RAJKOT URBAN DEVELOPMENT AUTHORITY

e - Tender No.RUDA/188/2020-21

Bid Documents For

Construction of road from Anandpar bus stand to Ahmadabad National highway (Anandpar main road) at Anandpar village in Ruda Area

Last date for e-tendering is as under	
1. Downloading of e-Tender documents	09-06-2020 to 30-06-2020 upto 15.00 hours
2. Pre-Bid meeting	18-06-2020 at 11:00 Hours
3. Last Date of online submission of e - Tender	30-06-2020 upto 18.00 hours
4. Physical submission of EMD, Tender fee and other documents.	Submission of EMD, Tender fee and other documents during office hours on or before 07-07-2020 upto 18.00 hrs
5. Verification of submitted documents (EMD, e - Tender fee, etc.)	08-07-2020 at 12.00 Hours onwards
6. Opening of online Technical Bid	08-07-2020 at 11.00 Hours onwards
7. Opening of Price Bid (If possible)	to be intimated to Technically qualified Bidders
8. Bid Validity	180 Days

2020 - 21

DIRECTOR (PROJECTS)
RAJKOT URBAN DEVELOPMENT AUTHORITY
SHRI CHIMANBHAI PATEL VIKAS BHAVAN
JAMNAGAR ROAD,
RAJKOT - (GUJARAT)
Ph::0281-2476874,Fax 081-2450523 Email : rajurbandev@yahoo.com

Rajkot Urban Development Authority

e-TENDER
FOR

Construction of road from Anandpar bus stand to Ahmadabad National highway (Anandpar main road) at Anandpar village in Ruda Area

PART – I	
Section-1	Invitation to Bid, Additional Conditions to Contractors, Eligibility Criteria, Instructions to Bidders.
Section-2	General Conditions of Contract Additional instructions, Format
PART – II	
Section-2	Technical Specifications Quality control manual for works
PART – III	
Section-3	Price Bid -Schedule – B

Rajkot Urban Development Authority
PMU Branch

TERMS AND CONDITIONS OF TENDER

I/We agree to carry out the below work at _____% (In figures) _____ _____(In words) above/ below the estimated cost.

Name of work :- **CONSTRUCTION OF ROAD FROM ANANDPAR BUS STAND TO AHMADABAD NATIONAL HIGHWAY (ANANDPAR MAIN ROAD) AT ANANDPAR VILLAGE IN RUDA**

Approved estimated cost :- Rs. 3,12,06,561/-
Earnest Money :- Rs. 3,12,065/-
Security Deposit :- 2.5% FDR OR BG(Initiatial)
2.5% from R.A.Bill (@ 5.0% from RA Bill)

Name of contractor :- _____

Address :- _____
_____
_____

Date: :- _____
Witness :- _____

Address :- _____
_____
_____

Occupation :- _____

Sign of Tenderer

Rates approved on behalf of Rajkot Urban Development Authority

Date: Sign of Sanctioning authority

Part- I Section - I

Rajkot Urban Development Authority

:: *e*-Tender Notice ::

Rajkot Urban Development Authority, Jamnagar Road, Rajkot, invites tenders with two bid system by e-tendering from the contractors registered in State Government / Central Government in appropriate Class (as per R & B rules) with special category (Road) for work of "CONSTRUCTION OF ROAD FROM ANANDPAR BUS STAND TO AHMADABAD NATIONAL HIGHWAY (ANANDPAR MAIN ROAD) AT ANANDPAR VILLAGE IN RUDA " as detailed below:

Sr No	Name of work	a) Estimated cost b) Earnest Money c) e-Tender fee d) Time limit for completion of work
1	**CONSTRUCTION OF ROAD FROM ANANDPAR BUS STAND TO AHMADABAD NATIONAL HIGHWAY (ANANDPAR MAIN ROAD) AT ANANDPAR VILLAGE IN RUDA** **Tender No.RUDA/188/2020-21**	a) Rs. 3,12,06,561/- b) Rs. 3,12,065/- c) Rs 8,850/-(include GST@18%) d) 9 Months

Last date for e-tendering is as under	
1.Downloading of e-Tender documents	09-06-2020 to 30-06-2020 upto 15.00 hours
2. Pre-Bid meeting	18-06-2020 at 11:00 Hours
3. Last Date of online submission of e – Tender	30-06-2020 upto 18.00 hours
4. Physical submission of EMD, Tender fee and other documents.	Submission of EMD, Tender fee and other documents during office hours on or before 07-07-2020 upto 18.00 hrs
5. Verification of submitted documents (EMD, e - Tender fee, etc.)	08-07-2020 at 12.00 Hours onwards
6. Opening of online Technical Bid	08-07-2020 at 11.00 Hours onwards
7. Opening of Price Bid	to be intimated to Technically qualified Bidders

1. All bidders must submit a bid security to be submitted in form of Demand Draft in favour of "Rajkot Urban Development Authority, Rajkot", from any Nationalized/Scheduled Bank in India. The physical submission shall have to be made at below mentioned address:

   Director(Projects)
   Rajkot Urban Development Authority
   Shri Chimanbhai Patel Vikas Bhavan,
   Jamnagar Road, RAJKOT-360001.

2. The e-tender fee will be accepted in form of Demand Draft only in favor of "Rajkot Urban Development Authority" Rajkot, from any Nationalized/Scheduled Bank/Private Sector Bank approved by GoG. in India and must be delivered to above address.

3. **The prequalification requirement is as under**:

   i) Financial Criteria:

   1. An average annual turnover of last five years should be not less than tender amount.
   2. Available bid capacity-ABC must be more than the estimated tender cost.
   3. Working capital and Solvency should not be less than 25% of the estimated amount.

   Note: Enhancement factor at 10% per year for last five years will be applicable to arrive average annual turnover and finalize the magnitude of work done in last five years.

   ii) Experience Criteria:

   The bidder should posses following minimum experience:

   1. Bidder should have completed one work of similar nature(i.e. concrete road) of 60% of tender amount or 2 work of 40% of tender amount or 3 work of 30% of tender amount of either government or Semi-government as a main contractor in period of last Seven years.

4. The tenders of those bidders who fail to submit the required documents physically within the prescribed date and time, will be treated as non-responsive and their Price Bid will not be opened.
5. Chief Executive Officer, Rajkot Urban Development Authority, Rajkot, reserves the right to accept / reject any or all e-tender(s) without assigning any reasons thereof.

Chief Executive Officer
Rajkot Urban Development Authority

Part – I Section-I

IMPORTANT INSTRUCTIONS

1. The contractor or his authorized representative may remain present at the time of online opening BID at RUDA office, Shri Chimanbhai Patel Vikas Bhavan, Jamnagar Road, Rajkot.

2. The Tender fee and E.M.D. must be submitted in stipulated time.

3. The valid proof of having Mechanical Sensor Paver Finisher (As per Annexure "B"), Vibratory Roller (Steel wheeled Tandem) and Batch Mix Plant (for concrete) having minimum capacity of 30 cum/hrs shall be attached**.**

Name Of Work :- **CONSTRUCTION OF ROAD FROM ANANDPAR BUS STAND TO AHMADABAD NATIONAL HIGHWAY (ANANDPAR MAIN ROAD) AT ANANDPAR VILLAGE IN RUDA**

1. Estimated cost put to tender : Rs. 3,12,06,561/-
2. Earnest Money Deposit : Rs. 3,12,065/-in form of FDR only in Favour of **Rajkot Urban Development Authority**.
3. Validity Period of Tender Offered : 180 Days

4. Security Deposit : 5 % of Contract value.
   1) 2.5 % in form of F. D. R./ Bank Guarantee in favour of **Rajkot Urban Development Authority**. As an initial security deposit &
   2) Remaining 2.5% to be deducted deduction from each running bill at the 5.0 % of Bill amount.
5. Time limit for completion of work : **9 months**
6. Other Details : B – Percentage Rate
7. Defect Liability Period : 2(Two) years from the date of Completion

Last date for e-tendering is as under	
1.Downloading of e-Tender documents	09-06-2020 to 30-06-2020 upto 15.00 hours
2. Pre-Bid meeting	18-06-2020 at 11:00 Hours
3. Online submission of e – Tender	30-06-2020 upto 18.00 hours
4. Physical submission of EMD, Tender fee and other documents.	Submission of EMD, Tender fee and other documents during office hours on or before 07-07-2020 upto 18.00 hrs
5. Verification of submitted documents (EMD, e - Tender fee, etc.)	08-07-2020 at 12.00 Hours onwards
6. Opening of online Primary Bid	08-07-2020 at 11.00 Hours onwards
7. Opening of Price Bid (If possible)	to be intimated to Technically qualified Bidders

Director(Projects)
Rajkot Urban Development Authority

Part – I Section - I

Additional Conditions for Contractors

Name Of Work :- **CONSTRUCTION OF ROAD FROM ANANDPAR BUS STAND TO AHMADABAD NATIONAL HIGHWAY (ANANDPAR MAIN ROAD) AT ANANDPAR VILLAGE IN RUDA.**

1. ~~The quantities given in the Schedules are provisional. The Rajkot Urban Development Authority reserves the right to increase or decrease the quantity of work up to 30% or totally omit any item work and the contractor shall not be entitled to claim any extras or damages on these grounds & he is bound to execute the work as per the instruction of the Engineer-in-charge. The Payment of Quality beyond 30% will be paid as per S.O.R. of RMC for the year 2018-19.~~

2. The tenderer must understand clearly that the prices quoted are for the totally works or the part of the total works quoted for and include all costs due to materials, labour, equipments, supervision, other services, royalties, taxes, duties, etc., and to include all extra to cover the cost. No claim for additional payment beyond the prices quoted will be entertained and the tenderer will not be entitled subsequently to make any claim on any ground.

3. Plant must be located within 40 kms from work/site location or Agency should establish the Plant within 40 kms from work/site location in 15 days after receiving letter of acceptance of the bid.

4. The agency to whom the work will be awarded shall have to arrange its own vehicle for to and fro transportation of the staff of Rajkot Urban Development Authority till the work is completed at his own cost.

~~5. Basic rate for bitumen is considered of IOC, Rajkot dated 1st Dec 2018 as below:~~

~~Sr. No.~~	~~Item~~	~~Rate~~	~~Rajkot dated 1st Dec 2018 as below~~
~~1~~	~~Bitumen 60/70 (VG30)~~	~~**41241.00**~~	

~~The Star Rate will be considered as per the letters of IOC Ltd., Rajkot. However the rates of IOC and rates of other suppliers for the same period will be collected and deference will be either paid or recover considering the lowest rates. It is mandatory to quote rates for "Star Rate" as per tender document.~~

6. If any sample tested at plant/Site fails in bitumen extraction test, than the whole mix will be rejected and this mix will not be allowed to deliver/Laid on site.
7. Conditions for variation in rates of asphalt:
1. This clause shall be operative from the date of issue of work order and upto the expiry of original and extended time limit.
2. The difference between two actual rate of purchase as per original bill produced and the basic rate for the quantity of asphalt actually used in the work during original or extended time limit only will be paid / recovered for ACTUAL use of asphalt.
3. The difference will be payable / recoverable from the date of issue of work order And this price variation will not be subject to any ceiling.
4. If any delay is caused behalf of handing over sites to contractor, for providing any utilities or for any other reason , no extra payment or claim or price rise shall be paid to contractor except price variation of basic rate mentioned in the tender.
8. If any irregularities found during laying / after laying of bitumen construction, the penalty will be imposed by Engineer-in-charge or any higher officer. If any disputes arises regarding penalty imposed by Engineer-in-charge the decision of Chief Executive Officer, RUDA will be final and binding to agency.

9. For cleaning work in resurfacing & recarpeting; no extra payment will be paid.
10. The time limit will remain same as mentioned in the tender document and the work is to be completed accordingly.

11. Tender of such Contractor not having registration in appropriate Class will be treated as non-responsive. In case of any conflicting provisions between registration of appropriate Class and Pre-qualification criteria, the later shall govern the process of bid evaluation.

12. The agency shall have to quote their rates only after visiting the site and looking to the site conditions.
This ROW is provisional and may be changed / modified as per requirement.

13. All work should be paved by Mechanical paver and for concrete road slip form paver as per instruction of Engineer-in charge.

14. **Batching plant having capacity of minimum 30 cum/hr. Plant must be purchased directly from the manufacturer only.**

15. DEFECTS : Date of completion for start of defect liability period for a particular road will be considered as the last date mentioned in the completion of work recorded & certified by engineer in charge with sign and date (Measurement Book). The contractor shall be required to make good all the damages / defects identified and conveyed to him, during the entire defect liability period. The method and time limit of rectification will be decided by the Engineer in charge. If he fails to carry out rectification as per the instructions, the same will be carried out at his cost and it shall be recovered from the amount retained.

16. The contractor is to set out and level the works and will be responsible for the accuracy of the same. He shall also be responsible for the correctness of the positions, levels, dimensions and alignment of all parts of the structures as shown in the drawings supplied to him or as per the instruction. If at any time any error shall appear during the progress of any part of the work, the contractor shall at his own expense rectify such error if called upon to the satisfaction of the Engineer in charge. The contractor shall be required to construct before starting the works and maintain till the end of the defect liability period, the temporary bench marks at regular interval preferably at the interval of 100m. Longitudinally all along the stretch as per the design as approved by Engineer In Charge. The Contractor shall not be paid extra for constructing and maintaining the temporary bench marks.

17. After laying of Mix the field density test must be taken as per MORT&H Specification.

18. As per Government of Gujarat G.R. No.- EMD-SD/1020006/108/DMO, Dt-04/05/2011 approved Bank are...
    1. All Nationalized Banks including the Public Sector Bank – IDBI LTD.
    2. Private Sector Banks authorized by RBI to undertake State Government Business (at Present : at present : AXIS Bank, ICICI Bank, HDFC Bank, Kalupur Co-operative Bank, Rajkot Nagrik Bank) .
    3. Guarantee issued by all above bank will only be Accepted

Special Note : The issuing branch of all bank guarantees shall be of Rajkot City Only.

19. The work of laying aggregates mixed with Cement shall generally start on site of work of only after 8:00 a.m. and shall continue up to 06:00 p.m. hours in winter season and up to 07:30 p.m. hours in summer. However, under Special Circumstances Engineer-in-Charge may ask to carry out work in the Night hours also. No work shall be done except during the period mentioned above and also

on Sundays and National Holidays viz. 26th January, 15th August and 2nd October. As per Government Circular No.SHR/1087/205/(121)/C dt.24/05/1990. The work of laying bituminous surface shall not be carried out after 15th June (during monsoon period) or onset of monsoon.

20. The work of laying Asphalt mix shall start latest within 10 days from the date of completion of work of wet-mix will be completed as per time limit. Reason for delay in starting of work after 10 days shall result into sufficient cause for laying compensation for misappropriate progress. However, the period from 15th June to 15th October being monsoon shall not be counted for the purpose of misappropriate progress consequent for levy of compensation.
Further of after commencement of work within 10 days of issue of order and after doing the some work, the contractor leave the work incomplete except for the following reasons, compensation at the rate of Rs.5,000/day will be levied from the stoppage of Asphalt work till the date its resumption. The competent authority may waive the amount of penalty in case of allotted work completed within time limit.

A. For the days the stoppage is solely due to breakdown of machinery and
B. Paver plant if not shifted from the site and no work is done on other site through the paver plant during the period of breakdown of machinery.

21. The Contractor shall invariably get the job mix formula for the mix approved by the Engineer-in charge or by TPI agency where applicable before starting of the work and when instructed by engineer-in-charge.

22. Joint venture shall not be allowed under this tender.

23. Contractor must have Produce a valid Proof of having Batching Plant of 30 Cum/Hr.

24. Demarcation of Road shall be Done by Contractor at his Own Cost. Soft copy of Demarcation Data will be Provided by RUDA, Contractor has to Demark Centre line also.

Director (Projects)

Signature of Contractor **Rajkot Urban Development Authority**

Part-I Section-I

INSTRUCTIONS TO BIDDERS

Part-I Section-I
Rajkot Urban Development Authority

:: INSTRUCTIONS TO TENDERER ::

IT 1. GENERAL

The contract documents may be secured in accordance with the Notice Inviting e - TENDER for the work called. The work shall include supply of materials necessary for construction of the work.

IT 2. INVITATION TO E - TENDER

The Rajkot Urban Development Authority hereinafter referred as the RUDA will receive e-Tenders for the work as per the specifications and schedule of prices in the e-Tender document. The e-Tenders shall be opened online as specified in the e-Tender notice in the presence of interested Tenderers or their representatives. The RUDA reserves the right to reject the lowest or any other or all e- Tenders or part of it which in the opinion of the RUDA does not appear to be in its best interest, and the Tenderer shall have no cause of action or claim against the RUDA or its officers, employees, successors or assignees for rejection of his e-Tender.

IT 3. LANGUAGE OF e - Tender

e-TENDERs shall be submitted in English, and all information in the e-Tender shall also be in English, Information in any other language shall be accompanied by its translation in English. Failure to comply with this may make the e-Tender liable to rejection.

IT 4. QUALIFICATIONS OF TENDERERS

A. The Tenderers shall abide by the laws of the Union of India and of Gujarat State and legal jurisdiction of the place where the works are located.

B. The Tenderer shall furnish a written statement of financial and technical parameters with details and documents along with his e-Tender which contains namely as below:

i. The Tenderer's experience in the fields relevant to this contract.
ii. The Tenderer's financial capacity/resources and standing over at least 5 (Five) years.
iii. The Tenderer's present commitments (Jobs on hand).
iv. The Tenderer's capability and qualifications of himself and his regular staff etc.
v. Plants and Machinery available with the Tenderer for the work Tendered.

IT 5. e - Tender DOCUMENTS

The e-Tender documents and drawings shall comprehensively be referred to as e - Tender document. The several sections form in the document are the essential parts of the contract and a requirement occurring in one shall be as binding as though occurring in all, they are to be taken as mutually, explanatory and describe and provide for complete works.

IT 6. EXAMINATION BY TENDERERS

A. At this own expense and prior to submitting his e-Tender, each Tenderer shall (a) examine the Contract Documents, (b) visit the site and determine local conditions which may affect the work including the prevailing wages and other pertinent cost factors, (c) familiarize, himself with all central, state and local laws, ordinance, rules regulations and codes affecting the material supply including the cost of permits and licenses required for the work and (d) correlate his observations,

investigations, and determinations with the requirements of the e-Tender Documents, site & subsoil investigation.

B. The e-Tender is invited on Percentage Rate basis The works shall have to be completed in all respect as stated in the e-Tender document to the satisfaction of the RUDA.

C. The following comprises in Contract Documents at a price of Rs. 8,850/- (Include GST@18%)

e - Tender Document:

PART – I

Section-1	Invitation to Bid, Additional Conditions to Contractors, Eligibility Criteria, Instructions to Bidders.
Section-2	General Conditions of Contract Additional instructions, Format

PART – II

Section-2	Technical Specifications Quality control manual for works

PART – III

Section-3	Price Bid Schedule – B

D. Copy of the e-Tender Document should be completed, checked in a responsible manner, digitally signed, and submitted. Security Bond shall be submitted in person up to the stipulate date, which shall be as per tender condition.

The e-Tender is required to be filled with necessary details in all the pages in which entries are required to be made by the Tenderer are contained in the e - Tender documents and the Tenderer shall not take out or add to or amend the text of any of the documents except in so far as may be necessary to comply with any addenda issued pursuant to Clause IT. 17 hereof.

IT 7. EARNEST MONEY DEPOSIT:

A. Each Tenderer must submit DD/FDR as Tender guarantee towards **Earnest money** amounting to Rs.3,12,065/- in the form of crossed Demand Draft in favor of "Rajkot Urban Development Authority", from any Nationalized/Scheduled bank in India acceptable to owner payable at Rajkot.

B. The Earnest Money Deposit will be refunded to the unsuccessful Tenderers after an award has been finalized.

C. The Earnest Money Deposit (Tender Guarantee) will be forfeited in the event, the successful Tenderer fails to accept the contract and fails to submit the "Performance Guarantee" to the Owner as stipulated in this e-Tender documents within ten days. (10) days after receipt of notice of award of contract.

D. No interest shall be paid by the owner on any e-Tender guarantee.

E. EMD of successful bidder will be returned after submission of performance guarantee and award of contract.

IT 8. INCOME TAX CLEARANCE CERTIFICATE :

Latest Income Tax return papers in prescribed Performa of Income Tax Dept must accompany with the e-Tender without which the e-Tender is liable to be summarily rejected. The Income Tax papers clearly indicate the Income Tax Pan No/Circle/Ward, District and the reference number of the assessment along with the assessment year.

IT 9. PREPARATION OF e-TENDER DOCUMENTS

Tenderers are required to note the following while preparing the e-TENDER Documents:

A. e-TENDER shall be submitted on the e-TENDER form bound here in English. All statements shall be properly filled in. Numbers shall be stated both in words and in figures were so indicated.

B. All entries or prices and arithmetic shall be checked before submission of the e - TENDERs. If there is discrepancy between the rates quoted in figures and in words, the rates expressed in words shall be considered as binding.

C. Each e-Tender shall be accompanied by the prescribed e-Tender security bond and other required documents and drawings. All witnesses and sureties shall be persons of status and probity and their full names, occupations and addresses shall be stated below their signature.

D. Variation to the contract Documents requested by the Tenderer may be affixed and duly signed and stamped. Such variations may be approved or refused by the RUDA is not obliged to give reason for his decisions.

IT 10. SUBMISSION OF e-TENDER DOCUMENTS

Tenderers are requested to submit the e-TENDER Documents on following lines.

A. Volume containing following documents :

I. Tender Fee DD
II. Earnest Money Deposit.
III. Certificates as registered contractor in appropriate class with Government of Gujarat or appropriate authority.
IV. Tenderer's financial capability statement including last five years Income tax returns, balance sheet, duly signed by registered chartered account.
V. Tenderer's experience in the field relevant to this contract.
VI. A list of the equipments the Tenderer possesses and that which he proposed to acquire and use for the purpose related to the work.

The time limit for receipt of e-Tender shall strictly apply in all cases. The Tenderers should therefore ensure that their e-Tender is received by the competent authority **The Rajkot Urban Development Authority** at before expiry of the time limit. No delay on account of any cause for receipt of e-Tender shall be entertained.

The e-Tender must contain the name address of residence and place of business of the person or persons submitting the e-Tender and must be digitally signed.

e-TENDERs by partnership firm must be furnished with the full names and addresses of all partners and be signed by one of the members of the partnership or by a legally authorized representative holding power of attorney followed by signature and designation of the person of person signing. e-TENDERs by corporations/companies must be signed with the legal name of the Corporation/Companies by the president/or by the secretary or other person or persons legally authorized to bind the Corporation/Company in the matter.

IT 11 TENDER VALIDITY PERIOD

The validity period of the e-Tender submitted for this work shall be of one hundred eighty (180) calendar days from the date of opening of the e-Tender and that the Tenderer shall not be allowed to withdraw or modify the e-Tender offer on his own during the validity period. The Tenderer will not be allowed to withdrawn the e-Tender or make any modifications or additions in the terms and conditions on his own e-Tender. If this is done then the RUDA shall, without prejudice to any other right or remedy, be at liberty to reject the e-Tender and forfeit the Earnest Money Deposit in full and Tenderer will be debarred for next three year in Rajkot Urban Development Authority.

In exceptional circumstances, prior to expiry of the original bid validity period, the Employer may request the bidders to extend the period of validity for a specified additional period. The request and the responses thereto shall be made in writing or by fax. 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 the period of the extension.

IT 12 GENERAL PERFORMANCE DATA

Tenderers shall present all the information which sought for in the e-Tender document in form of various schedules if given. e-TENDERs may not be considered if left blank or the schedules are not properly filled in.

IT 13 SIGNING OF e-TENDER DOCUMENTS

If the Tender is made by an individual it shall be signed with his full name above his current address. If the Tender is made by a proprietary firm, it shall be signed by the proprietor above his name and the name of his firm with his current address.

If the e-Tender is made by a firm in partnership, it shall be signed by all the partners of the firm above their full names and current address, or by a partner holding the power of attorney for the firm, in which case a certified copy of the power of attorney shall accompany the e-TENDER. A certified copy of the partnership deed, current addresses of all the partners of the firm shall also accompany the e-Tender.

If the e-Tender is made by a limited company or a limited corporation, it shall be signed by a duly authorized person holding the power of attorney, shall accompany the e-Tender. Such limited company or corporation may be required to furnish satisfactory evidence of its existence before the contract is awarded.

