

**RAJKOT MUNICIPAL CORPORATION**  
(RMC)



**BID DOCUMENT FOR**

**CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) FLYOVER BRIDGE AT NANA  
MAVA ROAD CROSSING ON 150 FT RIG ROAD (BRTS CORRIDOR) AT 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) FLYOVER BRIDGE AT NANA MAVA ROAD CROSSING ON 150 FT RIG ROAD (BRTS CORRIDOR) AT RAJKOT**

1. Rajkot Municipal Corporation invites bids with two-bid system 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 criteriaas specified.

Sr. No.	Name of work	a) Estimated cost. b) EMD (Bid Security 1%) c) E-TENDER fee. d) Time limit for comp. of work e) Registration Class
1	Construction of 4 lane (2 lane +2 lane) flyover bridge at Nana mava road crossing on 150 ft. Ring Road (BRTS Corridor) at Rajkot.	a) Rs. 30,40,26,796/- b) Rs. 30,40,268/ - c) Rs. 23,500/- d) 24Months (including monsoonperiod) e) Class 'AA' category and SpecialCategory-1 for bridges

**Milestone Dates for e-Tendering**

Milestone Dates for e-Tendering		
1	Downloading of e-Tender documents	16/03/2020 to 31/03/2020 up to 18:00 Hrs.
2	Pre- Bid Meeting at West Zone Conference Room, RMC	23/03/2020 at 16:00 Hrs.
3	Last date of online submission of e - Tender	31/03/2020 up to 18:00 Hrs.
4	Physical submission of EMD, Tender fee and other required documents as per Financial, Experience criteria etc. by SPEED POST/RPAD Only	03/04/2020 up to 18:00 Hrs.
5	Verification of submitted documents	04/04/2020 at 11:00 Hours onwards
6	Opening of online Technical Bid	04/04/2020 at 11:00 Hours onwards
7	Physical Verification of documents submitted (originals to be bought by contractor)	07/04/2020 between 11:00 to 13:00 Hours
8	Opening of Price Bid for technically qualified bidders only (if possible)	08/04/2020 at 11:00 Hours onwards
9	Bid Validity	180 Days

1. 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 ICIC0000153 or submit at below mentioned address only in form of DD and DD/FDR/BG respectively in favor of "Rajkot Municipal Corporation", Rajkot, from any Nationalized OR Scheduled Bank (except Cooperative Bank) in India. The DD/FDR/BG No., date and name of the bank, branch shall have to be mentioned online and subsequently it 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 Addl. City Engineer  
Rajkot Municipal Corporation,  
West Zone, Shri Harisinghji Gohil Zone Office,  
150' Ring Road, Behind Big Bazar  
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, 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. 300 Lacs
- (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).

- **The bidder(s) submitting the tender shall also have to submit the copy of ESIC & EPF Registration document along with the other documents, duly self attested, failing which, the tender of such bidder(s) will be considered as non-responsive and their online price bid will not be opened.**

**B. Experience Criteria:**

The bidder should possess following minimum experience.

- (a) Bidder should have completed at least one work of similar nature of 60% or two works of 40% or

three works of 30% each of tender amount is completed in last seven years.

Similar nature work shall mean construction of Fly over bridge (FOB) or Railway over bridge (ROB) with Precast/PSC/Composite girder.

Additionally the agency should have carried out the followings:

- i. Open foundation in rocky strata for any bridge work
- ii. At least one completed work of 20m or larger span of RCC box / RCC/Precast/Steel/Composite Girder for 2 or more lane vehicular traffic

(b) 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. Year 2019-20 shall be effective as base with zero enhancement.

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. Pre-Bid Queries to be submit online before 24 Hours on email Id: ksgohel@rmc.gov.in
6. 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  
BID INFORMATION**

Municipal Commissioner, Rajkot Municipal Corporation, invites sealed tenders on Percentage rate basis from the experienced contractors for **Construction of 4 lane (2 lane +2 lane) Flyover Bridge at Nana mava road crossing on 150 ft. Ring Road (BRTS Corridor) at Rajkot**

- |                                    |  |
|------------------------------------|--|
| 1. Name of Work:                   | <b>Construction of 4 lane (2 lane + 2 lane) Flyover Bridge at Nana mava road crossing on 150 ft. Ring Road (BRTS Corridor) at Rajkot</b> |
| 2. Estimated Amount put to tender  | Rs. 30,40,26,796/-   |
| 3. Time Limit:                     | 24 Months including monsoon period.  |
| 4. 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, contractors registered in Other State Government/ Central Government in appropriate class and meeting the qualifying criteria as specified.

**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. 300 Lacs
- (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 tenders are invited).

**Experience Criteria:**

The bidder should possess following minimum experience.

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

Similar nature work shall mean construction of Fly over bridge (FOB) or Railway over bridge (ROB) in city area only.

Additionally the agency should have carried out the followings:

- iii. Open foundation in rocky strata for any bridge work
- iv. At least one completed work of 20 m or larger span of RCC box / RCC Plate girder/composite

Girder for 2 or more lane vehicular traffic

(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.

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.

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.

Right to accept / reject any or all e-Tender(s) without assigning any reasons is here by reserved.

5. Tender Fee(Nonrefundable): Rs.23,500/- (only Demand Draft in favor of Rajkot Municipal Corporation, Rajkot) OR directly deposited in Account No. 015305010638 (Rajkot Municipal Corporation) IFSC Code ICIC0000153
6. Bid Security (EMD): **1% of estimated cost**Rs. 30,40,268/- **in form of DD/FDR/BG** in favor of Rajkot Municipal Corporation, Rajkot To be submitted of any Nationalized OR Scheduled Bank (Except Cooperative Bank) valid for 180 days OR directly deposited in Account No. 015305010638 (Rajkot Municipal Corporation) IFSC Code ICIC0000153
7. Downloading of e-tender documents:Date From: 16/03/2020 to 31/03/2020 up to 18:00 Hrs.
8. Submission of Bid Security and Tender Fees to be submitted in separate sealed cover on 31/03/2020 upto to 18:00Hrs. AtOffice of the City EngineerthroughRPAD or speed post only and shall reach on time. Delayed receipt shall not be opened and return to the bidder. The City Engineer Rajkot Municipal Corporation, West Zone, Shri Harisinghji Gohil Zone Office,150' Ring Road, Behind Big Bazar, Rajkot – 360005.Gujarat.
9. Pre bid meeting: Date As prescribed in Milestone Dates. Quarries for Prebid Meeting should be reach online before 24 hrs. on Email id. ksgohel@rmc.gov.in  
**Venue:** Conference Hall, Rajkot Municipal Corporation, Office of the Addl. City Engineer, West Zone, Shri Harisinghji Gohil Zone Office, 150' Ring Road, Behind Big Bazar, Rajkot – 360005.Gujarat.
10. Last date of online submission of e-tender:  
As prescribed in Milestone Dates
11. Time and Date of Opening of technical bid  
As prescribed in Milestone Dates
12. Time and Date of Opening Financial Bid Opening of Qualified bidder's financial bid –  
As prescribed in Milestone Dates.
13. Place of opening of technical bid &financial bid  
Address: Office of the Addl. City Engineer, West Zone, Shri Harisinghji Gohil Zone Office, 150' Ring Road, Behind Big Bazar, Rajkot – 360005.Gujarat.

**Rajkot Municipal Corporation**

**Bid Information**

14. Bid Validity Period: 180 days from date of opening of the bid.

15. Officer Inviting Bid: Municipal Commissioner,  
Rajkot Municipal Corporation

16. Web site: [www.nprocure.com](http://www.nprocure.com) and [www.rmc.gov.in](http://www.rmc.gov.in)

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

Conditional tenders will not be accepted. Rights to reject any or all the tenders without assigning any reasons are hereby reserved.

**Commissioner**  
**Rajkot Municipal Corporation**  
**Rajkot**



## RAJKOT MUNICIPAL CORPORATION

INFORMATION TO TENDERERS**Name of Work: Construction of 4 lane (2 lane +2 lane) Flyover Bridge at Nana mava road crossing on 150 ft. Ring Road (BRTS Corridor) at Rajkot.**

1. Estimated Amount put to Tender: Rs. 30,40,26,796/-
  - f) Bid Security: Rs. 30,40,268/- (1% of Estimated Tender value) to be submitted in form of DD/FDR/BG in favor of Municipal Commissioner, Rajkot valid for (180 days) of any Nationalized OR Scheduled Bank (Except Cooperative Bank) OR directly deposited in Account No. 015305010638 (Rajkot Municipal Corporation) IFSC Code ICIC0000153.
2. Defect Liability Period: 3 Years after issue of completion certificate or otherwise stated in particular item.
3. Bidder should have registration of Employee Provident Fund (EPF) and ESIC.
4. Liquidated Damages: Delay : (0.10%) zero point one zero percentage of contract price for uncompleted work per day subject to a maximum upto (10%) 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 wherever 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. After award of work, agency has to submit the working methodology; list of machinery, staff, source of material for approval. After approval of methodology, mobilization advance shall be release. All work shall be executed at site as per approved methodology, bar chart and schedule.
10. 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.
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 be considered with analysis of 3 quotations.
13. The utilities fouling with Flyover bridge and approach portion, which shall be, shifted by contractor in such a manner that it does not foul with any other activity bridge 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 ten percent of project cost would be released to the agency for commencement of project against the same amount of bank guarantee to be produced by agency to RMC.

“The employer shall make payment of mobilization advance at 10% simple rate of interest per annum, to facilitate mobilization on the part of the contractor not exceeding 10.75%(Ten point Seven five) of the contract value against un revocable and unconditional bank guarantee issued by a Nationalized & Scheduled bank (Except co-operative bank) in India. Such advance will be paid in two installments as under:

- a) 5% of the construction contract price shall be payable after issuance of work order / order to commence the work.
- b) Balance 5% shall be payable after one month of actual mobilization of men, machinery and equipment on site.

The amount of mobilization advance will be recovered as under:

- a) 10% of value of every running account bill.

OR

- b) The total mobilization advance amount will be recovered in original prescribe time limit.

As per above (a) or (b), whichever is higher/earlier

The bidder shall renew the bank guarantee at least 15 days prior to expiry of submitted of bank guarantee failing which employer reserves right to encash the bank guarantee without any prior intimation to bidder or extend it at the risk and cost of contractor which will be recovered from the bill.

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 vide 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. 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.
21. No escalation would be allowed due to changes in taxes and duties
22. Batch mix plant will have to be used for bituminous NSitems
23. 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.
24. Contractor has to provide safety barricades for the bridge taken up for execution keeping sufficient space for traffic as per design & drawings.
25. Excavation in hard rock with Blasting is strictly prohibited for Construction of the bridge and its approaches.

**Rajkot Municipal Corporation****Bid Information**

26. RCC stem finish on exposed surface of RE retaining wall shall be F3 type exposed concrete finish of required quality to be required as per tender item.
27. The earth, which has been excavated on site, shall be reused while filling behind RE retaining walls.
28. During construction of Obligatory span of RCC Girder, corridor for main traffic on both side shall be in operation. For this provision of trusses, resting on temporary steel columns or any other suitable method leaving required traffic corridor shall be provided with 4.5m vertical clearance.
29. Contractor have to set up own laboratory for testing of Concrete cube , sieves, oven, weigh balances, temperature rod, bitumen testing equipment , cement testing etc. as require with calibration certificate along with experience Civil Engineer to conduct tests, prepare test as per frequency.

**Signature of Contractor:****Addl.City Engineer  
Rajkot Municipal Corporation  
Rajkot****Date**

**Section-1 (Instruction to Bidders)  
Rajkot Municipal Corporation**

**CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE) FLYOVER BRIDGE AT NANA  
MAVA ROAD CROSSING ON 150 FT RIG ROAD (BRTS CORRIDOR) AT 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****Table of Clauses**

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- 3.0 Eligible Bidders
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- 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 is 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.
- III. Contractor registered with Government of Gujarat in class ‘AA’ category and special Category-1 for bridges, 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. 300 Lacs
- (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 of 60% or two works of 40% or three works of 30% each of tender amount is completed in last seven years.  
Similar nature work shall mean construction of Fly over bridge (FOB) or Railway over bridge (ROB) with Precast girder/PSC/Composite/Steel Girder in city area only.  
Additionally the agency should have carried out the followings:
- v. Open foundation in rocky strata for any bridge work
  - vi. At least one completed work of 20 m or larger span of RCC box / RCC/PSC/Steel/Composite Girder for 2 or more lane vehicular traffic
- (C) 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, type 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, working methodology

## 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 is delayed / postponed for some administrative / technical decision whatsoever taken by RMC it 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:

**Volume No. 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 discretion, and as necessary the deadline for submission of bids, in accordance with Sub-Clause 19.1.

## 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 Office of the Addl. City Engineer, West Zone, Shri Harisinghji Gohil Zone Office, 150' Ring Road, Behind Big Bazar, Rajkot – 360005. Gujarat.

- (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 gazetteer 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, at par the estimated cost Rs. 30,40,26,796/- and payment will be made as per actual quantity executed and the rate mentioned in price bid with the % (percentage) above or below, at par 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. 015305010638 (Rajkot Municipal Corporation) IFSC Code ICIC0000153.
- 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 'EMD/TENDER FEE' 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 within 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 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 and shall reach on time.

**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 on line only.

**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) Technical Bid as Volume-1 and (2) Bid security & tender fee 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.

- TO - Bid for \_\_\_\_\_ (name of work)
- Bid reference No. \_\_\_\_\_
- DO NOT OPEN BEFORE \_\_\_\_\_ (time& date for bid opening)
- ORIGINAL / Duplicate
- From - 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-tender process 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 time schedule.

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 a holiday, the Bids will be opened by the specified time and location on the next working 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 within 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.

**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 (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 Bid Price 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 ConsultingEngineers 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 Clause30 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 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 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.

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.

**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. 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 shall constitute sufficient grounds for cancellation of the award and forfeiture of EMD and RMC may debar from the works of RMC for the period of three years.
- 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 claims to be made.

**31 Dispute Review Expert /Arbitration**

- 31.1 The word "Arbitration" or "Arbitration Clause" wherever mentioned in this tender document, is now to be treated as "Deleted". In this context, an Order bearing No.RMC/Legal/1858 dated 18-02-2017 of Legal Department of Rajkot Municipal Corporation is uploaded separately along with this tender, which Order, will hereafter referred and taken into consideration for Arbitration related purpose.

**32 Corrupt or Fraudulent Practices**

- 32.1 The Employer will reject a proposal either 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, indefinitely or for a stated period.
- 32.2 Furthermore, Bidders shall be aware of the provision stated in Sub-Clause 23.3

**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

**UNDERTAKING**

I, the undersigned do hereby undertake that our firm M/s \_\_\_\_\_ would invest minimum cash up to 15 % ( Fifteen) 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 ....., in the form detailed in Para ..... 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 .....Of ITB will be taken.

We have reviewed the construction methodology submitted by you along with the bid in response to ITB Clause ..... 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 \_\_\_\_\_ 2020, 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 ..... 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)

**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 obligor, 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**

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Applicable to Establishments Engaged in Building and Other Construction Work

**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 or SMS.

- 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. Special work like HT Steel Girder from approved vendors, bearings, transportation, shall be got approval from the Engineer. 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 RCC girder bridge, Steel girder with RCC deck slab type superstructure, open foundation in rocky strata 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(CAR-Contractor All Risk)**

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. Methodology shall get approved from the Employer.
- 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 100 sq.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, 2TB HDD, DVD combo drive, and latest necessary original software-(Window, Autocad.....of approved useable at site), H.P. Laser jet Printer A-3 size, Camera of Nikon 3500 or equivalent with 256 GB Memory card and internet facility.
  - Drinking water facility
  - Toilets with accessories
  - Full furnished site Laboratory with calibration certificate

**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 programme, Methodology, list of staff, Machineries, Laboratory /equipment 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 day as well as night time by the contractor, wherever required and as directed by the Engineer.

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 Engineer's 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 is responsible.
- b. Permit the use of any temporary works or Contractor's 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 Site Working Methodology related with Items, Quantity of work, Staff deployed at site, List of Machinery, Tools, placement of benchmark, Monthly/weekly bar chart, testing frequency of material, approved vendors, Equipments, etc.... for his consent programme showing the general methods of construction, arrangements, order and timing and sequence for all the activities including traffic diversion, emergency plan, safety plan with resources, resource schedules including material, manpower and machinery and equipment scheduling monthly cash flow forecast and any other details the Engineer may require. This methodology shall be approved and work accordingly.
- 31.3 If at any time it should appear to the Engineer that the actual progress of works does not confirm to the programme to which consent has been given as per clause 31.2 above, the Contractor shall produce, at the request of the Engineer, a revised programme showing modifications to the programme 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 programme, 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 has 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. Contractor has to keep references codes, Manuals, BIS codes at site related with each items.

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 Contractor suffers 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 Contractor's 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 carry out 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. 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. Contractor shall establish full Civil Engineering lab for testing of Cement, Concrete cubes, Bitumaneous, Aggregate and other important items with calibration test report, Authorised Civil Engineer.
  - iii. 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.
  - iv. All samples shall be provided by the Contractor free of costs.
  - v. Tests shall be conducted at per standard frequency in presence of Engineer. Some test shall be conducted from ISO approved lab for reconfirmation of results.
- 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(36months)**

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.

**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, NH-R & B-Rajkot 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 Contractors 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 Contractors 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.

- Payment certificate must be with all Material bills, Test reports, Pour card, Copy of site order book, Material consumption register, Progress photographs as per approved formats.
- 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 lay 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 1931-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 /Escalation During construction phase**

**NOT APPLICABLE and deleted**

**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:

56.2.1 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:

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

56.2.1.2 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

56.2.2 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 Period :36months from date of Handing over site or issuing completion certificate whichever is earliest.

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 28 days 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 Employer's 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 reasonable 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:

57.5 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)

57.6 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 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 anyother 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, ifso instructed by the Engineer, within 14 days of such entry and termination referred toin clause 61.1 above assign to the Employer the benefit of any agreement for thesupply of any goods or materials or services and/or for the execution of any work forthe 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 entirelyoutside the control of either the Engineer or the Contractor the Employer shall certifythat 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 whichcommitment was made.

