform. Cement shall not be stored in the open. All cement shall be kept well stacked and no cement other than intended to use in the work, shall be used. The cement shall be stored as received and shall be consumed in the order in which consignments are received and shall not be stored for long periods. No clogged cement caused by dampness shall be used. Blended cement for finishing work shall be used with the prior approval of the Engineer In-charge.

**2.2.4.FINE AGGREGATE**

The sand shall be clean, well graded, hard, strong, durable and gritty particles of size 0.15 mm to 5 mm free from mica, dust, clay, kankar, soft or flaky particles and other deleterious materials. If the fine aggregate contain more than 4 percent of clay, dust or silt it shall be washed. Sea sand should not be used. The fineness modulus may range between 2.6 to 3.6.

**2.2.5.COARSE AGGREGATE**

All stone aggregate to be used for cement concrete shall be from approved sources. The aggregate shall be clean hard, strong and durable. It shall not contain soft, flaky thin or elongated pieces, alkali organic matter or other notorious matter. The specific gravity of the aggregate shall be between 2.5 to 2.7.

**2.2.6.STORAGE, SCREENING AND WASHING**

It shall be stored at the work site in such a manner as to prevent contamination. All aggregate shall be stored to convenient height on hard and dry platform. The contractor shall install screens, one for coarse aggregate and one for sand and shall thoroughly wash all aggregate if directed by Engineer-in-charge.

**2.2.7.WATER**

The water shall be conforming to IS 3025. The water shall be clean and free from deleterious matters such as acids, oils, alkalis, sugar and vegetable matter. Every attempt shall be made to use water that is fit for drinking and whenever possible, water shall be used direct from the supply mains. PH value of water shall not be less than 6.

#### **2.2.8.PROPORTIONING OF MIX**

In ordinary concrete although proportion of cement to fine and course aggregate is specified by volume, the quantity of cement shall be determined by weight assuming one bag of cement weighing 50 kg. Net to be equivalent to 35 Liters. Fine and course aggregate shall be measured by dry volume in suitable measuring boxes. The allowance shall be made for bulking in the fine aggregate due to moisture if any at the time of mixing. Water cement ratio will be such as will give concrete just sufficient workable to place and compact without difficulty.

#### **2.2.9.MIXING**

In all the cases concrete shall be mixed in a mechanical mixer at the site of work, mixer and other accessories should be in first class condition and well maintained throughout the construction. Mixing shall be continued till the homogeneous mixture is obtained but in no case mixing shall be done for less than 1.5 Minutes.

When hand mixing is permitted by Engineer-in-charge in any special condition, it shall be done on a smooth, hard and water tight, platform large enough to allow sufficient turning over of the ingredients of concrete after adding the water. The material shall be mixed in dry state and turned over until they are thoroughly and fully mixed homogeneously. In hand mixing, the quantity of cement shall be increased by 10 percent without any extra cost. Repapering or remixing of partially hardened concrete shall not be permitted.

#### **2.2.10. PLACING**

The concrete shall be transported in such a manner that there shall be no tendency for the segregation of the different ingredients and it shall not be dropped into position from the height greater than 1.00 meter and shall be placed within 30 minutes after mixing. It shall not be interfered when once it has become to set.

When new concrete is to be placed on the already set concrete, the surface of the old concrete shall be thoroughly roughened & wetted before the new concrete is laid.

Cement: Sand (1:2) slurry should be laid over the surface of the old concrete which is roughened, washed and wetted. The stripped surface of concrete shall be smooth & sharp. Any honey combing, air holes, board marks etc, shall be finished smooth prior to re-concreting.

**2.2.11. COMPACTION**

The concrete shall be thoroughly compacted during depositing to get dense concrete. The concrete shall not be disturbed once it is set. For important works, the use of mechanical vibrator is essential. The vibrator shall not be less than 4000 to 5000 impulse per minute and shall be worked at an interval about 600 mm. Over vibration shall be avoided.

**2.2.12. DEWATERING**

The item rate shall include bailing or pumping out all water if accumulated during the progress of the work either from seepage, springs, rain or any other cause.

**2.2.13. FORM WORK**

The forms shall generally comply with IS 456 & IS 14687. The shuttering shall be of wood or metal. Before placing the concrete the inside of the forms which comes into contact with concrete shall be coated with mineral oil. The forms shall be erected in position firmly so that it should not be dislocated during concreting. The forms shall be removed without damaging the concrete structure after development of sufficient strength and taking consent of the Engineer- In-Charge.

**2.2.14. DEFECTIVE CONCRETE**

The defective concrete surface shall be made good as per the direction of Engineer- In-Charge at the contractor's own cost and charges.

**2.2.15. WATERING AND CURING**

All the concrete work shall be kept wet continuously for a period of least 14 days to prevent excessive evaporation. In hot and dry weather matting or gunny bags may be hung on outside of the concrete surface to keep moist.

**2.2.16. THE RATE INCLUDES FOR**

1. Installation and removal of scaffolding and shuttering.
2. Cost includes transporting, placing, compacting, curing and finishing cement concrete,
3. Necessary sampling and tests for materials and concrete.
4. Dewatering the pit or trench if found necessary till completion of work.