If the e-TENDER is made by a group of firms, the sponsoring firm shall submit complete information pertaining to each firms in the group and state along with the bid as to which of the firms shall have the responsibility for e-Tendering and for completion of the contract documents and furnish evidence admissible in law in respect of the authority to such firms on behalf of the group of firms for e-Tendering and for completion of contract documents. The full information and satisfactory evidence pertaining to the participation of each member of the group of firms in the e-Tender shall be furnished along with the e-Tender.

All witnesses and sureties shall be persons of status and probity and their full names, occupations and addresses shall be stared below their signatures. All the signatures in the e-Tender document shall be dated.

IT 14 WITHDRAWAL OF TENDERS

If, during the tender validity period, the Tenderer withdraws his Tender, Tender security (Earnest Money) shall be forfeited and Tenderer will be debarred for next three years to quote in RUDA.

IT 15 PRICES ARE FIRM & FIX

Prices are Firm and Fix and No price escalation will be entertained for the contract period or extended period except or otherwise specified anywhere.

IT 16 INTERPRETATIONS OF e-TENDER DOCUMENTS

Tenderers shall carefully examine the e-TENDER Document and fully inform themselves as to all the conditions and matters which may in any way affect the work or the cost thereof. If a Tenderer finds discrepancies, or omission from the specifications or other documents or should be in doubt as to their meaning, he should at once address query to the Director(Projects), RUDA. The result of interpretation of the e-TENDER will be issued to all Tenderers as addendum.

IT 17 ERRORS AND DISCREPANCIES IN e-TENDERS

In case of conflict between the figures and words in the rates the rate expressed in words shall prevail and apply in such cases.

IT 18 MODIFICATION OF DOCUMENTS

Modification of specifications and extension of the closing date of the e-Tender, if required will be made by an addendum. Each addendum will be made available online to all Tenderers. These shall form a part of e-Tender. The Tenderer shall not add to or amend the text of any of the documents except in so far as may be necessary to comply with any addendum.

ADDENDA

Addenda form part of the Contract Documents, and full consideration shall be given to all Addenda in the preparation of e-Tender. Tenderers shall verify the number of Addenda issued, if any and acknowledge the receipt of all Addenda in the e-TENDER Failure to so acknowledge may cause the e-Tender to be rejected.

A. The Owner may issue Addenda to advise Tenderers of changed requirements. Such addenda may modify previously issued Addenda.

B. No addendum may be issued after the closing time(Last date of submission) stated in the notice inviting e - Tenders.

IT 19. TAX AND DUTIES ON MATERIALS

All charges on account of excise duties, Central / State, sales tax, work contract tax and other duties etc. on materials obtained for the works from any source shall be borne by the contractors. No (P) or 'C' or 'D' form shall be supplied.

IT 20 EVALUATION OF E - TENDERS

While comparing e-Tenders, the Rajkot Urban Development Authority shall consider factors like price offer is workable with the market price, efficiency and reliability of construction method proposed, compliance with the specifications, relative quality, work done in past with Rajkot Urban Development Authority or other Government Organizations, litigation issues etc. Evaluation criteria specifically mentioned in the specification will also be taken into consideration in the evaluation of e- Tenders.

IT 21 TIME REQUIRED FOR COMPLETION

The completion period mentioned in this schedule is to be reckoned from the date of notice to proceed. Total completion period is **9 Months** from the date of issue

of notice to proceed and contractor should adhere to this completion time. Monsoon period from 15th June to 14th September will be considered as non-working period and hence excluded in time limit.

IT 22 POLICY FOR TENDER UNDER CONSIDERATION

TENDER shall be termed to be under consideration from the opening of the e - Tender until such time any official announcement or award is made.

While e-Tenders are under consideration, Tenderers and their representative or other interested parties are advised to refrain from contacting by any means any RUDA personnel or representatives on matters related to the e-Tenders under study. The RUDA's representatives if necessary will obtain clarification on e-Tenders by requesting such information from any or all the Tenderers, either in writing or through personal contact, as may be necessary. The Tenderer will not be permitted to change the substance of his e-Tender after e-Tenders have been opened. This includes any post Tender price revision. Non-compliance with his provision shall make the Tender liable for rejection.

IT 23 PRICES AND PAYMENTS

The Tenderer must understand clearly that the prices quoted are for the total works or the part of the total works quoted for and include all costs due to materials, labour, equipment, supervision, other services, royalties, taxes etc. and to include all extra to cover the cost. No claim for additional payment beyond the prices quoted will be entertained and the Tenderer will not be entitled subsequently to make any claim on any ground.

IT 24 PAYMENT TERMS

The terms of payment are defined in the General Conditions of Contract and Technical specifications. The RUDA shall not under any circumstances relax these terms of payment and will not consider any alternative payment terms. Tenderers should therefore in their own interest note this provision to avoid rejection of their e-Tenders.

IT 25 AWARD

Award of the contract or the rejection or e-TENDERs will be made during the Tender validity period. A separate Schedule-B (Price Schedule) is given. The contractors are requested to quote their price offer **in the schedule-B of Price Schedule only.**

A. After all contract contingencies are satisfied and the Notice of Award is issued, the successful Tenderer shall execute the Contract Agreement within the time stated and shall furnish the Bond as required herein. The contract Agreement shall be executed, in form stipulated by the Owner.

B. If the Tenderer receiving the Notice of Award fails or refuses to execute the Contract Agreement within the stated time limit or fails or refuses to furnish the Bond as required herein. The agency may be black listed / debarred from Rajkot Urban Development Authority for three years.

C. A corporation, partnership firm or other consortium acting as the Tenderer and receiving the award shall furnish evidence of its existence and evidence that the officer signing the contract agreement and Bonds for the corporation, partnership firm or other consortium acting as the Tenderer is duly authorized to do so.

IT 26 SIGNING OF CONTRACT

The successful Tenderer shall be required to execute the contract agreement within 10 days of receipt of intimation to execute the contract, failing which the Authority will be entitled annul to the award and forfeit the Earnest Money

Deposit. The person to sign the contract document shall be person as detailed in Article IT. 13 (signing of e-Tender documents).

IT 27 DISQUALIFICATION

A e-Tender shall be disqualified and will not be taken for consideration if,

(a) The Tender fee and Tender Earnest Money Deposit is not deposited in full and in the manner as specified as per Article IT. 7 i.e. Earnest Money Deposit.
(b) The e-Tender is in a language other than English or does not contain its English Translation in case of other language adopted for e-Tender preparation.
(c) The e-Tender documents are not signed by an authorized person (as per Article IT. 13 i.e. signing of e-Tender documents).
(d) The general performance data for qualification is not submitted fully (as per Article IT 12 i.e. General performance Data).
(e) Tenderer does not agree to payment terms defined as per Article IT. 23 i.e. payment terms.

A. A e-Tender may further be disqualified if,

(a) Price variation is proposed by the Tenderer on any principle other than those provided in the e-TENDER Documents.
(b) Completion schedule offered is not consistent with the completion schedule defined and specified in e-Tender document.
(c) The validity of e-Tender bond is less than that mentioned in Article IT. 11 i.e. e - Tender validity period.
(d) Any of the page or pages of e-Tender is/are removed or replaced.
(e) Any conditional tender.

IT 28 PERFORMANCE GUARANTEE (SECURITY DEPOSIT)

As a contract security the Tenderer to whom the award is made shall furnish a performance guarantee (Security deposit) for the amount of **5%** of the contract price to guarantee the faithful performance, completion and maintenance of the works of the contract in accordance with all conditions and terms specified herein and to the satisfaction of the Engineer-in-charge and ensuring the discharge of all obligations arising from the execution of contract in the forms mentioned below:

1. A fixed deposit receipt or bank guarantee of any Schedule Bank or Nationalized Bank & Private Sector Bank approved by Govt. (Except Co-operative Bank) duly endorsed in favour of the **Rajkot Urban Development Authority, Rajkot.**
2. The performance guarantee shall be delivered to the RUDA within ten (10) days of the notice of award and at least Ten (10) days before the contract agreement is signed unless otherwise specified by the Engineer-in-charge. Alternatively, the contractor may at his option deposit an amount of **2.5%** of the value of the contract price within ten days and the balance **2.5%** to be recovered in installments through deduction @ the rate of 5% from the running account bills.

   On due performance and completion of the contract in all respects, **THE PERFORMANCE GUARANTEE WILL BE RETURNED TO THE CONTRACTOR WITHOUT ANY INTEREST AFTER THE DEFECT LIABILITY PERIOD IS OVER.**

IT 29 STAMP DUTY

The successful Tenderer shall have to enter into an agreement on a non-judicial stamp paper of Rs.100/- as per the form of the agreement approved by the RUDA. The cost of stamp paper and adhesive stamp shall be borne by the contractor.

IT 30 BRAND NAMES

Specific reference in the specifications to any material by manufacturer's name, or catalogue shall be constructed as establishing a standard or quality and performance and not as limiting competition and the Tenderer in such cases, may at his option freely use only other product, provided that it ensures an equal of higher quality than the standard mentioned and meets RUDA approval.

IT 31 NON TRANSFERABLE

e-TENDER documents are not transferable.

IT 32 COST OF e-Tendering

The owner will not defray expense incurred by Tenderers in e - Tendering.

IT 33 EFFECT OF e-Tender

The e-Tender for the work shall remain valid for a period of 180 calendar days from the date of opening of the e-Tenders for this work and that the Tenderer shall not be allowed to withdraw or modify the offer in his own during the period. If any Tenderer withdraws or makes any modification or additions in the terms and conditions of his own e-Tender, then the RUDA shall, without prejudice to any other right or remedy, be at liberty to reject the e-Tender and forfeit the earnest money in full.

IT 34 CHANGE IN QUANTITY

The RUDA reserves the right to waive any information in any e-Tender and to reject one or all e-Tenders without assigning any reasons for such rejection and also to vary the quantities of items or group as specified in the scheduled of prices as may be necessary.

IT 35 NEW EQUIPMENT AND MATERIAL

All materials, equipment and spare parts thereof shall be new, unused and originally coming from manufacturer's plant to the Authority. The rebuilt or overhauled equipment/materials will not be allowed to be used on works.

IT 36 RIGHTS RESERVED

The owner reserves the right to reject any or all e-Tenders, to waive any informality or irregularity in any e-Tender without assigning any reason. The owner further reserves the right to withhold issuance of the notice to proceed, even after execution of the contract agreement. No payment will be made to the successful Tenderer on account of such withholding. The owner is not obliged to give reasons for any such action.

IT 37 ADDITIONAL RIGHTS RESERVED

The Chief Executive Officer, Rajkot Urban Development Authority, reserves right to reduce the scope of work & split the e-Tender on two or more parts without assigning any reason even after the awards of contract.

IT 38 MOBILIZATION ADVANCE

No mobilization advance or advance on machinery will be given.

IT 39 CONDITIONAL e-Tenders

The scope of work is clearly mentioned in the e-Tender documents. The contractor shall have to carry out the work in accordance with the details specifications. No condition will be accepted. The conditional e-Tender will liable to be rejected.

IT 40 <u>1%</u> <u>CESS</u> <u>&</u> <u>REGISTRATION</u>:

For the welfare of labour working under construction Industry, the agency shall have to take the registration with competent authority as per Circular No.CWA/2004/841/M-3 dated 30-01-2006 of Government of Gujarat. Rajkot Urban Development Authority will deduct 1% Cess of the value of work and will deposit the same in Government.

IT 41 PROFESSIONAL TAX

The bidder shall have to pay the Professional Tax for current financial year imposed by Government of Gujarat, and also the bidder shall have to produce Enrollment Certificate for the same if asked by the authority .

IT 42 P F Code

The contractor shall have to avail P F Code and he is responsible for payment of amount of P.F. every month as per the prevailing Circular of Government for the employees on work, which will binding to the contractor. The required documents shall have to be submitted by the contractor to the competent authority whenever required.

IT 43 FILLING OF e-TENDER

The bidder shall have to fill all the details required in on-line bidding form of e-Tender. Incomplete OR inappropriate OR wrong information filled may cause the e-Tender to be rejected.

IT 44 Laboratory Test

The Contractor shall setup a field laboratory along with all the calibrated equipments for testing of asphalt, aggregates and Hot Mix material along with the Material Engineer of required qualification in the Laboratory having experience of at least 3 years in Laboratory testing.

IT 45 Road Works

A) Site clearance, removal of scrub and dismantling of obstructions etc. before commencement of the Works;

B) True and proper setting out and layout of the Works, setting of bench marks, provisions of all necessary labor, instruments, and appliances;

C) Widening and strengthening/reconstruction of the existing carriageway including raising manholes, catch pits, valves, etc.

D) Environmental measures.

E) Any other item of work as may be required to be carried out for completing the road works in all respects in accordance with the provisions of the Contract.

IT 46 Commencement of Work

As per Clause 20 of additional conditions

IT 47 Vehicle

From the date of work order up to completion of the work in all manner, the contractor shall have to provide 1 (One) diesel vehicle of A.C.bolero campus, swift or equivalent model shall not be older than January 2017. The vehicle shall be provided during execution. The vehicle will be provided with driver having valid license. The cost of all operation and maintenance/fuel charges, oil-greases etc. will be borne by contractor. RUDA will use vehicle maximum 3000 km per month per vehicle. On completion of this project vehicle will be returned to contractor. Authority can use vehicle for any use for RUDA work For non supply of vehicle except valid reason, RUDA will levy Rs. 1500/- per day penalty till the vehicle is provided by the agency.

Signature of Contractor **Director(Projects)**
RUDA

Part-I Section-II
:: GENERAL CONDITIONS OF CONTRACT ::

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GC-01 DEFINITIONS AND INTERPRETATIONS :

1.0 In the contract (as hereinafter defined) the following words and expressions shall, unless repugnant to the subject or context thereof, have the following means assigned to them.

1.1 The **"Owner / RUDA"** shall mean Rajkot Urban Development Authority and shall include its Chief Executive Officer, RUDA or other Officers authorized by the RUDA and also include owner's successors and assignees.

1.2 The **"Contractor"** shall mean the person or the persons, firm or Company whose tender has been accepted by the Owner and includes the Contractors legal representative, his successors and permitted assigned.

1.2.1 "**Consultant**" shall mean Advisor who are the Technical Advisor to RUDA for these assigned works

1.3 Deleted

1.4 The **"Engineer-In-Charge"** shall mean the person designated as such by the owner from time to time and shall include those who are expressly authorized by the RUDA to act for and on its behalf for all functions pertaining to the operation of this contract.

1.5 **"Engineer-In-Charge's Representative"** shall mean any resident Engineer or Assistant to the Engineer-In-Charge appointed from time to time by the owner to perform duties set forth in the Tender Document whose authority shall be notified in writing to the Contractor by the Engineer-In-Charge.

1.6 **"Tender"** – the offer or proposal of the Tenderer submitted in the prescribed form setting for the prices for the work to be performed, and the details thereof.

1.7 **"Contract Price"** shall mean total money payable to the Contractor under the contract.

1.8 **"Addenda"** shall mean the written or graphic notices issued prior to submission of tender which modify or interpret the contract documents.

1.9 **"Contract Time"** – the time specified for the completion of work.

1.10 **"Contract"** shall mean agreement between the parties for the execution of works including therein all contract documents.

1.11 **"Contract Document"** shall mean collectively the tender documents, designs, drawings, specifications, agreed variations, if any and such other documents constituting the tender and acceptance thereof.

1.12 **"The Sub-Contractor"** shall mean any person, firm or company (other than the Contractor) to whom any part of the work has been

entrusted by the Contractor with the written consent of the Engineer-In-Charge and the legal representative successors and permitted assignee of such person, firm or company.

1.13 The **"Specifications"** shall mean all directions, the various Technical Specifications, provisions and requirements attached to the contract which pertains to the method and manner of performing the work, to the quantities and qualities of the work and the materials to be furnished under the contract for the work and any order(s) or instruction(s) there under. It shall also mean the latest Indian Standard Institute Specification relative to the particular work or part thereof, so far as they are not contrary to the Tender specifications and in absence of any other Country applied in Indian as a matter of standard engineering practice and approved in writing by the Engineer-In-Charge with or without modification.

1.14 The **"Drawings"** shall include maps, plans, tracings, or prints thereof with any modification approved in writing by the Engineer-In-Charge and as such other drawings as may, from time to time, be furnished or approved in writing by the Engineer-In-Charge in connection with the work.

1.15 The **"Work"** shall mean the works to be executed in accordance with the contract or the part thereof as the case may be and shall include extra, additional, altered or substituted works as required for the purpose of the contract. It shall mean the totality of the work by expression or implication envisaged in the contract and shall include all materials, equipment and labour required for or relative or incidental to or in connection with the commencement, performance and completion of any work and / or inRUDA in the work.

1.16 The **"Permanent Work"** shall mean works which will be incorporated in and form part of the work to be handed over to the owner by the Contractor on completion of the contract.

1.17 The **"Temporary Work"** shall mean all temporary works of every kind required in or about the execution, completion and maintenance of the work.

1.18 **"Site"** shall mean the land and other places, on, under, in or through which the permanent works are to be carried out and any other lands or places provided by the RUDA for the purpose of the contract together with any other places designated in the contract as forming part of the site.

1.19 The **"Construction Equipment"** shall mean all appliances / equipment of whatever nature required in or for execution, completion or maintenance of works or temporary works (as herein before defined) but does not include materials or other things intended to form or forming part of the permanent work.

1.20 **"Notice in writing or written Notice"** shall mean a notice written, typed or in printed form delivered personally or sent by Registered Post to the last known private or business address or Registered Office of the Contractor and shall be deemed to have been received in the ordinary course of post it would have been delivered.

1.21 The **"Alteration / variation order"** shall mean an order given in writing by the Engineer-In-Charge to effect additions or deletions from or alterations in the work.

1.22 **"Final Test Certificate"** shall mean the final test certificate issued by the owner within the provisions of the contract.

1.23 The **"Completion Certificate"** shall mean the certificate to be issued by the Engineer-In-Charge when the work has been completed and tested to his satisfaction.

1.24 The **"Final Certificate"** shall mean the final certificate issued by the Engineer-In-Charge after the period of defects liability is over and the work is finally accepted by the owner.

1.25 **"Defects Liability Period"** shall mean the specified period between the issue of Completion Certificate and the issue of final certificate during which the Contractor is responsible for rectifying all defects that may appear in the works.

1.26 **"Approved"** shall mean approved in writing including subsequent confirmation in writing of previous verbal approval and "Approval" means approved in writing including as aforesaid.

1.27 **"Letter of Acceptance"** shall mean an intimation by a letter to tenderer that his tender has been accepted in accordance with the provisions contained therein.

1.28 **"Order"** and **"Instructions"** shall respectively mean any written order or instruction given by the Engineer-In-Charge within the scope of his powers in terms of the contract.

1.29 **"Running Account Bill"** shall mean a bill for the payment of "On Account" money to the Contractor during the progress of work on the basis of work done and the supply of non-perishable materials to be incorporated in the work.

1.30 **"Security Deposit"** shall mean the deposit to be held by the owner as security for the due performance of the contractual obligations.

1.31 The **"Appointing Authority"** for the purpose of Arbitration shall be the CEO, Rajkot Urban Development Authority.

1.32. **"Retention Money"** shall mean the money retained from R.A.Bills for the due completion of the "LET WORS".

1.33 Unless otherwise specifically stated, the masculine gender shall include the feminine and neuter genders and vice-versa and the singular shall include the plural and vice-versa.

GC-02 LOCATION OF SITE AND ACCESSIBILITY :

The intending tenderer should inspect the site and make himself familiar with the site condition and available communication facility. The work is to be carried out in Ruda Area. Non-availability of access roads shall in no case be the cause to condone delay in the execution of the work or be the cause for any claim or extra compensation.

GC-03 SCOPE OF WORK :

The scope of work is defined broadly in the special conditions of contract and specifications. The Contractor shall provide all necessary materials, equipment and labour etc. for the execution and maintenance of the work. All material that goes with the work shall be approved by the Engineer-In-Charge prior to procurement and use.

Power Supply :

The Contractor shall make his own arrangement for power supply.

Land for Contractor's Field Office, Go down Etc.:

Owner will not be in a position to provide land required for Contractor's field office, go down, etc. The Contractor shall have to make his own arrangement for the same.

GC-04 RULING LANGUAGE :

The language according to which the contract shall be construed and interpreted shall be English. All entries in the contract document and all correspondence between the contractor and the RUDA or the Engineer-In-Charge shall be in English. All dimensions for the materials shall be given in metric units only.

GC-05 INTERPRETATION OF CONTRACT DOCUMENT :

1. The provision of the General Conditions of Contract and Special Conditions of Contract shall prevail over those of any other documents of the contract unless specifically provided otherwise, should have there be any discrepancy, inconsistency, error or omission in the several documents forming the contract, the matter may be referred to the Engineer-In-Charge for his instructions and decision. The Engineer-In-Charge's decision in such case shall be final and binding to the Contractor.

2. Works shown upon the drawings but not described in the specifications or described in the specifications without showing on the drawings shall be taken as described in the specifications and shown on the drawings.

3. The headings and the marginal notes to the clause of these General Conditions of Contract or to the specifications or to any other part of tender documents are solely for the purpose of giving a concise indication and not a summary of contents thereof. They shall never be deemed to be part thereof or be used in the interpretation or construction of the contract.

4. Unless otherwise states specifically, in this contract documents the singular shall include the plural and vice-versa wherever the context so requires. Works imparting persons shall include relevant Corporations / Body of individual / firm of partnership.

5. Notwithstanding the sub-division of the documents into separate section and volumes every part of each shall be supplementary to and complementary of every other part and shall be read with and into the context so far as it may be practicable to do so.

6. Where any portion of the General Conditions of Contract is repugnant to or at variance with any provisions of the Special Conditions of Contract, then, unless a different intention appears, the provisions of the special conditions of contract shall be deemed to over ride the provisions of General Conditions of Contract to the extent of each repugnancy of variance.

7. The materials, design, and workmanship shall satisfy the relevant BIS, and codes referred to. If additional requirements are shown in the specifications, the same shall be satisfied over and above BIS and other codes.

8. If the specifications mention that the Contractor shall perform certain work or provide certain facilities, it shall mean that the Contractor shall do so at his own cost.

9. Contractor to Collect His Own Information -

The details given in the tender are arranged making necessary investigations for framing an estimate. However, when the work is being executed, changes in soil conditions are likely to be met with in view of the formation of soil, strata in Rajkot District. It is, therefore, desirable that the Contractor makes his own investigations or additional investigations as may be required for correctly assessing the cost of different items of work and submit his tender accordingly. Any change in description or quantity of an item shall not vitiate the contract or release the Contractor from executing the work comprised in the contract according to the drawings and specifications at the tendered rates.

He is deemed to have know the scope, nature and magnitude of the work and the requirements of materials and labour involved and as to whatever work he has to complete in accordance with the contract. The Contractor is expected to visit the site and surroundings to satisfy himself as to the nature of all existing structures, if any, and also as to the nature and the conditions of

railways, roads, bridges and culverts, means of transport and communications whether by land, air or water and as to possible interruptions thereto and the access and gross from the site, to have examined and satisfied himself as to the sites for obtaining sand, stones, bricks and other materials, the site for disposal of surplus materials, the available accommodation and make such enquiries as may be necessary for executing and completing the work, to have local enquiries as to the sub-soil, subsoil water and variation thereof, storms, prevailing winds, climatic conditions and all other similar matters, effecting work. He is expected to be familiar with his liability for payment of Government taxes, customs and excise duty, Octroi and other charges etc. in contract with the execution of this contract. The contractor shall give a certificate for this.

GC-06 CONTRACTOR TO UNDERSTAND HIMSELF FULLY :

The Contractor by tendering shall be deemed to have satisfied himself, as to all considerations and circumstances affecting the tender price, as to the possibility of executing the works as shown and described in the contract and to have fixed his prices according to his own view on these matters and to have understood that no additional allowances except as otherwise expressly provided, will afterwards be made beyond the contract price. The Contractor shall be responsible for any misunderstanding or incorrect information, however, obtained.

GC-07 ERRORS IN SUBMISSIONS :

The Contractor shall be responsible for any errors or omissions in the particulars supplied by him, whether such particulars have been approved by the Engineer-In-Charge or not.

GC-08 SUFFICIENCY OF TENDER :

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness of the tender rates which rates shall, except as otherwise provides for, cover all the Contractor's liabilities and obligations set forth or implied in the contract for the proper execution of the work for compliance with requirements of Article GC-19 thereof.