**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) flyover bridge at Nana mava road crossing on 150 ft Ring Road (BRTS Corridor) at 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 3.0 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. may be 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 Contractors 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 Contractors 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.
- 69.13 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 Engineers 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.
- 69.14 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 to the Engineer the sand needs washing, the same shall be done at contractors cost. The source of sand should be responsibility of contractor and contractor has to get approval from engineer in charge.
- 69.15 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, List of staff, office address, Telephone no, list of procurement of materials query monthly payment schedule list of equipment, list of BIS codes, manuals 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 to such authorities. He shall co-ordinate his activities during execution, with all agencies including RMC, Design Consultants, construction management consultants, agencies like PGVCL (Paschim Gujarat Vij 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 cementas procured by the contractor, consumption in work and balance available on thesite, 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 ofEvents**

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 inwhich the representative to the Engineer and the Contractor/s will have to sign. Allregisters, 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 andtesting of samples in sufficient quantities as required and provided in relevant IS codesat the laboratory approved by the Engineer. All these will be at no extra cost to theclient.

**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 shallinvariably be signed by the contractor or his representative and also by Engineer or hisauthorized 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 tremmie 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 with test certificate of loading 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 like sand, aggregate .... Etc. 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.
- 79.7 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.
- 79.8 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
- 79.9 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.
- 79.10 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.

**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. For Reinforced Earth wall, contractor have to arrange most suitable material for it, accordingly design the structure, its drawing, approve the structure from Approved Govt. institute at own cost and expenditure.
- 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 workup 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 30m<sup>3</sup>/hr for Ready Mixed Concrete within a 10 km radius of the site. No manual concrete is allowed at 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. For precast yard, agency have to arrange own land, water connection, electrical connection, hutment for labour and machinery parking. No hutment, parking facility shall be allowed at construction site.
- 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. 15000/- per month or less. 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 18 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.



**SECTION - III**  
**CONTRACT DATA**

**Section - III:Contract Data**

1. **Name of Work: Construction of 4 lane (2 lane +2 lane) Flyover Bridge at Nana mava road crossing on 150 ft Ring Road (BRTS Corridor) at Rajkot.**
2. The Employer is Rajkot Municipal Corporation  
Address:Office of the Addl. City Engineer, Rajkot Municipal Corporation,West Zone, Shri Harisinghji Gohil Zone Office,150' Ring Road, Behind Big Bazar, Rajkot – 360005.Gujarat.  
  
Name of authorized Representative of Employer: The Municipal Commissioner, Rajkot or his representative deputed by him.
3. The Design Consultant is:  
**JINDALS CONSORTIUM**  
Address: Manthan, 24-C,Navideta Nagar Housing Society,  
Opp. Shivalik-8 Complex, Chandan Park Main Road,  
Rajkot-360005  
Phone: 8320693151.  
Email:jindalsrjt@gmail.com
4. Defect Liability Period: 3 Years after issue of completion certificate or otherwise stated in particular item.
5. The Start Date shall be the date ofnotice to proceed with the works.
6. The Completion Period for the whole of the Works shall be 24( Twenty Four Months) calendar months (including monsoon period) after the start date.
7. The Site is located in Rajkot City.
8. 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
  9. The language of the contract document is English
  10. Subcontracting is allowed only with prior permission from Engineer / Employer.
  11. The Schedule of Other Contractors : Nil

12. The Schedule of Key Personnel As specified.
13. 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.
14. The Site Possession Date shall be the immediate next day on award of work
15. Appointing Authority for the Dispute Review Expert - The Municipal Commissioner, Rajkot Municipal Corporation
16. The period for submission of the programme for approval of Engineer shall be 15 days from the issue of Letter of Acceptance.
17. The period between program updates shall be 15 days.
18. The amount to be withheld for late submission of updated programme shall be Rs. 1,00,000. (Rupees One Lacs). In absence of Team leader- Recovery of Rs.5000/-, Site Engineer- Rs.2000/-, Laboratory Engineer Rs.2000/-, Surveyor Rs. 2000/-, Site Supervisor- Rs.1000/- per day shall be recover from the bill. Contractor have to ensure that Engineers shall be posted as per the requirement and submit the Staff list with CV/Certificate.
19. 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.
20. The currency of the Contract is Indian Rupees.
21. Retention Money @ 5% of value of work done) will be deducted from each RA bill. It will be released as mentioned in tender.
22. Amount of Liquidated damages for delay in completion of works
23. 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.)

24. 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) flyover bridge at Nana mava road crossing on 150 ft Ring Road (BRTS Corridor) at Rajkot.

**1.1 Scope of Work**

Main component of the Fly over Bridge are as under;

- g) Estimated cost of work –Rs. 30,40,26,796/-
  - i) Foundation - Open RCC Foundation
  - ii) Sub-structure - RCC piers
  - iii) Super Structure - PSC Girder 20m span ,HT steel Girder 45m span
  - iv) Bearing –POT PTF
  - v) Approaches –Reinforced Retaining Wall (Design, drawing, approval in scope of contractor with most suitable material)
  - vi) Service road & footpath
  - vii) Electrical component for bridge & service Road
  - viii) Under space development
  - ix) Wearing coat of the bridge
  - x) Storm Water Drainage Disposal and Utility Shifting works

**1.2 Work Planning**

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

The spans of the approach portion are of PSC girder on RCC piers founded on RCC open foundation. At the end RE Retaining Walls are provided. Reinforced Earth wall design/drawing is in the scope of Contractor as contractor has to arrange filling material suitable available near by the location.

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 Bridge
- (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**

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. No overloaded vehicle working at site/carry material at site be allowed to move on bridges, roads, service road, if any damages found due to overloading shall be repair, redo, recovered from the contractor.**

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.

- i)** During Construction of Re retaining walls, Special Precaution shall be taken for Service road vehicular movement.
- ii)** 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.
- iii)** 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 2 months old. The contractor may study the possibility should of adding the necessary plasticizers and admixtures 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 span arrangement shown is tentative and may be changed if any underground services are encountered and is fouling with pier 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 labor 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, methodology. 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, HT steel Girder workshop/welding drawings for structural steel work shall be prepared by the contractor and got approved from the Engineer-in-charge well 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.
3. Contractor have to arrange copy of BIS Codes, MORTH specification manual, Reference codes related with concrete, Material testing, Concrete, Steel, Welding of HT steel girder, Safety, RE wall, Bitumen, machinery manuals and safety manual.

## GENERAL SPECIFICATION

Sr. No.	Section	Item	Page No.
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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. For Reinforced wall, contractor have to arrange most suitable material, design it accordingly at own cost, drawing, specifications, approval of design from the approved Govt. institute and submit the same at own cost.

#### **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.1.8.7 All Excavated Soil, rock shall be dumped in designated place\* as decided by Engineer In Charge**

### **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.

#### B.1.10.5 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 stands 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 upto 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 upto 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.Ifno 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 or 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 filing 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, organize, 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 vibrators<sup>12</sup> 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 43 or 53 Grade 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.5.4.2.1.3All 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.5.4.2.1.4Aggregates 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.5.4.2.2.1Samples 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.5.4.2.4.1Aggregates 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
1.19 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, 1.19 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 1/4th 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
M45	475

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.5.7.2.1.4A 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, falsework, 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 ..
- 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, hessain 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.(POTABLE WATER)

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 from 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 screeding 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.

It is the responsibility of contractor to keep the joints within 3mm tolerances and smooth finish immediately after DE shuttering with grinder, level the joints.No further treatment shall be allowed.

### **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 flowable 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;   | b) Characteristic compressive strength; |
| c) Specified mix proportions;             | d) Minimum cement content;              |
| e) Maximum free-water / cement ratio;     | f) Workability;                         |
| g) Temperature of fresh concrete;         | h) Density of fully compacted concrete; |
| i) Cover to embedded steel;               | j) Curing;                              |
| k) Tolerances in dimensions;              | l) Tolerances in levels;                |
| m) Durability;                            | n) Surface finishes;                    |
| 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.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 take 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-6 Deleted****SECTION: B-7 STRUCTURAL STEEL**

All structural steel , HT 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, steel girder. 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 IS 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 war page 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 gone 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, buckets 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 inclusive of contract and extra payment shall be payable

B.7.12.2 The contract rate shall be suitable for unit of one metric tone of structural steel and quantity shall be from drawing in meters measurement and weight calculated from Steel Table and multiply it.

## **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 conforming 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, appropriate space bars, chairs but wastage, avoidable overlaps, couplis and welded joints, 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-10Deleted**

**SECTION: B-11Deleted**

## **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:

- D) 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 of 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 / cc. 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

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 marker 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 m 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 loosened 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 or any other similar equipment manually or machine operated shall be invariably 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 COARSE 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.
10. For Reinforced Earth wall, contractor have to submit the design of RE Wall, panel size, design/logo on outer panel face, method of casting, erection, transportation as a complete job for approval with material specifications, test report. After approval, casting will take place.

### **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 spoils shall be spread after measurement is recorded and orders are obtained from the Engineer – in –charge.
10. The rubble spoils shall be screened for any rubbish dust or grass. Rubbles or spoils 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 soiling 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 he 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 1S: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 not 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 19%





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
1.19	-	-
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	Minimum VMA, Percent related to design air voids, percent
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particle size (mm)	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, 1.19 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 Gs synthetics 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 shall 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 (ie 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 to 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.



**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
1.19	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 <sup>0</sup> 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 in 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 of 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
- 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), 2419 (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.

**NAME OF WORK: CONSTRUCTION OF 4 LANE (2 LANE + 2 LANE ) FLYOVER BRIDGE AT  
NANA MAVA ROAD CROSSING ON 150 FT RIG ROAD (BRTS  
CORRIDOR) AT RAJKOT**

**ITEMWISE SPECIFICATION**

**Item No. NIL**

**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 four lane bridge is to be done for bridge and also for approaches / RE retaining walls in both ends shall be surveyed along their lengths. Center line pegs for four 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 four lane bridge including tangent distances shall be demarcated 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 in completing the job as required, as per direction of Engineer-in-charge.

**The rate shall be included in the Civil works.**

**Item No.1**

**Dismantling of the existing road, asphaltic road, crust in approach portion including demolishing asphalt carpet with soling, meta etc. with stacking the same as directed by Engineer-in-charge.**

**202 DISMANTLING CULVERTS, BRIDGES AND OTHER STRUCTURES/ PAVEMENTS**

**202.1**

**Scope**

This work shall consist of dismantling and removing existing culverts, bridges, pavements, kerbs and other structures like guard-rails, fences, utility services, manholes, catch basins, inlets, etc., from the right of way which in the opinion of the Engineer interfere with the construction of road or are not suitable to remain in place, disposing of the surplus/unsuitable materials and backfilling to after the required compaction as directed by the Engineer.

Existing culverts, bridges, pavements and other structures which are within the highway and which are designated for removal, shall be removed upto the limit and extent specified in the drawings or as indicated by the Engineer.

Dismantling and removal operations shall be carried out with such equipment and in such a manner as to leave undisturbed, adjacent pavement, structures and any other work to be left in place.

All operations necessary for the removal of any existing structure which might endanger new construction shall be completed prior to the start of new work.

## **202.2**

### **Dismantling Culverts and Bridges**

The structures shall be dismantled carefully and the resulting materials so removed as not to cause any damage to the part of the structure to be retained and any other properties or structures nearby:

Unless otherwise specified, the superstructure portion of culverts/bridges shall be entirely removed and other parts removed up to at least 600 mm below the sub-grade, slope face or original ground level whichever is the lowest or as necessary depending upon the interference they cause to the new construction. Removal of overlying or adjacent material, if required in connection with the dismantling of the structures, shall be incidental to this item.

Where existing culverts/bridges are to be extended or otherwise incorporated in the new work, only such part or parts of the existing structure shall be removed as are necessary and directed by the Engineer to provide a proper connection with the new work. The connecting edges shall be cut, chipped and trimmed to the required lines and grades without weakening or damaging any part of the structure to be retained. Due care should be taken to ensure that reinforcing bars which are to be left in place so as to project into the new work as dowels or ties are not injured during removal of concrete.

Pipe culverts shall be carefully removed in such a manner as to avoid damage to the pipes. Steel structures shall, unless otherwise provided, be carefully dismantled in such a manner as to avoid damage to members thereof. If specified in the drawings or directed by the Engineer that the structure is to be removed in a condition suitable for re-erection, all members shall be match-marked by the Contractor with white lead paint before dismantling; end pins, nuts, loose plates, etc. shall be similarly marked to indicate their proper location; all pins, pin holes machined surfaces shall be painted with a mixture of white lead and tallow and all loose s shall be securely wired to adjacent members or packed in boxes.

Timber structures shall be removed in such a manner as to avoid damage to such timber or lumber having salvage value as is designated by the Engineer.

### **202.3 Dismantling Pavements and Other Structures**

In removing pavements, kerbs, gutters, and other structures like guard-rails, fences, holes, catch basins, inlets, etc., where portions of the existing construction are to be left e finished work, the same shall be removed to an existing joint or cut and chipped to a line with a face perpendicular to the surface of the existing structure. Sufficient removal shall be made to provide for proper grades and connections with the new work as directed by the Engineer.

All concrete pavements, base courses in carriageway and shoulders etc., designated for oval shall be broken to pieces whose volume shall not exceed 0.02 cu.m and used with approval of the Engineer or disposed off.

### **202.4 Back-filling**

Holes and depressions caused by dismantling operations shall be backfilled with excavated her approved materials and compacted to required density as directed by the Engineer.

### **202.5 Disposal of Materials**

**All dismantled material shall be dumped in designated place\* as decided by Engineer In Charge**

## 202.6 Measurements for Payment

The work of dismantling shall be paid for in units indicated below by taking measurements re and after, as applicable:

i)	Dismantling brick/stone masonry/concrete (plain and reinforced)	cu.
ii)	) Dismantling flexible and cement concrete pavement	mcu
iii)	Dismantling steel structures	tonne
iv)	Dismantling timber structures	cu.m
v)	Dismantling pipes, guardrails, kerbs, gutters and fencing	linear m
vi)	Utility services	No.

## 202.7 Rates

The Contract unit rates for the various items of dismantling shall be paid in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment, safeguards and incidentals necessary to complete the work. The rates will include excavation and backfilling to the required compaction and for handling, giving credit towards salvage value disposing of dismantled materials with all lifts and leads.

**ItemNo.1.1**

**Providing and installation of barricading of G.I. Sheet with retro-reflective paint/film/tapes, 3m high with angle iron as per approved drawing around the construction site of bridge along with necessary diversion arrangement for smooth movement of traffic round the clock, all direction signs, diversion board with light in the night with all fabrications, tools, Equipments, alignment, shifting, reshifting, foundation work, drilling, grouting ,all material, labour with all taxes. Contractor have to maintain the barricading throughout the construction period and clean it/wash it every 15 days for clear visibility. After completion of Project, contractor will take it so 50% cost is considered as resale value in this estimate.**

1. Relevant Specifications of MORT&H fifth revision Section – 800 &1900 shall apply to this item specifications as given in item shall apply to this item.
2. The measurements shall be based on Sq.m. (each segment of 3.0m length to be considered for payment)
3. The rate includes labour, material, equipment & removal the same after completion of work. (All material will be the property of the contractor after completion of the bridge).
4. The mode of payments shall be in per Sq.m. basis.

**ItemNo.2.1**

**Excavation for foundation in sand, gravel, clay soft soils and murrum etc. including shoring, strutting dewatering as necessary and disposing of the excavated stuff in designated place\* as directed.(A) Depth upto 3.0 M. and lead upto 100m for 10 Cum.**

1. The relevant specification for excavation for foundation for open foundation given in MORT&H fifth revision Clause-304 & RDSO specifications shall be applicable to this item.
2. The measurements shall be in Cum. basis.
3. The rate includes shoring, strutting, dewatering, as necessary and disposing of the excavated stuff as directed.
4. The mode of payments shall be in per cum. basis.
5. All Excavated sand, gravel, clay soft soils and murrum etc. shall be dumped out side of the Rajkot City area as decided by Engineer In Charge

**ItemNo.2.2**

**Excavation in large boulders and soft rock by wedging including shoring, strutting and dewatering as necessary and disposing of the excavated stuff in designated place\* as directed by Engineer in Charge.**

**AND**

**ItemNo.2.3**

**Excavation in hard rock by dry-wet blasting and mechanically chiselling, hammering including dewatering preparing foundation base by proper benching and stepping and disposing of the excavated stuff in designated place\* as directed.(B) prohibited Blasting. work.**

**301.1 Scope**

This work shall consist of excavation, removal and disposal of materials necessary for the construction of roadway, side drains and waterways in accordance with requirements of these Specifications and the lines, grades and cross-sections shown in the drawings or as indicated by the Engineer. It shall include the hauling and stacking of for hauling to sites of embankment and subgrade construction suitable cut materials as required, as also the disposal of unsuitable cut materials in specified manner, with all leads and lifts, reuse of cut materials as may be deemed fit, trimming and finishing of the road to specified dimensions or as directed by the Engineer.



## 301.2 Classification of Excavated Material

301.2.1 **Classification:** All materials involved in excavations shall be classified by the Engineer in the following manner:

**a) Soil:**

This shall comprise top soil, turf, sand, silt, loam, clay, mud, peat, black-cotton soil, soft shale or loose moorum, a mixture of these and similar material which yields to the ordinary application of pick, spade and/or shovel, rake or other ordinary digging equipment. Removal of gravel or any other modular material having dimensions in any one direction not exceeding 75 mm shall be deemed to be covered under this category.

**b) 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 crowbars, 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 bound; soling of roads, cement concrete pavement, cobblestone, etc. compacted moorum or stabilized soil requiring use of pickaxe or shovel or both.
- iii) lime concrete, stone masonry and brick work in lime/cement mortar below ground level, reinforced cement concrete which may be broken up with crowbars or picks and stone masonry in cement mortar below ground level; and
- iv) boulders which do not require blasting found lying loose on the surface or embedded in river bed, soil, talus, slope wash and terraced material of dissimilar origin.

**c) Hard Rock (requiring blasting) This shall comprise:**

- 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 below ground level and in bridge/ROB/RUB/flyover piers and abutments, boulders requiring blasting.