5. All labor, materials, use of equipment, tools and plants.

**2.2.17. MODE OF MEASUREMENT**

The measurement shall be for unit cubic meter of concrete or as specified in schedule of work. The concrete shall be measure for its length, breadth and depth. Deduction for pipe shall be made as per the actual outer dimension of the pipe.

**2.2.18. MODE OF PAYMENT**

The contract rate shall be for unit cubic meter of concrete or as specified in the schedule of work.

**2.3. BRICK MASONARY****2.3.1.GENERAL**

This specification covers requirement of the Brick Work in specified proportion of cement mortar.

**2.3.2.BRICK**

Brick shall generally confirm to IS 1077. All the bricks to be used in the work shall be well bunt clay brick of class 35, red color, homogeneous in texture, free from flaws, cracks and crevices. They shall have a frog of 10 mm. depth on one side of their flat faces. No brick after twenty four hours immersion in water shall absorb more than 25% of its own weight and strength should not be less than 3.5 MPa (35 kg/Sq.cm). The test report of the bricks shall be submitted to the Engineer-in-charge at the contractor's own cost, if required Brick shall be uniformly burnt throughout but not over burnt, shall give the clear metallic ringing sound when struck.

**2.3.3.BRICK WORK**

All bricks shall be thoroughly soaked in water before use till the bubbles ceases to come up. No half or quarter brick shall be used except as closures. The course shall be horizontal and the wall shall be raised to plumb. Joints in brick wall shall not exceed to 10mm thick. Brick work shall be uniformly raised around to heights as per drawings. All joints shall thoroughly flush with mortar at every course. Care shall be taken to see that the bricks are properly bedded and joint completely filled to full depth. No bat or cut bricks shall be used in the work unless absolutely required to give proper shape. Brick work shall be built in cement and sand mortar as specified in the schedule or as per drawing. The joints shall be raked for a depth of 10 mm to receive cement plaster.

**2.3.4.DEWATERING**

The item rate shall include bailing or pumping out all water which may accumulate during the progress of the work either from seepage, springs, rain or any other cause.

**2.3.5.WATERING AND CURING**

All the brick work shall be kept damp continuously for a period of 14 days to prevent excessive evaporation in hot and dry weather matting or gunny bags may hang on the outside of brick work & kept moist.

**2.3.6.THE RATE INCLUDES FOR**

1. Erecting, dismantling and removing the scaffolding and curing brick work for at least 14 days.
2. Dewatering the pit or trench if found necessary till completion of work.
3. Labor, materials, tools, paint etc. used in the work.

**2.3.7.MODE OF MEASUREMENT**

The measurement shall be for unit cubic meter of brick work or as specified in the schedule of work. The brick wall shall be measured for its length, breadth and depth.

**2.3.8.MODE OF PAYMENT**

The contract rate shall be for unit cubic meter or as specified in the schedule of work.

**2.4. CEMENT PLASTER****2.4.1.GENERAL**

This specification covers the requirement of the Cement plaster in the specified proportions.

**2.4.2.CEMENT MORTAR**

Cement and sand shall be mixed to the proportions as described in the schedule. Cement and sand shall be first mixed dry on the dry platform after which sufficient clean water shall be added to bring the whole mix into a plastic condition. No mortar which has started to set shall be used nor such mortar remixed with new one. It shall be removed from the work site at once.

**2.4.3.PLASTERING**

In all plaster work, mortar shall be firmly applied and well pressed into the joints on the surface and drubbed and leveled with a flat wooden rule to give required thickness. Long

straight edge shall be freely used to ensure a perfectly plane and even surface. All corners must be finished to their true angle or rounded as directed. Cement plaster should be done in square or strips and shall be done from top to downward.

#### **2.4.4.FLOATING COAT**

The floating coat over the plaster shall be so done whenever specified in the item with neat cement to finish the surface so that cracks, crevices etc. are not developed in the plaster.

#### **2.4.5.DEWATERING**

The item rate shall include bailing or pumping out all water if accumulated during the progress of the work either from seepage, springs, rain or any other cause.

#### **2.4.6.WATERING AND CURING**

All the plaster work shall be kept damp continuously for a period of 14 days to prevent excessive evaporation. In hot and dry weather matting or gunny bag may be hung on the outside of the plaster in the beginning and kept moist.

#### **2.4.7.THE RATE INCLUDES FOR**

1. Erecting, dismantling and removing the scaffolding.
2. Preparation of the surface to receive the plaster of specified thickness and number of coats, curing etc.
3. Labor, materials, tools and plants used to complete the work.

#### **2.4.8.MODE OF MEASUREMENT**

The measurement shall be for unit square meter of cement plaster. The plaster shall be measured for its length, breadth / depth.

#### **2.4.9.MODE OF PAYMENT**

The contract rate shall be for unit square meter of plaster.

### **2.5. CUTTING OF ASPHALT ROAD AND PAVED YARD**

#### **2.5.1.GENERAL**

This specification covers the scope of cutting and breaking the asphalt, concrete roads, paths etc. and making good to its original condition.



**2.5.2.MATERIAL**

Wherever cutting is done across public paths, roads etc. the orders of materials excavated shall be preserved in well manner and reinstatement shall be done in the same order and road brought to the original condition. The contractor shall made up for any deficiency in/material at his own cost.