GC-09 DISCREPANCIES :

The drawings and specifications are to be considered as mutually explanatory of each other, detailed drawings being followed in preference to small-scale drawings and figured dimensions in preference to scale and special conditions in preference to General Conditions. The special directions or dimensions given in the specifications shall supersede all else. Should any discrepancies however, appear or should any misunderstanding arise as to the meaning and intent of the said specifications or drawings, or as to the dimensions or the quality of the materials or the due and proper execution of the works, or as to the measurement or quality and valuation of the work executed under this contract or as extra there upon, the same shall be explained by the Engineer-In-Charge and

his explanation shall be subject to the final decision of the RUDA in case reference be made to it, be binding upon the Contractor and the Contractor shall execute the work according to such explanation and without addition or to deduction from the contract price and shall also do all such works and things necessary for the proper completion of the works as implied by the drawings and specifications, even though such works and things are not specially shown and described in the said specifications. In cases where no particular specifications are given for any article to be used under the contract, the relevant specifications of the Indian Standard Institution shall apply.

GC-10 PERFORMANCE GUARANTEE (SECURITY DEPOSIT) :

1. A sum of 5% of the accepted value of the tender shall be deposited by the tenderer (hereinafter called the contractor when tender is accepted) as security deposit with the owner for the faithful performance, completion and maintenance of the works in accordance with the contract documents and to the satisfaction of the Engineer-In-Charge and assuring the payment of all obligations arising from the execution of the contract. This shall be deposited in one of the forms mentioned below :

   a. By a Demand Draft on the Rajkot Branch of any Scheduled Bank.

   b. A Fixed Deposit Receipt or Bank Guarantee of any Schedule Bank or Nationalized Bank / Private Sector Bank approved by Govt. (except Co-operative Bank) duly endorsed in favour of the "**RAJKOT URBAN DEVELOPMENT AUTHORITY**", Rajkot.

   OR

   c. The Contractor may pay 2.5% of the value of works as initial security deposit and the balance 2.5% shall be recovered in installments through deductions at the rate of 5 (Five) percent of the value of each running account bill till the total security deposit amount is made up. However, if the value of the work as per actual execution exceeds the accepted value of tender because of allotment of further work, further recoveries towards security deposit shall be effected at 5% of the R.A. Bills to make up the Five percent security deposit of the revised value of contract. Alternatively, the contractor may at his option deposit the full amount of **five (5) percent** of security deposit within ten days of receipt by him of the notification accepting the tender in the form as aforesaid.

2. If the Contractor, sub-contractor or their employees shall break, deface or destroy any property belonging to the owner or other agency during the execution of the contract, the same shall be made good by the contractor at his own expense and in default thereof, the Engineer-In-Charge may cause the same to be made good by other agencies and recover expense from the Contractor (for which the certificate of the Engineer-In-Charge shall be final). These expense can be recovered from the security deposit if recovery from other sources is not possible. The amount as reduced

in security deposit will be made good by deduction from the next R A Bill of the Contractor.

GC-11 INSPECTION OF WORK :

1. The Engineer-In-Charge shall have full power and authority to inspect the work at any time wherever in progress either on the site or at the Contractor's or any other manufacturer's workshop or factories wherever situated and the Contractor shall afford to Engineer-In-Charge every facility and assistance to carry out such inspection, Contractor or his authorized representative shall, at all time during the usual working hours and all times when so notified, remain present to receive orders and instructions.

   Orders given to Contractor's representative shall be considered to have the same force as if they had been given to the Contractor himself. Contractor shall give not less than ten (10) days notice in writing to the Engineer-In-Charge before covering up or otherwise placing beyond reach of inspection and measurement any work in order that the same may be inspected and measured. In the event of breach of the above, the same shall be uncovered at Contractor's expenses for carrying out such inspection or measurement.

2. No material shall be dispatched from Contractor's store on site of work before obtaining approval in writing of the Engineer-In-Charge. Contractor shall provide at all times during the progress of work and maintenance period of proper means of access with ladders, gangways, etc. and make necessary arrangement as directed for inspection or measurement of work by Engineer-In-Charge.

GC-12 DEFECT LIABILITY :

1. Contractor shall guarantee the work for a period of **Two Years** from the date of issue of Completion Certificate. Any damage or defect that may arise or that may remain undiscovered at the time of issue of Completion Certificate connected in any way with the equipment or materials supplied by him or in the workmanship shall be rectified or replaced by Contractor at his own expense as desired by Engineer-In-Charge or in default Engineer-In-Charge may cause the same to be made good by other agency and deduct expenses of which the certificate of Engineer-In-Charge shall be final from any sums that may then or any time thereafter become due to Contractor or from his security deposit or the proceeds of sale thereof or of a sufficient portion thereof.

2. From the commencement to completion of work Contractor shall take full responsibility for the care of the work including all temporary works and in case any damages, occur from any cause whatsoever he shall at his own cost, repair and make good the same so that on completion, work shall be in good order and in conformity, in every respect, with the requirements of contract and as per the instructions of the Engineer-In-Charge.

3. If at any time before the work is taken over, the Engineer-In-Charge shall -

a) Decide that any work done or materials used by the Contractor are defective or not in accordance with the contract or that work or any portion thereof is defective or do not fulfill the requirements of contract (all such materials being herein after called defects in this clause) he shall, as soon as reasonably practicably, give notice to Contractor in writing of the said defect specifying particulars of the same then Contractor shall at his own expense and with all speed make good the defects so specified.

b) In case Contractor fails to do so, owner may take, at the cost of the Contractor, such stops as may in all circumstances be responsible to make good such defects. The expenditure so incurred by owner will be recovered from the amount due to Contractor. The decision of Engineer-In-Charge with regard to the amount to be recovered from Contractor will be final and binding on the Contractor.

GC-13 POWER OF ENGINEER-IN-CHARGE TO GIVE FURTHER INSTRUCTIONS :

The Engineer-In-Charge shall have the power and authority from time to time and at all times to give further instructions and directions as may appear to him necessary or proper for the guidance of the Contractor and the works and efficient execution of the works according to the terms of the specifications, and the Contractor shall receive, execute, obey and be bound by the same, according to the true intent and meaning thereof, as fully and effectively as though the same had accompanied or had been mentioned or referred to in the specifications. No work which radically changes the original nature of the contract shall be ordered by the Engineer-In-Charge and in the event of any deviation being ordered, which in the opinion of the Contractor changes the original nature of the contract, he shall nevertheless carry it out and any disagreement as to the nature of the work and the rate to be paid to thereof shall be resolved.

The time of completion of works shall, in the event of any deviations being ordered resulting in additional cost or reduction in cost over the contract sum, be extended or reduced reasonably by the Engineer-In-Charge. The Engineer-In-Charge's decision in the case shall be final and binding.

GC-14 PROGRAMME :

The time allowed for execution of works shall be the essence of the contract. The contract period shall commence from the date of notice of intimation to proceed. The tenderer at the time of submitting his tender shall indicate in the construction schedule his programme of execution of work commencement with the total time specified. The Contractor shall provide the Engineer-In-Charge a detailed programme of time schedule for execution of the works in accordance with the specifications and the completion date. The

entire programme to be finalized by the Contractor, has to conform to the execution period mentioned along with the Bill of Quantities in the tender documents. The Engineer-In-Charge upon scrutiny of such submitted programme by Contractor, shall examine suitability of it to the requirement of contract and suggest modifications, if found necessary.

GC-15 SUB-LETTING OF WORK :

No part of the contract nor any share of interest thereon shall in any manner or degree be transferred, assigned or sublet by the Contractor directly or indirectly to any person, firm or Corporation whosoever except as provided for in the succeeding sub-clause, without the consent in writing of the owner.

GC-16 SUB-CONTRACTS FOR TEMPORARY WORKS ETC. :

The owner may give written consent to sub-contractors for execution of any part of the works at the site, being entered upon the contractor provided each individual contract is submitted to the Engineer-In-Charge before being entered into and is approved by him. List of sub-contractors to be supplied.

Not-withstanding any subletting with such approval as aforesaid and notwithstanding the Engineer-In-Charge shall have received of any sub-contractors, the Contractor shall be and shall remain solely responsible for the quality and proper and expeditious execution of the works and the performance of all the conditions of contract in all respects as if such subletting or subcontracting had not taken place and as if such works had been done directly by the Contractor.

GC-17 TIME FOR COMPLETION :

1. The work covered under this contract shall be commenced from the date the Contractor is served with a notice to proceed with the work and shall be completed before the date as mentioned in the time schedule of work. The time is the essence of the contract and unless the same is extended as mentioned in Clause GC-18 "Extension of Time", the Contractor shall pay liquidated damages for the delay.

2. The general time schedule for construction is given in the tender document. Contractor shall prepare a detailed weekly or monthly construction programme in consultation with the Engineer-In-Charge soon after the agreement and the work shall be strictly executed accordingly.
The time for construction includes, the time required for testing, rectifications, if any, retesting and completion of the work in all respects to the entire satisfaction of the Engineer-In-Charge.

GC-18 EXTENSION OF TIME :

Time shall be considered as the essence of the contract. If, however, the failure of the Contractor to complete the work as per the stipulated dates referred to above arises from delays on the part of RUDA in supplying the materials or equipment, it has undertaken

to supply under the contract or from delays on the quantity of work to be done under the contract, or force majeure an appropriate extension of time will be given by the CEO, RUDA. The Contractor shall request for such extension within one month of the cause of such delay and in any case before expiry of the contract period.

GC-19 CONTRACT AGREEMENT :

The successful tenderer shall enter into and execute the contract agreement within 10 (ten) days of the notice of award, in the form shown in tender documents with such modifications as may be necessary in the opinion of the RUDA. It shall be incumbent on the Contractor to pay the stamp duty and the legal charges for the preparation of the contract agreement.

GC-20 LIQUIDATED DAMAGES :

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 0.1 percent of contract value for each day of delay subject to maximum of 10% of the estimated amount put to tender or as decided by CEO, RUDA.

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 CEO, RUDA.

The amount of liquidated damages shall, however, be subjected to a maximum of 10 percent of the estimated amount put to tender. Delay in excess of one hundred days shall be a cause of termination of the contract and forfeiture of all security for performance.

GC-21 FORFEITURE OF SECURITY DEPOSIT :

Whenever any claim against the Contractor for the payment of a sum of money out of or under the contract arises, the RUDA shall be entitled to recover such sum by appropriating in part or whole, the security deposit of the Contractor. In case the security deposit is insufficient, the balance recoverable shall be deducted from any sum then due or which at any time thereafter may become due to the Contractor. The Contractor shall pay to the owner on demand any balance remaining due.

GC-22 ACTION OF FORFEITURE OF SECURITY DEPOSIT :

In any case in which under any Clause or Clauses of the contract, the Contractor shall have forfeited the whole of his security deposit or have committed a breach of any of the terms contained in this contract, the owner shall have power to adopt any of the following courses as he may deem best suited to his interest.

a) To rescind the contract (of which recession notice in writing to the contractor under the hand of the owner shall be conclusive

evidence) in which case the security deposit of the Contractor shall stand forfeited and be absolutely at the disposal of the owner.

b) To employ labour and to supply materials to carry out the balance work debiting Contractor with the cost of labour employed and the cost of materials supplied for which a certificate of the Engineer-In-Charge shall be final and conclusive against the Contractor and 10% of costs on above to cover all departmental charges and crediting him with the value of work done at the same rates as if it has been carried out by the Contractor under the terms of his contract. The certificate of Engineer-In-Charge as to the value of the work done shall be final and conclusive against the Contractor.

c) To measure up the work of the contractor and to take such part thereof as shall be unexecuted out of his hand and give it to another Contractor to complete, the same. in this case the excess expenditure incurred than what would have been paid to the original Contractor, if the whole work had been executed by him, shall be borne and paid by the original Contractor and shall be deducted from any money due to him by the owner under the contract or otherwise and for the excess expenditure, the certificate of the Engineer-In-Charge shall be final and conclusive.

In the event any of the above courses being adopted by the owner, the Contractor shall have no claims for compensation for any loss sustained by him by reason of his having purchased or procured any materials or entered into any agreements or made any advance on account of or with a view to the execution of the work or the performance of the contract.

In purchase the Contractor shall not be entitled to recover or be paid any sum for any work actually performed under this contract unless the Engineer-In-Charge will certify in writing the performance of such work and the value payable in respect thereof and he shall only be entitled to be paid the value so certified.

In the event of the owner putting in force the powers as stated in a, b, c, above vested in him under the proceeding clause, he may, if he so desires, take possession of all or any tools and plant, materials and stores in or upon the works or the site thereof belonging to the Contractor, or procured by him and intended to be used for the execution of the work or any part thereof paying or allowing for the same in account at the contract rates to be certified by the Engineer-In-Charge. The Engineer-In-Charge may give notice in writing to the Contractor or his representative requiring him to remove such tools, plant, materials or stores from the premises within the time specified in the notice and in the event of the Contractor failing to comply with any such notice, the Engineer-In-Charge may remove them at the Contractor's expenses or sell them by auction or private sale on account of the Contractor and his risks in all respects without any further notice as to the date, time or place of the sale and the certificate of Engineer-In-Charge as to the

expense of any such removal and the amount of the proceeds and the expenses of any such sale shall be final and conclusive against the Contractor.

GC-23 COMPENSATION FOR ALTERATION IN OR RESTRICTION IN WORK :

If at any time from the commencement of the work, the owner shall for any reasons whatsoever not require the whole work or part thereof as specified in the tender to be carried out, the Engineer-In-Charge shall give notice in writing of the fact to the Contractor, who shall have no claim to any payment or compensation whatsoever on account of any profit or advantage which he might have derived from the execution of the work in full but which he did not derive in consequence of full amount of the work not having been carried out. He also shall not have any claim for compensation by reasons of any alterations having been made in original specifications, drawings, designs and instructions which shall involve any curtailment of the work as originally contemplated.

When the Contractor is a partnership firm, the prior approval in writing of the owner shall be obtained before any change is made in the Constitution of the firm. Where the Contractor is an individual or a Hindu Undivided Family or business concern, such approval as aforesaid shall, likewise be obtained before Contractor enters into an agreement with other parties where under, the reconstituted firm would have the right to carry out the work hereby undertaken by the Contractor. In either case, if prior approval as aforesaid is not obtained, the contract shall be deemed to have been allotted contravention of subletting clause hereof and the same action may be taken and the same consequence shall ensure as provided in the subletting clause.

GC-24 IN THE EVENT OF DEATH OF THE CONTRACTOR :

Without prejudice to any of the rights or remedies under the contract, if the Contractor dies, the owner shall have the option of terminating the contract without compensation to the Contractor.

GC-25 MEMBERS OF THE OWNER NOT INDIVIDUALLY LIABLE :

No official or employee of the owner shall in any way be personally bound or liable for the acts or obligation of the owner under the contract, or answerable for any default or omission in the observance or performance of any acts, matters or things, which are herein, contained.

GC-26 OWNER NOT BOUND BY PERSONAL REPRESENTATIONS :

The Contractor shall not be entitled to any increase on the schedule of rates or any other rights or claims whatsoever by reason of representation, promise or guarantees given or alleged to have been given to him by any person.

GC-27 CONTRACTOR'S OFFICE AT SITE :

The Contractor shall provide and maintain an office at the site for the accommodation of his agent and staff and such office shall remain open at all reasonable hours to receive information, notices or other communications.

GC-28 CONTRACTOR'S SUBORDINATE STAFF AND THEIR CONDUCT :

1. The Contractor on award of the work shall name and depute a qualified Engineer having experience of carrying out work of similar nature, whom equipments, materials, if any, shall be issued and instructions for work given. the Contractor shall also provide to the satisfaction of Engineer-In-Charge sufficient and qualified staff, competent sub-agents, foreman and loading hands including those specially qualified by previous experience to supervise the type of works comprised in the contract in such manner as will ensure work of the best quality and expeditious working. If, in the opinion of the Engineer-In-Charge additional properly qualified supervision staff is considered necessary, it shall be employed by the Contractor, without additional charge on account thereof. The Contractor shall ensure to the satisfaction of the Engineer-In-Charge that sub-contractors, if any, shall provide competent and efficient supervision over the work entrusted to them.

2. If and whenever any of the Contractor's or sub-contractor's agents, sub-agents, assistants, foreman or other employees shall, in the opinion of the Engineer-In-Charge, be guilty of any misconduct or be incompetent or insufficiently qualified or negligent in the performance of their duties or that in the opinion of the owner or Engineer-In-Charge, it is undesirable for administrative or any other reason for person or persons to be employed in the works, the Contractor if so directed by the Engineer-In-Charge, shall at once remove such person or persons from employment thereon. Any person or persons so removed shall not again be re-employed in connection with the works without the written permission of the Engineer-In-Charge. Any person, so removed from the works shall be immediately replaced at the expense of the Contractor by a qualified and competent substitute. Should the Contractor be required to repatriate any person removed from the works he shall do so after approval of Engineer-In-Charge and shall bear all costs in connection therewith.

3. The Contractor shall be responsible for the proper behavior of all the staff, foreman, workmen and others and shall exercise proper control over them and in particular and without prejudice to the said generality, the Contractor shall be bound to prohibit and prevent any employee from trespassing or acting in any way detrimental or prejudicial to the interest of the community or of the properties or occupiers of land and properties in the neighborhood and in the event of such employees so trespassing, the Contractor shall be responsible therefore and relieve the owner of all consequent claims, actions for damages or injury or any other ground

whatsoever. The decision of the Engineer-In-Charge upon any matter arising under this claim shall be final.

4. If and when required by the owner, the Contractor's personnel entering upon the owner's premises shall be properly identified by badges of a type acceptable to the owner which must be worn at all times on owner's premises.

GC-29 TERMINATION OF SUB-CONTRACT BY OWNER :

If any sub-contractor engaged upon the works at the site execute any work which in the opinion of Engineer-In-Charge is not accordance with the contract documents, the owner may by written notice to the Contractor request him to terminate such sub-contract and the Contractor upon the receipt of such notice shall terminate such sub-contracts and the latter shall forthwith leave the works, failing which, the owner shall have the right to remove such sub-contractors from the site.

No action taken by the owner under the above clause shall relieve the Contractor of his liabilities under the contract or give rise to any right to compensation, extension of time or otherwise.

GC-30 POWER OF ENTRY :

If the Contractor shall not commence the work in the manner previously described in the contract documents or if he shall at any time, in the opinion of Engineer-In-Charge –

i) Fail to carry out works in conformity with the contract documents, or
ii) Fail to carry out the works in accordance with the time schedule, or
iii) Substantially suspend work or the works for a period of seven days without authority from Engineer-In-Charge, or
iv) Fail to carry out and execute the work to the satisfaction of the Engineer-In-Charge, or
v) Fail to supply sufficient or suitable construction plant, temporary works, labour, materials or things, or
vi) Commit breach of any other provisions of the contract on his part to be performed or observed or persists in any of the above mentioned breaches of the contract for seven days after notice in writing shall have been given to the Contractor by the Engineer-In-Charge requiring such breach to be remedied, or
vii) Abandon the work, or
viii) During the continuance of the contract becomes bankrupt, make any arrangement or compromise with his creditors, or permit any execution to be levied or go into liquidation whether compulsory or voluntary not being merely a voluntary liquidation for the purpose of amalgamation or reconstruction then in any such case.

The owner shall have the power to enter upon the works and take possession thereof and of the materials, temporary works, constructional plant and stores therein and to revoke the Contractor's license to use the same and to complete the works by his agents, other Contractor or workmen, to relate the same upon

any terms to such other person firm or RUDA as the owner in his absolute discretion may think proper to employ, and for the purpose aforesaid to use or authorize the use of any materials, temporary works, constructional plant, and stores as aforesaid with making payments or allowance to the Contractor for the said materials other than such as may be certified in writing by the Engineer-In-Charge to be reasonable and without making any payment or allowance to the Contractor for the use of said temporary works, constructional plant and stock or being liable for loss or damage thereto. If the owner shall be reason of his taking possession of the works or of the work being got completed by other Contractor incurred excess expenditure be deducted from any money which may be due for the work done by the Contractor under the contract and not paid for. Any deficiency shall forthwith be made good and paid to the owner by the Contractor and the owner shall have power to sell in such manner and for such price as he may think fit all or any of the constructional plant, materials etc., consist constructed by or belonging to and to recoup and retain the said deficiency or any part thereof out of the proceeds of the sale.

GC-31 CONTRACTOR'S RESPONSIBILITY WITH THE OTHER CONTRACTOR AND AGENCIES :

Without repugnance to any other conditions, it shall be the responsibility of the Contractor executing the work, to work in close co-operation and co-ordination with other Contractors or their authorized representatives and the Contractor will put a joint scheme with the concurrence of other contractors or their authorized representatives showing the arrangements for carrying his portion of the work to the Engineer-In-Charge and get the approval. The Engineer-In-Charge before approving the joint scheme will call the parties concerned and modify the scheme if required. No claim will be entertained on account of the above. The Contractor shall conform in all respects with the provisions of any statutory regulations, ordinances or bylaws of any local or duly constituted authorities or public bodies which may be applicable from time to time to works or any temporary works. The Contractor s shall keep the owner indemnified against all penalties and liabilities of every kind arising out of non-adherence to such statutes, ordinance, laws, rules, regulations etc.

GC-32 OTHER AGENCIES AT SITE :

The Contractor shall have to execute the work in such place and condition where other agencies will also be engaged for other works, such as site grading, filling and leveling, electrical and mechanical engineering works etc. No claim shall be entertained for works being executed in the above circumstances.

GC-33 NOTICES :

Any notice under this contract may be served on the Contractor or his duly authorized representative at the job site or may be served by Registered Post direct to the official address of the Contractor.

Proof of issue of any such notice could be conclusive of the Contractor having been duly informed of all contents therein.

GC-34 RIGHTS OF VARIOUS INTERESTS :

The owner reserves the right to distribute the work between more than one Contractor. Contractor shall co-operate and afford reasonable opportunity to other Contractor s for access to the works, for the carriage and storage of materials and execution of their works. Whenever the work being done by department of the owner or by other Contractor employed by the owner is contingent upon work covered by this contract, the respective rights of the various interests shall be determined by the Engineer-In-Charge to secure the completion of various portions of the work in general harmony.

GC-35 PRICE ADJUSTMENTS :

No adjustment in price shall be allowed and no price escalation will be allowed. However, the difference in the Asphalt will be paid or recover as per star rate.

GC-36 TERMS OF PAYMENT :

The payment of bills shall be made progressively according to the rules and practices followed by the RUDA. The progressive payment unless otherwise provided in the contract agreement or subsequently agreed to by the parties shall be made generally monthly on submission of a bill by the Contractor in prescribed form of an amount according to the value of the work performed less the price of materials supplied by owner aggregate of previous progressive payments and as required by Clause GC-37 (Retention of Money) herein. All such progressive payments shall be regarded as payments by way of advance against final payment. Payment for the work done by the Contractor will be based on the measurement at various stages of the work, in accordance with the condition at clause GC-81 (measurement of work in progress).

GC-37 RETENTION MONEY :

Pursuant to clause GC-36 (terms of payment), money due to the contractor for work done, the RUDA will hold as retention money five (5) percent of the value of work. The retention money will not normally be due for payment until the completion of the entire work & till such period the work has been finally accepted by the RUDA and a completion certificate issued by the RUDA in pursuant to clause-79 (Completion Certificate).

GC.38. PAYMENTS DUE FROM THE CONTRACTOR

All costs, damages or expenses, for which under the contract, contractor is liable to the RUDA

GC-38 PAYMENTS DUE FROM THE CONTRACTOR :

All costs, damages or expenses, for which under the contract, Contractor is liable to the RUDA, may be deducted by the RUDA from any money due or becoming due to the Contractor under the

contract or from any other contract with the RUDA or may be recovered by action at law or otherwise from the Contractor.

GC-39 CONTINGENT FEE :

i) The Contractor warrants that he has not employed a person to solicit or secure the contract upon any agreement for a commission, percentage, and brokerage contingent fee. Breach of this warranty shall give the RUDA the right to cancel the contract or to take any drastic measure as the RUDA may deem fit. The warranty does not apply to commissions payable by the Contractor to establish commercial or selling agent for the purpose of securing business.

ii) No officer, employer or agent of the RUDA shall be admitted to any share or part of this contract or to any benefit that may rise there from.