**d) Hard Rock (using controlled blasting):**

Hard rock requiring blasting as described under (c) but where controlled blasting is to be carried out in locations where built-up areas, huts, and are situated at within 200 m of the blast site.

**e) Hard Rock (blasting prohibited)**

Hard rock requiring blasting as described under (d) but where blasting is prohibited for any reason like people living within 20 m of blast sites etc. and excavation has to be carried out by chiseling, wedging or any other agreed method.

**f) Marshy soil**

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

### **301.2.2 Authority for Classification**

The classification of excavation shall be decided by the Engineer and his decision shall be final and binding on the Contractor. Notably the use of explosives in excavation will not be considered as a reason for higher classification unless blasting is clearly necessary in the opinion of the Engineer.

### **301.3 Construction Operations**

#### **301.3.1 Setting Out**

After the site has been cleared as per Clause 201, the limits of excavations shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer. Clause 109 shall be applicable for the setting out operations.

#### **301.3.2 Stripping and Storing Topsoil**

When so directed by the Engineer, the topsoil existing over the sites of excavation shall be stripped to specified depths and stock piled at designated locations for re-use in covering embankments, slopes, cuts, slopes, berms and other disturbed areas where re-vegetation is desired in accordance with Clause 305.3.3. Prior to stripping the topsoil, all trees, shrubs etc. shall be removed along with their roots, with approval of the Engineer.

#### **301.3.3 Excavation-General**

All excavations 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 excavation are satisfactorily utilized as deemed fit or as approved by the Engineer.

While planning or executing excavations, the Contractor shall take all adequate precautions against soil erosion, water pollution etc. as per Clause 306, and take appropriate drainage measures to keep the site free of water in accordance with Clause 311.

The excavations shall conform to the lines, grades, side slopes and levels shown on the drawings or as directed by the Engineer. The Contractor shall not excavate outside the limits of excavation. 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 to the requirements of Clause 305.

All debris and loose material on the slopes of cuttings shall be removed. No backfilling shall be allowed to obtain required slopes excepting that when boulders or soft materials are encountered in cuts, slopes, these shall be excavated to approved depth on instructions of the Engineer and the resulting cavities filled with suitable material and thoroughly compacted in an appropriate manner.

After excavation, the sides of excavated area shall be trimmed and the area contoured to minimize erosion and ponding, allowing for natural drainage to take place.

While planning or executing excavations, the Contractor shall take all adequate precautions against soil erosion, water pollution etc. as per Clause 306, and take appropriate drainage measures to keep the site free of water in accordance with Clause 311.

The excavations shall conform to the lines, grades, side slopes and levels shown on the drawings or as directed by the Engineer. The Contractor shall not excavate outside the limits of excavation. 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 to

the requirements of Clause 305.

All debris and loose material on the slopes of cuttings shall be removed. No backfilling shall be allowed to obtain required slopes excepting that when boulders or soft materials are encountered in cut slopes, these shall be excavated to approved depth on instructions of the Engineer and the resulting cavities filled with suitable material and thoroughly compacted in an appropriate manner.

After excavation, the sides of excavated area shall be trimmed and the area contoured to minimize erosion and ponding, allowing for natural drainage to take place.

#### **301.3.4 Methods, Tools and Equipment**

Only such methods, tools and equipment as approved by the Engineer shall be adopted/used in the work. If so desired by the Engineer, the Contractor shall demonstrate the efficacy of the type of equipment to be used before the commencement of work.

#### **301.3.5 Rock Excavation**

Rock, when encountered in road excavation, shall be removed up to the formation level or as otherwise indicated in the drawings. Where, however, unstable shales or other unsuitable materials are encountered at the formation level, these shall be excavated to the extent of 500 mm below the formation level or as otherwise specified. In all cases, the excavation operations shall be so carried out that at no point on cut formations the rock protrudes above the specified levels. Rocks and boulders which are likely to cause differential settlement and also local drainage problems shall be removed to the extent of 500 mm below the formation level in the formation width including side drains.

Where excavation is done to levels lower than those specified, the excess excavation shall be made good as per Clauses 301.3, 3 and 301.6 to the satisfaction of the Engineer. Slopes in rock cutting shall be finished to uniform lines corresponding to slope lines shown on the drawings or as directed by the Engineer. Notwithstanding the foregoing all loose pieces of rock on excavated slope surface which move when pierced by a crowbar shall be removed.

Where blasting is to be resorted to, the same shall be carried out as per Clause 302 and all precautions indicated therein observed.

Where pre-splitting is prescribed to be done for the establishment of a specified slope in rock excavation, the same shall be carried out as per Clause 303.

#### **301.3.6 Marsh Excavation**

The excavation of soil from marshes/swamps shall be carried out as per the programme approved by the Engineer. Excavation of marshes shall begin at one end and proceed in one direction across the entire marsh immediately ahead of backfilling with materials like boulders, sand, moor, bricks, bats, dismantled concrete as approved by the Engineer. The method and sequence of excavating and backfilling shall be such as to ensure, to the extent practicable, the complete removal or displacement of all muck from within the later limits indicated on the drawings or as stated by the Engineer.

#### **301.3.7 Excavation of Road Shoulders/Verge/Median for Widening of Pavement or Providing**

In the works involving widening of existing pavements or providing paved shoulders the existing shoulders/verge/median shall be removed to its full width and up to top of the subgrade. The subgrade material within 500 mm from the bottom of the pavement for the

widened portion or paved shoulders shall be loosened and recompact as per Clause 305. Any unsuitable material found in this portion shall be removed and replaced with the suitable material while doing so, care shall be taken to see that no portion of the existing pavement designated for retention is loosened or disturbed. If the existing pavement gets disturbed or loosened, it shall be dismantled and cut to a regular shape with sides vertical and the disturbed/loosened portion removed completely and relaid as directed by the Engineer, at the cost of the Contractor.

### **301.3.8 Excavation for Surface/Sub-Surface Drains**

Where the Contract provides for construction of surface/sub-surface drains, the same shall be done as per Clause 309. Excavation for these drains shall be carried out in proper sequence with other works as approved by the Engineer.

### **301.3.9 Slides**

If slips, slides, over-breaks or subsidence occur in cuttings during the process of construction, they shall be removed at the cost of the Contractor as ordered by the Engineer. Adequate precautions shall be taken to ensure that during construction, the slopes are not rendered unstable or give rise to recurrent slides after construction. If finished slopes slide into the roadway subsequently, such slides shall be removed and paid for at the Contractor rate for the class of excavation involved, provided the slides are not due to any negligence on the part of the Contractor. The classification of the debris material from the slips, slides etc. shall conform to its condition at the time of removal and payment made accordingly regardless of its condition earlier.

### **301.3.10 Dewatering**

If water is met within the excavations due to springs, seepage, rain or other causes, it shall be removed by suitable diversions, pumping or bailing out and the excavation kept dry whenever so required or directed by the Engineer. Care shall be taken to discharge the drained water into suitable outlets so as not to cause damage to the works, crops or any other property. Due to any negligence on the part of the Contractor, if any such damage is caused, it shall be the sole responsibility of the Contractor to repair/restore to the original condition at his own cost or compensate for the damage.

### **301.3.11 Use and Disposal of Excavated Materials**

All Excavated rock shall be dumped in designated place\* as decided by Engineer In Charge

### **301.3.12 Backfilling**

Backfilling of masonry/concrete or pipe or drain excavation shall be done with approved material with all leads and lifts after concrete/masonry/pipe is fully set and carried out in such a way as not to cause undue thrust on any part of the structure and/or not to cause differential settlement. All space between the drain walls and the side of the excavation shall be backfilled to the original surface making due allowance for settlement, in layers not exceeding 150mm compacted thickness to the required density, using suitable compaction equipment such as trench compactor, mechanical tamper, rammer or plate compactor as directed by the Engineer.

#### **301.4 Plying of Construction Traffic**

Construction traffic shall not use the cut formation and finished subgrade without the prior permission of the Engineer. Any damage arising out of such uses shall be made good by the Contractor at his own cost.

#### **301.5 Preservation of Property**

The Contractor shall undertake all reasonable precautions for the protection and preservation of any or all existing roads, side trees, drains, sewers, sub-surface drains, pipes, conduits and any other structures under or above ground, which may be affected by construction operations and which, in the opinion of the Engineer, shall be continued in use without any change. Safety measures taken by the Contractor in this respect, shall be got approved from the Engineer. However, if any of these objects is damaged by reason of the Contractor's negligence, it shall be replaced or restored to the original condition at his cost. If the Contractor fails to do so, within the required time as directed by the Engineer or if, in the opinion of the Engineer, the actions initiated by the Contractor to replace/restore the damaged objects are not satisfactory, the Engineer shall arrange the replacement/restoration directly through any other agency at the risk and cost of the Contractor after issuing prior notice to the effect.

#### **301.6 Preparation of Cut Formation**

The cut formation, which serves as a sub-grade, shall be prepared to receive the sub-base/base course as directed by the Engineer.

Where the material in the subgrade has a density less than specified in Table 300-1, the same shall be loosened to a depth of 500 mm and compacted in layers in accordance with the requirements of Clause 305 adding fresh material, if any required, to maintain the formation level as shown on the drawings. Any unsuitable material encountered in the subgrade level shall be removed as directed by the Engineer, replaced with suitable material and compacted in accordance with Clause 305.

In rocky formation the surface irregularities shall be corrected and the levels brought up to the specified elevation with granular base material as directed by the Engineer, laid and compacted in accordance with the respective Specifications for these materials. The unsuitable material shall be disposed of in accordance with Clause 301.3.11. After satisfying the density requirements, the cut formation shall be prepared to receive the sub-base/base course in accordance with Clauses 310 and 311.

#### **301.7 Finishing Operations**

Finishing operations shall include the work of properly shaping and dressing all excavated surfaces.

When completed, no point on the slope shall vary from the designated slopes by more than 150 mm measured at right angles to the slope, except where excavation is in rock (ordinary or hard) where no point shall vary more than 300 mm from the designated slope. In no case shall any portion of the slope encroach on the roadway.

The finished cut formation shall satisfy the surface tolerances described in Clause 902.

Where directed, the top soil removed and conserved (Clauses 301.3.2 and 305.3.3) shall be spread over cut slopes, shoulders and other disturbed areas. Slopes may be roughened and moistened slightly, prior to the application of top soil, in order to provide satisfactory bond. The depth of top soil shall be sufficient to sustain plant growth, the usual thickness being from 75 mm to 100 mm.

**301.8 Measurements for Payment**

Excavation for roadway shall be measured by taking cross-sections at suitable intervals before the excavation starts (after clearing and grubbing/stripping etc. as the case may be) and after its completion and computing the volumes in cu. m. by the method of average end areas for each class of material encountered. Where it is not feasible to compute volumes by this method because of erratic location of isolated deposits, the volumes shall be computed by other accepted methods.

At the option of the Engineer, the Contractor shall leave depth indicators during excavations of such shape and size and in such positions as directed so as to indicate the original ground level as accurately as possible. The Contractor shall see that these remain intact till the final measurements are taken.

For rock excavation, the overburden shall be removed first so that necessary cross-sections could be taken for measurement. Where cross-sectional measurements could not be taken due to irregular configuration or where the rock is admixed with other classes of materials, the volumes shall be computed on the basis of measurement of stacks of excavated rubble allowing a deduction of 35% therefrom. When volume is calculated on the basis of measurement of stacks of the excavated material other than rock, a deduction of 16% of stacked volume shall be allowed.

Works involved in the preparation of cut formation shall be measured in units indicated below:

i)	Loosening and recompacting the loosened material at subgrade	Cu.m.
ii)	Loosening and removal of unsuitable material and replacing with suitable material and compacting to required density	Cu.m.
iii)	Preparing rock subgrade	Sq.m.
iv)	Stripping including storing and reapplication of top soil	Cu.m.

**301.9 Rates**

301.9.1 The Contract unit rates for the items of roadway and drain excavations shall be payment in full for carrying out the operations required for the individual items including full compensation for:

- i) setting out;
- ii) transporting the excavated materials for use or disposal with all leads and lifts by giving suitable credit towards the cost of re-usable material and salvage value of unusable material;
- iii) trimming bottom and slopes of excavation;
- iv) dewatering;
- v) keeping the work free of water as per Clause 311;
- vi) arranging disposal sites; and
- vii) all labour, materials, tools, equipment., safety measures, testing and incidentals necessary to complete the work to Specifications.

Where presplitting of rock is prescribed it shall be governed by Clause 303.5.

301.9.2 The Contract unit rate for loosening and recompacting the loosened material at subgrade shall include full compensation for loosening to the specified depth, including breaking clods, spreading in layers, watering where necessary and compacting to the requirements.

301.9.3 Clauses 301.9.1 and 305.8 shall apply as regards Contract unit rate for item of removal of

unsuitable material and replacement with suitable material respectively.

301.9.4 The Contract unit rate for item of preparing rocky sub-grade as per Clause 301.6 shall be full compensation for providing, laying and compacting granular base material for correcting surface irregularities including all materials, labour and incidentals necessary to complete the work and all leads and lifts.

301.9.5 The Contract unit rate for the items of stripping and storing topsoil and of reapplication of topsoil shall include full compensation for all the necessary operations including all lifts and leads.

## **302 BLASTING OPERATIONS**

### **302.1 General**

Blastings shall be carried out in manner that completes the excavation to the lines indicated in drawings, with the least disturbance to adjacent material. It shall be done only with the written permission of the Engineer. All the statutory laws, regulations, rules, etc., pertaining to the acquisition, transportation, storage, handling and use of explosives shall be strictly followed by the contractor.

The Contractor may adopt any method or methods of blasting consistent with the safety and job requirements. Prior to starting any phase of the operation, the Contractor shall provide information describing pertinent blasting procedures, dimensions and notes.

The magazine for the storage of explosives shall be built to the designs and specifications of the Explosives Department concerned and located at the approved site. The storage places shall be clearly marked "DANGER-EXPLOSIVES". The Contractor shall be liable for property damage, injury or death resulting from the use of explosives. All permits shall be obtained by the Contractor. No unauthorized person shall be admitted into the magazine which, when not in use, shall be kept securely locked. No matches or inflammable material shall be allowed in the magazine. The magazine shall have an effective lightning conductor. The following shall be hung in the lobby of the magazine:

- a) A copy of the relevant rules regarding safe storage both in English and in the language with which the workers concerned are familiar,
- b) A statement of up-to-date stock in the magazine,
- c) A certificate showing the last date of testing of the lightning conductor, and d) A notice that smoking is strictly prohibited.

All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be marked. Where no local laws or ordinances apply, storage shall be provided to the satisfaction of the Engineer and in general not closer than 300m from the road or from any building or camping area or place of human occupancy.

In addition to these, the Contractor shall also observe the following instructions and any further additional instructions which may be given by the Engineer and shall be responsible for damage to property and any accident which may occur to workmen or public on account of any operations connected with the storage, handling or use of explosives and blasting. The Engineers shall frequently check the Contractor's compliance with these precautions.

### **302.2 Materials, Tools and Equipment**

All the materials, tools and equipment used for blasting operations shall be of approved type. The Engineer may specify the type of explosive to be allowed in special cases. The fuse to be used in wet locations shall be sufficiently water-resistant as to be unaffected when immersed in water for 30 minutes. The rate of burning of the fuses shall be uniform and definitely known to permit such a length being cut as will permit sufficient time to the firer to reach safely

before explosion takes place. Detonators shall be capable of giving effective blasting of the explosives. The blasting powder, explosives, detonators, fuses, etc., shall be fresh and not damaged due to dampness, moisture or any other cause. They shall be inspected before use and damaged articles shall be discarded totally and removed from the site immediately.

### 302.3

#### **Personnel**

The blasting operation shall remain in the charge of competent and experienced supervisor and workmen who are thoroughly acquainted with the details of handling explosives and blasting operations.

### 302.4

#### **Blasting Operations**

The blasting shall be carried out during the pre-determined hours of the day preferably during the mid-day lunge on hour or at the close of the work as ordered in writing by the Engineer. The hours shall be made known to the people in the vicinity.

The Contractor shall notify each public utility company having structures in proximity to the site of the work of his intention to use explosives. Such notices shall be given sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property from injury. In advance of any blasting work within 50 m of any railway track or structures, the Contractor shall notify the concerned Railway Authority of the location, date, time and approximate duration of such blasting operation.

Red danger flags shall be displayed prominently in all directions during the blasting operations. The flags shall be planted 200 m from the blasting site in all directions. People, except those who actually light the fuse, shall be prohibited from entering this area and all persons including workmen shall be kept away from the flagged area; and all persons, including workmen shall be removed from the flagged area at least 10 minutes before the firing. A warning siren shall be sounded for the above purpose.

Only controlled blasting shall be resorted to along with the safeguard above at locations where built-up area, huts and structures in use lie within 200 m. Similarly excavation of hard rock without blasting is mandatory where people live within 20 m of blast site.

The charge holes shall be drilled to required depths and at suitable places. Blasting should be as light as possible consistent with thorough breakage of the material necessary for economic loading and hauling. Any method of blasting which leads to overshooting shall be discontinued.

When blasting is done with powder, the fuse cut to the required length shall be inserted into the hole and the powder dropped shall be gently tamped with copper rods with rounded ends. The explosive powder shall then be covered with tamping material which shall be tamped lightly but firmly.

When blasting is done with dynamite and other high explosives, dynamite cartridges shall be prepared by inserting the square cut end of a fuse into the detonator and finishing it with nippers at the open end, the detonator gently pushed into the primer leaving 1/3rd of the copper tube exposed outside. The paper of the cartridge shall then be closed up and securely bound with wire or twine. The primers shall be housed into the explosive. Boreholes shall be cleared of all debris and explosives inserted. The space of about 200 mm above the charge shall then be gently filled with dry clay, pressed home and the rest of the tamping formed of any convenient material gently packed with a wooden rammer.

At a time not more than 10 such charges will be prepared and fired. The man in charge shall blow a siren in a recognized manner for cautioning the people. All the people shall then be required to move to safe distances. The charges shall be lighted by the man-in-charge only.



The man-in-charge shall count the number of explosions. He shall satisfy himself that all the charges have been exploded before allowing the workmen to go back to the work site.