**2.5.3.WORKMANSHIP**

The cutting of road and paved yard shall be done as directed by the E-I-C, Ramming the sub-grade for piping work. The soling stones, spreading the metals to required thickness and making water bound with stone dust/ murrum as per requirement shall be reinstated to the original condition at his own cost.

**2.5.4.THE RATE INCLUDES FOR**

1. Cutting asphalt road, water bound macadam and soling and stacking usable material at site.
2. Ramming sub-grade for laying pipe line and making asphalt road in original condition after completion of work.
3. Labor, materials, tools and plants used to complete the work.

**2.5.5.MODE OF MEASUREMENT**

The measurement shall be for unit square meter. The cutting portion shall be measured for its length and breadth.

**2.5.6.MODE OF PAYMENT**

The contract rate shall be for unit square meter.

**2.6. REMOVAL OF FOOT PATH TILES****2.6.1.GENERAL**

This specification covers the scope of removing stone tiles from foot paths and re fixing the tiles as good to its original condition.

**2.6.2.MATERIAL**

Wherever cutting is done across pubic foot paths and roads, the orders of materials removed from foot paths shall be preserved in well manner and reinstatement shall be done in the same order and foot path brought to the original condition. The contractor shall make up for any deficiency in material at his own cost.

**2.6.3.WORKMANSHIP**

The foot path tiles shall be removed in required area required or as directed by the E-I-C. Ramming the sub-grade for laying and fixing the tiles after completion of work to the original condition with 1:3 cement mortars.

**2.6.4.THE RATE INCLUDES FOR**

1. Removing the stone tiles from foot paths and stacking at site.
2. Ramming sub-grade for re fixing the tiles including cement, sand, tiles etc.
3. Labor, materials, tools and plants used to complete the work.

**2.6.5.MODE OF MEASUREMENT**

The contract rate shall be for unit square meter and it shall be measured for its length and breadth.

**2.6.6.MODE OF PAYMENT**

The contract rate shall be for unit square meter.

**2.7. REMOVAL OF KERB STONE****2.7.1.GENERAL**

This specification covers the scope of removing road side kerbed stone and re fixing the kerbed stone as good to its original condition.

**2.7.2.MATERIAL**

Wherever cutting is done across public paths and roads, the order of materials shall be preserved in well manner and reinstatement shall be done in the same order and it shall be brought to the original condition. The contractor shall make up for any deficiency in material at his own cost.

**2.7.3.WORKMANSHIP**

The road side kerbed stone shall be removed to the required length or as directed by the E-I-C. Ramming the sub-grade for fixing the kerbed stone after completion of work in the original condition with 1:3 cement mortars.

**2.7.4.THE RATE INCLUDES FOR**

1. Removing the kerbed stone and stacking at site.

2. Ramming sub-grade for re fixing the kerbed stone including cement, sand, kerbed stone etc.
3. Labor, materials, tools and plants used to complete the work.

**2.7.5.MODE OF MEASUREMENT**

The measurement shall be for unit running meter and it shall be measured for its length.

**2.7.6.MODE OF PAYMENT**

The contract rate shall be for unit running meter,

**4. DRAINAGE SYSTEM**

**4.1 RAIN WATER GRATING**

**4.1.1 GENERAL**

The item includes supplying of cast iron grating of specified diameter including fixing and painting.

**4.1.2 MATERIAL**

The rain water grating shall be Cast Iron with closed grained without any casting defects. The thickness should be uniform throughout, one shaped C.I. grating.

**4.1.3 FIXING**

C.I. rain water grating shall be fixed in position with 1:1 cement mortar.

**4.1.4 THE RATE INCLUDES FOR**

1. The cast iron rain water grating cement, sand etc.
2. Fixing the grating.
3. All necessary materials, labor and use of tools.

**4.1.5 MODE OF MEASUREMENT**

The measurement shall be for each unit of grating fixed.

**4.1.6 MODE OF PAYMENT**

The contracts rate shall be for each unit of grating fixed.

## 4.2 MANHOLES

### 4.2.1 GENERAL

The item includes provision of brick masonry manholes of internal size as specified in the schedule.

### 4.2.2 MATERIAL

Concreting, Brick work, plastering etc. shall be as per specifications as given in general specification under section II.

### 4.2.3 CONSTRUCTION

1. Internal dimensions and initial depth shall be as specified in the schedule of work or as shown in the drawing.
2. Foundation of 1:2:4 concrete shall be 200 mm thick and shall have 150 mm offset.
3. The concrete 1:2:4 shall be laid to necessary shapes to form the channel for the pipe being received in the channel. It shall be of appropriate diameter and shall be half round. The sides shall be kept sloping towards the channel.
4. Brick masonry shall be in cement mortar 1:2 or as specified in the schedule of work. These shall be constructed in 230 mm thick brick masonry up to 1.25M depth and remaining height shall be 345mm thick brick masonry.
5. Brick masonry shall be rendered with 15 mm thick plaster in cement mortar 1:1 or as specified in the schedule of work inside and outside surfaces in two courses and inside surface finished smooth with neat cement punning.