GC-40 BREACH OF CONTRACT BY CONTRACTOR :

If the Contractor fails to perform the work under the contract with due diligence or shall refuse or neglect to comply with instructions given to him in writing by the Engineer-In-Charge in accordance with the contract, or shall contravene the provisions of the contract, the RUDA may give notice in writing to the Contractor to make good such failure, neglect, or contravention. Should the Contractor fail to comply with such written notice within 10 (Ten) days of receipt, it shall be lawful for the RUDA, without prejudice to any other rights the RUDA may have under the contract, to terminate the contract for all or part of the works, and make any other arrangements it shall deem necessary to complete the work outstanding under the contract at the time of termination. In this event, the performance Bond shall immediately become due and payable to the RUDA. The value of the work done on the date of termination and not paid for shall be kept as deposit for adjustment of excess expenditure incurred in getting the remaining work completed and the RUDA shall have free use of any works which the Contractor may have at the site at the time of termination of the contract.

In the event of breach of contract by the contractor, the remaining work will be completed at the risk and cost of the contractor and the contractor will be black listed for 3 years.

GC-41 DEFAULT OF CONTRACTOR :

i) The RUDA may upon written notice of default to the Contractor terminate the contract circumstances detailed as under :

a) If in the opinion of the RUDA, the Contractor fails to make completion of works within the time specified in the completion schedule or within the period for which extension has been granted by the RUDA to the Contractor.

b) If in the opinion of the RUDA, the Contractor fails to comply with any of the other provisions of this contract.

ii) In the event, the RUDA terminates the contract in whole or in part as provided in Article GC-50 (Termination of the Contract) the RUDA reserves the right to purchase upon such terms and in such manner as it may be deem appropriate, plant similar to one which is not supplied by the Contractor and the Contractor will be liable to the RUDA for any additional costs for such similar plant and / or for liquidated damages for delay until such time as may be required for the final completion of works.

iii) If this contract is terminated as provided in this paragraph GC-30 (Power of Entry) (1) the RUDA in addition to any other rights provided in this clause, may require the Contractor to transfer title and deliver to the RUDA.

a) Any completed works
b) Such partially completed information and contract rights as the Contractor has specifically produced or acquired for the performance of the contract so terminated.

iv) In the event, the RUDA does not terminate the contract as provided in the paragraph GC-50 (Termination of Contract) the Contractor shall continue performance of the contract, in which case, he shall be liable to the RUDA for liquidated damages for delay until the works are completed and accepted.

GC-42 BANKRUPTCY :

If the Contractor shall become bankrupt or insolvent or has a receiving order made against him, or compound with his creditors, or being the RUDA commence to be wound up not being a member voluntary winding up for the purpose of amalgamation or reconstruction, or carry on its business under a receiver for the benefit of his creditors or any of them, the RUDA shall be at liberty to either (a) terminate the contract forthwith by giving notice in writing to the Contractor or to the receiver or liquidator or to any person or Organization in whom the contract may become vested and to act in the manner provided in Article GC-41 (Default of Contractor) as thought the last mentioned notice had been the notice referred to in such article or (b) to give such receiver, liquidator or other persons in whom the contract may become vested the option of carrying out the contract subject to his providing a satisfactory guarantee for the due and faithful, performance of the contract up to an amount to be agreed. In the event that the RUDA terminates the contract in accordance with this article, the performance bond shall immediately become due and payable on demand to RUDA.

GC-43 OWNERSHIP :

Works hand over pursuant to the contract shall become the property of the RUDA from whichever is the earlier of the following times, namely;

a) When the works are completed pursuant to the contract.

b) When the contractor has been paid any sum to which he may become entitled in respect thereof pursuant to Clause GC-36 (Terms of Payment).

GC-44 DECLARATION AGAINST WAIVER :

The condonation by the RUDA of any breach or breaches by the Contractor or an authorized sub-contractor of any of the stipulations and conditions contained in the contract, shall in no way prejudice or affect or be construed as a waiver of the RUDA's rights, powers and remedies under the contract in respect of any breach or breaches.

GC-45 LAWS GOVERNING THE CONTRACT :

This contract shall be construed according to and subject to the laws of India and the State of Gujarat and under the jurisdiction of the Courts of Gujarat at Rajkot.

GC-46 OVER PAYMENT AND UNDER PAYMENT :

Whenever any claim for the payment of a sum to the RUDA arises out of or under this contract against the Contractor, the same may be deducted by the RUDA from any sum then due or which at any time thereafter may become due to the Contractor under this contract and failing that under any other contract with the RUDA (which may be available with the RUDA), or from his retention money or he shall pay the claim on demand. The RUDA reserves the right to carry out post payment audit and technical examinations of the final bill including all supporting vouchers, abstracts etc. The RUDA further reserves the right to enforce recovery of any payment when detected, notwithstanding the fact that the amount of the final bill may be included by one of the parties as an item of dispute before an Arbitrator, appointed under Article GC-49 (Arbitration) of this contract and notwithstanding the fact that the amount of the final bill figures in the arbitration award. If as a result of such audit and technical examinations any over payment is discovered in respect of any work done by the Contractor or alleged to have been done by him under the contract, it shall be recovered by the RUDA from the Contractor as prescribed above. If any under payment is discovered by the RUDA, the amount due to the Contractor under this contract, may be adjusted against any amount then due or which may at any time thereafter become due before payment is made to the Contractor.

GC-47 SETTLEMENT OF DISPUTES :

Except as otherwise specifically provided in the contract, all disputes concerning questions of fact arising under the contract shall be decided by the Engineer-In-Charge subject to a written appeal by the Contractor to the Engineer-In-Charge and those decisions shall be final and binding on the parties hereto. Any disputes or differences including those considered as such by only one of the parties arising out of or in connection with this contract shall be to the extent possible settled amicably between the parties. If amicable settlement cannot be reached then all disputed issues shall

be settled as provided in Article GC-48 (Disputes or differences to be referred to) and Article No.GC-49 (Arbitration).

GC-48 DISPUTES OF DIFFERENCES TO BE REFERRED TO :

If at any time, any question, disputes or differences of any kind whatsoever shall arise between the Engineer-In-Charge and the contractor upon or in relation to or in connection with this contract either party may forthwith give to the other, notice in writing of the existence of such question, dispute or difference as to any decision, opinion, instruction, direction, certificate or evaluation of the Engineer-In-Charge. The question, dispute or differences shall be settled by the CEO, Rajkot Urban Development Authority, who shall state his decision in writing and give notice of same to the Engineer-In-Charge and to the Contractor. Such decision shall be final and binding upon both parties. The contract and work on contract if not already breached or abandoned shall proceed normally unless and until the same shall be revised (or uphold) by any arbitration proceedings as hereinafter provided. Such decisions shall be final and binding on the Engineer-In-Charge and the Contractor unless the Contractor shall require the matter to be referred to an Arbitration panel as hereinafter provided.

GC-49 ARBITRATION :

In case of any dispute arising during the course of execution, the matter should be referred to Chief Executive Officer, RUDA who will be sole Arbitrator whose decisions will be final and binding to the Contractor. The jurisdiction of the Court for dispute, if any, shall be Rajkot City.

GC-50 TERMINATION OF THE CONTRACT :

i) If the Contractor finds it impracticable to continue operation owing to force majeure reasons or for any reasons beyond his control and/or the RUDA find it impossible to continue operation, then prompt notification in writing shall be given by the party affected to the other.

ii) If the delay or difficulties so caused cannot be expected to cease or become unavoidable or if operations cannot be resumed within two (2) months then either party shall have the right to terminate the contract upon ten (10) days written notice to the other. In the event of such termination of the contract, payment to the Contractor will be made as follows :

a) The Contractor shall be paid for all works approved by the Engineer-In-Charge and for any other legitimate expenses due to him.

b) If the RUDA terminates the contract owing to Force Majeure or due to any cause beyond its control, the Contractor shall additionally be paid for any work done during the said two (2) months period including any financial commitment made for the proper performance of the contract and which are not reasonably defrayed by payments under (a) above.

c) The RUDA shall also release all bonds and guarantees at its disposal except in cases where the total amount of payment made to the Contractor exceeds the final amount due to him in which case the Contractor shall refund the excess amount within thirty (30) days after the termination and the RUDA thereafter shall release all bonds and guarantees. Should the Contractor fail to refund the amounts received in excess within the said period such amounts shall be deducted from the bonds or guarantees provided.

iii) On termination of the contract for any cause the Contractor shall see the orderly suspension and termination of operations, with due consideration to the interests of the RUDA with respect to completion safeguarding of storing materials procured for the performance of the contract and the salvage and resale thereof.

GC-51 SPECIAL RISKS :

If during the contract, there shall be an outbreak of war (whether war is declared or not), major epidemic, earthquake or similar occurrence in any part of the world beyond the control of either party to the contract which financially or otherwise materially affects the execution of the contract, the Contractor shall unless and until, the contract is terminated under the provisions of this article use his best endeavors to complete the execution of the contract, provided always that the RUDA shall be entitled at any item after the onset of such special risks, to terminate the contract by giving written notice to the contractor and upon such notice being given this contract shall terminate but without prejudice to the rights of either party in respect of any antecedent breach thereof.

The Contractor shall not be liable for payment of compensation for delay or for failure to perform the contract for reasons of Force Majeure such as acts of public enemy, acts of Government, fires, floods, cyclones, epidemics, quarantine restrictions, lockouts, strikes, freight embargoes and provided that the Contractor shall within 10 (ten) days from the beginning of such delay notify the Engineer-In-Charge in writing, of the cause of delay, the RUDA shall verify the facts and grant such extension as the facts justify.

GC-52 CHANGE IN CONSTITUTION :

Where the Contractor is a partnership firm, the prior approval in writing of the owner shall be obtained before any change is made in the constitution of the firm. Where the Contractor is an individual or undivided family business concern such approval as aforesaid shall likewise be obtained before the Contractor enters into any partnership agreement where under the partnership firm would have the right to carry out the works hereby undertaken by the Contractor. If prior approval as aforesaid is not obtained, the contract shall be deemed to have been assigned in contravention of contract.

GC-53 SUB-CONTRACTUAL RELATIONS :

All works performed for the contract by a sub-contractor shall be pursuant to an appropriate agreement between the Contractor and the sub-contractor, which shall contain provision to –

a) Protect and preserve the rights of the RUDA and the Engineer-In-Charge with respect to the works to be performed under the sub-contracting party will not prejudice such rights.

b) Require that such work be performed in accordance with the requirements of contract documents.

c) Require under such contract to which the contractor is a party, the submission to the Contractor of application for payment and claims for additional costs, extension of time, damages for delay or otherwise with respect to the sub-contracted portions of the work in sufficient time, that the Contractor may apply for payment comply in accordance with the contract documents for like claims by the Contractor upon the RUDA.

d) Waive all rights the contracting parties may have against one another for damages caused by fire or other perils covered by the property insurance except such rights as they may have to the proceeds of such insurance held by the RUDA as trustee and,

e) Obligate each sub-contractor specifically to consent to the provisions of this Article.

GC-54 PATENTS AND ROYALTIES :

1. Contractor, if licensed under any patent covering equipment, machinery, materials or composition of matter to be used or supplied or methods and process to be practiced or employed in the performance of this contract agrees to pay all royalties and license fees, which may be due with respect thereto. If any equipment, machinery, materials, composition matters, to be used or supplied or methods practiced or employed in the performance of this contract, is covered by a patent under which Contractor is not licensed, then the Contractor before supplying / using the equipment, machinery, materials, compositions, methods of process shall obtain such license and pay such royalties and license fees as may be necessary for performance of this contract. In the event Contractor fails to pay such royalty or to obtain any such license, any suit for infringement of such patents which is brought against the Contractor or the owner as a result of such failure will be defended by the Contractor at his own expenses and the Contractor will pay any damages and costs awarded in such suit. The Contractor shall promptly notify the owner if the Contractor has acquired knowledge of any plant under which a suit for infringement could be reasonably brought because of the use by the owner of any equipment machinery, materials, process methods to be supplied in hereunder. Contractor agrees to and does hereby grant to owner together with the right to extend the same to any of the subsidiaries of the owner an irrevocable royalty fee license to use in any Country, any invention made by the Contractor or his employees in or as a result of the performance of work under contract.

2. With respect to any sub-contract entered into by Contractor pursuant to the provisions of the relevant clause hereof, the Contractor shall obtain from the sub-contractor an understanding to provide the owner with the same patent protection that contracts is required to provide under the provisions of the clause.

3. The Contractor shall indemnify and save harmless the owner from any loss on account of claims against owner for the contributory infringement of patent rights arising out of and based upon the claim that the use by the RUDA of the process included in the design prepared by the Contractor and used in the operation of the plant infringes on any patent rights.

GC-55 LIEN:

If, at any time, there should be evidence of any lien or claim for which owner might have become liable and which is chargeable to the Contractor, the owner shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify the owner against such lien or claim or if such lien or claim be valid the owner may pay and discharge the same and deduct the amount as paid from any money which may be due or become due and payable to the Contractor. If any lien or claims remaining unsettled after all payments are made, the Contractor shall refund or pay to the owner all money that the latter may be compelled to pay in discharging such lien or claim including all costs and reasonable expenses.

GC-56 EXECUTION OF WORK :

The whole work shall be carried out in strict conformity with the provisions of the contract document, detailed drawings, specifications and the instructions of the Engineer-In-Charge from time to time. The Contractor shall ensure that the whole work is executed in the most substantial, and proper manner with best workmanship using materials of best quality in strict accordance with the specifications to the entire satisfaction of the Engineer-In-Charge.

GC-57 WORK IN MONSOON :

When the work continues in monsoon, the Contractor shall maintain minimum labour force required for the work and plan and execute the construction and erection work according to the prescribed schedule. No extra rate will be considered for such work in monsoon. During monsoon and entire construction period, the Contractor shall keep the site free from water at his own cost.

GC-58 WORK ON SUNDAYS AND HOLIDAYS :

No work except curing shall be carried out on Sunday and holidays. However, if the exigencies of the work need continuation of work on Sundays and Holidays, written permission of the Engineer-In-Charge shall be obtained in advance.

GC-59 GENERAL CONDITIONS FOR CONSTRUCTION WORK :

Working hours shall be eight every day. The overtime work in two shifts could be carried out with the written permission of the Engineer-In-Charge but no compensation shall be paid for the same. The rate quoted shall include this. The Contractor shall plan his work in such a way that his laborers do not remain idle. The owner will not be responsible for idle labour of the Contractor. The Contractor shall submit to the owner progress report every week. The details and Performa of the report will be as per mutual agreement.

GC-60 DRAWINGS TO BE SUPPLIED BY THE OWNER :

The drawings attached with the tender documents shall be for general guidance of the Contractor to enable him to visualize the type of work contemplated and scope of work involved. Detail working drawings according to which the work is to be done shall be prepared by the Contractor for executing the work.

GC-61 DRAWINGS TO BE SUPPLIED BY THE CONTRACTOR:

Where drawings, data are to be furnished by the Contractor they shall be as enumerated in special conditions of contract and shall be furnished within the specified time. Where approval of drawings has been specified it shall be Contractor's responsibility to have these drawings got approved before any work is taken up with regard to the same. Any changes becoming necessary in those drawings during the execution of the work shall have to be carried out by the Contractor at no extra cost. All final drawings shall bear the certification stamp as indicated below duly signed by both the Contractor and Engineer-In-Charge.

Certified true for …….Project Agreement No……..
Signed …….

Contractor Engineer-In-Charge

Drawings will be approved within three (3) weeks of the receipt of the same by the Engineer-In-Charge.

GC-62 SETTING OUT WORK :

The Contractor shall set out the work on the site handed over by the Engineer-In-Charge and shall be responsible for the correctness of the same. The work shall be carried out to the entire satisfaction of Engineer-In-Charge. The approval thereof or partaking by Engineer-In-Charge or setting out work shall not relieve Contractor of any of his responsibilities. The Contractor shall provide at his own cost all necessary level posts, pegs, bamboos, flags, ranging rods, strings and other materials and laborers required for proper setting out of the work. The Contractor shall provide fix and be responsible for the maintenance of all stakes, templates, level markets, profiles and similar other things and shall take all necessary precautions to prevent their removal or disturbance and shall be responsible for the consequences for such removal or

disturbance. The Contractor shall also be responsible for the maintenance of all existing survey marks, boundary marks, and distance marks and centerline marks either existing or face lines and cross lines shall be marked by small masonry pillars. Each pillar shall have distance mark at the center for setting up the theodolite. The work shall not be started unless the setting out is choked and approved by Engineer-In-Charge in writing but such approval shall not relieve the Contractor of his responsibilities about the correctness of setting out. The Contractor shall provide all materials, labour and other facilities necessary for checking at his own cost. Pillars bearing geodetic marks on site shall be protected by the Contractor. On completion of the work, the Contractor shall submit the geodetic documents according to which the work has been carried out.

GC-63 RESPONSIBILITIES OF CONTRACTOR FOR CORRECTNESS OF THE WORK :

The Contractor shall be entirely and exclusively responsible for the correctness of every part of the work and shall rectify completely any errors therein at his own cost when so instructed by Engineer-In-Charge. If any error has crept in the work due to non-observance of this clause, the Contractor will be responsible for the error and bear the cost of corrective work.

1. Materials to be supplied by the Contractor:

Contractor shall procure and provide all the material required for the execution and maintenance of work including M S rods; all tools, tackles, construction plant and equipment except, the materials to be supplied by the owner detailed in the contract documents. Owner, shall make recommendations for procurement of materials to the respective authorities if desired by the Contractor but assumes no responsibility of any nature. Owner shall insist for procurement of materials with ISI marks supplied by reputed firms of the DGS & D list.

2. If however, the Engineer-In-Charge feels that the work is likely to be delayed due to Contractor's inability to procure materials, the Engineer-In-Charge shall have the right to procure materials, from the market and the Contractor will accept these materials at the rates decided by Engineer-In-Charge.

GC-64 MATERIALS TO BE SUPPLIED BY THE OWNER :

1. If the contract provided certain materials or stores to be supplied by the owner, such materials and stores transported by the Contractor at his cost from owner's stores or Railway Station. The cost from Contractor for the value of materials supplied by the owner will be recovered from the R.A.Bill on the basis of actual consumption of materials in the work covered and for which R A Bill has been prepared. After completion of the work, the Contractor has to account for the full quantity of materials supplied to him.

2. The value of store materials supplied by owner to the Contractor shall be charged at rates shown in the contract document and in

case any other material not listed in the schedule of materials is supplied by the owner, the same shall be charged at cost price including carting and other expenses incurred in procuring the same. All materials so supplied shall remain the property of the owner and shall not be removed from the site on any account. Any material remaining unused at the time of completion of work or termination of contracts shall be returned to owner's store or any other place as directed by the Engineer-In-Charge in perfectly good condition at Contractor's cost. When materials are supplied free of cost for use in work and surplus and unaccounted balance thereof are not returned to the owner, recovery in respect of such balance will be effected at double the applicable issue rate of the material or the market rates whichever is higher.

GC-65 CONDITIONS OF ISSUE OF MATERIALS BY THE OWNER:

The materials specified to be issued by the owner to the Contractor shall be issued by the owner at his store and all expenses for it carting site shall be borne by the Contractor will be issued during working hours and as per rules of owner from time to time.

Contractor shall bear all expenses for storage and safe custody at site of materials issued to him before use in work.

Material shall be issued by the owner in standard / non-standard sizes as obtained from manufacturer.

Contractor shall construct suitable go downs at site for storing the materials to protect the same from damage due to rain, dampness, fire, theft etc.

The Contractor should take the delivery of the materials issued by the owner after satisfying himself that they are in good condition. Once the materials are issued, it will be the responsibility of the Contractor to keep them in good condition and in safe custody. If the materials get damaged or if they are stolen, it shall be the responsibility of the Contractor to replace them at his cost according to the instructions of the Engineer-In-Charge.

For delay in supply or for non-supply of materials to be supplied by the owner, on account of natural calamities, act of enemies, other difficulties beyond the control of the owner, the owner carries no responsibilities. In no case the Contractor shall be entitled to claim any compensation for loss suffered by him on this account.

None of the materials issued to the contractor, shall be used by the Contractor for manufacturing items which can be obtained from the manufacturer's. The materials issued by the owner shall be used for the work only and no other purpose.

Contractor shall be required to execute indemnity bond in the prescribed form for the safe custody and account of materials issued by the owner.

Contractor shall furnish sufficiently in advance a statement of his requirements of quantities of materials to be supplied by the owner and the time when the same will be required for the work, so as to enable Engineer-In-Charge to make arrangements to procure and supply the materials.

A daily account of materials issued by the owner shall be maintained by the contractor showing receipt, consumption and balance on hand in the form laid down by Engineer-In-Charge with all connected paper and shall be always available for inspection in the site office.

Contractor shall see that only the required quantities of materials are got issued and no more. The Contractor shall be responsible to return the surplus materials at owner's store at his own cost.

GC-66 MATERIALS PROCURED WITH ASSISTANCE OF THE OWNER :

Notwithstanding anything contained to the contrary in any of the clauses of this contract, where any materials for the execution of the contract are procured with the assistance of the owner either by issue from owner's stock or purchase made under orders or permits or licenses issued materials as trustees for owner, and use such materials not disposed them off without the permission of owner and unserviceable materials that may be left with him after completion of the contract or at its termination for any reason whatsoever on his being paid or credited such price as Engineer-In-Charge shall determine having due regard to the conditions of the materials. The price allowed to Contractor shall not exceed the amount charged to him excluding the storage of breach of the aforesaid condition, the Contractor shall in terms of license or permits and/or for criminal breach of trust be liable to compensate owner at double the rate or any higher rates. In the event of these materials at that time having higher rate or not being available in the market than any other rate to be determined by the Engineer-In-Charge at his decision shall be final and conclusive.

GC-67 MATERIALS OBTAINED FROM DISMANTLING :

If the Contractor, in the course of execution of work, is called upon to dismantle any part of work for reasons other than on account of bad or imperfect work, the materials obtained from dismantling will be property of the owner and will be disposed off as per instructions of Engineer-In-Charge in the best interest of the owner.

GC-68 ARTICLE OF VALUE OF TREASURE FOUND DURING CONS-TRUCTION :

All gold, silver and other minerals of any description and all precious stones, coins, treasures, relics, antiques and other similar things which shall be found in, under or upon site shall be the property of the owner and the Contractor shall properly preserve the same to the satisfaction of the Engineer-In-Charge and shall hand over the same to the owner.

GC-69 DISCREPANCIES BETWEEN INSTRUCTIONS:

If there is any discrepancy between various stipulations of the contract documents or instructions to the Contractor or his authorized representative or if any doubt arises as to the meaning of such stipulation or instructions, the Contractor shall immediately refer in writing to the Engineer-In-Charge and shall hand over the same to the owner.

GC-70 ALTERATIONS IN SPECIFICATIONS & DESIGNS & EXTRA WORK :

The Engineer-In-Charge shall have power to make any alterations in, omission from, addition to substitution for, the schedule of rates, the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of work and the Contractor shall be bound to carry out such altered / extra / new items of work in accordance with any instructions which may be given to him in writing signed by Engineer-In-Charge and such alteration omissions, additions or substitutions, shall not invalidate contract and any altered, additional or substituted work shall be carried out by the Contractor on the same conditions of contract. The time of completion may be extended by Architect as may be considered just and reasonable by him. The rates for such additional, altered or substitute work shall be worked out as under :

a) If the rates for additional, altered or substitutes work are specified in the contract for work, the Contractor is bound to carry out such work at the same rates as specified in the contract.

b) If the rates for additional, altered or substituted work are not specifically provided in the contract for the work, the rates will be derived from the rates of similar items of work in the contract work. The opinion of Engineer-In-Charge as to whether the rates can be reasonably so derived the items of contract will be final and binding to the Contractors.

c) If the rates of altered, additional or substitute work cannot be determined as specified in (a) or (b) above, the rate shall be paid as per S.O.R. of R&B, Gujarat.

d) If the rates of altered, additional or substitute work cannot be determined as specified in (a) or (b) or (c) above, the Contractor shall within seven days of the receipt of order to carry out the work inform the Architect / Engineer-In-Charge of the rate which he intends to charge for such work supported by rate analysis and the Architect / Engineer-In-Charge will determine the rate on the basis of prevailing market rates of materials, labour cost at schedule of labour plus 15% there on as Contractor's supervision overheads and profit. The opinion of Architect / Engineer-In-Charge as to the market rates of materials and the quantity of labour involved per unit of measurement will be final and binding on Contractor.