After blasting operation, the Contractor shall compact the loose residual material below subgrade and replace the material removed below subgrade with suitable material.

### **302.5 Misfire**

In case of misfire, the following procedure shall be observed:

- i) Sufficient time shall be allowed to account for the delayed blast. The man-in-charge shall inspect all the charges and determine the missed charge.
- ii) If it is the blasting powder charge, it shall be completely flooded with water. A new hole shall be drilled about 450 mm from the old hole and fired. This should blast the old charge. In case, it does not blast the old charge, the procedure shall be repeated till the old charge is blasted.
- iii) In case of charges of gelignite, dynamite, etc., the man in-charge shall gently remove the tamping and the primer with the detonator. A fresh detonator and primers shall then be used to blast the charge. Alternatively, the hole may be cleared of 300 mm of tamping and the direction then ascertained by placing a stick in the hole. Another hole may then be drilled 150 mm away and parallel to it. This hole shall then be charged and fired when the misfired hole should explode at the same time. The man-in-charge shall at once report to the Contractor's office and the Engineer all cases of misfire, the cause of the same and what steps were taken in connection therewith.

If a misfire has been found to be due to defective detonator or dynamite, the whole quantity in the box from which defective article was taken must be sent to the authority directed by the Engineer for inspection to ascertain whether all the remaining materials in the box are also defective.

### **302.6 Account**

A careful and day-to-day account of the explosives shall be maintained by the Contractor in an approved register and manner which shall be open to inspection by the Engineer at all times.

## **304 EXCAVATION FOR STRUCTURES**

### **304.1 Scope**

Excavation for structures shall consist of the removal of material for the construction of foundations for bridges, culverts, retaining walls, headwalls, cutoff walls, pipe culverts and other similar structures, in accordance with the requirements of these Specifications and the lines and dimensions shown on the drawings or as indicated by the Engineer. The work shall include construction of the necessary cofferdams and cribs and their subsequent removal; all necessary sheeting, shoring, bracing, draining and pumping; the removal of all logs, stumps, grubs and other deleterious matter and obstruction, necessary for placing the foundations; trimming bottoms of excavations; backfilling and clearing up the site and the disposal of all surplus material.

### **304.2 Classification of Excavation**

All materials involved in excavations shall be classified in accordance with Clause 301.2.

### **304.3 Construction Operations**

#### **304.3.1 Setting Out**

After the site has been cleared according to Clause 201, the limits of excavation shall be set out true to lines, curves and slopes to Clause 301.3.1.

### **304.3.2 Excavation**

Excavation shall be taken to the width of the lowest step of the footing including additional width as required for construction operation. The sides shall be left plumb where the nature of soil allows it. Where the nature of soil or the depth of the trench and season of the year do not permit vertical sides, the Contractor at his own cost shall put up necessary shoring, strutting and planking or cutslopes to a safe angle or both with due regard to the safety of personnel and works and to the satisfaction of the Engineer.

The depth to which the excavation is to be carried out shall be as shown on the drawings, unless the type of material encountered is such as to require changes, in which case the depth shall be as ordered by the Engineer. Propping shall be undertaken when any foundation or stressed zone from an adjoining structure is within a line of 1 vertical to 2 horizontal from the bottom of the excavation.

Where blasting is to be resorted to, the same shall be carried out in accordance with Clause 302 and all precautions indicated therein observed. Where blasting is likely to endanger adjoining foundations or other structures, necessary precautions such as controlled blasting, providing rubber mat cover to prevent flying of debris etc. shall be taken to prevent any damage.

### **304.3.3 Dewatering and Protection**

Normally, open foundations shall be laid dry. Where water is met within excavation due to stream flow, seepage, springs, rain or other reasons, the Contractor shall take adequate measures such as bailing, pumping, constructing diversion channels, drainage channels, bunds, depression of water level by well-points system, cofferdams and other necessary works to keep the foundation trenches dry when so required and to protect the green concrete/ masonry against damage by erosion or sudden rising of water level. The methods to be adopted in this regard and other details thereof shall be left to the choice of the Contractor but subject to the approval of the Engineer. Approval of the Engineer shall, however, not relieve the Contractor of the responsibility for the adequacy of dewatering and protection arrangements for the quality and safety of the works.

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

If it is determined beforehand that the foundations cannot be laid dry or the situation is found that the percolation is too heavy for keeping the foundation dry, the foundation concrete shall be laid under water by tremie pipe only. In case of flowing water or artesian springs, the flow shall be stopped or reduced as far as possible at the time of placing the concrete.

Pumping from the interior of any foundation enclosure shall be done in such a manner as to preclude the possibility of the movement of water through any fresh concrete. No pumping shall be permitted during the placing of concrete and for a period of at least 24 hours thereafter, unless it is done from a suitable sump separated from the concrete work by a watertight wall or other similar means.

At the discretion of the Contractor, cement grouting or other approved methods may be used to prevent or reduce seepage and to protect the excavation area.

The Contractor shall take all precautions in diverting channels and in discharging the drained water so as not to cause damage to the works, crops or any other property.

#### **304.3.4 Preparation of Foundation**

The bottom of the foundations shall be levelled both longitudinally and transversely or stepped as directed by the Engineer. Before footings are laid, the surfaces shall be slightly watered and rammed in the event of excavation having been made deeper than that shown on the drawings or as otherwise ordered by the Engineer, the extra depth shall be made up with concrete as per Clause 2104.1 at the cost of the Contractor. Ordinary fillings shall not be permitted to bring the foundation to the design level as shown in the drawing.

When rock or other hard strata is encountered, it shall be freed of all soft and loose material, cleaned and cut to a firm surface either level or stepped as directed by the Engineer. All seams shall be cleaned out and filled with cement mortar or grout to the satisfaction of the Engineer. In the case of excavation in rock, annular space around footings shall be filled with lean concrete M15 up to the top level of rock.

If the depth of fill required is more than 1.5m in soft rock or 0.6m in hard rock above the foundation level, the filling up to this level shall be done with M-15 concrete and portion above shall be filled by concrete or by boulders grouted with cement.

When foundation piles are used, the excavation for pile cap shall be done after driving/casting of all piles forming the group. After pile driving operations in a given pit are completed, all loose and displaced material therein shall be removed to the level of the bottom of the pile cap.

#### **304.3.5 Slips and Slip-Outs**

If there are any slips or slip-outs in the excavation, these shall be removed by the Contractor at his own cost.

#### **304.3.6 Public Safety**

Near towns, villages and all frequented places, trenches and foundation pits shall be securely fenced, provided with proper caution signs and marked with red lights at night to avoid accidents. The Contractor shall take adequate protective measures to see that the excavation operations do not affect or damage adjoining structures. For safety precautions, guidance may be taken from IS: 3764.

#### **304.3.7 Backfilling**

Backfilling shall be done with approved material after concrete or masonry is fully set and carried out in such a way as not to cause undue thrust on any part of the structure. All space between foundation masonry or concrete and the sides of excavation shall be filled to the original surface in layers not exceeding 150mm compacted thickness. The compaction shall be done with the help of suitable equipment such as trench compactor, mechanical tamper, rammer, plate vibrator etc., after necessary watering, so as to achieve the maximum dry density.

#### **304.3.8 Disposal of Surplus Excavated Materials**

All Excavated soft rock, hard rock etc. shall be dumped in designated place\* as decided by Engineer In Charge

#### **304.4 Measurements for Payment**

Excavation for structures shall be measured in cu.m for each class of material encountered, limited to the dimensions shown on the drawings or as directed by the Engineer. Excavation over increased width, cutting of slopes, production/support to the existing structures shoring, shuttering and planking shall be deemed as incidental to the main work and shall not be measured and paid separately.

Preparation of rock foundations shall be measured in square metres.

**\*Removal of Excavated Stuff and Laying within the sites specified in Notification as directed by Engineer-in-Charge**

After Refilling the pipe / chamber trenches by the excavated stuff is 15 cm thick layer, including ramming, watering and consolidating up to possible extent as specified in excavation & refilling item, the surplus stuff shall be disposed off at the following sites as directed within the prescribed limits of Notification as directed by the engineering in charge.

1. Beside Kotharia Police Station near Stone Quarry
2. All Quarry areas of Raiya Smart City

The excavated material of black cotton soil should be stacked at the location specified by the engineer in charge at no extra cost.

If the contractor fails to dispose the excavated stuff as specified, penalty will be imposed by Rajkot Municipal Corporation as per the Notification for C&D waste,

After refilling surplus earth shall have to carted by the contractor within specified limit including loading transporting unloading spreading.

**304.5 Rates**

304:5.1 The Contract unit rate for the items of excavation for structures shall be payment in full for carrying out the, required operations including full compensation for:

- i) Setting out;
- ii) Transporting the excavated materials for use or disposal with all leads and lifts;
- iii) Construction of necessary cofferdams, cribs/sheeting, shoring and bracing and their subsequent removal;
- iv) Removal of all logs, stumps, grub and other deleterious matter and obstructions, for placing the foundations including trimming of bottoms of excavations;
- v) Foundation sealing, dewatering including pumping when no separate provision for it is made in the Contract;
- vi) Backfilling, clearing up the site and disposal of all surplus material with all leads and lifts or as otherwise specified; and
- vii) All labour, materials, tools, equipment, safety measures, diversion of traffic and incidentals necessary to complete the work to Specifications.

304.5.2 The Contract unit rate for preparation of rock foundation shall be full compensation for cutting, trimming and cleaning the foundation surface and filling/sealing of all seams with cement grout or mortar including all materials, labour and incidentals required for completing the work.  
incidentals necessary to complete the work to Specifications.

304.5.2 The Contract unit rate for preparation of rock foundation shall be full compensation for cutting, trimming and cleaning the foundation surface and filling/sealing of all seams with cement grout or mortar including all materials, labour and incidentals required for completing

the work.

**Item No. 2.4**

**Providing and filling in foundation with ordinary Cement concrete M-15 mix and providing necessary vertical pin headers including formwork, vibrating, ramming and curing complete. (more than 10 ton) UPTO 5 m height/depth**

1. The relevant specifications given for machine mixed plain cement concrete M15 grade as per Section-1500 & 1700 of MORT & H fifth revision specification & as per relevant RDSO specification.
2. The measurements shall be per cum basis.
3. The rate includes tamping, vibrating, leveling and curing complete with all formwork, dewatering wherever required including all materials, labours, plants, machineries & tools, all leads and lifts, etc. complete as per specification.
4. The mode of payments shall be in per cum basis.

**Item No. 2.5**

**Providing and Casting in situ controlled Cement Concrete M-35 for R.C.C. Raft and including necessary shuttering laying, vibrating, ramming and curing complete. (upto 10 ton)**

1. The relevant specifications given for machine mixed plain cement concrete M35 grade as per Section-1500, 1700, 2100 & 2200 of MORT & H fifth revision specification.
2. The measurements shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payments shall be in per cum basis.

**Item No. 2.6**

**Supply, fitting, placing TMT-FE500 (PC) bar reinforcement in sub structure complete as per drawing and technical specifications**

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT & H fifth revision section 1600 shall apply to this item.
2. The measurements shall be in MT basis.
3. The rate includes for supply, loading, unloading, transporting to site, cutting, bending, hooking, placing, tying in position with contractor's own GI annealed binding wire, welding, forming the cage and lowering it in position in pile bore etc. Welding and supporting in position to ensure lines and levels during concreting, maintaining proper cover / spacing, all leads & lifts, etc. including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.
4. The mode of payments shall be in per MT basis.

**Item No. 3.1**

**Furnishing and placing reinforced/prestressed cement concrete in super-structure as per technical specification, RCC/PSC grade M35. (up to 10 ton) Upto 5 to 10m height. (RCC work in slab, approach slab, pier, pier cap, abutment, dirt wall, bearing and seismic block including all shuttering, scaffolding, laying, vibrating, curing, and finishing as a complete job)**

1. The relevant specifications given for machine mixed plain cement concrete M35 grade as per Section -1500, 1700, 2100 & 2200 of MORT & H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch Mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering Carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all Lead and lift with contractor's labour, tools & plants, machineries, as required.

4. The mode of payment shall be in per cum. Basis.

#### **Item No.3.2**

**Furnishing and placing reinforced cement concrete (M-40) for construction of bearing pedestal in as per drawing and technical specification.PSC grade M-40 (height 5m to 10m)**

The details specification should follows as per item no. 3.1.

#### **ItemNo.3.3**

**Supplying, fitting and fixing in position true to line and level POT-PTFE bearing consisting of a metal piston supported by a disc or unreinforced elastomer confined within a metal cylinder, sealing rings, dust seals, PTFE surface sliding against stainless steel mating surface, complete assembly to be of cast steel/fabricated structural steel, metal and elastomer elements to be as per IRC:83 parts I&II respectively and other parts conforming to BS:5400, sections 9.1 & 9.2 and clause 2006 of MoRT&H specifications complete as per drawing and approved technical specification**

1. Therelevant specifications forPOTcumPTFEbearings asperSection-2000 &2006ofMORT&H fifth revisionasperrelevantRDSOs specificationsshallapplytothisitem.
2. Themeasurements shallbeTon.Basis
3. Therateisforfinisheditemcompleteandpaidonlyafterfixinginpositionbelowthegirder.
4. The bearing shall be procured from the MORTH approvedmanufactureronly.
5. Themodeofpayments shallbeMetricTonbasis.

#### **ItemNo.3.4**

**Providing and fixing in position Fe-500D (T.M.T) for RCC pier, pier cap, seismic arrester, pedestal & super structure as per detailed drawing, including cutting, bending, hooking, tying and welding complete and including forming the cage and lowering it in position. (For 100KG).**

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT&H fifth revision Section 1600 shall apply to this item.
2. The measurement shall be in MT basis.
3. The rate includes for supply, loading, unloading, transporting to site, cutting, bending, hooking, placing, tying in position with contractor's own GI annealed binding wire, welding, forming the cage and lowering it in position in pile bore etc. Welding and supporting in position to ensure lines and levels during concreting, maintaining proper cover / spacing, all leads & lifts, etc. Including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawingsand specification.
4. The mode of payment shall be in per MT. basis.

#### **ItemNo.4.1**

**Precast-PSC girders(Providing, precasting,loading/unloading with own cranes of required certified capacity, shifting, launching and placement in position, precast,PSC concrete girder as per drawing and technical specifications including all material, concrete, cement, admixtures, steel, reinforcement, binding/welding, fixing, helical pipes, strands of drawings, pressure grouting, tensioning with Jacks of required certified capacity, shuttering, cranes, jacks, plugging and concealing ,manpower, material, lifting and placement at proper location, alignment, level ,fixing and positioning with POTPTF bearing as a complete job including removal of defects in surface as per direction of Engineer in charge )**

1. The relevant specifications given for machine mixed plain cement concrete M45 grade as per Section -1500, 1700, 1800 & 2300 of MORT&H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-

- shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per cum. Basis.

**ItemNo.4.2**

**Furnishing and placing RCC work/prestressed cement concrete in super-structure as per drawing and technical specification PSC grade M-45 for solid slab/voided slab , cantilever slab, including centering/shuttering, vibrating as complete job up to 12m height.**

The details specification should follow as per item no. 4.1.

**ItemNo.4.3**

**Supply, fitting, cutting, and placing TMT FE-500 bar reinforcement in super structure complete as per drawing, technical specification.**

The details specification should follow as per item no. 3.4.

**ItemNo.4.4**

**Providing and fixing 65 mm dia GI pipe hand rail including RCC the crash barrier of concrete grade-M-40 kern at end of carriage way, approach slab, median including reinforcement, shuttering, staging, concreting and consisting of MS base plate, embedded fastener and nuts, MS vertical plates and pipes etc., as shown in the drawings and as per specifications and painting the same with 3 or more coats of paints. All the railing components as mentioned above to be hot dip galvanized with a zinc coating of at least 175 gm/sqm. Item to include all incidental works required to complete the work as directed by the Engineer-in-charge.**

1. The relevant specifications given for machine mixed plain cement concrete M45 grade as per Section -1500, 1700, 1800 & 2300 of MORT&H fifth revision specification.
2. The measurement shall be per Rmt basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch mixplant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per Rmt Basis.

**ItemNo.4.5**

**Providing and fixing 20mm thick fibre board in expansion joint complete per drawing & Technical specification pre-moulded.**

**And**

**ItemNo.4.6**

**Providing and fixing in position 20mm thick pre-moulded joint filler in expansion joint for fixed ends of simply supported spans not exceeding 10 m to cater for a horizontal movement upto 20 mm covered with sealant complete as per drawing and technical specification**

**And**

**ItemNo.4.7**

**Providing and laying of a strip seal expansion joint catering to maximum horizontal movement upto 70mm, complete as per approved drawings and standard specifications to be installed by the manufacturer / supplier or their authorized representative ensuring compliance to the manufacturer's instructions for installation.**

- 1 The relevant specifications given in tender as per clause 2600 of MORT&H fifth revision As per relevant RDSO specification shall apply to this item.

2. The measurement shall be in Rmt. basis.
3. The rate is inclusive of supplying, fixing with contractor's own materials, equipments, machineries, labour, transport, testing, bolts, socket tubes, neoprene sheet/cap etc. complete. The rate is finished item complete and will be paid after fixing in all respect. The Contractor shall procure Expansion Joint, confirming to relevant MORTH specification from approved MORTH vendor with prior approval of Engineer in- charge
4. The mode of payment shall be in per Rmt. basis.

**ItemNo.4.8**

**Providing and casting in situ controlled cement concrete M-30 for approach slab including form work curing and finishing complete(more than 10 ton)**

1. The relevant specifications given for machine mixed plain cement concrete M30 grade as per Section -2704, 1500 & 1700 of MORT&H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary mixing in fully automatic batch mix plant, transport, curing, vibrating, placing in position, scaffolding, shuttering, formworks, de-shuttering carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all lead and lift with contractor's labour, tools & plants, machineries, as required, with F3 type exposed concrete finish and form work.
4. The mode of payment shall be in per cum. Basis.