### 4.2.4 DEWATERING

The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

### 4.2.5 THE RATE INCLUDES FOR:

1. Concreting in foundation, forming the channels, constructing brick masonry and plastering over the brick work and finishing smooth inside surfaces.
2. Cutting existing stoneware/RCC Hume pipe line to facilitate construction of new manhole.

3. Dewatering the pit if found necessary till completion of work.
4. All necessary labor, materials and use of tools.

#### **4.2.6 MODE OF MEASUREMENT**

The measurement shall be for one manhole of specified finished internal size and initial depth measured vertically from top of the frame and cover to the invert of manhole. Extra over for additional depth or rebate for lesser depth shall be measured in R.M.

#### **4.2.7 MODE OF PAYMENT**

The contract rate shall be for unit of manhole of specified internal size and initial depth, Extra/Rebate for additional/lesser depth respectively shall be paid in RM.

### **4.3 EXTRA DEPTH FOR INSPECTION CHAMBER AND MANHOLE**

#### **4.3.1 GENERAL**

The item includes provision for extra depth of manholes of brick masonry for depths beyond the specified depth of the manhole.

#### **4.3.2 MATERIAL**

Brick work, plastering etc. shall be as per specifications. Only brick masonry and plastering shall be included for the material for extra depth.

#### **4.3.3 CONSTRUCTION**

Extra depth for manholes shall be constructed as per the details for Manhole.

#### **4.3.4 DEWATERING**

The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

#### **4.3.5 THE RATE INCLUDES FOR**

1. Constructing brick masonry and plastering over the brick work.
2. Dewatering the pit if found necessary till completion of work.
3. All necessary labor, materials and use of tools.

**4.3.6 MODE OF MEASUREMENT**

The measurement shall be for unit 0.1 meter depth or part thereof for manhole constructed. Extra Depth of manhole or chamber shall be measured from top of the frame and cover to the invert level of manhole deducting the initial depth of at manhole/ chamber. Extra for additional depth or rebate for lesser depth shall be measured in R.M.

**4.3.7 MODE OF PAYMENT**

The contract rate shall be for each unit of 0.1 meter depth of manhole constructed.

**4.4 C.I. FRAME AND COVER FOR MANHOLES****4.4.1 GENERAL**

The item includes supply LD/MD/HD/EHD/C.I. Frame and cover as specified in schedule including fixing and painting.

**4.4.2 MATERIAL**

C.I. Frame and cover shall conform to IS 1720 and shall have IS certification mark with grade LD/MD/HD/EHD and the weight of frame and cover shall not be less than as specified in the schedule.

**4.4.3 FIXING**

Frame shall be fixed in the cement concrete 1:2:4 for bearing course and capping on the brick masonry wall of the chamber of manhole and finishing shall be done in 1:2 cement plaster finished smooth with neat cement.

**4.4.4 PAINTING**

The frame and cover shall be painted with two coats of approved black bitumastic anticorrosive paint over a coat of primer.

**4.4.5 THE RATE INCLUDES FOR**

1. C.I. frame and cover cement concrete, cement plaster, painting etc.
2. All necessary labor, material and use of tools.

**4.4.6 MODE OF MEASUREMENT**

The measurement shall be for C.I. Frame & cover on actual unit weight basis.

**4.4.7 MODE OF PAYMENT**

The contract rate shall be for C.I. Frame and cover on actual unit weight basis.

**4.5 PRECAST CONCRETE FRAME AND COVER FOR MANHOLES****4.5.1 GENERAL**

The item includes supply LD/ MD/ HD/ EHD factory made precast steel fiber reinforced concrete (SFRC) frame and cover as specified in schedule including fixing and placing.

**4.5.2 MATERIAL**

The precast frame and cover shall be of steel fiber reinforced concrete (SFRC) conforming to IS: 12592 and shall be of approved make. The frame and cover shall be of LD/ MD/ HD/ EHD grade, size and thickness as mentioned in the description of the item. The defective Frame and cover shall be replaced by the contractor at his own cost and charges.

**4.5.3 FIXING**

Frame shall be fixed in cement concrete 1:2:4 for bearing course & capping on the top of masonry wall of chamber or manhole and finishing shall be done in 1:2 cement plaster finished smooth with neat cement.

**4.5.4 THE RATE INCLUDES FOR**

1. Precast S.F.R.C. Frame and cover, cement concrete, cement plaster etc.
2. All necessary labor, material and use of tools.

**4.5.5 MODE OF MEASUREMENT**

The measurement shall be for unit set of Precast S.F.R.C. Frame and cover fixed.

**4.5.6 MODE OF PAYMENT**

The contract rate shall be for unit set of Precast S.F.R.C. Frame and cover fixed.

**4.6 CAST IRON STEPS / RUNGS****4.6.1 GENERAL**

The item includes supplying of cast iron steps including fixing and painting

**4.6.2 MATERIAL**

The steps shall be of cast iron and minimum 150 mm wide. The minimum weight of each step shall not be less than 5 kg or as specified in the schedule.

#### **4.6.3 FIXING**

The steps shall be fixed in brick masonry wall with 1:2:4 cement concrete with 75 mm cement concrete cover at all around the step. The first step shall be 450 mm below from top surface of structure and next shall be fixed 300 mm centre to centre in two rows at 300 mm distance or as shown in the drawing.