But under no circumstances, the Contractor suspends work or the plea of non settlement of items falling under this clause.

GC-71 ACTION WHEN NO SPECIFICAITONS ARE ISSUED :

In case of any class of work for which no specifications is supplied by the owner in the tender documents, such work shall be carried out in accordance with relevant latest ISS and if ISS do not cover the same, the work shall be carried out as per General Technical Specification for building work; and if not covered in then it is to be with standard Engineering Practice subject to the approval of Engineer-In-Charge.

GC-72 ABNORMAL RATES :

Contractor is expected to quote rate for each item after careful analysis of cost involved for the performance of the completed item considering all specifications and conditions of contract.

GC-73 ASSISTANCE TO ENGINEER-IN-CHARGE:

Contractor shall make available to Engineer-In-Charge free of cost all necessary instruments and assistance in checking of any work made by the Contractor setting out for taking measurement of work etc.

GC-74 TESTS FOR QUALITY OF WORK :

1. The Contractor shall be required to give satisfactory hydraulic test where required and shall rectify the defects, if any, free of cost. The necessary water power, labour etc., required for the hydraulic test shall also be arranged by the Contractor at his own cost.

2. All workmanship shall be of the best kind described in the contract documents and in accordance with the instructions of Engineer-In-Charge and shall be subjected from time to time to such tests at Contractor's cost as the Engineer-In-Charge may direct at the place of manufacture of fabrication or on the site or at any such place. Contractor shall provide assistance, instruments, labour and materials as are normally required for examining, measuring and testing of any work of workmanship as may be selected and required by Engineer-In-Charge.

3. All tests necessary in connection with the execution of work as decided by Engineer-In-Charge shall be carried out at an approved laboratory at Contractor's cost.

4. Contractor shall furnish the Engineer-In-Charge for approval when requested or if required by the specification, adequate samples of all materials and finished goods to be used in work sufficiently in advance to permit tests and examination thereof. All materials furnished and finished goods applied in work shall be exactly as per the approved samples.

GC-75 ACTION AND COMPENSATION IN CASE OF BAD WORKMANSHIP :

If it shall appear to the Engineer-In-Charge that any work has been executed with materials of inferior description, or quality or are unsound or with unsound, imperfect or unskilled workmanship or

otherwise not in accordance with the contract, the Contractor shall, on demand in writing from Engineer-In-Charge or his authorized representative specifying the work, materials or articles complained of, notwithstanding that the same may have been inadvertently passed, certified and paid for, forthwith rectify or remove and reconstruct the work, so specified. In the event of failure to do so within a period to be specified by the Engineer-In-Charge in his aforesaid demand, Contractor shall be liable to pay compensation at the rate of half a percent of the estimated cost of work for every work limited to a maximum of ten (10%) percent of the value of work while his failure to do so continues and in the case of any such failure, the Engineer-In-Charge may on expiry of the notice period rectify and remove and re-execute the work or remove and replace with others at the risk and cost of the Contractor. The decision of the Engineer-In-Charge as to any question arising under this clause shall be final and conclusive.

GC-76 SUSPENSION WORK :

Contractor shall, if ordered in writing by Engineer-In-Charge or his representative temporarily suspended the work or any part thereof for such time (not exceeding one month) as ordered and shall not after receiving such written notice proceed with the work until he shall have received a written order to proceed therewith. The Contractor shall not be entitled to claim compensation for any loss or damage sustained by him by reason of temporary suspension of work as aforesaid. An extension of time for completion of work will be granted to the Contractor corresponding to the delay caused by such suspension of work if he applies for the same provided the suspension was not consequent upon any default or failure on the part of the Contractor.

GC-77 OWNER MAY DO PART OF THE WORK :

When the Contractor fails to comply with any instructions given in accordance with the provisions of this contract, the owner has the right to carry out such parts of work as the owner may designate whether by purchasing materials and engaging labour or by the agency of another Contractor. In such case the owner shall deduct from the amount which otherwise might become due to Contractor, the cost of such work and materials with then (10) percent added to cover all departmental charges and should the total amount thereof exceed the amount due to contract, Contractor shall pay the difference to owner.

GC-78 POSSESSION PRIOR TO COMPLETION :

The Engineer-In-Charge shall have the right to take possession of or to use any completed or partly completed work or part of work. Such possession or use shall not be deemed to be an acceptance of any work completed in accordance with the contact. If such prior possession or use by Engineer-In-Charge delays the process of work, equitable adjustment in the time of completion will be made and the contract shall be deemed to be modified accordingly.

GC-79 COMPLETION CERTIFICATE :

As soon as the work has been completed in accordance with contact (except in minor respects that do not affect their use for the purpose for which they are intended and except for maintenance thereof) as per General Conditions of Contract the Engineer-In-Charge shall issue a certificate (hereinafter called completion certificate) in which shall certify the date on which work has been completed and has passed the said tests and owner shall be deemed to have taken over work on the date so certified. If work has been divided in various groups in contract, owner shall be entitled to take over any group or groups before the other or others and there upon the Engineer-In-Charge will issue a completion certificate, which will, however, be for such group or groups so taken over only.

In order that Contractor could get a completion certificate, he shall make good will all speed any defect arising from the defective materials supplied by Contractor of workmanship or any act or omission of Contractor that may have been discovered or developed after the work or groups of works has been taken over. The period allowed for carrying out such work will be normally, one month. If any defect be not remedied within the time specified, owner may proceed to do work at Contractor's (Agency, or Firm) risk and expenses and deduct from the final bill such amount as may be decided by owner. If by reason of any default on the part of the Contractor, a completion certificate has not been issued in respect of every portion of work within one month after the date fixed by contract for completion of work, owner shall be at liberty to use work or any portion thereof in respect of which a completion certificate has been issued, provided that work or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completion of that work or the portion thereof so used as aforesaid shall be afforded reasonable opportunity for completion of that work for the issue of completion certificate.

GC-80 SCHEDULE OF RATES :

1. The rates quoted by the Contractor shall remain firm till the completion of the work and shall not be subject to escalation. Schedule of rates shall be deemed to include and cover all costs, expenses and liabilities of every description and risks or every kind to be taken in executing, completing and handing over the work to owner by Contractor. The contractor shall be deemed to have known the nature, scope, magnitude and the extent of work and materials required though contract documents may not fully and precisely furnish them. He shall make such provision in the Schedule of Rates as he may consider necessary to cover the cost of such items of work and materials as may be reasonable and necessary to complete the work. The opinion of Engineer-In-Charge as to the item of work which are necessary and reasonable for completion of the work shall be final and binding on Contractor although the same may be not shown on drawings or described specifically in contract documents.

2. The Schedule of Rates shall be deemed to include and cover the cost of all constructional plant, temporary work, materials, labour and all other matters in connection with each item in Schedule of Rates and the execution of work or any portion thereof finished complete in every respect and maintained as shown or described in the contract document or as may be ordered in writing during the continuance of the contract.

3. The Schedule of Rates shall be deemed to include and cover the cost of all royalties and fees for the articles and processes, protected by letters patent or otherwise incorporated in or used in connection with work, also all royalties, rents and other payments in connection with obtaining material of whatsoever kind for work and shall include an indemnity to owner which Contractor hereby gives against all action, proceedings, claims, damages, costs and expenses arising from the incorporation in or use on the works of any such articles, processes or materials. Octroi or other Municipal or local Board charges if levied on material, equipment or machineries to be brought to site for use on work shall be borne by the Contractor.

4. No exemption or reduction of custom duties, excise duties, sales tax or any other taxes or charges of the Central or State Government or of any Local Body whatsoever will be granted or obtained and all such expenses shall be deemed to have been included in and covered by Schedule of Rates. Contractor shall also obtain and pay for all permits or other privileges necessary to complete the work.

5. The Schedule of Rates shall be deemed to include and cover risk on account of delay and interference with Contractor's conduct of work which may occur from any cause including orders of owner in the exercise of his powers and on account of extension of time granted due to various reasons.

6. For work under unit rate basis, no alteration will be allowed in the Schedule of Rates by reasons of work or any part of them being modified, altered, extended, diminished or omitted.

GC-81 PROCEDURE FOR MEASUREMENT OF WORK IN PROGRESS:

1. All measurements shall be in metric system. All the work in progress will be jointly measured by the representative of Engineer-In-Charge and Contractor's authorized agent. Such measurements will be got recorded in the Measurement Book by the Engineer-In-Charge or his authorized representative and signed by the Contractor or his authorized agent in token of acceptance. If the Contractor or his authorized agent fails to be present whenever required by the Engineer-In-Charge for taking measures for every reasons whatsoever, the measurement will be taken by the Engineer-In-Charge or his authorized representative notwithstanding the absence of Contractor and these measurements will be deemed to be correct and binding on the Contractor.

2. Contractor will submit a bill in approved Performa in quadruplicate to the Engineer-In-Charge of the work giving abstract and detailed measurements of various items executed during a month as mutually agreed. The Engineer-In-Charge shall verify the bill and the claim, as far as admissible, adjusted if possible, within 10 days of presentation of the bills.

GC-82 RUNNING ACCOUNT PAYMENTS TO BE REGARDED AS ADVANCES :

1. All running account payments shall be regarded as payments by way of advance against the final payment only and not as payment for work actually done and completed and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be removed and taken away and reconstructed or rejected or to be considered as an admission of the due performance of contract or any part thereof.

2. Five (5) percent of the gross R A Bill amount shall be retained from each bill as retention amount and the same will be paid with the final bill.

GC-83 NOTICE FOR CLAIM FOR ADDITIONAL PAYMENT :

If the Contractor considers that he is entitled to extra payment or compensation or any claim whatsoever in respect of work, he shall forthwith give notice in writing to the Engineer-In-Charge about his extra payment and / or compensation. Such notice shall be given to the Engineer-In-Charge within ten (10) days from the happening of any event upon which Contractor basis such claims and such notice shall contain full particulars of the nature of such claim with full details and amount claimed. Failure on the part of the Contractor to put forward any claim with the necessary particulars as above, within the time above specified shall be an absolute waiver thereof. No omission by owner to reject any such claim and no delay in dealing therewith shall waiver by owner or any rights in respect thereof.

GC-84 PAYMENT OF CONTRACTOR'S BILL :

1. The price to be paid by the owner to Contractor for the work to be done and for the performance of all the obligations undertaken by the Contractor under contract shall be based on the contract price and payment to be made accordingly for the work actually executed and approved by the Engineer-In-Charge.

2. No payment shall be made for work costing less than Rs.10,000/- till the work is completed and a certificate of completion given. But in case of work estimated to cost more than Rs.10,000/-. Contractor on submitting the bill thereof will be entitled to receive a monthly payment proportionate to the part thereof, approved and passed by Engineer-In-Charge, whose certificate of such approval and passing of the sum so payable shall be final and conclusive against contractor. This payment shall be made after necessary deductions as stipulated elsewhere in the contract documents for materials,

security deposit etc. The payment shall be released to the Contractor within forty five (45) days of submission of the bill duly pre-occupied on proper revenue stamp. Payment due to Contractor shall be made by the owner by crossed Account Payee Cheque in Indian currency forwarding the same to the registered office of the Contractor. Owner shall not be responsible if the cheque is mislaid of misappropriated by unauthorized persons.

GC-85 FINAL BILL :

The final bill shall be submitted by Contractor within two (2) month of the date of physical completion of work, otherwise the Engineer-In-Charge's certificate of the measurement and of total amount payable for work shall be final and binding on all parties.

GC-86 RECEIPT FOR PAYMENT :

Receipt for payment made on account of work when executed by a firm must be signed by a person holding Power of Attorney in this respect on behalf of Contractor except when described in the tender as a limited company in which case the receipt must be signed in the name of the Company by one of its principal officers or by some person having authority to give effectual receipt for the Company.

GC-87 COMPLETION CERTIFICATE :

1. When the Contractor fulfils his obligation as per terms of contract, he shall be eligible to apply for Completion Certificate. Contractor may apply for separate Completion Certificate in respect of each such portion of work by submitting the completion documents along with such application for Completion Certificate.

   The Engineer-In-Charge shall normally issue to Contractor the Completion Certificate within one (1) month after receiving an application thereof from Contractor after verifying, from the completion documents and satisfying himself that work has been completed in accordance with and as set out in the construction and erection drawings and the contract documents. Contractor after obtaining the Completion Certificate is eligible to present the final bill for work executed by him under the terms of contract.

2. Within one month of completion of work in all respects Contractor shall be furnished with a certificate by the Engineer-In-Charge of such completion but no certificate shall be given nor shall work be deemed to have been executed until all (i) scaffolding, surplus materials and rubbish is cleaned off site completely, (ii) until work shall have been measured by the Engineer-In-Charge whose measurement shall be binding and conclusive and, (iii) until all the temporary works, labour and staff colonies etc. constructed are removed and the work site cleaned to the satisfaction of the Engineer-In-Charge. If Contractor shall fail to comply with the requirements as aforesaid or before date fixed for the completion of work, the Engineer-In-Charge may at the expense of Contractor remove such scaffolding, surplus materials and rubbish and dispose of the same as he thinks fit.

3. The following documents will form the completion documents:-

a) Technical documents according to which the work has been carried out.
b) Three sets of construction drawings showing therein the modifications and corrections made during the course of execution signed by the Engineer-In-Charge.
c) Completion Certificate for "Embedded" or "Covered" up work.
d) Certificate of final levels as set out for various works.
e) Certificate of test performed for various work.
f) Material appropriation statement for the materials issued by owner for work and list of surplus materials returned to owner's store duly supported by necessary documents.
g) Operation and maintenance manual (If necessary).

4. Upon expiry of the period of defect liability and subject to Engineer-In-Charge being satisfied that work has been duly maintained by Contractor during the defect liability period of fixed originally or as extended subsequently and that Contractor has in all respects made up any subsidence and performed all his obligations under contract, the Engineer-In-Charge (without prejudice to the rights of owner in any way) give final certificate to that effect. The Contractor shall not be considered to have fulfilled the whole of his obligation until final certificate shall have been given by the Engineer-In-Charge.

5. Final Certificate only evidence of completion:
Except the final certificate, no other certificate of payment against a certificate or on general account shall be taken to be an admission by owner of the due performance of contract or any part thereof of occupancy or validity or any claim by the Contractor.

GC-88 TAXES, DUTIES, OCTROI ETC. :

1. Contractor agrees to and does hereby accept full and exclusive liability for the payment of any and all taxes including Sales Tax, Duties, Octroi etc., now or hereinafter imposed, increased or modified from time to time in respect of work and materials and all contributions and taxes for unemployment, compensation, insurance and old age pension or annuities now or hereinafter imposed by the Central or State Government authorities with respect to or covered by the wages, salaries or other compensation paid to the persons employed by Contractor.

If the Contractor is not liable to Sales Tax assessment, a certificate to that effect from the Competent Authority shall be produced without which final payment to the Contractor shall not be made No. IP, 'C' and 'D' Form shall be supplied by the owner, and the Contractor shall be required to pay full tax as applicable.

2. Contractor shall be responsible for compliance with all obligations and restrictions imposed by the labour law or any other law affecting employer-employee relationship.

3. Contractor further agrees to comply and to secure the compliance of all sub contractors with applicable Central, State, Municipal and local laws and regulations and requirement. Contractor also agrees to defend, indemnify the hold harmless the owner from any liability or penalty which may be imposed by Central, State or local authority by reasons of any violation by Contractor or sub Contractor of such laws, regulations or requirements and also from all claims, suits or proceedings that may be brought against owner arising under, growing out of or by reasons or work provided for by this Contract by third parties or by Central or State Government authority or any administrative Sub-Division thereof.
The Sales Tax on work contract will be borne by Contractor.

GC-89 INSURANCE :

Contractor shall at his own expenses carry and maintain the reputable Insurance Companies to the satisfaction of owner as follows :

1. Contractor agrees to and uses hereby accept full and exclusive liability for compliance with all obligations imposed by the Employer's State Insurance Act, 1948 and Contractor further agrees to defend, indemnify and hold owner hardness from any liability or penalty which may be imposed by the Central or State Government or local authority by reasons of any assorted violation by Contractor or Sub-Contractor or the Employees State Insurance Act, 1948 and also from all claims, suits or proceedings that may be brought against owner arising under, growing out of or by reasons of the work provided for by this contract whether brought by employees of Contractor by third parties or by Central or State Government authority or any administrative Sub-division thereof.

Contractor agrees to fill in with the Employees State Insurance Corporation, the declaration form and all forms which may be required in respect of Contractor's or sub-Contractor's employees whose aggregate remuneration is Rs.400/- p.m. or less and who are employed in work provided for or those covered by ESI from time to time under the agreement. The Contractor shall deduct and secure the agreement of the sub-Contractor to deduct the employees contribution as per the first schedule of the Employees State Insurance Act from wages. Contractor shall remit and secure the agreement of sub-contractor to remit to the State Bank of Indian Employees State Insurance Accounts, the employee's contribution as required by the Act. Contractor agrees to maintain all cards and records as required under the Act in respect of employees and payments and Contractor shall secure the agreements of the sub contractors to maintain in such records, any expenses incurred for the contributions, making contributions or maintaining records shall be to Contractors or sub-contractors own account. owner shall retain such sum as may be necessary from the contract value until Contractor shall furnish satisfactory proof that all contribution as required by the Employees State Insurance Act, 1948 have been paid.

2. **Workman's compensation and employees liability insurance:** Insurance shall be effected for all Contractors employees engaged in the performance of this contract. If any part of work is sublet, Contractor shall require the sub-Contractor to provide workman's compensation and employer's liability insurance, which may be required by owner.

3. Other Insurance required under law of regulations or by owner Contractor shall also carry and maintain any and all other insurance which may be required under any law or regulation from time to time. He shall also carry and maintain any other insurance, which may be required by owner.

GC-90 DAMAGE TO PROPERTY :

1. Contractor shall be responsible for making good to the satisfaction of owner any loss of and any damage to all structures and properties belonging to owner or being executed or procured or being procured by owner or of other agencies within the premises of all work of owner, if such loss or damage is due to fault and / or the negligence of willful act or omission of Contractor, his employees, agent, representatives or sub-Contractor s.

2. Contractor shall indemnify and keep owner harmless of all claims for damage to properties other than property arising under by reasons of this agreement, such claims result from the fault and / or negligence or willful act or omission of Contractor, his employees, agents representative or sub-contractor.

GC-91 CONTRACTOR TO INDEMNIFY OWNER :

1. The Contractor shall indemnify and keep indemnified the owner and every member, officer and employee of owner from and against all actions, claims, demands and liabilities whatsoever under the in respect of the breach of any of the above clauses and / or against any claim, action or demand by any workman / employee of the Contractor or any sub-contractor under any laws, rules or regulations having force of laws, including but not limited to claims against the owner under the workman compensation Act, 1923, the Employee's Provident Funds Act, 1952 and / or the contract labour (Abolition and Regulations) Act, 1970.

2. **PAYMENTS OF CLAIMS AND DAMAGES :** If owner has to pay any money in respect of such claims or demands aforesaid, the amount so paid and the cost incurred by the owner shall be charged to and paid by Contractor without any dispute notwithstanding the same may have been paid without the consent or authority of the Contractor.

3. In every case in which by virtue of any provision applicable in the workman's Compensation Act, 1923 or any other Act, owner be obliged to pay compensation to workmen employed by Contractor the amount of compensation so paid, and without prejudice to the

rights of owner under Section-(12) Sub-section-(2) of the said Act, owner shall be at liberty to recover such amount from any surplus due to on to become due to the Contractor or from the security deposit. Owner will not be bound to contest any claim made under Section-(12) Sub-section-(2) of the said act except on written request of Contractor and giving full security for all costs consequent upon the contesting of such claim.

The Contractor shall protect adjoining sites against structural, decorative and other damages that could be cased to adjoining premises by the execution of these works and make good at his cost, any such damage, so caused.

GC-92 IMPLEMENTATION OF APPRENTICE ACT 1954 :

Contractor shall comply with the provisions of the apprentice Act 1954 and the orders issued there under from time to time. If he fails to do so, it will be a breach of contract.

GC-93 HEALTH AND SANITARY ARRANGEMENTS FOR WORKERS:

Contractor shall comply with all the rules and regulations of the local Sanitary Authorities or as framed by owner from time to time for the protection of health and provide sanitary arrangements of all labour directly or indirectly employed on the work of this contract.

GC-94 SAFETY CODE :

General :

Contractor shall adhere to safe construction practice and guard against hazardous and unsafe working conditions and shall comply with owner's rules as set forth herein.

1.0 First Aid and Industrial Injuries :

1.1 Contractor shall maintain First-Aid facilities for its employees and those of his sub-contractors.

1.2 Contractor shall make outside arrangements for ambulance service and for the treatment of industrial injuries. Name of those providing these services shall be furnished to Engineer-In-Charge prior to start of construction, and their telephone numbers shall be prominently posted in Contractor's field office.

1.3 All injuries shall be reported promptly to Engineer-In-Charge and a copy of Contractor's report covering each personal injury requiring the attention of a physician shall be furnished to owner.

2.0 General Rules :

2.1 Carrying and striking, matches, lighters inside the project area and smoking within the job site is strictly prohibited. Violators of smoking rules shall be discharged immediately. Within the operation area, no hot work shall be permitted, without valid gas, safety, fire permits. The Contractor shall also be held liable and responsible for all lapses of his sub-Contractor s / employees in this regard.

3.0 Contractor's Barricades :

3.1 Contractor shall erect and maintain barricades without any extra cost, required in connection with his operation to guard or protect during the entire phase of the operation of this contract for -

i) Excavation
ii) Hoisting areas
iii) Areas adjudged hazardous by Contractor's OR Owner's inspectors.
iv) Owner's existing property liable to be damaged by Contractor's operations, in the opinion of Engineer-In-Charge / Site Engineer.
v) Rail / Road, loading / unloading spots.

3.2 Contractor's employees and those of his sub-contractors shall become acquainted with owner's barricading practices and shall respect the provisions thereof.

3.3 Barricades and hazardous areas adjacent to but not located in normal routes of travel shall be marked by red lantern at night.

4.0 Scaffolding :

4.1 Suitable scaffolding shall be provided for workman for all works that cannot safely be done from ladders.
When a ladder is used, an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and handholds shall be provided on the ladder and the same shall be given an inclination not steeper that 1 in 4 (1 horizontal and 4 vertical).

4.2 Scaffolding or staging, more than 3.6 M. (12') above the ground or floor, swing or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise fixed at least 1.0 M (3') high above the floor or platform or scaffolding or staging and extending along the entire length of the outside ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.

4.3 Working platforms, gangways, and stairways should be so constructed that they should not sag unduly or inadequately and if the height of the platform or the gangway of the stairway is more than 3.6 (12') above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in 4.2 above.

4.4 Every opening in the floor of a building or in a working platform be provided with suitable means to prevent the fail of persons or materials by providing suitable fencing or railing whose minimum height shall be 1.0 M (3'.0").

4.5 Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9.0 M. (30') in length while the width between the side rails in rung ladder shall in no case be less than 30 cms (12 inches) for ladder up to and including 3.0 M. (10'), in longer ladders this width would be increased at least 6 mm (1/4") for each addition 30 c.m. (1.0) of length. Uniform step spacing shall not exceed 30 cms. (12"). Adequate precaution shall be taken to prevent danger from electrical equipment. No materials on any of the side of work shall be so stacked or placed as to cause danger or inconvenience to any person or public. The Contractor shall also provide all necessary all necessary fencing and lights to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit action or other proceedings at law that may be brought by any persons for injury sustained owning to neglect of the above precautions and to pay damages and costs which may be awarded in any such suit or action or proceedings to any such person, or which, may be with the consent of the Contractor be paid to compromise any claim by any such person.

5.0 Excavation :

5.1 All trenches 1.2 M (4') or more in depth, shall at all time be supplied with at least one ladder.

5.2 Ladder shall be extended bottom of the trench to at least 3" above the surface of the ground. The side of the trench which are 1.5 M (5') or more in depth shall be stopped back to give suitable slope, or securely held by timber bracing, so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 M (5') of the trench of half of the trench depth whichever is more. Cutting shall be done from top to bottom. Under no circumstances, undermining or under cutting be done.

6.0 Demolition :

6.1 Before any demolition work is commenced and also during the progress of the work all roads and open area adjacent to the work site shall either be closed or suitably protected.