**ItemNo.4.9**

**Providing and casting in situ controlled cement concrete concrete M-15 for approach slab cladding formwork curing and finishing complete. (More than 10 ton)**

1. The relevant specifications given for machine mixed plain cement concrete M15 grade as per Section 1500 & 1700 of MORT&H fifth revision specification & as per relevant RDSO specification.
2. The measurement shall be per cum basis.
3. The rate includes tamping, vibrating, leveling and curing complete with all formwork, dewatering Wherever required including all materials, labours, plants, machineries & tools, all leads and lifts, etc. complete as per specification.
4. The mode of payment shall be in per cum. basis.

**ItemNo.4.10**

**Providing and applying tack coat with bitumen VG-10 using Bitumen pressure distributor at the rate of 0.20 kg per sqm on the prepared bituminous/granular surface cleaned with mechanical broom as per clause 503 of MoRT&h specification.**

1. The relevant specifications for Bituminous Concrete are as per MORT&H fifth revision Clause 503 applicable to this item.
2. The measurement shall be in Sqm basis.
3. The rate includes labour, material, equipment etc. complete as per direction of engineer in charge.
4. The mode of payment shall be in per Sqm basis.

**ItemNo.4.11**

**Bituminous concrete - Providing and laying bituminous concrete with 100-120 TPH batch type hot mix plant producing an average output of 75 tons per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.4 per cent of 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 as per MORTH specification clause no. 507 complete in all respects(i) For grading - I(19mm nominal size)**

1. The relevant specifications for Bituminous Concrete are as per MORT&H fifth revision Clause 501,



- 507, 900 & 2702 applicable to this item.
2. The measurement shall be in cum basis.
  3. The rate includes labour, material, equipment etc. complete as per direction of engineer in charge.
  4. The mode of payment shall be in per Cum basis.

**ItemNo.4.12**

**Providing and laying 25mm thick mastic asphalt wearing course with paving grade bitumen VG-40 meeting the requirements given in table 500-39, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen pre-coated fine-grained hard stone chipping of 13.2 mm nominal size at the rate of 0.005 cum per 10 sqm and at an approximate spacing of 10 cm center to center in both directions, pressed into surface when the temperature of surfaces not less than 1000C, protruding 1 mm to 4 mm over mastic surface, all complete as per clause 516.**

1. The relevant specifications for Bituminous Concrete are as per MORT&H fifth revision Clause 516 Applicable to this item.
2. The measurement shall be in Sqm basis.
3. The rate includes labour, material, equipment etc. complete as per direction of engineer in charge.
4. The mode of payment shall be in per Sqm basis.

**Item No.4.13**

**Providing G. I. 100 mm. Diameter water spouts including necessary iron gratings as per drawings.**

1. Material for the drainage spout shall be as mentioned in the item and shall be got approved from the Engineer-in-charge.
2. Water spout shall be 100 mm internal dia G.I. rating 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 for the Engineer-in-charge. The water spouts shall project at-least 10 cm. outside the concrete and shall be rigidly fixed in it. The grating and C.I. pipes shall be painted with two coats of anticorrosive black bitumen paint.
3. Measurement & payment shall be per number of drainage spout fixed.
4. Unit rate includes necessary iron gratings as per drawings

**ItemNo.4.14**

**Providing and fixing PVC pipe 150 mm dia Heavy duty with Galvanized M.S. clamps at 1.5m c/c to keep in position with all staging, drilling in Down take pipe as a complete job.**

As per specification shown in item and as directed by an Engineer in Charge

**ItemNo.4.15**

**Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorizing glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35. The finished surface to be level, uniform and free from streaks and holes as per clause 803 of MoRT&H specification.**

1. The relevant specifications given in Section – 800 of MORT&H fifth revision and latest GR Of R&B Department as per SOR / 1018/715 / C-1 part, file specification shall apply to these items.
2. The measurement shall be in Sq.mt basis.
3. The rate includes of reflect rising glass beads at 250 gm/smt area. Thickness of 2.5 mm is exclusive of Surface applied glass beads as per IRC 35. The finished surface to be level uniform free from streak sand holes and as per direction of engineer in charge.
4. The mode of payment shall be in per Sq.mt basis.

**ItemNo.4.16**

Applying two coats of Birla or Asian acrylic lapy (putty) & two coats of primer of approved brand and manufacture on new wall surface to give an even shade including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand papered smooth.

As per specification shown in item and as directed by an Engineer in Charge.

**ItemNo.4.17**

Structural steel work with HT Steel work welded in buildup section, trusses, girder, frame work, girder staging etc. including cutting, bending, straightening, cleaning with sand/acid wash, primer coating, enamlingaluminium or metalizing 150micron, galvanising in RSDO approved vendor workshop including inspection at each stage,transportation, stacking, hoisting with approved capacity crane with manpower, placement, fitting with POT PFT bearing, truel level, alignment and placement as a complete job as per approved drawing and approved methology at site as a complete job.

1. The relevant portion pertaining to specifications of high tensile prestressing strands from plain, reinforcedcement concrete and prestressed concrete along with Section 1800 of MoRT&H 5th Revision shall apply to this item.
2. The measurement and mode of payment shall be in MT.
3. Rate includes cutting, cleaning, forming cables etc. and further including providing and laying corrugated HDPE sheathing of specified dia., anchorages, stage wise stressing, grouting testing of materials and all enabling work for pre tensioning / post tensioning of steel etc. complete including all lifts and leads as per Sp. In addition, drawing and as directed by Engineer. (Including reserve prestressing cable)

**Item No. 5.1 to 5.7**

**Reinforced earth retaining walls have two main components as under: a)Facia material and its placement's) Assembling,joiningwithfacingelementsandlayingofthereinforcingelements.**

**3101. SCOPE**

Theworkcoverstheconstruction ofreinforced earthstructures, togetherwiththeconstructionof earthworkinlayers,assemblyanderectionofreinforcing elementsandplacementoffacingpanels andallassociatedcomponents.

**3102. REINFORCING ELEMENT**

**3102.1.** Thereinforcingelement shallbeofGeotextile, aluminumalloystrip,copperstrip,carbonsteelstrip,matsofmetalorsyntheticgrids,oranyotherproprietarymaterial, which maybeapprovedby theEngineerandindicatedonthedrawings.

**3102.2. Geotextile**

ThematerialshallconformtoClause701.2.6.

**3102.3.** AluminumalloystripshallcomplywithBS: 1470quality5454intheH24condition.

**3102.4.** CopperstripshallcomplywithBS: 2870qualityC101orC102inthe½Hconditionandshall have0.2percentproofstressofnotlessthan180N/mm<sup>2</sup>.

**3102.5.** Carbon steelstripwhichshallbegalvanized shallcomply withBS: 1449(Part1), eitherquality KHR34/20Porkquality50/35P, eachhavingasiliconcontentofnotlessthan0.25percentand not more than 0.40 per cent. The fabricated element shall be galvanized in accordancewith BS: 729 andtheaveragezinccoatingweightfor any individualtestareashallnotbeslessthan1000 gm/sqm.

**3102.6.** StainlesssteelstripshallcomplywithBS: 1449(Part2)quality316S31or3/6S33exceptthatthematerialshallbecoldrolledtoprovidea0.2perc

entproofstressofnotlessthan400N/sq. mmandthetensilestrengthshallnotbelessthan540N/sqm.  
**3102.7.** Allmetalliccomponentsburiedinsoilshallbeofelectrolyticallycompatiblematerials.

**3102.8. Geogrids**

The supply of Geogrids shall carry certification of BIS or ISO-9002 for all works. While the reinforcing element for wall or slope portion shall be with mono oriented Geogrids, the reinforcement for the foundation of a reinforced earth wall or slope shall be with bi-directionally oriented Geogrid. For mono oriented Geogrid, the characteristic design tensile strength at a strain not exceeding 10 percent in 100 years shall be at least 40 kN/m when measured as per GR1:GG3. The strength for bi-directionally oriented Geogrid in the longitudinal direction shall be at least 40 kN/m at a maximum elongation of 15 percent. The Geogrid shall be inert to all naturally occurring chemicals, minerals and salts found in soil.

**3103. EARTH FILL**

The fill material for reinforced earth structures shall have an angle of interface friction between the compacted fill and the reinforcing element of not less than 25°C, measured in accordance with IS: 1332 6 (Part 1). The soil should be predominantly coarse grained; not more than 10 percent of the particles shall pass 75 micron sieve. The soil should have properties such that it does not react chemically or electrically with the reinforcing elements in an adverse manner.

**3104. FACIA MATERIAL**

**3104.1.** The facings shall comprise of one of the following:

- (i) reinforced concrete (Cast in situ or precast) slabs
- (ii) Plain cement concrete form fill hollow block (Precast)
- (iii) Masonry construction, Rubble facia
- (iv) Other proprietary and patented proven system

The facings shall be sufficiently flexible to withstand any deformation of the fill.

**3104.2.** Facia unit joint filler should be durable resistant to the effect of air pollution and water/saline water.

**3104.3.** Bedding material shall consist of either cement mortar or a durable gasket seating such as resin bonded cork strip.

**3104.4.** Connection between the Facia and the reinforcing element shall be by using polyethylene strips/rods, fiberglass dowels or any other material shown in the drawing. Any other material used shall be tested to provide 100 percent joint strength as of parent element in continuity. Overlapping in principal reinforcement in the joint shall ensure load transfer through joints, perpendicular to the direction of laying.

**3105. CONSTRUCTION DETAILS**

**3105.1.** The plan area of the reinforced earth structures shall be excavated to provide a nominally level base, which may be stepped at the back as required to receive the horizontal reinforcing element grid. The depth of the foundation below the finished ground level at the foot of the slope or wall shall not be less than 1000 mm.

Additional strip footing, trough guide made of concrete or anchor key pad shall be provided at founding level to receive the Facia or the bottom most reinforcement connection. This shall have adequate soil cover against erosion and scouring particular cases.

**3105.2. Orientation**

The reinforcing elements shall be placed at right angle to the face of the wall, with greater cross-

sectional dimension in the horizontal plane. The placement of the elements including their vertical/horizontal spacing and length shall be as in the drawing.

**3105.3. Facing Batter**

It may be necessary to set facing unit at an additional batter than as provided in the drawing as there is a tendency for initially positioned units of Facia to lean outward as the fill material is placed and compacted. Care and cautions shall be taken to rectify this phenomenon.

**3105.4. Drainage**

Drainage shall be provided as per drawing given in detail. The retained fill shall have a suitably designed drainage bay to allow free draining of the reinforced fill.

**3105.5. Laying and Compacting**

The reinforcing elements shall be laid free from all kinks, damage and displacement during deposition, spreading, levelling and compaction of the fill. The programme of fillings shall be such that no construction plant runs directly on the reinforcement.

All construction plant having a mass exceeding 1000 kg shall be kept at least 1.5 m away from the face of slope or wall. In this area (upto 1.5 m from the face of slope or wall), following compaction plant shall be used:

- (i) Vibratory roller having a weight per meter width of roll not exceeding 1300 kg with total weight not exceeding 10,000 kg.
- (ii) Vibratory plate compactor of maximum weight 1000 kg.
- (iii) Vibrotamper having a weight not exceeding 75 kg.

Compaction by any other method like using dozer or back blade compaction by dozer or excavator bucket shall be permitted with due approval from the Engineer after ascertaining the level of compaction so achieved.

During construction of reinforced fill, the retained material beyond the reinforcement at the rear or the structure shall be maintained at the same level as reinforced fill.

The compacted layer shall not be more than 200 mm, to achieve compaction of 95 percent of maximum laboratory density where measured per IS 2720 (Part 8). Temporary formwork shall be used to support the construction as per specified details given in the drawing. The forms, scaffolding and props shall be sufficient in numbers to allow taking up of sectoral construction schedules specified in the design.

**3106. MEASUREMENTS FOR PAYMENT**

Measurement for reinforcing elements shall be in linear meter for anchor strips or in sqm. For Geogrids/geotextile etc. The measurement for Facia (components of RE wall) shall be in sq. metres.

**3107. RATES**

Rate shall include cost of labour, plant hire, material storage and handling expenses, for completing the works.

Rate for providing reinforcing elements shall include material cost, all transportation costs and storage of the same as per special provisions. The rates shall also include cost of laying of the reinforcing elements including all overlaps, jointing or stitching, heat bonding or extension.

Rate for Facia fixings shall include cost of joints, all necessary temporary formwork, scaffolding and all lifts and leads, if any, as shown in the drawing, unless otherwise specified to be treated

separately along with foundation or slope/wall kerb at the top of slope or wall. Rate for bed block and capping beam shall include all items of excavation, concrete, reinforcing steel, formwork, labour and equipment.

Rate for soil fill shall include compaction as desired in requisite layer through mechanical means, cost of hire or labour for plant operations, dressing and levelling slopes, including special measures for edge reinforcements as shown in the drawing.

**ItemNo.6.1**

**Construction of embankment with fly ash obtained from thermal plant or crusher dust or mixture of aggregate as per approval of RE wall Designer though the working contractor with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of Table 300-2 as per clause 305 of MoRT&H specification.**

1. Therelevant specifications given in MoRT&H Clause 305<sup>th</sup> Revisions shall apply to this item.
2. The measurements shall be in Cum basis.
3. The mode of payments shall be in Cum basis.

**ItemNo.6.2**

**Construction of sub-grade and earthen shoulders with approved material obtained from borrowpits with all lifts and leads transporting to site, spreading, grading to required slope and compacted to meet requirement of table 300-2**

1. Therelevant specifications given in MoRT&H Clause 305<sup>th</sup> Revisions shall apply to this item.
2. The measurements shall be in Cum basis.
3. The mode of payments shall be in Cum basis.

**ItemNo.6.3**

**Construction of granular sub-base by providing close graded material, 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 clause 401.**

1. Therelevant specifications given in MoRT&H Clause 401<sup>5th</sup> Revisions shall apply to this item.
2. The measurements shall be in Cum basis.
3. The mode of payments shall be in Cum basis.

**ItemNo.6.4**

**Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam 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 as per clause 406 of MoRT&H specification.**

1. The relevant specifications given in Section – 406 of MORT&H fifth revision specification shall apply to this item.
2. The measurement shall be per Cum. basis.
3. The mode of payment shall be in per Cum basis.

**ItemNo.6.5**

**Providing and laying dense graded bituminous macadam with 100-120 TPH batch type HMP producing an average output of 75 tonne per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.0 to 4.5 percent 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 as per MoRT&H specification clause 505 complete in all respect.**

1. Therelevant specifications given in tender as per clause 501, 502, 503, 505 & 900 of MORT&H fifth revision specification shall apply to this item.
2. The measurements shall be in Cum basis.
3. The mode of payments shall be in per Cum basis.

**ItemNo.6.6**

**Providing and applying primer coat with bitumen emulsion on prepared surface of granular base including clearing of road surface and spraying primer at the rate of 0.60 kg/sqm using mechanical means as per clause 502 of MoRT&H specification.**

1. Therelevant specifications given in tender as per clause 502 of MORT&H fifth revision specification shall apply to this item.
2. The measurements shall be in Cum basis.
3. The mode of payments shall be in Cum basis.

**ItemNo.6.7**

**Providing and applying tack coat with bitumen VG-10 using Bitumen pressure distributor at the rate of 0.25 kg per sqm on the prepared bituminous/granular surface cleaned with mechanical broom as per clause 503 of MoRT&h specification.**

1. Therelevant specifications given in MoRT&H clause 503 5<sup>th</sup> Revisions shall apply to this item.
2. The measurements shall be in Cum basis.
3. The mode of payments shall be in Cum basis.

**ItemNo.6.8**

**Providing and laying bituminous concrete with 100-120 TPH batch type hot mix plant producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder VG-40 @ 5.2 per cent of mix and filler, transporting the hot mix to work site laying with a hydrostatic pver finisher with sensor MoRT&H control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause no. 507 complete in all respect Grading-I(19mm nominal size).**

1. The relevant specifications for Bituminous Concrete areas per MORT&H fifth revision Clause 501, 507, 900 & 2702 applicable to this item.
2. The measurements shall be in cum basis.
3. The rate includes labour, material, equipment etc. complete as per direction of engineer in charge.
4. The mode of payments shall be in per cum basis.

**Item No. 6.9**

**Furnishing and placing reinforced cement concrete (M-40) for construction of bearing pedestal in as per drawing and technical specification.**

2. The relevant specifications given for machine mixed plain cement concrete M35 grade as per Section -1500, 1700, 2100 & 2200 of MORT&H fifth revision specification.
2. The measurement shall be per cum basis.
3. The rate is inclusive of all materials, including necessary dewatering, mixing in fully automatic batch Mix plant, transport, curing, vibrating, placing in position, shuttering, formworks, de-shuttering Carefully, making good the damages, fixing embedment, inserts, pockets, wherever necessary, with all Lead and lift with contractor's labour, tools & plants, machineries, as required.
4. The mode of payment shall be in per cum. Basis.

**Item No. 6.10**

**Providing and casting in situ controlled cement concrete concrete M-150 for approach slab cladding formwork curing and finishing complete. (More than 10 ton)**

1. The relevant specifications given for machine mixed plain cement concrete M15 grade as per Section 1500 & 1700 of MORT&H fifth revision specification & as per relevant RDSO specification.
2. The measurement shall be per cum basis.
3. The rate includes tamping, vibrating, leveling and curing complete with all formwork, dewatering Wherever required including all materials, labours, plants, machineries & tools, all leads and lifts, etc. Complete as per specification.
4. The mode of payment shall be in per cum. basis.

**Item No. 6.11**

**Providing and fixing in position Fe-500D (T.M.T) for RCC bored piles, pile cap, pier cap, seismic arrester, pedestal & super structure as per detailed rowing, including cutting, bending, hooking, tying and welding complete and including forming the cage and lowering it in position. (For 100KG).**

1. The relevant specifications as per IS 1786 Specification & as per relevant MORT&H fifth revision Section 1600 shall apply to this item.
2. The measurement shall be in MT basis.
3. The rate includes for supply, loading, unloading, transporting to site, cutting, bending, hooking, placing, tying in position with contractor's own GI annealed binding wire, welding, forming the cage and lowering it in position in pile bore etc. Welding and supporting in position to ensure lines and levels during concreting,

maintaining proper cover / spacing, all leads & lifts, etc. including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.