#### **4.6.4 PAINTING**

The projected portion of the cast iron step shall be painted with two coats of approved black bitumastic anti corrosive paint over a coat of primer.

#### **4.6.5 DEWATERING**

The contract rate shall include bailing or pumping out all the water if accumulated during the progress of the work either from rain, seepage, springs or any other cause.

#### **4.6.6 THE RATE INCLUDES FOR**

1. C.I. Steps cement concrete and painting etc.
2. Dewatering if found necessary till completion of work.
3. All necessary labor, material and use of tools.

#### **4.6.7 MODE OF MEASUREMENT**

The measurement for C.I. steps shall be on actual unit weight basis or unit C.I. step fixed as specified in the schedule.

#### **4.6.8 MODE OF PAYMENT**

The contract rate for C.I. steps shall be on actual unit weight basis or unit C.I. step fixed.

### **4.7 RCC PIPES**

#### **4.7.1 GENERAL**

The item includes supplying, laying and fixing the Non-Pressurized Reinforced Cement Concrete pipes of Class NP3 constructed as per IS: 458, with necessary fittings of specified diameter including laying, jointing etc for external drainage disposal.



#### 4.7.2 MATERIAL

The pipe shall be new & of first class quality RCC & free from rough texture, inside & outside straight with uniform bore throughout.

All pipes shall be centrifugally spun NP3 class unless otherwise specified.

Pipe shall be tested at manufacturer's works prior to dispatch at site. A certificate shall be produce for the same.

Pipe shall be with or without reinforcement as required & of the class as specified.

The pipes shall conform to IS: 458.

#### 4.7.3 LAYING

RCC spun pipes shall be laid on cement concrete bed or cradles as specified. Cradles shall be pre cast & sufficiently cured to prevent cracks & breakage in handling.

The invert of cradle shall be left 12 mm below the invert level of the pipe & properly placed on the soil to prevent any disturbance.

The pipe shall then be placed on cradles & set for the line & gradient by means of sight rails, bonding rods, etc. Cradles or concrete bed may be omitted if directed by engineer in charge.

#### 4.7.4 JOINTING

After setting out the pipes, the collars shall be centered over the joint & filled in with tarred gaskin, so that sufficient space is left on either side of the collar to receive mortar.

The space then shall be filled with cement mortar 1:2 & caulked by means of proper tools.

All joints shall be finished at an angle of 45 degree to the longitudinal axis of the pipe on both sides of the collars neatly.

**4.7.5 TESTING**

All pipes shall be tested to a hydraulic test of 2.5 m head for at least 50 minutes at the highest point in the section under test.

Smoke test is to be carried out by the contractor, if directed by engineer in charge.

**4.7.6 RATES**

1. RCC pipes of specified diameter.
2. Laying the pipe wherever necessary and wastage.
3. Underground installation with trenching, bedding, encasing, dewatering, etc. civil work as specified in schedule of quantities.
4. Making joint, painting the pipe line if mentioned in schedule of quantities.
5. Making all damage good to original condition after completion of installation work.
6. Testing the entire system and rectification of defects if any.
7. All necessary materials, labor and use of tools.

**4.7.7 MODE OF MEASUREMENT**

The measurement shall be for unit running meter length of pipe line laid or fixed. The measurement shall be taken along the center line of pipe. No measurement shall be recorded separately for fittings, making joint, painting, It shall also include required civil work for underground installation if mentioned in schedule of quantities.

**4.7.8 MODE OF PAYMENT**

Mode of payment shall be Unit length of pipe line laid or fixed. No extra payment shall be made for fittings, making joint, painting. It shall also include required civil work for underground installation if mentioned in schedule of quantities.

**4.8 VERTICAL TURBINE PUMP SYSTEM****4.8.1 SCOPE**

4.8.1.1 This Specification is for close-coupled vertical turbine pumps for applications in sumps or suction cans, including discharge head, column, shaft, bowl assembly, vortex suppressor, lubrication system, and, if applicable, suction can. All equipment furnished under this section shall be new and of current manufacture and shall be guaranteed free from defects in material, design, or workmanship. All parts of the pump exposed to water shall be of stainless steel, brass, heavy cast iron, or equivalent corrosion-proof material. Unless otherwise specified herein, all applicable provisions of ANSI/AWWA E-101, Part A, latest edition, for Vertical Turbine Pumps, are hereby made a part of these Specifications.

4.8.1.2 The item includes the Vertical Turbine Centrifugal Type Pumps, pump suction & delivery piping, manifolds & valves, flexible bellows, Fixed speed/ variable frequency drive, control panels, (Microprocessor based operation) and all accessories including installation, testing & commissioning.

**4.8.2 TECHNICAL SPECIFICATION FOR VERTICAL TURBINE PUMP FOR FLOOR WATER ACTIVE WATER DRAINAGE TRANSFER****4.8.2.1.1 SCOPE**

This specification together with the attendant data sheets covers the technical requirement for the design, manufacture, inspection and testing at vendor's works, delivery to site and guarantee of vertical turbine pump for floor water active water drainage, complete with driver and drive mechanisms, reducing gears if any, lubricating systems, controls, safety devices and instrumentation and all required auxiliary equipment.

Bidder shall be thoroughly conversant with the specified requirements, high quality and standards in engineering and workmanship for a satisfactory and trouble free operation of the pumps throughout the guaranteed life time.