6.2 No electric cable or apparatus which is liable to be a source of danger shall remain electricity charged.

6.3 All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion of flooding. No floor or other part of the building shall be so over loaded with debris or materials as to render it unsafe.

7.0 Safety Equipment :

7.1 All necessary personal safety equipment as considered necessary by the Engineer-In-Charge should be made available for the use of persons employed on the site and maintained in a condition suitable for immediate use, and the Contractor should take adequate steps to ensure proper use of equipment by those concerned.

7.2 Workers employed on mixing asphaltic materials, cement and line mortars shall be provided with protective footwear and protective gloves.

8.0 Risky Place :

8.1 When the work is done near any place where there is a risk of drowning, all necessary safety equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision should be made for prompt first-aid treatment of all injuries likely to be sustained during the course of the work.

9.0 Hoisting Equipment :

9.1 Use of hoisting machines and tackles including their attachments, and storage and supports shall conform to the following standards or conditions.

9.2 These shall be of good mechanical construction, sound material and adequate strength and free from patent defect and shall be kept in good condition and in good working order.

9.3 Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength and free from patent defects.

9.4 Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in-charge of any hoisting machine including any scaffolding.

9.5 In case of every hoisting machine and of every chain ring hook, shackle, swivel and pulley block used in hoisting or lowering or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine and all gear referred to above shall be plainly marked with the safe working load and the conditions under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

9.6 In case of departmental machine, the safe work load shall be notified by the Engineer-In-Charge, as regards Contractor s machine, the Contractor shall, notify, the safety working load of the machine to the Engineer-In-Charge. Whenever the Contractor brings any machinery to site of work he should get it verified by the Engineer-In-Charge concerned.

10.0 Electrical Equipment :

Motors, gears, transmission, electric wiring and other dangerous parts of hoisting appliances shall be provided with efficient safeguards, hoisting appliances should be provided with such means when will reduce to the minimum the risk of accidental descent of the load, adequate precautions shall be taken to reduce to the minimum the risk of any part or a suspended load becoming accidentally displaced. When workers are employed on electrical

installations which are already energized, insulating mats, wearing apparel such as gloves, and booths as may be necessary shall be provided. The workers shall not wear any rings, watches and carry keys or other materials which are good conductors of electricity.

11.0 Maintenance of Safety Devices :

All scaffolds, ladders and other safety devices as mentioned or described herein shall be maintained in sound condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near place of work.

12.0 Display of Safety Instructions :

The safety provisions should be brought to the notice of all concerned by display on a Notice Board at a prominent place at the work spot. The persons responsible for compliance of the safety code shall be named therein by the Contractor.

13.0 Enforcement of Safety Regulations :

To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangement made by the Contractor shall be open to inspection by the Welfare Officer, Engineer-In-Charge or Safety Engineer of the owner or their representatives.

14.0 No Exemption :

14.1 Notwithstanding the above clause 1.0 to 13.0 there is nothing to exempt the Contractor from the operations of any other Act or Rules in force in the Republic of India.

14.2 In addition to the above, the Contractor shall abide by the safety code provisions as per C.P.W.D. safety code framed from time to time.

GC-95 ACCIDENTS :

It shall be Contractor's responsibility to protect against accidents on the works. He shall indemnify the owner against any claim for damage or for injury to person or property resulting from, and in the course of work and also under the provisions of the workman's compensation Act. On the occurrence of an accident arising out of the works which results in death or which is so serious as to be likely to result in death, the Contractor shall within twenty-four hours of such accident, report in writing to the Engineer-In-Charge, the facts stating clearly and in sufficient details the circumstances of such accident and the subsequent action. All other accidents on the works involving injuries to person or damage to property other than that of the Contractor shall be promptly reported to the Engineer-In-Charge, stating clearly and in sufficient details the facts and circumstances of the accidents and the action taken. In all cases, the Contractor shall indemnity the owner against all loss or damage resulting directly or indirectly from the Contractor's failure to report in the manner aforesaid. This includes penalties or fines, if any, payable by the owner as a consequence of failure to give notice

under the Workman's Compensation Act, or failure to conform to the provisions of the said act in regard to such accidents.

In the event of an accident in respect of which compensation may become payable under the Workman's Compensation Act VIII of 1923 including all modification thereof, the Engineer-In-Charge may retain out of money due and payable to the Contractor such sum of sums of money as may in the opinion of Engineer-In-Charge be sufficient to meet such liability. On receipt of award from the Labour Commissioner in regard to quantum of compensation, the difference in amount will be adjusted.

Signature of Contractor

Director (Projects)
RUDA

RAJKOT URBAN DEVELOPMENT AUTHORITY
Additional Instructions to persons tendering

1. EXAMINATION OF LOCATION:-

Statement as to the conditions under which the work is to be performed including surveys, measurements, dimensions calculations, estimates, etc. are made solely to furnish a basis of completion of tenders and the Rajkot Urban Development Authority does not guarantee on represent that, they are given approximately correct. The contractor shall satisfy himself by his own inquiry, investigation and search regarding all materials affecting the work to be done and labour and materials needed and shall make himself reliance thereon.

2. The work including in this contract, shall be carried out in accordance with the specifications, rules and regulations as per Indian Standard Specifications & MoRT&H of the latest Edition. If any of the items of this contract are not covered by the reference books quoted above decision and specifications as directed by the CEO, RUDA shall be final. This shall depend on the standard specifications followed the items concerned.

3. PROGRAMME:

The Engineer In-Charge may at any time give direction as to in order and manner in which the several parts of the work shall be carried out and the contractor shall strictly observe & implement such directions.

4. PROGRESS:-

The Contractor shall furnish to the Engineer in charge every week the progress of the work.

5. PROCUREMENT OF PETROLIUM PRODUCTS:

The contractor shall submit monthly, the purchase bills for bitumen. The contractor shall submit the monthly returns in the prescribed forms as to the receipts and actual use of the bitumen during the month to the Engineer in charge close of every calendar month.

6. PERMIT & LICENCE :-

The contractor shall procure his sole expenses all permits and license and pay all charges and fees for lawful execution of the work.

7. TEMPORARY QUARTERS:- (LABOUR ACCOMODATION)

The contractor will be required to make his own arrangement for the housing of his staff required as per statutory provision.

8. Conditions regarding medical and sanitary arrangement to be provided by the contractor as per statutory Provision.

9. SUBLETING OF WORK.

The Contractor will not be permitted to sublet any of the work.

10. EMPLOYMENT OF RESIDENT ENGINEER :-

The contractor shall employ skilled and fully experienced, qualified engineer for carrying out the work. Before employing a skilled and experienced Resident Engineer, the contractor shall obtain the previous permission and approval of the Engineer in charge for making such appointment as to the suitability and eligibility of the Resident Engineer. The Resident Engineer shall be considered at any time to be acting for the contractor with full responsibility in every respect. While submitting such proposal, the qualifications and experience of the persons shall be fully listed. It must be seen that person with proven and sufficient experience shall be preferred. Resident engineer shall have minimum B.E. (Civil) degree of engineering.

11. CO-ORDINATION OF SPECIFICATION, PLANT AND SPECIAL PROVISIONS:-

The Standard specifications, the plants, the special provisions and all supplementary documents are essential parts of the contract and requirement occurring in one shall be binding as though in occurring in all. They shall be intended to be co-operative to describe and provide for a complete work. Incase of disagreement the plant shall have procured over the standard specifications. Figures, dimensions shall given over scale dimension. In any case such variation shall be decided by the Engineer in charge.

12. INSPECTION OF WORK AND MATERIALS:-

(i) For Resident Engineer, Agent and employees of the contractor, contractor shall provide proper facilities.

(ii) The inspection of the work shall not relieve the contractor from his obligation to fulfill the terms of the contract as herein prescribed by the plans and specification.

(iii) The contractor shall furnish written information to the Engineer in charge stating the original sources of supply and dates of manufacturing of all materials brought or manufactured away from the actual site of the work.

(iv) The contractor shall furnish the Engineer in charge with every reasonable facility as assistance for ascertaining whether or not the work performed is in accordance with the requirements and instructions of the plans and estimates and specification, if so, directed, the contractor any times before and after considered, necessary for fresh inspection at his own cost. After the inspection, the contractor shall restore the said portion of the work to the conditions required by the specifications at his own cost.

(v) In order to ensure a proper time sequence for required inspection and approval, this information shall be furnished at least two weeks before of otherwise as directed by the Engineer in charge in advance of the use of incorporation in the work of any such materials and this shall be given in writing by the contractor.

(vi) Failure to reject any defective work of materials, any time will not in any way, prevent later rejection when such defect is discovered or observed.

13. The contractor shall obtain from employer stations of the place or places, where it is permitted for his to deposit the materials excavated. the contractor shall accept the site as he finds it, and any work that may go necessary to carry out, the contractor shall be provided for in his contract price.

14. The contractor shall be responsible for the true and proper setting out of the works and or the correctness of the positions, levels, dimensions, and alignments of all parts of the works and for the provisions of all necessary instruments appliances and labour in connection therewith. If any time, during the progress of the works any error shall appear or arises in the positions, levels, dimensions or alignment or any part of the works. The contractor shall at his own expenses, rectify such errors is based on the correct date supplied in writing by Engineer in charge in which case the expense of rectifying the same shall be borne by the Contractor. The checking or any setting out or any line or level by the Engineer in charge or his representative shall not in any way, relieve the contractor of his responsibilities for the correctness thereof. The contractor shall carefully protect and procure all bench marks, site, nails, pegs and other thing used in setting out work.

15. As order book shall be provided and maintained by the contractor for the work and the contractor shall sign the orders given by the department and shall carry them out. Work order book is the property of the RUDA and shall remaining the custody of RUDA, that is supervisory staff on duty. Compliance shall be carried out promptly and reported to the Engineer in charge in good time so that work can be checked.

16. **EXTRA- ITEM RATE LIST** :-

In case of the extra items, The rate of extra items shall be decided by the competent authority of the department as per the clause GC-70. The final decision of the competent authority of the employer regarding rates, specifications etc. shall be binding upon the contractor. The decision of competent authority shall be final

17. As petty items occurring in the work and as found necessary actual execution shall be carried out in general as per general specification current in division and as per orders of the Engineer in charge from time to time.

18. It shall be distinctly and clearly understood that commodity of the contract and specifications on the ground of custom prevailing is not be allowed. Extra charges of claims in respect of the extra works will not be allowed unless the work to which they related is clearly beyond the sprit and meaning of the specifications or unless such work are ordered of the specified manner before the work is taken in hand, in writing by the Engineer in charge.

19. The contractor shall provide all labour and pegs, strings and other materials as required for lining and measuring all the work without any payment from the Government.

20. The dimensions, figures and drawing etc. shall be followed as supplied by the Engineer in-charge from time to time. No claims or dispute from contractor shall be entertained due to charge in plans or detailed drawings.

21. The contractor shall provide suitable stones with flat top and temporary bench mark, page, required for lining out and fixing the necessary levels without any extra cost. If required such stones may be build in masonry at such places and in such manner as the Engineer in charge or his Assistant in charge of the work determines.

22. All purpose connected with work, the contractor are required to make their own arrangements for a sufficient supply or water or quality and quantity and at such places on the work as may be order by the Engineer in charge. The rate quoted in the contract are for completed work and shall cover all the contractor's cost in supplying water to the terms stipulated in the clause of this contract. In case the contractor wants to make use of plots, adjacent to work site, for stacking material etc. they have to approach owners of these plots or such other authority and make their own arrangements. The Engineer in charge will not be held responsible for any complaints on such cases from anybody.

23. Every spot on the work and site shall be kept clear of accumulation of debris from time to time.

24. All the materials to be used in the work may from time to time subject to test as per relevant IS or
As directed by the Engineer in charge at the expenses of the Contractor.

25. Notwithstanding that, all proper precautions may have been taken by the contractor during the progress of the work, the contractor shall be held responsible for all damages, whether to the work under execution or to any other property or live persons during the progress work and the period maintenance.

26. The site of the work after the completion of the work shall be given to the RUDA Engineer-in-charge in neat and clean conditions after removing all the rubbish

27. The contractor shall as far as possible employ the labour work giving priority to the labour resides locally.

Director (Projects)

Signature of the Contractor **Rajkot Urban Development Authority**

Information / Details to be submitted by the Tenderers in the Performa
mentioned under Statement no 1 to 9. All the documents submitted herewith as supporting documents shall be duly attested and certified true copy.

STATEMENT NO-1
DECLARATION

I/We hereby declared that I/We am/are not partner(s) blacklisted or connected with firm blacklisted in any states, CPWD / MES / Railways or any Government, Semi- Government or
Private body.

At present I/We am/are registered as approved contractor (s), firms in any state, CPWD / MES / Railways.

We, the partners/owners of this firm, hereby give an undertaking that we are jointly and severally responsible to meet all the liabilities over and above the business of this firm and will make good the financial loss sustained by the Rajkot Urban Development Authority as a result of our abandoning the works entrusted to us.

Seal and Signature of the Bidder
Date:

STATEMENT NO-2

APPLICABILITY OF PROVIDENT FUND AND MISCELLANEOUS PROVISIONS ACT 1952

Successful bidder i.e. the agency whose tender is accepted by the RUDA shall have to comply the necessary formalities under the employees provident fund and Miscellaneous Provisions Act, 1952 as Contributory Provident Fund Scheme is applicable to labourers engaged in construction activity and shall have to submit proofs regarding deduction of provident fund and other dues and depositing the same with government department under the act and the scheme regularly on monthly basis failing which no running / final bill payment will be made by the RUDA to the contractor in any circumstances.

A certificate to the above effect has to be given by the contractor as under.

Declaration
Of
Depositing Provident Fund contribution

This to certify that we will deduct the employees' P.F. and deposited the same along with employer's contribution towards provident fund on labour charges / wages paid by us to the labourers to be engaged for the work of _____ _____with Provident Fund Authority under our Provident Fund Code No._____

We will produce herewith the copies of the challans for the provident fund deduction and contribution deposited as mentioned above.

Seal and Signature of the Bidder

STATEMENT NO. –3
CURRICULAM VITAE

Sr No	**Details of person**	
1	Name	
2	Age	
3	Qualifications	
4	Experience in Project Related field	
5	Other experiences	
6	Employment Record	

Sr No	Period From	To	**Organization under which work**	**Status /position in the organization**

Note:

(1) Separate sheet for each person to be furnished as above.

(2) The contractor's Project Team should consist of persons in the following disciplines.

a) Senior Engineer (BE Civil with experience of Building & Road work minimum experience 10 years)

b) Senior material Engineer (Degree in Civil Engineering with 5 years experience).

c) Senior Quantity Surveyor (Degree in Civil Engineering with 5 years experience).

d) Project management expert (Degree in Civil Engineering with 15 years experience).

e) Site in charge (Degree in Civil Engineering with 5 years experience).

Seal and Signature of the Bidder

STATEMENT NO. 4/ A

Detailed information of similar type of road construction work costing completed with good quality and workmanship in the Last Five years.

Name of Contractor:

Sr No.	Name of work	Name of client	Estimated cost of work (Rs. Lacs)	Tendered amount Rs. (Lacs)	Date of award of contract	Target date of completion	Actual date of completion	Reason for delay	Amount of work done during last five years preceding this tender (Rs. Lacs).					Remarks
									2019-20	2018-19	2017-18	2016-17	2015-16	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

***Note**: Certificate from the owners in support of above works may be enclosed with this statement.*

Seal and Signature of the Bidder

STATEMENT NO. – 4/B
DETAILS OF ONGOING PROJECT

Sr No	Name of project	The Total Value of Work (Rs. In lacs)	Value of work completed till 31.12.2019 (Rs. In lacs)	Value of remaining work Rs. in lakhs.	Start date	Likely date of Comple-tion	Name, address, telephone, fax Number of project authority & contact person.

Seal and Signature of the Bidder

STATEMENT NO. – 4 / C
AVAILABLE BID- CAPACITY

	2019-20	2018-19	2017-18	2016-17	2015-16
Value of works executed in Rs. Crores in last Five years.					

The available bid capacity will be worked out as follows.
Available bid capacity = (A x N x 2) – B,
where
A = Maximum of updated total amount of work executed in any one year of the last five
financial years.
B = The amount of the existing commitments and ongoing works to be discharge during time
interval of N years from the bid due date.
N = Number of years prescribed for completion of the proposed works

Seal and Signature of the Bidder

STATEMENT NO. – 5

LIST OF SINGLE ROAD PROJECT WORK OF SIMMILAR NATURE COSTING NOT LESS THAN 1 WORK OF 60% OR 2 WORK OF 40% OR 3 WORKS OF 30% OF THE ESTIMATED COST COMPLETED DURING THE LAST SEVEN YEARS. AS A MAIN CONTRACTOR

Sr No	***Year of Construc-tion work***	**Name of project**	**Name of owner & contact person of the project, address, phone no. fax no.**	**Total cost of the work**	**Total value of work done Rs.**	**Date of starting work**	**Date of Actual completion of work**
1	2	3	4	5	6	7	8

***Note**: Certificate from the owners in support of above works may be enclosed with this statement.*

Seal and Signature of the Bidder

STATEMENT NO. – 5/A
BIDDER'S FINANCIAL CAPACITY

Sr No	Financial Year	Annual Turnover in Engineering Project Rs.	Net worth Rs.	Net cash Rs.	Working Capital Rs.
1	2019-20				
2	2018-19				
3	2017-18				
4	2016-17				
5	2015-16				

Note:-

1) Figures to be taken from audited balance sheets. Duly certified attested true copy

2) Copies of the balance sheet to be attached..

3) The bidder shall have to provide that for a period of at least 4 months the bidder has
ability to sustain negative cash balance and how he proposes to meet with the same.

4) Cash Plan / Cash flow Statement.

Seal and Signature of the Bidder

STATEMENT – 5/B

INFORMATION REGARDING FINANCIAL CAPACITY OF THE CONTRACTORS.

Sr. No.	Details	**Amount (Rs. in lacs)**	**Remarks**
1	Solvency		A Banker's Certificate of current financial year may please be attached
2	Working Capital		A Banker's Certificate of current financial year may please be attached

Seal and Signature of the Bidder

STATEMENT NO.-6

DETAILS OF PLANT & MACHINERY TO BE DEPLOYED ON THIS WORK

Name of the contractor/company :

Sr No	**Name of plants/machinery**	**Nos. available (with make & year)**	**Nos. proposed to be deployed for this project**	**Present Location**	**Present value of plant / machineries**
1	**2**	**3**	**4**	**5**	**6**

Note:

Plant / machineries which are proposed to be procured shall have to be procured at the earliest after award of the work and before the start of the work.

Seal and Signature of the Bidder

Statement No.7

(Accompaniment to govt. R & B. Department, Resolution No..INC/1034/IB-204/(26)/C dated 24-1-1965)

FOR ::

PLACE ::

DATE ::

To
The Director (Projects)
Rajkot Urban Development Authority
Rajkot.

Details regarding my / our partners / our Company (in the case of Limited Company) names address(es), telephone number(s), income tax office etc., are as under ::

Sr No	Name(s) of persons/Partners/ Company	Full address of the place of business (with pin code)	Telephone No(s). (Office)	Residential address (es)	Telephone No(s) (Resi.)	Full address of Income Tax office/Ward where Income Tax return is filed.

I / We hereby agree to intimate to you about change, if any, in the above mentioned address(es) and telephone No(s). within fifteen days of its occurrence, till my / our deposit, for the said work paid by me / us is, not refunded to me / us.

Signature of contractor.

Rajkot Urban Development Authority

:: SPECIAL CONDITIONS ::

1. The Royalty of each and every material, required to be paid is to be borne by the contractor.

2. Testing of each material as and when required by Rajkot Urban Development Authority, is to be carried out by the contractor at his own cost. Schedule of testing of material will be as per R&B, State Government Manual and I S Code provision.

3. The whole work shall be executed by qualified Site Engineer. The required L-Section, Cross section and other required drawings and designs is to be prepared by contractor at his own cost. The work should be done by total station or any other levelling instruments suggested by engineer-in-charge. The Drawings shall be submitted in hard and soft copy accordingly in advance before starting the work. No extra payment will be made for the above work. Contractor has to submit Bill form with hard copy and soft copy of cross section and L-section of work completed. No bill will be accepted without above drawings.

4. Necessary tests for material quality, soil tests etc. shall be carried out as per the instructions of engineer-in-charge by contractor at his own cost and reports to be submitted to the engineer-in-charge.

5. When the Quantity of any item exceeds the quantity as in the tender by more than 10% the contractor will be paid for the quantity in excess of 10% at the rate enterned in the SOR of the during which the excess in quantity is first executed or tender rate whichever is less.

Seal and Signature of the Bidder

ટેન્ડરમાં જથ્થાવધારા તથા જથ્થાવધારાના ભાવના માપદંડમાં સુધારણા કરવા બાબત

ગુજરાત સરકાર
માર્ગ અને મકાન વિભાગ
બ્લોક નં.૧૪/૨, સરદાર ભવન,
સચિવાલય, ગાંધીનગર
ઠરાવ ક્રમાંકઃ TNC-10-2017-01-C
તા.૧૧/૦૭/૨૦૧૭

ઠરાવ

ટેન્ડરમાં જથ્થાવધારા તથા જથ્થાવધારાના ભાવના માપદંડ બાબતે બી-૧ અને બી-૨ ટેન્ડરના કલોઝ-૧૪.૨ માં જણાવ્યા મુજબ જથ્થાવધારા માટે 30 ટકા સુધીનો જથ્થો ટેન્ડરના ભાવથી અને 30 ટકાથી વધુ જથ્થામાં વધારો હોય તો જે તે વર્ષમાં કામગીરી કરેલ હોય તે વર્ષના એસ.ઓ.આર.થી કરવાની જોગવાઇ છે.

સદરહુ જોગવાઇમાં સુધારણા કરવા બાબતે સરકારશ્રીમાં ઘણા લાંબા સમયથી વિચારણા હેઠળ હતું. જે અન્વયે નીચે મુજબનો સુધારો કરવામાં આવે છે.

EXISTING CLAUSE	AMENDMENT
Form B-1 Clause- 14.2 **Form B-2 Clause- 14.2** Except that when the quantity of any item exceeds the quantity as in the tender by more than 30% the contractor will be paid for the quantity in excess of 30% at the rate entered in the SOR of the year during which the excess in quantity is first executed and for the material consumed in excess quantity the rate for the material to be charged would be basic rate taken into account for fixing the rate for the SOR above instead of the rate stipulated in Schedule-A.	**Form B-1 Clause- 14.2** **Form B-2 Clause- 14.2** Except that when the quantity of any item exceeds the quantity as in the tender by more than **10%** the contractor will be paid for the quantity in excess of **10%** at the rate entered in the SOR of the year during which the excess in quantity is first executed or tender rate whichever is less.

ઉપરોકત તમામ સુચનાનો અમલ ચુસ્તપણે તાત્કાલિક અસરથી કરવાનો રહેશે.

ગુજરાત રાજયના રાજયપાલશ્રીના હુકમથી અને તેમના નામે.

(એન.જી.પરમાર)
ખાસ ફરજ પરના અધિકારી (વિ.વી.)
માર્ગ અને મકાન વિભાગ
ગાંધીનગર

121. FIELD LABORATORY

121.1. 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.

121.2. 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. Atleast 4 racks of slotted angles and M.S. sheets as at Sl. No. 10 of Table 100-2 and atleast 6 stools for laboratory test operators as at Sl. No 7 of Table 100-2 shall also be provided.

121.3. 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^{O}C sensitivity 1^{O}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 $1^{O}C$	1 No.
(vi)	Thermometers: 4 Nos. Mercury-in-glass thermometer range $0^{O}C$ to 250 ^{O}C Mercury-in-steel thermometer with 30 cm stem, range upto $300^{O}C$	4 Nos.
(vii)	Kerosene or gas stove or electric hot plate	1 No.
(viii)	Glassware, spatulas, wire gauzes, As required steel scales, measuring tape, casseroles, karahis, enameled 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 sieves with lid and pan: **450 mm diameter**: 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 **200mm diameter:** 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)	Atterberg 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 liters 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.

APPROVAL OF WORK PRIOR TO START

1. Contractor shall submit the approval of material like Earth for Embankment & Sub grade , Granular Sub base , Wet Mix Macadam and Bituminous work prior to start the execution of work at site in Prescribed Format.

Box cutting.

1. Specification No. 162 and 553 of P.W.D. Hand Book volume II and the following additional specifications shall be here.