4. The mode of payment shall be in per MT. basis.

**ItemNo. 6.12**

**Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorizing glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35. The finished surface to be level, uniform and free from streaks and holes as per clause 803 of MoRT&H specification.**

1. The relevant specifications given in Section – 803 of MORT&H fifth revision and latest GR Of R&B Department as per SOR / 1018/715 / C-1 part, file specification shall apply to these items.
2. The measurement shall be in Sq.mt basis.
3. The rate includes of reflect rising glass beads at 250 gm/smt area. Thickness of 2.5 mm is exclusive of Surface applied glass beads as per IRC 35. The finished surface to be level uniform free from streak sand holes and as per direction of engineer in charge.
4. The mode of payment shall be in per Sq.mt basis.

**ItemNo. 6.13**

**Applying two coats of Birla or Asian acrylic lapy (putty) & two coats of primer of approved brand and manufacture on new wall surface to give an even shade including thoroughly brushing the surface free from mortar dropping and other foreign matter and sand papered smooth.**

As per specification shown in item and as directed by an Engineer in Charge.

**ItemNo. 6.14**

**Providingandfixingmarbleslabincludingengravingandpaintingcomplete. (I)Size75cmx60cmx4cm**

1. SizeofTakti1.05x1.0m,Making boarder allgroundbycarvingto completelystoneofgranite, 3.Carving letters upto 0” to 3” size is including finishing, filling with golden paint, Making the R&B Symbol including finishing, fillingwithgoldenpaint,P.F.decorating teakwoodframing size3”x1”allaround granite takti with wooden polishing etc. Fixing Granite takti onwall including necessary demolition, repairingandfinishingwithadhesivemateriallikecementplasterorfixinggranitetaktiinstructureframe withnecessarynutboltsetc. P.F.thepullies,curtain&stringarrangementforinaugurationoftakti.
2. NumbersandsizeoflettersandsizeoftaktimaybevariableasperinstructionbyR&BEng.incharge.
3. ColorofstonewillbedecidedbyR&B.
4. ThemodeofMeasurement &paymentshallbeinperNo.Basis.

**ItemNo.6.15**

**Providingandfixingpre-castRubberDyeinterlockingconcreteblock60mmthickwithgradeof concrete M250pneumaticcompressedbymechanically pressedandasperapproveddesign including75mmSand layerforlevellingandfillingthejointwithsandinproperlineandleveetc.complete.**

1. Relevantspecificationshallbefollowedasperitemdescriptionandasdirectedbyengineerincharge
2. ThemeasurementsshallbeinSqm.basis.
3. ThemodeofpaymentshallbeinperSqm.basis.

**ItemNo. 6.16**

**Providing and fixing of sign boards made of 2mm aluminium sheet of size 60cm dia as per design IRC-67 pre treated with phospheting process and acid etching coated epoxy primer and epoxy painting reflectroised as per specification with angle iron of 35x35x5mm and 75x75x6mm stand with concrete block of 45x45x60cm with true line and level.**

1. Therelevant specifications giveninSection–800ofMORT&H fifthrevisionandlatestGRofR&B DepartmentasperSOR/1018/715/C-1partfile specificationshallapplytothisitem.
2. Themeasurement&PaymentshallbeinSq.mt.basis



**ItemNo. 6.17**

Providing and fixing of sign boards made of 2mm aluminium sheet of size 244x122 cm dia as per design IRC-67 pre treated with phosphating process and acid etching coated epoxy primer and epoxy painting reflectroised as per specification with angle iron of 50x50x5mm and 75x75x6mm stand with concrete block of 45x45x60cm with true line and level.

1. The relevant specifications given in Section –800 of MORT&H fifth revision and latest GR of R&B Department as per SOR/1018/715/C-1 part file specifications shall apply to this item.
2. The measurement & Payments shall be in No. basis

**ItemNo. 8.1**

Construction of sub-grade and earthen shoulders with approved material obtained from borrowpits with all lifts and leads transporting to site, spreading, grading to required slope and compacted to meet requirement of table 300-2

The detail specifications should follow as per item no. 6.3.

**ItemNo. 8.2**

Construction of granular sub-base by providing close graded material, 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 clause 401.

The detail specifications should follow as per item no. 6.3.

**ItemNo. 8.3**

Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam 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 as per clause 406 of MoRT&H specification.

The detail specifications should follow as per item no. 6.4.

**ItemNo. 8.4**

Providing and applying primer coat with bitumen emulsion on prepared surface of granular base including clearing of road surface and spraying primer at the rate of 0.60 kg/sqm using mechanical means as per clause 502 of MoRT&H specification.

The detail specifications should follow as per item no. 6.6.

**ItemNo. 8.5**

Providing and applying tack coat with bitumen VG-10 using Bitumen pressure distributor at the rate of 0.25 kg per sqm on the prepared bituminous/granular surface cleaned with mechanical broom as per clause 503 of MoRT&h specification.

The detail specifications should follow as per item no. 6.7.

**ItemNo. 8.6**

Providing and laying dense graded bituminous macadam with 100-120 TPH batch type HMP producing an average output of 75 tonne per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.0 to 4.5 percent 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 as per MoRT&H specification clause 505 complete in all respect.

The detail specifications should follow as per item no. 6.5.

**ItemNo. 8.7**

Providing and laying bituminous concrete with 100-120 TPH batch type hot mix plant producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder VG-40 @ 5.2 per cent of mix and filler, transporting the hot mix to work site laying with a hydrostatic paver finisher with sensor MoRT&H control to the required grade, level and alignment, rolling with smooth

wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause no. 507 complete in all respect.

The detail specifications should follow as per item no. 6.8.

**ItemNo. 9.1**

**Excavation for foundation in sand, gravel, clay soft soils and murrum etc. including shoring, strutting dewatering as necessary and disposing of the excavated stuff as directed.(A) Depth upto 3.0 M. and lead upto 100m for 10 Cum.**

The detail specifications should follow as per item no. 2.1.

**ItemNo. 9.2**

**Providing and filling in foundation with ordinary Cement concrete M-15 mix and providing necessary vertical pin headers including formwork, vibrating, ramming and curing complete. (more than 10 ton)**

The detail specifications should follow as per item no. 2.4.

**ItemNo. 9.3**

**Providing and Casting in situ controlled Cement Concrete M-35 for R.C.C. Raft and including necessary shuttering laying, vibrating, ramming and curing complete. (upto 10 ton)**

The detail specifications should follow as per item no. 2.5

**ItemNo. 9.4**

**Providing and fixing in position Fe-500D (T.M.T) for RCC bored piles, pile cap, pier cap, seismic arrester, pedestal & super structure as per detailed rawing, including cutting, bending, hooking, tying and welding complete and including forming the cage and lowering it in position. (For 100KG).**

The detail specifications should follow as per item no. 2.6

**ItemNo. 10**

**Gantry mounted variable message sign board(Providing & erecting gantry mounted sign board fixing Gantry over a designed support system, galvanised as per standard design, drawing with lateral clearance .(Foundation excavation and Concrete,display board steel shall be paid extra)**

1. The relevant specifications given in Section –1900 of MORTH fifth revision.
2. The measurement shall be in MT basis.
3. The rate includes for supply, loading, unloading, transporting to site, welding, forming the cage and lowering it in position etc. Welding and supporting in position to ensure lines and levels during all leads & lifts, etc. including contractor's own equipment, labour, supervisor, taxes, machineries, etc. complete as per drawings and specification.
4. The mode of payment shall be in per MT. basis.

## **AIR QUALITY PROTECTION OF THE ENVIRONMENT**

1. General
  - 1.1. This section of the Specification sets out limitations on the Contractor's activities specifically intended to protect the environment.
  - 1.2. The Contractor shall take all necessary measures and precautions and otherwise ensure that the execution of the works and all associated operations on site or off-site are carried out in conformity with statutory and regulatory environmental requirements including those prescribed elsewhere in this document.
  - 1.3. The Contractor shall take all measures and precautions to avoid any nuisance or disturbance arising from the execution of the Works. This shall wherever possible be achieved by suppression of the nuisance at source rather than abatement of the nuisance once generated.
  - 1.4. In the event of any spoil, debris, waste or any deleterious substance from the Site being deposited on any adjacent land, the Contractor shall immediately remove all such material and restore the affected area to its original state to the satisfaction of the Engineer.
2. Water Quality.
  - 2.1. The Contractor shall prevent any interference with the supply to or abstraction from, and prevent any pollution of, water resources (including underground percolating water) as a result of the execution of the Works.
  - 2.2. Areas where water is regularly or repetitively used for dust suppression purposes shall be laid to fall to specially constructed settlement tanks to permit sedimentation of particulate matter. After settlement, the water may be re-used for dust suppression and rinsing.
  - 2.3. All water and other liquid waste products arising on the Site shall be collected and disposed of at a location on or off the Site and in a manner that shall not cause either nuisance or pollution.
  - 2.4. The Contractor shall not discharge or deposit any matter arising from the execution of the Works into any waters except with the permission of the Engineer and the regulatory authorities concerned.
  - 2.5. The Contractor shall at all times ensure that all existing stream courses and drains within, and adjacent to, the Site are kept safe and free from any debris and any materials arising from the Works.
  - 2.6. The Contractor shall protect all watercourses, waterways, ditches, canals, drains, lakes and the like from pollution as a result of the execution of the Works.

### 3. Air Quality

- 3.1. The Contractor shall devise and arrange methods of working to minimize dust, gaseous or other air-borne emissions and carry out the Works in such a manner as to minimize adverse impacts on air quality.
- 3.2. The Contractor shall utilize effective water sprays during delivery manufacture, processing and handling of materials when dust is likely to be created, and to dampen stored materials during dry and windy weather. Stockpiles of friable materials shall be covered with clean tarpaulins, with application of sprayed water during dry and windy weather. Stockpiles of material or debris shall be dampened prior to their movement, except where this is contrary to the Specification.
- 3.3. Any vehicle with an open load-carrying area used for transporting potentially dust-producing material shall have properly fitting side and tailboards. Materials having the potential to produce dust shall not be loaded to a level higher than the side and tail boards, and shall be covered with a clean tarpaulin in good condition. The tarpaulin shall be properly secured and extend at least 300 mm over the edges of the side and tail boards.
- 3.4. In the event that the Contractor is permitted to use gravel or earth roads for haulage, he shall provide suitable measures for dust palliation, if these are, in the opinion of the Engineer, necessary. Such measures may include spraying the road surface with water at regular intervals.

### 4. Noise

- 4.1. The Contractor shall consider noise as an environmental constraint in his planning and execution of the Works.
- 4.2. The Contractor shall take all necessary measures so that the operation of all mechanical equipment and construction processes on and off the Site shall not cause any unnecessary or excessive noise, taking into account applicable environment requirements. The Contractor shall use all necessary measures and shall maintain all plant and silencing equipment in good condition to minimize the noise emission during construction works.

### 5. Control of Wastes

- 5.1. The Contractor shall control the disposal of all forms of waste generated by the construction operations and in all associated activities. No uncontrolled deposition or dumping shall be permitted. Wastes to be so controlled shall include, but shall not be limited to, all forms of fuel and engine oils, all types of bitumen, cement, surplus aggregates, gravels, bituminous mixtures etc. The Contractor shall make specific provision for the proper disposal of these and any other waste products, conforming to local regulations and acceptable to the Engineer.

### 6. Emergency Response

- 6.1. The Contractor shall plan and provide for remedial measures to be implemented in the event of occurrence of emergencies such as spillages of oil or bitumen or chemicals.

6.2. The Contractor shall provide the Engineer with a statement of the measures he intends to implement in the event of such an emergency, which shall include a statement of how he intends to provide personnel adequately trained to implement such measures.

7. Measurement

7.1. No separate measurement shall be made in respect of compliance by the Contractor with the provisions of this Section of the Specification. The Contractor shall be deemed to have made allowance for such compliance with these provisions in the preparation of his prices for items of work included in the Bills of Quantities and full compensation for such compliance will be deemed to be covered by them.

## QUALITY CONTROL OF ALIGNMENT, LEVEL AND SURFACE REGULARITY

### 902.1. General

All works performed shall conform to the lines, grades, and cross sections and dimensions shown on the drawings or as directed by the Engineer, subject to the permitted tolerances described hereinafter.

### 902.2. Horizontal Alignment

Horizontal alignments shall be reckoned with respect to the centerline of the carriageway as shown on the drawings. The edges of the carriageway as constructed shall be correct within a tolerance of  $\pm 10$  mm there from. The corresponding tolerance for edges of the roadway and lower layers of pavement shall be  $\pm 25$  mm.

### 902.3. Surface Levels

The levels of the subgrade and different pavement courses as constructed, shall not vary from those calculated with reference to the longitudinal and cross-profile of the road shown on the drawings or as directed by the Engineer beyond the tolerances mentioned in Table 900-1.

TABLE 900-1. TOLERANCES IN SURFACE LEVELS

1.	Subgrade	+ 20 mm
		- 25 mm
2.	Sub-base +10 mm	
	(a) Flexible pavement	- 20 mm
	(b) Concrete Pavement	
	[Dry lean concrete or Rolled concrete]	+ 6 mm
		- 10 mm
3.	Base-course for flexible pavement	
	(a) Bituminous course	+ 6 mm
		- 6 mm
	(b) Other than bituminous	
	(i) Machine laid	+ 10 mm
	(ii) Manually laid	

	- 10 mm
	+ 15 mm
	- 15 mm
4. Wearing course for flexible pavement	
(a) Machine laid	+ 6 mm
	- 6 mm
(b) Manually laid	+ 10 mm
	- 10 mm
5. Cement concrete pavement	+ 5 mm
	- 6 mm *

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\* This may not exceed - 8 mm at 0 - 30 cm from the edges.

Provided, however, that the negative tolerance for wearing course shall not be permitted in conjunction with the positive tolerance for base course, if the thickness of the former is thereby reduced by more than 6 mm for flexible pavements and 5 mm for concrete pavements.

For checking compliance with the above requirement for subgrade, sub-base and base courses, measurements of the surface levels shall be taken on a grid of points placed at 6.25 m longitudinally and 3.5 m transversely. For any 10 consecutive measurements taken longitudinally or transversely, not more than one measurement shall be permitted to exceed the tolerance as above, this one measurement being not in excess of 5 mm above the permitted tolerance.

For checking the compliance with the above requirement for bituminous wearing courses and concrete pavements, measurements of the surface levels shall be taken on a grid of point spaced at 6.25 m along the length and at 0.5 m from the edges and at the center of the pavement In any length of pavement, compliance shall be deemed to be met for the final road surface, only if the tolerance given above is satisfied for any point on the surface.

#### 902.4. Surface Regularity of Pavement Courses

The longitudinal profile shall be checked with a 3-metre long straight edge/moving straightedge as desired by the Engineer at the middle of each traffic lane along a line parallel to the centerline of the road.

The maximum permitted number of surface irregularities shall be as per Table 900-2.

TABLE 900-2. MAXIMUM PERMITTED NUMBER OF SURFACE IRREGULARITIES

Irregularity	Surfaces of carriageways and paved shoulders				Surfaces of laybys, service areas and all bituminous base courses			
	4 mm		7 mm		4 mm		7 mm	
Length (m)	300	75	300	75	300	75	300	75
National Highways/ Expressways	20	9	2	1	40	18	4	2
Roads of lower category	40	18	4	2	60	27	6	3

\* Category of each section of road as described in the Contract

The maximum allowable difference between the road surface and underside of a 3 m straightedge when placed parallel with, or at right angles to the centerline of the road at points decided by the Engineer shall be:

For pavement surface (bituminous and cement concrete)	3 mm
For bituminous base courses	6mm
For granular sub-base/ base courses	8 mm
For sub-bases under concrete pavements	10 mm

902.5. Rectification

Where the surface regularity of subgrade and the various pavement courses fall outside the specified tolerances, the Contractor shall be liable to rectify these in the manner described below and 10 the satisfaction of the Engineer.

- i) Subgrade: Where the surface is high, it shall be trimmed and suitably compacted. Where the same is low, scarifying the lower layer and adding fresh material and recompiling to the required density shall correct the deficiency. The degree of compaction and the type of material to be used shall conform to the requirements of Clause 305.



- ii) Granular Sub-base: Same as at (i) above, except that the degree of compaction and the type of material to be used shall conform to the requirements of Clause 401.
- iii) Lime/Cement Stabilized Soil Sub-base: For lime/cement treated materials where the surface is high, the same shall be suitably trimmed while taking care that the material below is not disturbed due to this operation. However, where the surface is low, the same shall be corrected as described herein below.
- iv) For cement treated material, when the time elapsed between detection of irregularity and the time of mixing of the material is less than 2 hours, the surface shall be scarified to a depth of 50 mm supplemented with freshly mixed materials as necessary and recompact to the relevant specification. When this time is more than 2 hours, the full depth of the layer shall be removed from the pavement and replaced with fresh material to Specification. This shall also apply to lime treated material except that the time criterion shall be 3 hours instead of 2 hours.
- v) Water Bound Macadam/Wet Mix Macadam Sub-base/Base: Where the surface is high or low, the top 75 mm shall be scarified, reshaped with added material as necessary and recompact to Clause 404. This shall also apply to wet mix macadam to Clause 406.
- vi) Bituminous Constructions: For bituminous construction other than wearing course, where the surface is low, the deficiency shall be corrected by adding fresh material over a suitable tack coat if needed and recompact to specifications. Where the surface is high, the full depth of the layer shall be removed and replaced with fresh material and compacted to specifications.
- vii) For wearing course, where the surface is high or low, the full depth of the layer shall be removed and replaced with fresh material and compacted to specifications. In all cases where the removal and replacement of a bituminous layer is involved, the area treated shall not be less than 5 m in length and not less than 3.5 m in width.
- viii) Dry Lean Concrete Sub-base/Rolled Cement Concrete: The defective length of the course shall be removed to full depth and replaced with material conforming to Clauses 601 or 603, as applicable. The area treated shall be at least 3 m long, not less than 1 lane wide and extend to the full depth. Before relaying the course, the disturbed subgrade or layer below shall be corrected by levelling, watering and compacting.
- ix) Cement concrete pavement: The defective areas having surface irregularity exceeding 3 mm but not greater than 6 mm may be rectified by bump cutting or scrubbing or grinding using approved equipment. When required by the Engineer, areas which have been reduced in level by the above operation(s) shall be retextured in an approved manner either by cutting grooves (5 mm deep) or roughening the surface by hacking the surface. If high areas in excess of 6 mm or low areas in excess

of 3 mm occur, exceeding the permitted numbers and if the Contractor cannot rectify, the slab shall be demolished and reconstructed at the Contractor's expense and in no case the area removed shall be less than the full width of the lane in which the irregularity occurs and full length of the slab.