The equipment to be offered against this tender will be of proven design by way of a record of longtime, trouble free field operation, without any deficiency and problem what so ever. As such, manufacturing technicalities to achieve high engineering quality and performance guarantee for compliance with this specification shall be the prime responsibility of the successful bidder.

#### **4.8.2.2 UNIT RESPONSIBILITY:**

All combinations of manufactured equipment which are approved under this specification shall be entirely compatible and the Contractor and the listed manufacturer shall be responsible for the compatible and successful operation of the various components of the units conforming to the specified requirements. All necessary mountings, couplings, and appurtenances shall be included with each unit. All materials employed in the pump equipment shall be suitable for the intended application and shall be high grade commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended. Should the equipment selected by the Contractor require revisions to the structures, piping, electrical, or other work shown on the drawings, the Contractor shall include the cost of such revisions in his bid for the equipment, and no extra payment shall be made for such revisions. All such revisions shall be submitted for approval of and shall be subject to the approval of the Engineer-in-charge.

#### **4.8.2.3 SUBMITTALS:**

Submittals shall be provided to the Engineer for approval prior to beginning manufacture/construction of the pumping units in accordance with the General Conditions.

Submittals shall include:

A. Shop Drawings including the following information:

1. Pump name and identification number.
2. Pumping unit outline diagrams.
3. Pump detailed description and specification.
4. Electrical data including control and wiring diagrams.
5. Assembly and installation drawings including shaft size, coupling anchor bolt plan, part nomenclature, materials list, outline, dimensions, and shipping weight.

B. Certified Pump Curves showing head versus capacity, bowl efficiency versus capacity; NPSH and BHP requirements, and thrust and moment of inertia characteristics. Each curve shall be continuous over the full operating range from zero (0) flow up to the maximum flow permissible through each pump, and shall be based upon the RPM listed. Each curve shall state the RPM speed of the pumping unit, and shall be furnished fullsize on 8-1/2" x 11" paper. The Contractor shall provide pumps capable of meeting all aspects of the Detailed Vertical Turbine Pump Specification section and as shown on the Drawings.

C. Operation & Maintenance Manuals.

Sets of printed instructions relating to proper maintenance and parts lists indicating the various parts by name, number and diagram where necessary shall be furnished in duplicate with each unit or set of identical units as required by the General and/or Special Conditions. Recommended spare parts lists shall be included and local supplier's name where spare parts are available.

**4.8.2.4 OPERATING CONDITIONS:**

The capacities, heads, efficiencies, and horsepower requirements are for completely assembled units and are specified in the Detailed Vertical Turbine Pump Specification section. Each pumping unit shall meet the requirements and design points as specified therein. Each pump and motor combination shall be matched to deliver at least the maximum flow rate at the rated speed without entering into the motor's service factor. Motors shall meet the requirements of Section 16150 and shall be the "hollowshaft" type. The units shall be capable of withstanding a complete flow reversal (backspinning) without damage to the pump, motor, bowls, or line shaft.

**4.8.2.5 DESIGN & CONSTRUCTION FEATURES**

**4.8.2.5.1 PUMP CONSTRUCTION**

**A. Pump Bowls.**

The bowls shall be of close-grained, gray cast iron, Class 30 or better, precision cast, free from blow holes, sand pockets, and other detrimental defects. The water passageways in said bowls shall be smooth so as to allow freedom from cavitation and permit maximum efficiency. For pumps with totally enclosed impellers, (all pumps less than 75 B.H.P.), each bowl shall have a rubber or bronze lateral seal ring and a side seal to prevent slippage of

water between bowl and impeller. In order to improve the guaranteed efficiency of the design point(s), lined bowls shall be furnished. Said lining, vitreous porcelain enamel or equal, shall be of such material and applied in such manner to produce a long effective life which shall not be applied for the purpose of a short time gain in efficiency. Lining, identical to that furnished hereunder, shall have been used in the field, under identical conditions, with satisfactory results for a least a five-year period. The outside diameter of the bowls shall be of such size to fit the suction can I.D., with proper clearances. The bowls shall be able to withstand a minimum of 1-1/2 times the maximum pump shut-off head (zero GPM) pressure or twice the pressure at rated capacity, whichever is greater. In no case shall the pressure rating of the bowl be less than 300 psi. Bowl material shall have a minimum tensile strength of 30,000 psi.

#### **B. Pump Impellers.**

Impellers for pumps less than 75 B.H.P. shall be the totally enclosed type. For applications of 75 B.H.P. or greater, impellers may be either the totally enclosed or semi-open type unless otherwise specified in the Detailed Vertical Turbine Pump Specification section. The impellers shall be of the enclosed or semi-open type, constructed of SAE 40 or 64 bronze. They shall be balanced hydraulically and dynamically to prevent vibration and shall be smoothly finished on all surfaces to reduce friction losses to a minimum. The impellers shall be accurately fitted and securely locked to the pump shaft and vertical adjustment of the impellers shall be possible by means of an adjustment method in the driver assembly.

#### **C. Impeller Lock Collets.**

The lock collets shall be constructed of AISI-1113 steel or stainless steel.