2. Cutting shall be done in proper grade & camber as per measurements given. Care must be taken the tall slopes are evenly and truly dressed. Cutting shall be done to the exact depth required and shall be as per formation level in proper grade and the camber. If extra depth of cutting is done due to negligence of contractor the same shall be refilled with approved quality of materials duly consolidated to the satisfaction of the Engineer-in-charge (without extra cost) Box cutting for soling and metalling in required width the depth shall be done.

3. The stuff received from the cutting shall be utilized for filling cuts and correcting side slopes of bank with all lead and lift directed. Useful Stuff shall be carefully stacked separately as directed,

4. The measurement shall be taken as per cross section measurement of the cutting based on length, breadth, depth measured with tape at every 25 metres interval.

5. The payment shall be made on Cum. basis.

111. PRECAUTIONS FOR SAFEGUARDING THE ENVIRONMENT

111.1. General

The Contractor shall take all precautions for safeguarding the environment during the course of the construction of the works. He shall abide by all laws, rules and regulations in force governing pollution and environmental protection that are applicable in the area where the
works are situated.

111.2. Borrow pits for Embankment Construction

Borrow pits shall not be dug in the right-of-way of the road. The stipulations in Clause 305.2.2. shall govern.

111.3. Quarry Operations

The Contractor shall obtain materials from quarries only after the consent of the Forest Department or other concerned authorities is obtained. The quarry operations shall be undertaken within the purview of the rules and regulations in force.

111.4. Control of Soil Erosion, Sedimentation and Water Pollution

The Contractor shall carry out the works in such a manner that soil erosion is fully controlled, and sedimentation and pollution of natural water courses, ponds, tanks and reservoirs is avoided. The stipulations in Clause 306 shall govern,

111.5. Pollution from Hot-Mix Plants and Batching Plants

Bituminous hot-mix plants and concrete batching plants shall be located sufficiently away from habitation, agricultural operations or industrial

establishments. The Contractor shall take every precaution to reduce the levels of noise, vibration, dust and emissions from his plant and shall be fully responsible for any claims for damages caused to the owners of property, fields and residences in the vicinity.

111.6. Substances Hazardous to Health

The Contractor shall not use or generate any materials in the works which are hazardous to the health of persons, animals or vegetation. Where it is necessary to use some substances which can cause injury to the health of workers, the Contractor shall provide protective clothing or appliances to his workers.

111.7. Use of Nuclear Gauges

Nuclear gauges shall be used only where permitted by the Engineer.

General Section 100

The Contractor shall provide the Engineer with a copy of the regulations governing the safe use of nuclear gauges he intends to employ and shall abide by such regulations.

111.8. The Contractor must take all reasonable steps to minimize dust nuisance during the construction of the works.

111.9. All existing highways and roads used by vehicle of the Contractor or any of his sub-contractors or suppliers of materials or plant, and similarly any new road* which are part of 'the works and which are being used by traffic, shall be kept clean and clear of all dust/mud or other extraneous materials dropped by the said vehicles or their tyres. Similarly, all dust/mud or other extraneous materials from the works spreading on these highways shall be immediately cleared by the Contractor.

111.10. Clearance shall be effected immediately by manual sweeping and removal of debris, or, if so directed by the Engineer, by mechanical sweeping and clearing equipment, and all dust, mud and other debris shall be removed entirely from the road surface. Additionally, if so directed by the Engineer, the road surface shall be hosed or watered using suitable equipment.

111.11. Any structural damage caused to the existing roads by the Contractor's construction equipment shall be made good without any extra cost.

111.12. Compliance with the foregoing will not relieve the Contractor of any responsibility for complying with the requirements of any Highway Authority in respect of the roads used by him.

CLAUSE 112.ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

112.1. General

The Contractor shall at all times carry out work on the highway in a manner creating least interference to the flow of traffic while consistent with the satisfactory execution of t he same. For all works involving improvements to the existing highway, the Contractor shall, in accordance with the directives of the Engineer, provide and maintain, during execution of the work, a passage for traffic

either along a pant of the existing carriageway tinder improvement, or along a temporary diversion constructed close to the highway. The Contractor shall take prior approval of the Engineer regarding traffic arrangements during construction.

112.2. Passage of Traffic along a part of the Existing Car - carriageway under Improvement

For widening/strengthening existing carriageway where part width of the existing carriageway is proposed to be used for passage of traffic, treated shoulders shall be provided on the side on which work is not in progress. The treatment to the shoulder shall consist of providing at least 150 mm thick granular base course covered with bituminous surface dressing in a width of at least 1.5 m and the surface shall be maintained throughout the period during which traffic uses the same to the satisfaction of the Engineer. The continuous length in which such work shall be carried out, would be limited normally to 500 m at a place. However, where work is allowed by the Engineer in longer
stretches passing places at least 20 m long with additional paved width of 2.5 m shall be provided at every 0.5 km interval.

In case of widening existing two -lane to four-lane, the additional two lanes would be constructed first and the traffic diverted to it and only thereafter the required treatment to the existing carriageway would be carried out. However, in case where on the request of the Contractor, work on existing two -lane carriageway is allowed by the Engineer with traffic using part of the existing carriageway, stipulations as in para above shall apply.

After obtaining permission of the Engineer, the treated shoulder shall be dismantled, the debris disposed of and the area cleared as per the direction of the Engineer.

112.3. Passage of Traffic along a Temporary Diversion

In stretches where it is not possible to pass the traffic on part width of the carriageway, a temporary diversion shall be constructed with 7 m carriageway and 2.5 m earthen shoulders on each side (total width of roadway 12 m) with the following provision for road crust in the 7 m width:

(i) 200 mm (compacted) granular sub base;
(it) 225 mm (compacted) granular base course; and
(iii) Premix carpet with Seal Coal/Mix Seal Surfacing.

The alignment and longitudinal section of diversion including junctions and temporary cross drainage provision shall be as approved by the Engineer.

112.4. Traffic Safety and Control

The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such bar - ricades, including signs, markings, flags, lights and flagmen as may be required by the Engineer for the information and protection of traffic approaching or passing through the section of the highway under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic on the highway shall be drawn up in consultation with the Engineer.

The barricades erected on either side of the carriageway/portion of the carriageway closed to traffic, shall be of strong design to resist violation, and painted with alternate black and white stripes. Red lanterns or warning lights of similar type shall be mounted on the barricades at night and kept lit throughout from sunset to sunrise.

At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the carriageway) the channel for traffic shall

be clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the Engineer.
At night, the passage shall be delineated with lanterns or other suitable light source.
One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two –lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and l an terns/lights.
On both sides, suitable regulatory/warning signs as approved by the Engineer shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs shall be of approved design and of reflectory type, if so directed
by the Engineer.

112.5. Maintenance of Diversions and Traffic Control Devices
Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversions shall be maintained in a satisfactory condition till such lime they are required as directed by the Engineer.
The temporary travelled way shall be kept free of dust by frequent applications of water, if necessary.

General Section 100

112.6. Measurements for Payment and Rate
All arrangements for traffic during construction including provision of temporary cross drainage structures, if required, and treated shoulder as described in Clause 112.2 including their maintenance, dismantling and clearing debris, where necessary, shall be considered as incidental to the works and shall be the Contractors responsibility.
The construction of temporary diversion including temporary cross drainage structures as described in Clause 112.3, shall be measured in linear metre and the unit contract rate shall be inclusive of full compensation for construction (including supply of material, labour, tools etc.). maintenance, final dismantling, and disposal.

CLAUSE 301. EXCAVATION FOR ROADWAY AND DRAINS

301.1. Scope
This work shall consist of excavation, removal and satisfactory disposal of all 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 or hauling to sites of embankment and subgrade construction, suitable cut materials as required, as also the disposal of unsuitable cut materials in specified manner, 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 excavation shall be classified by the Engineer in the following manner:

(a) Soil
This shall comprise topsoil, turf, land, sill, loon, day, mud, peat. Mack cotton toil, loft shale or loose mooium, a mixture of these and similar material which yields to the ordinary application of pick, 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 75 mm occurring in such strata shall be deemed to be covered under mil category.

(b) Ordinary Rock (not requiring blasting this shall include:
(i) rock types such as lalerites, shales and conglomerates, varieties *of* limestone and sandstone etc., which may be quarried or split with crow ban, 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 Air bound; soling of roads, paths etc. and hard core; compact' murrum or 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 300 mm;

(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 300 mm, found lying loose on (he surface or embedded in river bed, soil, talus, slope wash and terrace material of dissimilar origin.

Earthwork, Erosion Control and Drainage Section 300
(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 (reinforcement cut through but not separated from the concrete) below ground level; and
(iii) boulders requiring blasting.

(d) Hard Rock (blasting prohibited)
Hard rock requiring blasting as described under (c) but where blasting is prohibited for any reason and excavation has to be carried out by chiselling, wedging or any other agreed method.

(e) Marshy Soil
This shall include soils like soft clays and peats 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. Merely 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 excavation shall be set out true to tines, curves, slopes, grades and sections as shown on the drawings or as directed by the Engineer. The Contractor shall provide all labour, survey instruments
and materials such as strings, pegs, nails, bamboos, stones, lime, mortar, concrete, etc., required in connection with the setting out of works and the establishment of bench marks. The Contractor shall be responsible for the maintenance of bench marks and other marks and stakes as long as in the opinion of the Engineer, they are required for the work.

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 constituting Horizon "A" and stockpiled at designated locations^ for re -use in covering embankment slopes, cut slopes, berms and other disturbed areas where re-vegetation is desired. 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 decided upon beforehand.

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 approved 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. If trees were removed, new trees shall be planted, as directed by the

Engineer. The cost of planting new trees shall be deemed to be incidental to the work.

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 upto the formation level or as otherwise indicated on 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 formation the rock protrudes above the specified levels. Rocks and large boulders which are likely to cause differential settlement and also local drainage problems should be removed to the extent of 500 mm below the formation level in full
formation width including drains and cut through the 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 to Clause 302 and all precautions indicated therein observed.
Where presplitting is prescribed to be done for the establishment of a specified slope in rock excavation, the same shall be carried out to Clause 303.

301.3.6. Marsh excavation :
The excavation of soils 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. 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 lateral limits called for on the drawings or as slaked by the Engineer, and to the bottom of the marsh, firm support or levels indicated.

301.3.7. Excavation of road shoulders/verge/median for widening of pavement or providing treated shoulders :
In works involving widening of existing pavements or providing treated shoulders, unless otherwise specified, the shoulder/verge/median shall be removed to their full width and to levels shown on drawings or as indicated by the Engineer. White 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 to Clause
309, excavation for these 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 Contract 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 with in 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 b y the Engineer. Care shall be taken to discharge the drained water into suitable outlets 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. Disposal of excavated materials :
All the excavated materials shall be the property of the Employer. The material obtained from the excavation of roadway, shoulders, verges, drains, crossdrainage works etc., shall be used for filling up of (i) roadway embank ment, (ii) the existing pits in the right -of-way and (iii) for landscaping of the road as directed by the Engineer, including levelling and spreading with all lifts and lead upto 1000 m and no extra payment shall be made for the same.

All hard materials, such as hard moorum, rubble, etc., not intended for use as above shall be stacked neatly on specified land as directed by the Engineer with all lifts and lead upto 1000 m.
Unsuitable and surplus material not intended for use within the lead specified above shall also, if necessary, be transported with all lifts and lead beyond initial 1000 m, disposed of or used as directed by the Engineer.

3013.12, Backfilling :
Backfilling of masonry/concrete/hume pipe drain excavation shall be done with approved material after concrete/masonry/hume 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 refilled to the original surface making due allowance for settlement, in layers generally not exceeding 150 mm compacted thickness to the required density, using suitable compaction equipment such *as* 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 use shall be made good by the Contractor at his own expense.

301.5. Preservation of Property

The Contractor shall undertake all reasonable precautions for the protection and preservation of any or all existing roadside trees, drains, sewers or. other 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 expense. If the Contractor fails to do so, within the required time as directed-by the Engineer or if, in th e 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 a prior notice to the effect,

301.6. Preparation of Cut Formation

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

Where the material in the subgrade (that is within 500 mm from the lowest level of the pavement) has a density less than specified in Table 300-2, the same shall be loosened to a depth of 500 mm and compacted in layers in accordance with the requirements of Clause 305.

Any unsuitable material encountered in the subgrade level shall be removed as directed by the Engineer and replaced with suitable material compacted in accordance with Clause 305.

In rocky formations, 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. Af ter satisfying the density requirements, the cut formation shall be prepared to receive the subbase/base course in accordance with Clauses 310 and 311 to receive the sub-base/basc course.

301.7. Finishing Operations

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

When completed, no point on the slopes shall vary from the designated slopes by more than 150 mm measured at right angles to the slope, except where excavation is in rock (hard or soft) 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 topsoil removed earlier and conserved (Clauses 301.3.2 and 305.3.3) shall be spread over cut slopes, where feasible, berms and other disturbed areas. Slopes may be roughened and moistened slightly, prior to the application of topsoil, in order to provide satisfactory bond. The depth of topsoil 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 in the original position before the work starts 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 stacks of excavated rubble after making 35 per cent deduction there from. When volumes are calculated in this manner for excavated material other than rock, deduction made will be to the extent of 16 per cent of stacked volumes. Works involved in 'the preparation of cut formation shall be measured in units indicated below :

(j)	Loosening and re compacting the loosened material at sub grade	... cu. m.
(ii)	Loosening and removal of unsuitable material and replacing with a suitable material and compacting to required density	... cu. m.
(iii)	Preparing rocky sub grade	... sq. m,
(iv)	Stripping including storing and reapplication of topsoil	... cu. m.
(v)	Disposal of surplus material beyond initial 1000 m lead	... cu. m,

301.9. Rates

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

(i) selling out;
(ii) transporting the excavated materials and depositing the same on sites of embankments, spoil banks or stacking as directed within all lifts and lead upto 1000 m or as otherwise specified;
(iii) trimming bottoms and slopes of excavation;
(iv) dewatering;

(v) keeping the work free of water *as* per Clause 311; and
(vi) all labour, materials, tools, equipment, safety measures, testing and incidentals necessary to complete the work to Specifications.

Provided, however, where presplitting is prescribed to achieve a specified slope in rock excavation, the same shall be paid for vide Clause 303.5.

301.9.2. The Contract unit rate for loosening and recompacting the loosened materials at iubgrade 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 subgrade 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 ail lifts, but leads upto 1000 m.

301.9.6. The Contract unit rate for disposal of surplus earth from roadway and drain excavation shall be full compensation for all labour, equipment, tools and incidentals necessary on account of the additional haul or transportation involved beyond the initial lead of 1000 m.

CLAUSE 305 - EMBANKMENT CONSTRUCTION

305.1. General
305.1.1. Description :
These Specifications shall apply to the construction of embankments including subgrades, earthen shoulders and miscellaneous backfills with approved material obtained from roadway and drain excavation, borrow pits or other sources. All embankments, subgrades, earthen shoulders and miscellaneous backfills shall be constructed in accordance with the requirements of these Specifications and in conformity with the lines, grades, and cross-sections shown on the drawings or as directed by the Engineer.

305.2. Materials and General Requirements
305.2.1. Physical requirements:
305.2.1.1. The materials used in embankments, subgrades, earthen shoulders and miscellaneous backfills shall be soil, moorum, gravel, a mixture of these or any other material approved by the Engineer. Such materials shall be free of logs, stumps, roots, rubbish or any other ingredient likely to deteriorate or affect the stability of the embankment/subgrade.

The following types of material shall be considered unsuitable for embankment:
(a) Materials from swamps, marshes and bogs;

(b) Peat, log, stump and perishable material: any soil that, classifies as OL, OI, OH or Pt in accordance with IS : 1498;
(c) Materials susceptible to spontaneous combustion;
(d) Materials in a frozen condition;
(e) Clay having liquid limit exceeding 70 and plasticity index exceeding 45; and
(f) Materials with sails resulting in leaching in the embankment.

305.2.1.2. Expansive clay exhibiting marked swell and shrinkage properties ("free swelling index" exceeding 50 per cent when tested as per IS: 2720 - Part 40} shall not be used as a fill material. Where an expansive clay with acceptable "free swelling index" value is used as a fill material, subgrade and top 500 mm portion of the embankment just below subgrade shall be non-expansive in nature.

305.2.1.3. Any fill material with a soluble sulphate consent exceeding 1.9 grams of sulphate (expressed as SO3) per litre when tested in accordance with BS : 1377 Test 10, but using a 2:1 water-soil ratio shall not be deposited within 500 mm or other distance described in the Contract, of concrete, cement bound materials or other cementitious materials forming part of the Permanent Works, Materials with a total sulphate content (expressed as SO3) exceeding 0.5 per cent by mass, when tested in accordance with BS : 1377 Test 9 shall not be deposited within 500 mm, or other distances described in the Contract, of metallic items forming part of the Permanent Works.

305.2.1.4. The size of the coarse material in the mixture of earth shall ordinarily not exceed 75 mm when being placed in the embankment and 50 mm when placed in the subgrade. 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 placement of fill material and its compaction to the requirements of these Specifications. The maximum particle, size shall not. be., more than two-thirds of the compacted layer thickness.

305.2.1.5. Ordinarily, only the materials satisfying the density requirements given in Table 300*1 shall be employed for the construction of the embankment and the subgrade.

TABLE 300-1. DENSITY REQUIREMENTS OF EMBANKMENT AND SUBGRADE MATERIALS

S. No	Type of Work	Maximum laboratory dry unit weight when tested as per IS: 2720 (Part 8)
1	Embankments up to 3 metres height, not subjected to extensive flooding,	Not less than 15.2 kN/cu.m.
2	Embankments exceeding 3 metres height or embankments of any height subject to long periods of inundation	Not less than 16.0 kN/cu.m.
3	Subgrade and earthen shoulders/verges/backfill	Not less than 17.5 kN/cu.m.

Notes:
(1) This Table is not applicable for lightweight fill material e.g. cinder, fly ash etc.
(2) The Engineer may relax these requirements at his discretion taking into account the availability of materials for construction and other relevant factors.

(3) The material to be used in subgrade should also satisfy design CBR at the dry unit weight applicable as per Table 30Q-Z

305.2.2. General requirements :

305.2.2.1. The materials for embankment shall be obtained from approvedsources with preference given to materials becoming available from nearby roadway excavation or any other excavation under the same Contract.

The work shall be so planned and executed that the best available materials -are saved for the sub grade and the embankment portion just below the subgrade.

305.2.2.2. Borrow materials : Where the materials are to be obtained from designated borrow areas, the location, size and shape of these areas shall be as indicated by the Engineer and the same shall not be opened without his written permission. Where specific borrow areas are not designated by the Employer/the Engineer, arrangement for locating the source of supply of material for embankment and sub grade as well as compliance to environmental requirements in respect of excavation and borrow areas as stipulated, from time to time by the Ministry of Environment and Forests, Government of India and the local bodies, as applicable, shall be the sole responsibility of the Contractor, Borrowpits along the road shall be discouraged. If permitted by the Engineer, these shall not be dug continuously. Ridges of not less than

8 m width should be left at intervals not exceeding 300 m. Small drains shall be cut through the ridges to facilitate drainage. The depth of the pits shall be so regulated that their bottom does not cut an imaginary line having a slope of 1 vertical to 4 horizontal projected from the edge of the final section of the bank, the maximum depth in any case being limited-to 1.5 m. Also, no pit shall be dug within the offset width from the toe of the embankment required as per the consideration of stability with a minimum width of 10 m.

Haulage of material to embankments or other areas of fill shall proceed only when sufficient spreading and compaction plant is operating at the place of deposition.
No excavated acceptable material other than surplus to requirements of the Contract shall be removed-from the site. Should the Contractor be permitted to remove acceptable material from the site to suit his operational procedure, then he shall make good any consequent deficit of material arising therefrom.

Where the excavation reveals a combination of acceptable and un-acceptable materials, the Contractor shall, unless otherwise agreed by the Engineer, carry out the excavation in such a manner that the acceptable materials are excavated separately for use in the permanent works without contamination by the unacceptable materials.

The acceptable materials shall be stockpiled separately. The Contractor shall ensure that he does not adversely affect the stability of excavation or fills by the methods of stockpiling materials, use of plants or siting of temporary buildings or structures. The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme approved by the Engineer. It shall be ensured that the subgrade material when compacted to the density requirements as in Table 300-2 shall yield the design CBR value of the subgrade.

TABLE 300-2. COMPACTION REQUIREMENTS FOR EMBANKMENT AND SUBGRADE

Sr.No.	Type of work/ material	Relative compaction *as* percentage of max. laboratory dry density *as* per IS: 2720 (Part g)
1	Subgrade and earthen shoulders	Not less than 97
2	Embankment	Not less than 95
3	Expansive Clays a) Subgrade and 500 mm portion just below the subgrade b) Remaining portion of embankment	 Not allowed Not less than 90

The Contractor shall at least 7 working days before commencement of compaction submit the following to the Engineer for approval:

(i) The values of maximum dry density and optimum moisture content obtained in accordance with IS: 2720 (Part 7) or (Part 8), as the case may be, appropriate for each of the fit! materials he intends to use.
(ii) A graph of density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined.
(iii) The Dry density-moisture content -CBR relationships for light, intermediate and heavy compactive efforts (light corresponding to IS: 2720 (Part 7), heavy corresponding to IS: 2720 (Part 8) and intermediate in-between the two) for each of the fill materials he intends to use in the subgrade.

Once the above information has been approved by the Engineer, it shall form the basis for compaction.

305.3. Construction Operations

305.3.1. Setting out : After the site has been cleared to Clause 201, the work shall be set out to Clause 301.3.1, The limits of embankment/subgrade shall be marked by fixing batter pegs on both sides at regular intervals as guides before commencing the earthwork.

The embankment/sub grade shall be built sufficiently wider than the design dimension so that surplus material may be trimmed, ensuring that the remaining material is to the desired density and in position specified and conforms to the specified side slopes.

305.3.2. Dewatering :

If the foundation of the embankment is in an area with stagnant water, and in the opinion of the Engineer it is feasible to remove it, the same shall be removed by bailing out or pumping, as directed by the Engineer and the area of the embankment foundation shall be kept dry. Care shall be taken to discharge the drained water 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 it to original condition or compensate
the damage at his own cost.

If the embankment is to be constructed under water, Clause 305.4.6 shall apply.

305.3.3. Stripping and storing topsoil :
In localities where most of the available embankment materials are not conducive to plant growth, or when so directed by the Engineer, the topsoil from all areas of cutting and from all areas to be covered by embankment foundation shall be stripped to specified depths not exceeding 150 mm and stored in stockpiles of height not exceeding 2 m for covering embankment slopes, cut slopes and other disturbed areas where re-vegetation is desired. Topsoil shall not be unnecessarily trafficked either before stripping or when in a stockpile. Stockpiles shall not be surcharged or otherwise loaded and multiple handling shall be kept to a minimum.

305.3.4. Compacting ground supporting embankment/sub grade:
Where necessary, the original ground shall be levelled to facilitate placement of first layer of embankment, scarified, mixed with water and then compacted by rolling so as to achieve minimum dry density as given in Table 300-2.
In case where the difference between the subgrade level (top of the subgrade on which pavement rests) and ground level is less than 0.5 m and the ground does not have 97 per cent relative compaction with respect to the dry density as given in Table 300-2, the ground shall be loosened upto a level 0.5 m below the sub grade level, watered and compacted in layers in accordance with Clauses 305.3,5 and 305.3.6 to not less than 97 per cent of dry density as given in Table 300-2.
Where so directed by the Engineer, any unsuitable material occurring in the embankment foundation shall be removed and replaced by approved materials laid in layers to the required degree of compaction.
Embankment or sub grade work shall not proceed until the foundations for embankment/sub grade have been inspected by the Engineer for satisfactory condition and approved.
Any foundation treatment specified for embankments especially high embankments, resting on suspect foundations as revealed by borehole logs shall be carried out in a manner and to the depth as desired by the Engineer. Where the ground on which an embankment is to be built has any of the material types (a) to (f) in Clause 305.2.1, at least 500 mm of such material must be removed and replaced by acceptable fill material before embankment construction commences.

305.3.5. Spreading material in layers and bringing to appropriate moisture content
305.3.5.1. The embankment and sub grade material shall be spread in layers of uniform thickness not exceeding 200 mm compacted thickness over the entire width of embankment by mechanical means, finished by a motor grader and compacted as per Clause 305.3.6. The motor grader blade shall have hydraulic control suitable for initial
adjustment and maintain the same so as to achieve the specific slope and grade. Successive layers shall not be p laced until the layer under construction has been thoroughly compacted to the specified requirements as in Table 300-2 and got approved by the Engineer. Each compacted layer shall be finished parallel to the final cross-section of the embankment.