- x) If deemed necessary by the Engineer, any section of the slab, which deviates from the specified levels and tolerances, shall be demolished and reconstructed at the Contractor's expense.

## 903. QUALITY CONTROL TESTS DURING CONSTRUCTION

### 903.1. General

The materials supplied and the works carried out by the Contractor shall conform to the specifications prescribed in the preceding Clauses.

For ensuring the requisite quality of construction, the materials and works shall be subjected to quality control tests, as described hereinafter. The testing frequencies set forth are the desirable minimum and the Engineer shall have the full authority to carry out additional tests as frequently as he may deem necessary, to satisfy himself that the materials and works comply with the appropriate specifications. However, the number of tests recommended in Tables 900-3 and 900-4 may be reduced at the discretion of the Engineer if it is felt that consistency in the quality of materials can still be maintained with the reduced number of tests.

Test procedures for the various quality control tests are indicated in the respective Sections of these Specifications or for certain tests within this Section. Where no specific testing procedure is mentioned, the tests shall be carried out as per the prevalent accepted engineering practice to the directions of the Engineer.

### 903.2. Tests on Earthwork for Embankment, Subgrade Construction and Cut Formation

903.2.1. Borrow material : Grid the borrow area at 25 m c/c (or closer, if the variability is high) to full depth of proposed working. These pits should be logged and plotted for proper identification of suitable sources of material. The following tests on representative samples shall be carried out:

- a) Sand Content [IS 2720 (Part 4)]: two tests per 3000 cubic metres of soil.
- b) Plasticity Test [IS 2720 (Part 5)]: Each type to be tested, two tests per 3000 cub. Metres of soil.
- c) Density Test [IS 2720 (Part 8)]: Each soil type to be tested, two tests per 3000 cubic metres of soil.
- d) Deleterious Content Test [IS 2720 (Part 27)]: As and when required by the Engineer.
- e) Moisture Content Test (IS 2720 (Part 2)]: One test for every 250 cubic metres of soil.
- f) CBR Test on materials to be incorporated in the subgrade on soaked/unsaturated samples [IS 2720 (Part 16)]: One CBR test for every 3000 cu. m. at least or closer as and when required by the Engineer.

903.2.2. Compaction Control: Control shall be exercised on each layer by taking at least one measurement of density for each 1000 square metres of compacted area, or closer as required to yield the minimum number of test results for evaluating a day's work on statistical basis. The determination of density shall be in accordance with IS 2720 (Part 28).

Test locations shall be chosen only through random sampling techniques. Control shall not be based on the result of any one test but on the mean value of a set of 5-10 density determinations. The number of tests in one set of measurements shall be six (if non-destructive tests are carried out, the number of tests shall be doubled) as long as it is felt that sufficient control over borrow material and the method of compaction is being exercised. If considerable variations are observed between individual density results, the minimum number of tests in one set of measurement shall be increased to 10. The acceptance criteria shall be subject to the condition that the mean density is not less than the specified density plus:

$$\left[ 1.65 - \frac{1.65}{(\text{No. of samples})^{0.5}} \right] \text{times the standard deviation}$$

However, for earthwork in shoulders (earthen) and in the subgrade, at least one density measurement shall be taken for every 500 square metres for the compacted area provided further that the number of tests in each set of measurements should be at least 10. In other respects, the control shall be similar to that described earlier.

903.2.3. Cut formation : Tests for the density requirements of cut formation shall be carried out in accordance with Clause 903.2.2.

903.3. Tests on Sub-bases and Bases (excluding bitumen bound bases) : The tests and their frequencies for the different types of bases and sub-bases shall be as given in Table 900-3. The evaluation of density results and acceptance criteria for compaction control shall be on lines similar to those set out in Clause 903.2.2.

903.3.1. Acceptance criteria: The acceptance criteria for tests on the strength of cement/lime stabilized soil and distribution of stabilizer content shall be subject to the condition that the mean value is not less than the specified value plus:

$$\left[ 1.65 - \frac{1.65}{(\text{No. of samples})^{0.5}} \right] \text{times the standard deviation}$$

TABLE 900-3. CONTROL TESTS AND THEIR MINIMUM FREQUENCY FOR SUB-BASES AND BASES (EXCLUDING BITUMEN BOUND BASES)

Sl. No.	Type of Construction	Test	Frequency (min).
1	Granular	(i) Gradation	One test per 200m <sup>3</sup>
		(ii) Atterberg limits	One test per 200m <sup>3</sup>
		(iii) Moisture content prior to compaction	One test per 250m <sup>3</sup>
		(iv) Density of compacted layer	
		(v) Deleterious constituents	
		(vi) C.B.R.	One test per 500m <sup>2</sup>
			As required
			As required
2	Lime /Cement Stabilized Soil Sub-base	(i) Quality of lime/cement	One test for each consignment subject to a minimum of one test per 5 tons
		(ii) Lime/Cement content	Regularly, through procedural checks
		(iii) Degree of pulverization	Periodically as considered necessary
		(iv) CBR or Unconfined Compressive Strength test on a set of 3 specimens	As required
		(v) Moisture content prior to compaction	
		(vi) Density of compacted layer	One test per 250 sqm

		(vii) Deleterious constituent	One test per 500m <sup>2</sup>
3	Water bound Macadam	(i) Aggregate Impact Value	As required On test per 200m <sup>3</sup> of aggregate
		(ii) Grading	
		(iii) Flakiness Index and Elongation Index	One test per 100m <sup>3</sup>
		(iv) Atterberg limits of binding material	One test per 200m <sup>3</sup> of aggregate
		(v) Atterberg limits of portion of aggregate passing 425 micron sieve	One test per 25m <sup>3</sup> of binding material
			One test per 100 cubic meter of aggregate
4	Wet mix Macadam	(i) Aggregate Impact Value	One test per 200m <sup>3</sup> of aggregate
		(ii) Grading	One test per 100m <sup>3</sup> of aggregate
		(iii) Flakiness and Elongation Index	One test per 200m <sup>3</sup> of aggregate
		(iv) Atterberg limits of portion of aggregate passing 425 micron sieve	One test per 100m <sup>3</sup> of aggregate
		(v) Density of compacted layer	One test per 500m <sup>2</sup>

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#### 903.4. Tests on Bituminous Construction

903.4.1. Tests and frequency: The tests and their minimum frequencies for the different types of bituminous works shall be as given in .Table 900-4. The Engineer may direct additional testing as required.

903.4.2. Acceptance criteria : The acceptance criteria for tests on density and Marshall stability shall be subject to the condition that the mean value is not less than the specified value plus :

$$\left[ 1.65 - \frac{1.65}{(\text{No. of samples})^{0.5}} \right] \text{times the standard deviation}$$

TABLE 900-4. CONTROL TESTS FOR BITUMINOUS WORKS, AND THEIR MINIMUM FREQUENCY

Sl. No.	Type of Construction	Test	Frequency (min).
1.	Prime Coat/Tack Coat/ Fog Spray	(i) Quality of binder	Number of samples per lot and tests as per IS 73, IS 217 and IS 8887 as applicable.
		(ii) Binder temperature for application	At regular close intervals
		(iii) Rate of spread of Binder	One test per 500m <sup>2</sup> and not less than two tests per day.
2.	Seal Coat/Surface Dressing	(i) Quality of Binder	Same as mentioned under Serial No. 1
		(ii) Aggregate Impact Value/Los Angeles Abrasion Value	One test per 50 m <sup>3</sup> of aggregate
		(iii) Flakiness index and Elongation Index	-do-
		(iv) Stripping value of aggregates (Immersion Tray Test)	Initially one set of 3 representative specimens for each source of supply. Subsequently when warranted by changes in the quality of aggregates
		(v) Water absorption of aggregates	-do-
		(vi) Water sensitivity of mix	Initially one set of 3 representative specimens for each source of supply. Subsequently when warranted by changes in the quality of aggregates (if required)
		(vii) Grading of aggregates	One test per 25m <sup>3</sup> of aggregate
		(viii) Soundness (Magnesium and Sodium Sulphate)	Initially, one determination by each method for each source of supply, then as warranted by change in the quality of the aggregates.
		(ix) Polished stone value	As required
		(x) Temperature of binder at application	At regular close intervals
		(xi) Rate of spread of materials	One test per 500m <sup>2</sup> of work, and, not less than two tests per day
		(xii) Percentage of fractured faces	When gravel is used, one test per 50m <sup>3</sup> test per day
3.	Open-graded Premix Surfacing/ Close-graded Premix Surfacing	(i) Quality of binder	Same as mentioned under Serial No. 1



- (ii) Aggregate Impact Value/Los Angeles Abrasion Value Same as mentioned under Serial No.2
  - (iii) Flakiness Index and Elongation Index -do-
  - (iv) Stripping value Same as mentioned under Serial No.2
  - (v) Water absorption of aggregates Same as mentioned under Serial No.2
  - (vi) Water sensitivity of mix Same as mentioned under Serial No.2
  - (vii) Grading of aggregates Same as mentioned under Serial No.2
  - (viii) Soundness (Magnesium and Sodium Sulphate) Same as mentioned under Serial No.2
  - (ix) Polished stone value As required
  - (x) Temperature of binder at application At regular close intervals
  - (xi) Binder content One test per 500m<sup>3</sup> and not less than two tests per day
  - (xii) Rate of spread of mixed material Regular control through checks of layer thickness
  - (xiii) Percentage of fractured faces Same as mentioned under Serial No.2
  - (xiv) (i) Quality of binder Same as mentioned under Serial No. 1
  - (ii) Aggregate Impact Value/Los Angeles Abrasion Value Same as mentioned under Serial No.2
  - (iii) Flakiness Index and Elongation Index Same as mentioned under Serial No.2
  - (iv) Stripping Value Same as mentioned under Serial No.2
  - (v) Water sensitivity of mix -do-
  - (vi) Grading of aggregates Two tests per day per plant both on the individual constituents and mixed aggregates from the dryer
  - (vii) Water absorption of aggregates Same as in Serial No. 2
  - (viii) Soundness (Magnesium and Sodium Sulphate) Same as mentioned under Serial No.2
  - (ix) Percentage of fractured faces Same as mentioned under Serial No.2
  - (x) Binder content and aggregate grading Periodic, subject to minimum of two tests per day per plant
4. Bituminous Macadam

	(xi) Control of temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling	At regular close intervals
	(xii) Rate of spread of mixed material	Regular control through checks of layer thickness
	(xiii) Density of compacted	One test per 250m <sup>2</sup> of area
5. Bituminous Penetration Macadam/Built-up Spray-Grout	(i) Quality of binder	Same as mentioned under Serial No. 1
	(ii) Aggregate Impact Value/Los Angeles Abrasion Value	One test per 200 m <sup>3</sup> of aggregate
	(iii) Flakiness Index and Elongation Index	-do-
	(iv) Stripping value	Same as mentioned under Serial No. 2
	(v) Water absorption of aggregates	Same as Serial No. 2
	(vi) Water sensitivity of mix	Same as Serial No. 2
	(vii) Aggregate grading	One test per 100m <sup>3</sup> of aggregate
	(viii) Soundness (Magnesium and Sodium Sulphate)	Same as mentioned under Serial No.2
	(ix) Percentage of fractured faces	Same as mentioned under
	(x) Temperature of binder at application	At regular close intervals
	(xi) Rate of spread of binder	Same as mentioned under Serial No.2
6. Dense Bituminous Macadam/Semi Dense Bituminous Concrete/Bituminous Concrete	(i) Quality of binder	Same as mentioned under Serial No. 1
	(ii) Aggregate Impact Value/Los Angeles Abrasion	Same as mentioned under Serial No.2
	(iii) Flakiness Index and Elongation Index	-do-
	(iv) Stripping Value	Same as mentioned under Serial No.2
	(v) Soundness (Magnesium and Sodium Sulphate)	Same as mentioned under Serial No.2

(vi) Water absorption of aggregates	As in Serial No. 2
(vii) Sand equivalent test	As required
(viii) Plasticity Index	As required
(ix) Polished stone value	As required, for Semi Dense Bituminous Concrete/  Bituminous Concrete
(x) Percentage of fractured faces	Same as mentioned under Serial No 2
(xi) Mix grading	One set of tests on individual constituents and mixed aggregate from the dryer for each 400 tons of mix subject to a minimum of two tests per plant per day
(xii) Stability of Mix	For each 400 tons of mix produced, a set of 3 Marshall specimens to be prepared and tested for stability, flow value, density and void content subject to a minimum of two sets being tested per plant per day
(xiii) Water sensitivity of mix (Retained Tensile Strength)	Same as mentioned under Serial No.2
(xiv) Swell test on the mix	As required for the Bituminous Concrete
(xv) Control of temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling	At regular close intervals
(xvi) Control of binder content and grading of the mix	One test for each 400 tons of mix subject to a minimum of two tests per day per plant
(xvii) Rate of spread of mixed material	Regular control through checks on the weight of mixed material at layer thickness
(xviii) Density of compacted layer	One test per 250m <sup>2</sup> area
7. Mastic Asphalt	
(i) Quality of binder	Same as mentioned under
(ii) Aggregate Impact Value/Los Angeles Abrasion Value	Same as mentioned under  Serial No.2
(iii) Flakiness Index and Elongation Index	-do-

	(iv) Stripping Value	-do-
	(v) Water sensitivity of mix	-do-
	(vi) Grading of aggregates	Two tests per day per plant both on the individual constituents and mixed aggregates from the dryer
	(vii) Water absorption of aggregates	Same as in Serial No. 2
	(viii) Soundness (Magnesium and Sodium Sulphate)	Same as mentioned under Serial No.2
	(ix) Percentage of fractured faces	Same as mentioned under Serial No.2
	(x) Binder content and aggregate grading	Periodic, subject to minimum of two tests per day per plant
	(xi) Control of temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling	At regular close intervals
	(xii) Rate of spread of mixed material	Regular control through checks of layer thickness
	(xiii) Hardness number	One test for each 400 tons of mix subject to a minimum of two tests per day
8. Slurry seal	(i) Quality of binder	Same as mentioned under Serial No. 1.
	(ii) Film stripping test	Initially one set of 3 representative specimens for each source of supply, then as warranted by changes in the quality of aggregates
9. Recycled material	(i) Binder content and aggregate grading	Minimum of one test per 25 m <sup>3</sup> of recycled material
	(ii) Recovered binder penetration	Minimum of one test per 50m <sup>3</sup> of recycled material
	(iii) Mix stability (Remix/Repave)	For each 400 tons of mix recycled, a set of 3 Marshall specimens to be prepared and tested for stability, flow, density and void content, subject to a minimum of two sets of

		tests per day
10. Cold Mix	(i) Quality of binder	Same as mentioned under
	(ii) Aggregate Impact Value/Los Angeles Abrasion Value	Same as mentioned under Serial No.2
	(iii) Flakiness Index and Elongation Index	-do-
	(iv) Stripping Value	-do-
	(v) Water sensitivity of mix	-do-
	(vi) Grading of aggregates	Two tests per day per plant both on the individual constituents and mixed aggregates from the dryer
	(vii) Percentage minimum coating	Two tests per day per plant
	(viii) Water absorption of aggregates	Same as in Serial No. 2
	(ix) Soundness (Magnesium and Sodium Sulphate)	Same as mentioned under Serial No.2
	(x) Percentage of fractured faces	When gravel is used, one test per 50m <sup>3</sup> of aggregate
	(xi) Binder content and aggregate grading	Periodic, subject to minimum of two tests per day per plant
	(xii) Mix stability	For each 400 tons of mix produced, one set of 3 Marshall specimens to be prepared and tested for stability, flow, density and void content, subject to a minimum of two sets of tests per plant per day

11. Sand Asphalt Base Course	(i)	Quality of binder	Same as mentioned under Serial No. 1
	(ii)	Los Angeles Abrasion Value	Same as mentioned under Serial No.2
	(iii)	Sand equivalent test	Serial No.2
	(iv)	Plasticity Index	As required
	(v)	Mix grading	As required
			One set of tests on individual constituents and mixed aggregate from the dryer for each 400 tons of mix subject to a minimum of two tests per plant per day
	(vi)	Stability of Mix	For each 400 tons of mix produced, a set of 3 Marshal (specimens to be prepared and tested for stability, flow value, density and void content subject to a minimum of two sets being tested per plant per day
	(vii)	Control of temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling	At regular close intervals
	(viii)	Control of binder content and grading of the mix	One test for each 400 tons of mix subject to a minimum of two tests per day per plant
	(ix)	Rate of spread of mixed material	Regular control and through checks on the weight of mixed material and layer thickness
	(x)	Density of compacted layer	One test per 250 m <sup>2</sup> area
12. Modified Binder	(i)	Softening Point	Initially on submission thereafter daily if site blended, weekly if pre-blended
	(ii)	Penetration at 25°C and 4°C	-do-
	(iii)		

- |        |   |                         |
|--------|---|-------------------------|
| (iv)   | Elastic Recovery  | -do-                    |
| (v)    | Ductility   | -do-                    |
| (vi)   | Flash Point   | -do-                    |
| (vii)  | Fraass Breaking   | Initially on submission |
| (viii) | Viscosity at 150°C  | -do-                    |
| (x)    | Thin film oven test, penetration, softening point, elastic recovery of residue, loss on heating | -do-                    |

### 903.5. Quality Control Tests for Concrete Road Construction

#### 903.5.1. Dry lean concrete sub-base :

903.5.1.1. Sampling and testing of cubes, Samples of dry lean concrete for making cubes shall be taken from the unaccompanied material from different locations immediately before compaction at the rate of three samples for each 1000 sqm. Alternatively, part thereof laid each day. The sampling of mix shall be done from the paving site.

Test cubes of 150 mm size shall be made immediately from each mix sample.