#### **D. Pump Shaft.**

The pump shaft shall be constructed of AISI-416 stainless steel and shall be accurately machined to a sufficient dimension to provide smooth operation and to easily withstand torsional loads and other stresses encountered within the pump. The pump shaft shall have adequate bearing support at every bowl section and at the top and bottom case section and shall be equipped with a suitable steel coupling for connection to the line shaft.

**E. Pump Bearings.**

The suction case section and the discharge case section shall be sleeve type constructed of SAE 64 bronze. The bowl bearings shall be sleeve type of zinc-free bronze, or equal as approved by the engineer. Bearing area, bearing cooling, and bearing lubrication shall be ample for long trouble-free operating life of the equipment.

**F. Pump Discharge Case.**

The discharge case shall securely fasten the top pump bowl assembly to the column piping. This section shall be heavily reinforced with streamlined fluid passages and shall contain bearings for the pump shaft.

**G. Pump Suction Case.**

The suction case shall securely fasten the bottom bowl assembly to the suction bell. This section shall be heavily reinforced with streamlined fluid passages and shall contain a sleeve bearing for the pump shaft.

**H. Pump Suction Bell.**

A suction bell constructed of Class 30 cast iron shall be provided, with entrance vanes so designed to allow even flow of water in the pump. The suction bell shall have an inlet area of at least four times the eye area of the impeller supplied.

**I. Pipe Column Nipple.**

The column nipple shall be standard steel pipe and shall conform to the following diameter weight per foot table:

Nominal Sizes (inches)	O.D. (inches)	Weight per Foot (pounds)	Fitting
4	4.500	10.79	Threaded or flanged
6	6.625	18.97	Threaded or

			flanged
8	8.625	28.55	Threaded or flanged
10	10.750	40.48	Flanged only
12	12.750	49.58	Flanged only
14	14.000	54.57	Flanged only
16	16.000	62.58	Flanged only

For columns 8" in diameter and smaller, the column may be threaded.

For diameters 10" and larger, the column shall be a flanged assembly. The ends of the pipe section shall be faced parallel and machined with threads and/or flanged to insure proper alignment when assembled. The exterior and interior surfaces of all column pipe shall be cleaned, primed, and lined with high build epoxy, or approved equal, with application procedures per paint and manufacturer's published instructions. The minimum thickness shall be 10 mils applied in no less than three (3) coats.

#### **J. Pump Discharge Head Assembly.**

The pump discharge head shall be of fabricated steel or close grained, cast iron, ASTMA48 Class 30. Unless specifically shown on the construction drawings, the pump supplier shall be responsible for determining the type of discharge head to be used for the given application. Cast iron discharge heads shall be free of sand holes and other defects, accurately machined and with a surface discharge. Discharge shall be machined and drilled to ANSI standards for 125# rating and shall be of the diameter shown on the construction drawings. The top of the discharge head shall have a rabbet fit to accurately locate the vertical hollow shaft driver, and have a diameter equal to the driver base diameter (BD).

A shaft mechanical seal assembly of silicon carbide steel shall be provided, including permanent seal housing with renewable internals (faces and springs, etc.).

The seal assembly shall be approved by the Engineer and shall be manufactured by Chesterton, No. 155 or approved equal; specifically selected for the fluid being pumped at shut-off head pressure.



**K. Pump Line Shaft Assembly.**

A line shaft shall be supplied, of ASTM A276, Type 416 material, or equal as approved by the Engineer, and shall conform to AWWA E-101, Section A4.3 and A5.5. L.

**L. Pump Nameplate.**

The pump shall be supplied with an easy-to-read, corrosion resistant nameplate. It shall contain complete pump information including: pump manufacturer's name, serial number, pump model number, number of stages, speed, T.D.H. and capacity in GPM at the middle design point, year manufactured, etc. Said nameplate shall be mounted on the pump head.

**M. Watertight Seal.**

There shall be an appropriate full-face gasket installed between the suction can flange and the pump discharge head assembly to insure and provide a watertight seal.

**N. Vortex Suppressor.**

A stainless steel vortex suppressor, as manufactured by Peerless Pump Company or approved equal, shall be provided and attached to the suction bell of the pump in order to prevent excessive turbulence in the water as it passes from the suction inlet pipe into the suction can, down between the bowl assembly and the suction can, and into the suction bell of the pump.

**O. Thrust Bearings.**

Up-thrust loads encountered in normal service, including start-up, shall be accommodated by suitable thrust bearings in the pump and/or motor assembly.

**P. Coupling.**

The pump/hollow shaft motor coupling shall be, type 416 stainless steel and shall be capable of transmitting the total torque of the unit in either direction.

**4.8.3 SUCTION CAN**

(Applicable where required by Drawings or Special Conditions)

**A. Size.**

Suction cans shall be sized as shown on the Drawings unless a larger diameter or length is recommended by the pump manufacturer. As a minimum, suction cans shall be of sufficient size to accept a pump with a one inch larger diameter bowl (note this does not refer to impeller trim) and one additional stage. The can inside diameter shall be adequate to accommodate the column pipe flanges, and where applicable, provide adequate clearance for flow around flanges (i.e. tee head pumps).

**B. Materials & Fabrication.**

Suction cans shall be equipped with an adequately sized steel base plate, welded to top of can, designed for attachment of the pump discharge head. Suction can, including suction inlet pipe, shall be cement mortar lined by centrifugal application, in accordance with accepted manufacturing standards. Suction can coating shall be one (1) shop applied coat of damp-proof red primer (SO), refer to "Protective Coating for Water Pumping Plants," System P1, Section 09871.

**4.8.4 PUMP REQUIREMENTS - GENERAL****A. Pressure Gauges.**

Pressure gauges shall be installed on all pump discharge lines and, where applicable, on the pump suction via a port in the discharge head or suction can baseplate. The pressure gauges shall be 4" diameter and accurate to one-half percent of full-scale.

**B. Suction Can Air Release Valve (where applicable).**

A one (1) inch air release valve shall be installed on the discharge head or suction can baseplate for the purpose of venting accumulated air in the suction can. The valve shall be Model 50 as manufactured by APCO or approved equal.

**4.8.5 PART 3 - EXECUTION****4.8.5.1 PUMPING UNIT - PUMP SUPPLIER REQUIREMENTS**

Pump supplier shall have complete office/shop facilities located within 100 miles of the job site, and shall have a 10 years minimum successful experience record for pump sales/service.

**4.8.5.2 DELIVERY**

The Contractor shall order the pump at the earliest possible time to allow time for the preparation, submittal, approval of shop drawings, and subsequent manufacture and installation of the pump in a timely manner.

**4.8.5.3 PREPARATION**

Sets of instructions for field procedures for erection, adjustments, inspection, and testing shall be provided prior to installation of the pumps, as required by the General or Special Conditions.

**4.8.5.4 EQUIPMENT TESTING**

The purpose of equipment testing is to demonstrate that the pump units meet the specified requirements.

A. Tests shall be performed on the actual assembled unit over the entire operating range on the certified performance curve. Prototype model tests will not be acceptable.

B. All pumps 10 to 50 horsepower shall be factory-tested in accordance with the above specifications. Pumps larger than 50 horsepower may be subject to a "factory witness test" attended by a notified representative. The Engineer-in-charge shall be notified at least 2 weeks in advance such that a representative can witness the pump testing. Certified test results shall be submitted to the Engineer for approval prior to shipment.

C. Pump curves shall reflect data secured during actual test runs and shall be signed by a responsible representative of the pump manufacture. Test reports and procedures shall conform to applicable requirements of the Hydraulic Institute Standards.

**4.8.5.5 INSTALLATION**

The Contractor shall install all pumping equipment in strict accordance with the manufacturer's instructions. Care shall be used in handling to avoid bumping, twisting, dropping, or otherwise damaging the equipment. All pump manufacturers shall furnish the services of factory-trained personnel as required to examine the installation, supervise start-up of equipment installed, and repair the equipment at no additional expense to the Engineer-in-charge.

**4.8.5.6 FIELD ACCEPTANCE TEST**

The contractor under this specification shall have full responsibility for the proper installation and performance of said pumping equipment, including furnishing the services of a pumping equipment Field Service Engineer to inspect equipment installation, and to adjust, if necessary, any portion of the pumping equipment required herein. The manufacturer's Field Service Engineer shall assist the District in the proper conduct of pumping unit field acceptance tests. The pump units shall perform in the field as shown on the certified pump curves furnished by the Contractor. Tests shall also demonstrate operation without cavitation, vibration, overheating of moving parts, and excessive noise. The Contractor and pump manufacturer shall make necessary corrections to achieve smooth pump operation. In the event the tests reveal noncompliance of the workmanship or equipment, the Contractor shall either make alterations as necessary or replace the pumps in order to meet the requirements of the specifications at no additional cost to the Engineer-in-charge.

**4.8.5.7 CERTIFICATION OF INSTALLATION**

The Contractor shall submit the attached "Manufacturer's Certificate of Proper Installation" to the District confirming that all pumping equipment was inspected, operation checked, and installation approved in writing by the respective pumping equipment supplier.

**4.8.5.8 WARRANTY**

All pumping equipment shall carry an extended warranty for a two year period from the date of acceptance. All warranties shall be turned into the District prior to project completion.

**4.8.5.9 MAINTENANCE BOND FOR PUMPING EQUIPMENT**

The contractor or supplier shall provide a maintenance bond from a bonding company acceptable to the Engineer-in-charge equal to 100% of the pumping equipment value (including motors, pumps and pump assemblies) for a two (2) year term starting when the Engineer-in-charge has accepted the contracted work. Equipment and/or components failing within this period due to deficiency in design, workmanship or material shall be removed, replaced, and reinstalled at no cost to the Engineer-in-charge, and said replacement shall be guaranteed for two years continuous service.

The maintenance bond shall be submitted to the Engineer-in-charge prior to the performance test of the pump(s).

**LIST OF APPROVED MAKES:**

Sr.No.	Item	Approved Make
1	R.C.C. Pipes (NP3)	ALCOCK / INDIAN HUME PIPE / EQUIVALENT
2	VERTICAL TURBINE PUMP	LUBI OR EQUIVALENT
3	M.S. RUNGS	KK India / KGM / Accurate Buildcon
4	C.I. GRATING & COVERS	NECO / Thermodrain / Crescent Foundries