Cubes shall be made in accordance with the methods described in IS: 516 except that the cubes shall be compacted by means of a vibratory hammer with the moulds placed on a level and rigid base. The vibrating hammer shall be electric, pneumatic type fitted with a square, or rectangular foot having an area of between 7500 to 14000sq.mm. The compaction shall be uniformly applied for  $60 \pm 5$  seconds with a downward force of between 300 N and 400 N on to each of the 3 layers of the lean concrete material placed into the mould. The surface of each compacted layer shall be scarified before the next layer is added to give key for the next layer. The final layer shall be finished flush with the top of the cube mould.

The dry lean concrete cubes shall be cured in accordance with IS: 516.

903.5.1.2. In-situ density: The dry density of the laid material shall be determined from three density holes at locations equally spaced along a diagonal that bisects each 2000 square meter or part thereof laid each day and shall comply with the requirements as per Clause 601.5.5.1. This rate of testing may be increased at the discretion of the Engineer in case of doubt or to determine the extent of defective area in the event of non-compliance. Density holes at random may be made to check the density at edges.

903.5.1.3. Thickness: The average thickness of the subbase layer as computed by the level data of sub-base and subgrade or lower sub-base shall be as per the thickness specified in the contract drawings. The thickness at any single location shall not be 10mm less than the specified thickness. Such areas shall be corrected as stated in Clause 601.5.5.5. Areas,

which cannot be repaired, should be replaced over full width. The extent of deficient area should be decided based on cores.

903.5.1.4. Frequency of quality control tests: The frequency of quality control tests for levels, alignment and materials shall be as in Table 900-6.

903.5.2. Pavement concrete

903.5.2.1. Sampling and testing of beam and cube specimens: At least two beam and two cube specimens, one each for 7 day and 28 day strength testing shall be cast for ever 150 cu.m (or part thereof) of concrete placed during construction. On each day's work, not less than three pairs of beams and cubes shall be made for each type of mix from the concrete delivered to the paving plant. Each pair shall be from a different delivery of concrete and tested at a place to be designated by the Engineer in accordance with the testing procedure as outlined in Clause 602.3.3. Groups of four consecutive results from single specimens tested at 28 days shall be used for assessing the strength for compliance with the strength requirements. The specimens shall be transported in an approved manner to prevent sudden impact causing fractures or damage to the specimen. The flexural strength test results shall prevail over compressive strength tests for compliance.

A quality control chart indicating the strength values of individual specimens shall be maintained for continuous quality assurance. Where the requirements are not met with, or where the quality of the concrete or its compaction is suspect, the actual strength of the concrete in the slab shall be ascertained by carrying out tests on cores cut from the hardened concrete at such locations. The cores shall be cut at the rate of 2 cores for every 150 cu. m. of concrete. The results of crushing strength tests on these cores shall not be less than 0.8 times the corresponding crushing strength of cubes, where the height to diameter ratio of the core is two. Where height to diameter ratio is varied, then the necessary corrections shall be made in calculating the crushing strength of cubes in the following manner.

The crushing strengths of cylinders with height to diameter ratios between 1 and 2 may be corrected to correspond to a standard cylinder of height to diameter ratio of 2 by multiplying with the correction factor obtained from the following equation:

$$f = 0.11 n + 0.78$$

Where f = correction factor and

n = height to diameter ratio

The corrected test results shall be analyzed for conformity with the specification requirements for cube samples. Where the core tests are satisfactory, they shall have precedence for assessing concrete quality over the results of moulded specimens. The diameter of cores shall not be less than 150 mm.

If, however, the tests on cores also confirm that the concrete is not satisfying the strength requirements, then the concrete corresponding to the area from which the cores were cut should be replaced, i.e., at least over an area extending between two transverse joints where the defects could be isolated or over larger areas, if necessary, as assessed by additional



cores and their test results. The equivalent flexural strength at 28 days shall be estimated in accordance with Clause 602.3.3.2.

In order to ensure that the specified minimum strength at 28 days is attained in 99 per cent of all test beams, the mix shall be proportioned to give an average strength at 28 days exceeding the specified strength by 2.33 times the standard deviation calculated first from the flexural strengths of test beams made from the trial mix and subsequently from the accumulating result of flexural strengths of job control test beams.

The standard deviation shall be re-calculated from the test results obtained after any change in the source or quality of materials and the mix shall be adjusted as necessary to comply with the requirements.

An individual 28 day test strength below the specified strength shall not be evidence for condemnation of the concrete concerned if the average 28 day strength of this beam plus the preceding 5 and succeeding 4 beams exceeds the specified strength by 2.33 times the standard deviation and provided that there is no other evidence that the concrete mix concerned is substandard.

Beams shall be made each day in pairs at intervals, each pair being from a different batch of concrete. At the start of the work, and until such time as the Engineer may order a reduction in the number of beams required, at least six pairs of beams and cubes shall be made each day, one of each pair for testing at 28 days for determination of the minimum permissible flexural strength and the other for testing at an early age for the Engineer to assess the quality of the mix. When the first thirty numbers of 28-day results are available, and for so long as the Engineer is satisfied with the quality of the mix, he may reduce the number of beams and cubes required.

During the course of construction, when the source of any material is to be changed, or if there is any variation in the quality of the materials furnished, additional tests and necessary adjustments in the mix shall be made as required to obtain the specified strength.

The flexural strengths obtained on beams tested before 28 days shall be used in conjunction with a correlation between them and the 28 day flexural strengths to detect any deterioration in the quality of the concrete being produced. Any such deterioration shall be remedied without awaiting the 28-day strengths but the earlier strengths shall not constitute sole evidence of non-compliance of the concrete from which they were taken.

Concrete shall not comply with the Specification when more than one test beam in a batch has a 28-day strength less than the specified strength and the average 28-day flexural strength of the batch of beams is less than the specified strength plus 2.33 times the standard deviation of the batch.

Should the concrete fail to pass the Specification for strength as described above, the Contractor may, all at his own expense, elect to cut cores from the suspect concrete, as the Engineer shall direct. From the relation between cube strength and flexural strength, the core strength shall be converted to flexural strength.

The equivalent flexural strength at 28 days shall be the estimated insitu strength multiplied by 100 and divided by the age-strength relation obtained from Table 900-5.

Any concrete that fails to meet the strength specification shall be removed and replaced at Contractor's expense.

TABLE 900-5. AGE - STRENGTH RELATION OF CONCRETE  
(RELATED TO 100 PER CENT AT 28 DAYS)

DAYS	0	2	4	6	8
0	-	41.0	60.0	71.0	77.5
10	81.5	85.0	87.5	90.0	92.0
20	94.0	96.0	97.5	98.5	100.0
30	101.0	102.0	103.5	104.5	105.5
40	106.3	107.0	108.0	109.5	110.0
50	110.5	111.0	112.0	112.5	113.0
60	114.0	114.5	115.0	115.5	116.0
70	116.5	117.0	117.5	118.0	118.5
80	119.0	119.5	119.5	120.0	120.5
90	121.0	121.5	122.0	122.0	122.5
100	123.5	123.5	123.5	124.0	124.5
110	125.0	125.0	125.5	125.5	126.0
120	126.0	126.5	127.0	127.0	127.5
130	127.5	128.0	128.5	128.5	129.0
140	129.0	129.5	129.5	130.0	130.0
150	130.5	130.5	131.0	131.0	131.5
160	131.5	131.5	132.0	132.0	132.5
170	132.5	132.5	133.0	133.0	133.5
180	133.5	134.0	134.0	134.5	134.5
190	135.0	135.0	135.0	135.5	135.5
200	135.5	135.5	136.0	136.0	136.5
210	136.5	136.5	137.0	137.0	137.0
220	137.0	137.5	137.5	137.5	138.0
230	138.0	138.5	138.5	138.5	138.5

240	139.0	139.0	139.0	139.5	139.5
250	139.5	140.0	140.0	140.0	140.0
260	140.5	140.5	140.5	140.5	141.0
270	141.0	141.0	141.5	141.5	141.5
280	142.0	142.0	142.0	142.0	142.0
290	142.5	142.5	142.5	142.5	142.5
300	143.0	143.0	143.0	143.0	143.5
310	143.5	143.5	144.0	144.0	144.0
320	144.0	144.5	144.5	144.5	144.5
330	144.5	145.0	145.0	145.0	145.0
340	145.0	145.5	145.5	145.5	145.5
350	146.0	146.0	146.0	146.0	146.0
360	146.0	146.0	146.5	146.5	146.5

903.5.2.2. In-situ density: The density of the compacted concrete shall be such that the total air voids are not more than 3 per cent. The air voids shall be derived from the difference between the theoretical maximum dry density of the concrete calculated from the specific gravities of the constituents of the concrete mix and the average value of three direct density measurements made on cores at least 150 mm diameter. Three cores shall be taken from trial lengths and in first two km length of the pavement, while the slab is being constructed during normal working. The proportions of the mix and the vibratory effort imparted i.e. the frequency and magnitude of vibration shall be adjusted to achieve the maximum density.

All cores taken for density measurement in the trial section shall also be checked for thickness. The same cores shall be made use of for determining in-situ strength. In case of doubt, additional cores may be ordered by the Engineer and taken at locations decided by him to check the density of concrete slab or the position of dowel/tie bars without any compensation being paid for the same.

In calculating the density, allowance shall be made for any steel in cores.

Cores removed from the main carriageway shall be reinstated with compacted concrete with mix proportions of 1 part of Portland cement: 2 parts of fine aggregate : 2 parts of 10 mm nominal size single sized coarse aggregate by weight. Before filling the fine mix, the sides shall be hacked and cleaned with water. Thereafter cement-sand slurry shall be applied to the sides just prior to filling the concrete mix.

903.5.2.3. Thickness: Thickness shall be controlled by taking levels as indicated in Clause 902.3. Thickness of the slab at any point checked as mentioned above shall be within a tolerance

of -5 mm to + 25 mm of the specified thickness as per Drawing. Thickness deficiency more than 5 mm may be accepted and paid for at a reduced rate given in Clause 602.15.2. In no case, however, thickness deficiency shall be more than 25 mm.

903.5.2.4. Summary of control tests: Table 900-6 gives a summary of frequency of testing of pavement quality concrete.

TABLE 900-6. FREQUENCY OF QUALITY CONTROL TESTS FOR PAVING QUALITY CONCRETE

1. Levels, alignment and texture			
	(i) Level tolerance		Clause 902.3
	(ii) Width of pavement and position paving edges		Clause 902.2
	(iii) Pavement thickness		Clause 902.3 and 903.5.2.3.
	(iv) Alignment of joints, widths, depths of dowel grooves		To be checked @ one joint per 400m length or a day's work whichever is more.
	(v) Surface regularity both transversely and longitudinally		Once a day or one day's work, without disturbing the curing operation.
	(vi) Alignment of dowel bars and their accuracy/tie bars		To be checked in trial length as per Clause 602.10.5.2. and once on every 2 km.
	(vii) Texture depth		Clause 602.9.8
2. Quality of Materials and Concrete			
Control tests for materials and concrete shall be as under:			
1.	Cement	Physical and Chemical tests	IS:269 IS:455 IS:1489 IS:8112 IS:12269
			Once for each of supply and occasionally when called for in case Of long/improper storage. Besides, the Contractor also will submit daily test data on cement released by the Manufacture.
2.	Coarse and Fine aggregates	(i) Graduation	IS:2386 (Pt.1)
		(ii) Deleterious constituents	IS:2386 (Pt.2)
		(iii) Water absorption	IS:2386 (Pt.3)
			One test for every day's work of each fraction of coarse aggregate initially; may be relaxed later at the discretion of the Engineer. -do- Regularly as required subject to minimum of one test, a day for coarse aggregate & two tests a day for fine aggregate. This data shall be for correcting the water demand of the mix on daily basis.
3.	Coarse Aggregate	(i) Los Angeles Abrasion value or Aggregate Impact test	IS:2386 (Pt.4)
		(ii) Soundness	IS:2386 (Pt.5)
		(iii) Alkali aggregate reactivity	IS:2386 (Pt.7)
			Once for each source of supply and subsequently on monthly basis. Before approving the aggregates and every month subsequently -do-
4.	Water	Chemical tests	IS:456
			Once for approval of source of supply, subsequently only in case of doubt.
5.	Concrete	(i) Strength of concrete	IS:516
			2 cubes and 2 beams per 150 m <sup>3</sup> or

(ii) Core strength on hardened concrete	IS:516	part thereof (one for 7 day and other for 28 day strength) or minimum 6 cubes and 6 beams per day's work whichever is more.
(iii) Workability of fresh concrete-Slump Test	IS:1199	As per the requirement of the Engineer only in case of doubt. One test per each dumper load at both Batching plant site and paving site initially when work starts. Subsequently sampling may be done from alternate dumper. From the level data of concrete pavement surface and sub-base at grid point 5/6.25m x 3.5m 3 cores per trial length
(iv) Thickness determination		
(v) Thickness measurement for trial length		
(vi) Verification of level of string line in the case of slip form paving and steel forms in the cases of fixed form paving		String line or steel forms shall be checked for level at an interval of 5.0 m or 6.25m. The level tolerance allowed shall be $\pm 2$ mm. These shall be got approved 1-2 hours before the commencement of the concreting activity.

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**LABORATORY SET UP EQUIPMENT  
FIELD LABORATORY**

**1.0 Scope**

The work covers the provision and maintenance of an adequately equipped field laboratory as required for site control on the quality of materials and the works.

**1.1 Description**

The Contractor shall arrange to provide fully furnished and adequately equipped field laboratory . The field laboratory shall preferably be located adjacent to the site office of the Engineer and provided with amenities like water supply, electric supply etc. as for the site office of the Engineer in Clause 120.2.

The floor space requirement for the field laboratory shall be as indicated in the drawing. It shall include office space for the Materials Engineers, one from the Contractor's side and another from the Engineer's side and a store for the storage of samples. The remaining space shall be provided for the installation of equipment, laboratory tables and cupboards, working space for carrying out various laboratory tests, besides a wash basin, toilet facility and a curing tank for the curing of samples, around 4m x 2m x 1m in size and a fume chamber. The furnishing in each of two offices of the Materials Engineers shall be as provided for the Site Engineer in Table 100-2. Wooden/concrete working table with a working platform area of about 1m x 10m shall be provided against the walls, also providing wooden cupboards above and below the working tables to store accessories such as sample moulds etc. At least 4 racks of slotted angles and M.S. sheets as at Sl. No. 10 of Table 100-2 and at least 6 stools for laboratory test operators as at Sl. No 7 of Table 100-2 shall also be provided.

**Laboratory Equipment**

The following items of laboratory equipment shall be provided in the field laboratory.

## 121.3.1 General

(i)	Oven – Electrically operated, thermostatically controlled, range upto 200 <sup>o</sup> C sensitivity 1 <sup>o</sup> C	1 No.
(ii)	Platform balance 300 kg capacity	1 No.
(iii)	Balance 20 kg capacity-self indicating type	1 No.
(iv)	Electronic Balance 5 kg capacity accuracy 0.5 gm Electronic balance 600 gm accuracy 1.0 mg	2 Nos. 01 Nos
(v)	Water bath-electrically operated and thermostatically controlled with adjustable shelves, sensitivity 1 <sup>o</sup> C	1 No.

(vi)	Thermometers: 4 Nos. Mercury-in-glass thermometer range 0°C to 250 °C Mercury-in-steel thermometer with 30 cm stem, range upto 300°C	4 Nos.
(vii)	Kerosene or gas stove or electric hot plate	1 No.
(viii)	Glassware's, spatulas, wire gauzes, As required steel scales, measuring tape, casseroles, karahis, enamelled trays of assorted sizes, pestle-mortar, porcelain dishes, gunny bags, plastic bags, chemicals, digging tools like pickaxes, shovels etc.	As required
(ix)	Set of IS sives with lid and pan: <b>450 mm diameter:</b> 63mm, 53mm, 45.0 mm, 40.0 mm 37.5mm, 26.5mm, 25.0 , 22.4 mm , 20.0 mm ,16.0 mm ,19.0 mm, 13.2mm, 12.0 mm, 10.0 mm ,9.5mm, 6.7mm, and 4.75mm size <b>200mm diameter:</b> 2.36mm, 2.0mm, 1.18mm, 1.0 mm ,600 micron, 425 micron, 300 micron, 150 micron, and 75 micron	1 set  1set
(x)	Water testing kit	1 set
(xi)	First aid kit	1set
121.3.2. For soils and aggregates		
(i)	Rifle Box	1 No
(ii)	Atterbeg Limits (liquid and plastic limits) determination apparatus	1 set
(iii)	Compaction Test Equipment both 2.5 kg and 4.5 kg rammers (Light and Heavy Compactive efforts)	1set
(iv)	Dry Bulk Density Test apparatus (sand pouring cylinder, tray, can etc.) complete	1set
(v)	Speedy Moisture Meter complete with chemicals	1set
(vi)	Post-hole Auger with extensions	1set
(vii)	Core cutter apparatus 10 cm dia, 10/15 cm height, complete with dolly, rammer etc.	1 set
(viii)	Aggregate Impact Value Test apparatus/Los Angeles Abrasion Test apparatus	1 set
(ix)	Flakiness and Elongation Test Gauges	1 set
(x)	Standard measures of 30, 15 and 3 litres capacity along with standard tamping rod	1set
(xi)	California Bearing Ratio test apparatus	1 set
		1set

121.3.3 For bitumen and bituminous mixes		
(i)	Penetrometer with standard needles	1set
(ii)	Riffle box—small size	1 Nos.
(iii)	Centrifuge type bitumen extractor, hand operated, complete with petrol/commercial benzene	1 set
(iv)	Marshall stability test apparatus, complete with all accessories	1 set
(v)	Field density bottle along with cutting tray, chisel, hammer and standard sand	2 Nos.
(vi)	3 m straight edge	1 No.
(vii)	Camber board	1 No.
(ix)	Vacuum pump and 3 specific gravity bottles	1 set
121.3.4. For cement and cement concrete		
(i)	Vicat apparatus for testing setting times	1 set
(ii)	Slump testing apparatus	2 sets
(iii)	Compression and Flexural strength testing machine of 200 tonne capacity with additional dial for flexural testing	1 No.
(iv)	Needle Vibrator	1 Nos.

Note : The items and their numbers listed above in this Clause shall be decided by the Engineer as per requirements of the Project and modified accordingly.