305.3.5.2. Moisture content of the material shall be checked at the site of placement prior to commencement of compaction; if found to be out of agreed limits, the same shall be made good. Where water is required to be added in such constructions, water shall be sprinkled from a water tanker fitted with sprinkler capable of applying water

uniformly with a controllable rate of flow to variable widths of surface but without any flooding. The water shall be added uniformly and thoroughly mixed in soil by blading, discing or harrowing until a uniform moisture content is obtained throughout the depth of the layer.
If the material delivered to the roadbed is too wet, it shall be dried, by aeration 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 to the required amount by the above procedure, compaction work shall be suspended.

Moisture content of each layer of soil shall be checked in accordance with IS: 2720 (Part 2), and unless otherwise mentioned, shall be so adjusted, making due allowance for evaporation losses, that at the time of compaction it is in the range of 1 per cent above to 2 per cent below the optimum moisture content determined in accordance with IS:2720 (Part 7) or IS:2720 (Part 8) as the case may be. Expansive clays shall, however, be compacted at moisture content corresponding to the specified dry density, but on the wet side of the optimum moisture content obtained from the laboratory compaction curve.

After adding the required amount of water, the soil shall be processed by means of graders, harrows, rotary mixers or as otherwise approved by the Engineer until the layer is uniformly wet.

Clods or hard lumps of earth shall be broken to have a maximum size of 75 mm when being placed in the embankment and a maximum size of 50 mm when being placed in the subgrade.

305.3.5.3. Embankment and other areas of fill shall, unless otherwise required in the Contract or permitted by the Engineer, be constructed evenly over their full width and their fullest possible extent and the Contractor shall control and direct construction plant and other vehicular traffic uniformly over them. Damage by construction plant and other vehicular traffic shall be made good by the Contractor with material having the same characteristics and strength as the material had before it was damaged.
Embankments and other areas of unsupported fills shall not be constructed with steeper side slopes, or to greater widths than those shown in the Contract, except to permit adequate compaction at the edges before trimming back, or to obtain the final profile following any settlement of th e fill and the underlying material.

Whenever fill is to be deposited against the face of a natural slope, or sloping earthworks face including embankments, cuttings, other fills and excavations steeper than 1 vertical on 4 horizontal, such faces shall be benched as per Clause 305.4.1 immediately before placing the subsequent fill.
All permanent faces of side slopes of embankments and other areas of fill formed shall, subsequent to any trimming operations, be reworked and sealed to the satisfaction of the Engineer by tracking a tracked vehicle, considered suitable by the Engineer, on the slope or any other method approved by the Engineer.

305.3.6. Compaction : Only the compaction equipment approved by the Engineer shall be employed to compact the different material types encountered during construction. Smooth wheeled, vibratory, pneumatic tyred, sheepsfoot or pad foot rollers, etc. of suitable size and capacity as approved by the Engineer shall bt used

for the different types and grades of materials required to be compacted either individually or
in suitable combinations.
The compaction shall be done with the help of vibratory roller of 80 to 100 kN static weight with plain or pad foot drum or heavy pneumatic tyred roller of adequate capacity capable of achieving required compaction.
The Contractor shall demonstrate the efficacy of the equipment he intends to use by carrying out compaction trials. The procedure to be adopted for these site trials shall first be submitted to the Engineer for approval.
Earthmoving plant shall not be accepted as compaction equipment nor shall the use of a lighter category of plant to provide any preliminary compaction to assist the use of heavier plant be taken into account.
Each layer of the material shall be thoroughly compacted to the densities specified in Table 300-2. Subsequent layers shall be placed only after the finished layer has been tested according to Clause 903.2.2 and accepted by the Engineer. The Engineer may permit measurement, of field dry density by a nuclear moisture/density gauge used in accordance with agreed procedure and the gauge is calibrated to provide results identical to that obtained from tests in accordance with IS: 2720 (Part 28), A record of the same shall be maintained by the Contractor.
When density measurements reveal any soft areas in the embankment / subgrade/earthen shoulders, further compaction shall be carried out as directed by the Engineer. If inspire of that the specified compaction is not achieved, the material in the soft areas shall be removed and replaced by approved material, compacted to the density requirements and satisfaction of the Engineer.

305.3.7. Drainage :
The surface of the embankment/sub grade at all limes during construction shall be maintained at such a cross fall (not flatter than that required for effective drainage of an earthen surface) as will shed water and prevent ponding.

305.3.8. Repairing of damages caused by rain/spillage of water:
The soil in the affected portion shall be removed in such areas as directed by the Engineer before next layer is laid and refilled in layers and compacted using appropriate mechanical means such as small vibratory roller, plate compactor or power rammer to achieve the required density in accordance with Clause 305.3.6. If the cut is not sufficiently wide for use of required mechanical means for compaction,
the same shall be widened suitably to permit their use for proper compaction. Tests shall be carried out as directed by the Engineer to ascertain the density requirements of the repaired area. The work of repairing the damages including widening of the cut, if any, shall be carried out by the Contractor at his own cost, including the arranging of machinery/equipment for the purpose.

305.3.9. Finishing operations :
Finishing operations shall include the work of shaping and dressing the shoulders/verge/roadbed and side slopes to conform to the alignment, levels, cross-sections and dimensions shown on the drawings or as directed by the Engineer subject to .the surface tolerance described in Clause 902. Both the upper and lower ends of the side slopes shall be rounded off to improve appearance and to merge the embankment with the adjacent terrain.

The topsoil, removed and conserved carrier (Clause 301.3.2 and 305,3,3) shall be spread over the fill slopes as per directions of the Engineer to facilitate the growth of vegetation. Slopes shall be roughened and moistened slightly prior to the application of the topsoil in order to provide satisfactory bond. The depth of the topsoil shall be sufficient to sustain plant growth, the usual thickness being from 75 rnm to 150 mm.

Where directed, the slopes shall be turfed with sods in accordance with Clause 307. If seeding and mulching of slopes is prescribed, this shall be done to the requirement of Clause 30S, When earthwork operations have been substantially completed, the road area shall be cleared of all debris, and ugly scars in the construction area responsible for objectionable appearance eliminated,

305.4. Construction of Embankment and Sub grade under Special Conditions

305.4.1. Earthwork for widening existing road embankment:

When an existing embankment and/or subgrade is to be widened and its slopes are steeper than 1 vertical on 4 horizontal, continuous horizontal benches, each at least 300 mm wide, shall be cut into the old slope for ensuring adequate bond with the fresh embankment/sub grade material to be added. The material obtained from cutting of benches could be utilized in the widening of the embankment/sub grade. However, when -the existing slope against which the fresh material is to be placed is flatter than 1 vertical on 4 horizontal, the slope surface may only be ploughed or scarified instead of resorting to benching.
Where the width of the widened portions is insufficient to permit the use of conventional rollers, compaction shall be carried out with the help of small vibratory rollers/plate compactors/power rammers or any other appropriate equipment approved by the Engineer. End dumping of material from trucks for widening operations shall be avoided except in difficult circumstances when the extra width is too narrow to permit the movement of any other types of hauling equipment.

305.4.2. Earthwork for embankment and sub grade to be placed against sloping ground :

Where an embankment/sub grade is to be placed against sloping ground, the latter shall be appropriately benched or ploughed/scarified as required in Clause 305.4.1 before placing the embankment/sub grade material. Extra earthwork involved in benching or
due to ploughing/scarifying etc. shall be considered incidental to the work.
For wet conditions, benches with slightly inward fall and subsoil drains at the lowest point shall be provided as per the drawings, before the fill is placed against sloping ground.
Where the Contract requires construction of transverse subsurface drain at the cut-fill interface, work on the same shall be carried out to Clause 309 in proper sequence with the embankment and subgrade work as approved by the Engineer.

305.4.3. Earthwork over existing road surface :

Where the embankment is to be placed over an existing road surface, the work shall be carried out as indicated below :

(i) If the existing road surface is of granular or bituminous type and lies within 1 m of the new subgrade level, the same shall be scarified to a depth of 50 mm or more if specified, so as to provide ample bond between the old and new material ensuring that at least 500 mm portion below the top of new subgrade level is compacted to the desired density.

(ii) If the existing road surface is of cement concrete type and lies within 1 m of the new subgrade level the same shall be removed completely.

(iii) If the level difference between the existing road surface and the new formation level is more than 1m, the existing surface shall be permitted to stay in place without any modification.

305.4.4, Embankment and sub grade around structures :

To avoid interference with the construction of abutments, wing walls or return walls of culvert/bridge structures, the Contractor shall, at points to be determined by the Engineer suspend work on embankment forming approaches to such structures, until such time as the construction of the latter is sufficiently advanced to permit die completion of approaches without the risk of damage to the structure.

Unless Directed otherwise, the filling around culverts, bridges and other structures upto a distance twice the height of the road from the back of die abutment shall be carried out independent of the work on the main embankment. The fill material shall not be placed against any abutment or wing wall, unless permission has been given by the Engineer but in any case not until the concrete or masonry has been in position for 14 days. The embankment and subgrade shall be brought up simultaneously in equal layers on each side of die structure to avoid displacement and unequal pressure. The sequence of work in this regard shall be got approved from the Engineer.

The material used for backfill shall not be an organic soil or highly plastic clay having plasticity index and liquid limit more than 20 and 40 respectively when tested according to 15:2720 (Part 5). Filling behind abutments and wing, walls for ail structures shall conform to the general guidelines given in Appendix 6 of IRC:78 (Standard Specifications and Code of Practice Road Bridges-Section VII) in respect of the type of material, the extent of backfill, its laying and Compaction etc. The fill material shall be deposited in horizontal layers in loose thickness and compacted thoroughly to the requirements of Table 300-2.

Where the provision of any filter medium is specified behind the abutment, the same shall be laid in layers simultaneously with the laying of fill material. The material used for filter shall conform to the requirements for filter medium spelt out in Clause 2502/309.3.2 (B) unless otherwise specified in the Contract.

Where it may be impracticable to use conventional rollers, the compaction shall be carried out by appropriate mechanical means. such as small vibratory roller, plate compactor or power rammer. Care shall be taken to see that the compaction equipment does not hit or come too close to any structural member so as to cause any damage to them or excessive pressure against the structure.

305.4.5. Construction of embankment over ground incapable of supporting construction equipment : Where embankment is to be constructed across ground which will not support the weight of repeated heavy loads of construction equipment, the first layer of the fill may be constructed by placing successive loads of material in a uniformly distributed layer of a minimum thickness required to support the construction equipment as permitted by the Engineer. The

Contractor, if so desired by him, may also use suitable geosynthetic material to increase the bearing capacity of the foundation. This exception to normal procedure will not be permitted where, in the opinion of the Engineer, the embankments could be constructed in the approved manner over such ground by the use of lighter or modified equipment after proper ditching and drainage have been provided. Where this exception is permitted, the selection of the material and the construction procedure to obtain an acceptable layer shall be the responsibility of the Contractor.
The cost of providing suitable traffic conditions for construction equipment over any area of the Contract will be the responsibility of the Contractor and no extra payment will be made to him. The remainder of the embankment shall be constructed as specified in Clause 305.3.

305.4.6. Embankment construction under water :
Where filling or backfilling is to be placed under water, only acceptable granular material or rock shall be used unless otherwise approved by the Engineer. Acceptable granular material shall consist of graded, hard durable particles with maximum particle size not exceeding 75 mm. The material should be non-plastic having uniformity coefficient of not less than 10. The material placed in open water shall be deposited by end tipping without compaction.

305.4.7, Earthwork for high embankment :
In the case of high embankments, the Contractor shall normally use the material from the specified borrow area. In case he desires to use different material for his own convenience, he shall have to carry out necessary soil investigations and redesign the high embankment at his own cost.
The Contractor shall then furnish the soil test data and design o f high embankment for approval of the Engineer, who reserves the right to accept or reject it.
If necessary, stage construction of fills and any controlled rates of filling shall be carried out in accordance with the Contract including installation of instruments and its monitoring.
Where required, the Contractor shall surcharge embankments or other areas of fill with approved material for the periods specified in the Contract. If settlement of surcharged fill, results in any surcharging material, which is unacceptable for use in the fill being surcharged, lying below formation level, the Contractor shall remove the unacceptable material and dispose it as per direction of the Engineer. He shall then bring the resultant level up to formation level with acceptable material.

305.4.8. Settlement period :
Where settlement period is specified in the Contract, the embankment shall remain in place for the required settlement period before excavating for abutment, wingwall, retaining wall, footings, etc., or driving foundation piles. The duration of the required settlement period at each location shall be as provided for in the Contractor. as directed by the Engineer,

305.5. Plying of Traffic
Construction and other vehicular traffic shall not use the prepared surface of the embankment and/or subgrade without the prior permission of the Engineer, Any damage arising out of such use shall, however, be made good by the Contractor at his own expense as directed by the Engineer.

305.6. Surface Finish and **Quality Control** of **Work**
The surface finish of construction of subgrade shall conform to the requirements of Clause 902. Control on the quality of materials and works shall be exercised in accordance with Clause 903.

305.7. Sub grade Strength

305.7.1. It shall be ensured prior to actual execution that the borrow area material to be used in the sub grade satisfies the requirements of design CBR.

305.7.2. Sub grade shall be compacted and finished to the design strength consistent with other physical requirements. The actual laboratory CBR values of constructed subgrade shall be determined on undisturbed samples cut out from the compacted sub grade in CBR mould fitted with cutting shoe or on remolded samples, compacted to the field density at the field moisture content.

305.8. Measurements for Payment
Earth embankment/sub grade construction shall be measured separately by taking cross sections at intervals in the original position before the work starts and after its completion and computing the volumes of earthwork in cubic meters by the method of avg rage end areas.
The measurement of fill material from borrow areas shall be the difference between the net quantities of compacted fill and the net quantities of suitable material brought from roadway and drainage excavation. For this purpose, it shall be assumed that one cu.m. of suitable material brought to site from road and drainage excavation forms one cu.m. of compacted fill and all bulking or shrinkage shall be ignored.
Construction of embankment under water shall be measured in cu.m.
Construction of high embankment with specified material and in specified manner shall be measured in cu.m.
Stripping including storing and reapplication of topsoil shall be measured in cu.m.
Work involving loosening and re compacting of ground supporting embankment/sub grade shall be measured in cu. m.
Removal of unsuitable material at embankment/sub grade foundation and replacement with suitable material shall be measured in cu.m.
Scarifying existing granular/bituminous road surface shall be measured in square meters.
Dismantling and removal of existing cement concrete pavement shall be measured vide Clause 202.6.
Filter medium and backfill material behind abutments, wing walls and other retaining structures shall be measured as finished work in position in cu.m.

305.9. Rates
305.9.1. The Contract unit rates for the items, of embankment and sub grade construction shall be payment in full for carrying out the required operations including full compensation for :
(i) Cost of arrangement of land as a source of supply of material of required quantity for construction unless provided otherwise in the Contract;
(ii) Setting out;
(iii) Compacting ground supporting embankment/sub grade except where removal and replacement of unsuitable material or loosening and re compacting is involved;

(iv) Scarifying or cutting continuous horizontal benches 300 mm wide on side slopes of existing embankment and sub grade as applicable;
(v) Coil of watering or drying of material in borrow areas and/or embankment and sub grade during construction as - required;
(vi) Spreading in layers, bringing to appropriate moisture content and compacting to Specification requirements;
(vii) Shaping and dressing top and slopes of the embankment and sub grade including rounding of comers;
(viii) Restricted working at sites of structures;
(ix) Working on narrow width of embankment and sub grade;
(x) Excavation in all soils from borrow pits/designated borrow areas including clearing and grubbing and transporting the material to embankment and sub grade site with all lifts and leads unless otherwise provided for in the Contract;
(xi) All labour, materials, tools, equipment and incidentals necessary to complete the work to the Specifications;
(xii) Dewatering; and
(xiii) Keeping the embankment/completed formation free of water as per Clause 311.

305.9.2. In case the Contract unit rate specified is not inclusive of all leads, the unit rate for transporting material beyond the initial lead, as specified in the Contract for construction of embankment and sub grade shall be inclusive of full compensation for all labour, equipment, tools and incidentals necessary on account of the additional haul or trans portion involved beyond the specified initial lead.

305.9.3. Clause 301.9.5 shall apply as regards Contract unit rates for items of stripping and storing top soil and of reapplication of topsoil.

305.9.4. Clause 301.9.2 shall apply as regards Contract unit rate for the item of loosening and re compacting the embankment/sub grade foundation.

305.9.5. Clauses 301.9.1 and 305.8 shall apply as regards Contract rates for items of removal of unsuitable material and replacement with suitable material respectively.

305.9.6. The Contract unit rate for scarifying existing granular/bituminous road surface shall be payment in full for carrying out the required operations including full compensation for all labour, materials, tools, equipment and incidentals necessary to complete the work.
This will also comprise of handling, salvaging, stacking and disposing of the dismantled materials within all lifts and upto a lead of 1000 m or as otherwise specified.

305.9.7. Clause 202.7 shall apply as regards Contract unit rate for dismantling and removal of existing cement concrete pavement, **305.9.8.** The Contract unit rate for providing and laying .filter material behind abutments shall be payment in full for carrying out the required operations including all materials, labour, tools, equipment
and incidentals to complete the work to Specifications.

305.9.9. Clause 305.4.6 shall apply as regards Contract unit rate for construction of embankment under water.

305.9.10. Clause 305.4.7 shall apply as regards Contract unit rate for construction of high embankment. It shall include cost of instrumentation, its monitoring and settlement period, where specified in the Contract or directed by the Engineer.

511. OPEN-GRADED PREMIX SURFACING

511.1. Open-graded Premix Surfacing using Penetration Bitumen or Cutback.

511.1.1 Scope : This work shall consist of the preparation, laying and compaction of an open- graded premix surfacing material of 20 mm thickness composed of small-sized aggregate premixed with a bituminous binder on a previously prepared base, in accordance with the requirements of these Specifications, to serve as a wearing course.

511.1.2. Materials

511.1.2.1. Binder : The binder shall be a penetration bitumen of a suitable grade as specified in the Contract, or as directed by the Engineer, and satisfying the requirements of IS: 73.

511.1.2.2. Aggregate: The aggregate shall conform to Clause 504.2.2 except that the water absorption shall be limited to a maximum of 1 per cent. The Polished Stone Value, as measured by the test in BS 812- (Part114), shall not be less tha n 55.

511.1.2.3. Proportioning of materials: The materials shall be proportioned in accordance with Table 500-23.

511.13. Construction operations

511.1.3.1. Weather and seasonal limitations: Clause 501.5.1 shall apply.

511.1.3.2. Preparation of surface: The underlying surface on which the bituminous surfacing is to be laid shall be prepared, shaped and conditioned to the specified lines, grade and cross-section in accordance with Clause 501. A prime coat where needed shall be applied in accordance with Clause 502 as directed by the Engineer.

TABLE 500-23. QUANTITIES OF MATERIALS REQUIRED FOR 10 m' OF ROAD SURFACE FOR 20mm THICK OPEN -GRADED PREMIX SURFACING USING PENETRATION BITUMEN OR CUTBACK

	Aggregates	
(a)	Nominal Stone size 13.2mm (passing 22.4 mm sieve and retained on 11.2 mm sieve) -	0.18m^3
(b)	Nominal Stone size 1 1.2mm (passing 13.2 mm sieve and retained on 5.6 mm sieve).	0.09m^3
	Total	0.27m^3

Binder (quantities in terms of straight run bitumen)

(a)	For 0.18 m^3 of 13.2mm nominal size stone at 52 kg bitumen per m^3	9.5kg
(b)	For 0.09 m' of 11.2 mm nominal size stone at 56 kg bitumen per m^3	5.1 kg
	Total	14.6kg

511.1.3.3. Tack coat: A tack coat complying with Clause 503, shall be applied over the base preparatory to laying of the surfacing.

511.1.3.4. Preparation of premix : Hot mix plant of appropriate capacity and type shall be used for the preparation of the mix material. The hot mix plant shall have separate dryer arrangement for heating aggregate.

The temperature of the binder at the time of mixing shall be in the range of 150°C to 163°C and that of the aggregate in the range of 155'C to 163'C provided that the difference in temperature between the binder and aggregate at no time exceeds 14'C. Mixing shall be thorough to ensure that a homogeneous mixture is obtained in which all particles of the aggregates are coated uniformly and the discharge temperature of mix shall be between 130°C and 160°C.

The mix shall be immediately transported from the mixer to the point of use in suitable vehicles or hand barrows. The vehicles employed for transport shall be clean and the mix being transported covered in transit if so directed by the Engineer.

511.1.3.5. Spreading and rolling : The pre mixed material shall be spread by suitable means to the desired thickness, grades and cross- full (camber) making due allowance for any extra quantity required to fill up depressions, if any. The cross- fall should be checked by means of camber boards and irregularities levelled out. Excessive use of blades or rakes should be avoided. As soon as sufficient length of bituminous material has been laid, rolling shall commence with 8 – 10 tonne rollers, - smooth wheel tandem type, or other approved equipment. Rolling shall begin at the edge and progress toward the centre longitudinally, except that on superelevated and uni-directional cambered portions, it shall progress from the lower to upper edge parallel to the centre line of the pavement.

When the roller has passed over the whole area once, any high spots or depressions, which become apparent, shall be corrected by removing or adding premixed materials. Rolling shall then be continued until the entire surface has been rolled and all the roller marks eliminated. In each pass of the roller the preceding track shall be overlapped uniformly by at least

1/3 width. The roller wheels shall be kept damp to prevent the premix from adhering to the wheels. In no case shall fuel / lubricating oil be used for this purpose. Excess use of water for this purpose shall also be avoided.

Rollers shall not stand on newly laid material. Rolling operations shall be completed in every respect before the temperature of the mix falls below 100° C. Joints along and transverse to the surfacing laid and compacted earlier shall be cut vertically to "heir full depth so as to expose fresh surface which shall be painted with a L in coat of appropriate binder before the new mix is placed against it.

511.1.3.6. Seal coat : A seal coat conforming to Clause 513 of the type specified in the Contract shall be applied to the surface immediately after laying the surfacing.

511.1.4. Opening to traffic : No traffic shall be allowed on the road until the seal coat has been laid. After the seal coat is laid, the road may be opened to traffic according to Clause 513.4.

511.1.5. Surface finish and quality control of work : The surface finish of construction shall conform to the requirements of Clause 902. For control of the quality of materials supplied and the works carried out, the relevant provisions of Section 900 shall apply.

511.1.6. Arrangements for traffic : During the period of construction, arrangement of traffic shall be made in accordance with the provisions of Clause 112.

511.1.7. Measurement for payment : Open graded premix surfacing shall be measured as finished work, for the area instructed to be covered, in square metres. The area will be the net area covered, and all allowance for wastage and cutting of joints shall be deemed to be included in the rate.

511.1.8. Rate : The contract unit rate for open-graded premix surfacing shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2. (i) to (xi).

511.2. Open graded premix surfacing using cationic bitumen emulsion

511.2.1. Scope : This work shall consist of the preparation, laying and compaction of an open graded premix surfacing of 20 mm thickness composed of small-sized aggregate premixed with a cationic bitumen emulsion on a previously prepared surface, in accordance with the requirements of these Specifications, to serve as a wearing course.

511.2.2. Materials

511.2.2.1. Binder : The binder for Premix wearing course shall be cationic bitumen emulsion of Medium Setting (MS) grade complying with I.S.8887 and having a bitumen content 65 per cent minimum by weight. For liquid seal coat RS grade of Cationic bitumen emulsion shall be used. Where expressly specified in the Contract MS grade emulsion shall be used or otherwise directed by the Engineer. Slow Setting (SS) grade Cationic bitumen Emulsion shall be used for premix seal coat.

511.2.2.2. Aggregate : The requirements of Clause 511.1.2.2. shall apply.

511.2.3. Proportioning of materials: The materials shall be proportioned as quantities given in Tables 500-24 and 500-25.

TABLE 500-24. QUANTITIES OF AGGREGATE FOR 10 M2 AREA

(A)	**Premix Carpet**	
(a)	Coarse aggregate nominal 13.2 mm size; passing IS 22.4	
	sieve and retained on IS 11.2 mm sieve	0.18 m^3
(b)	Coarse aggregate nominal 11.2 mm size; passing IS 13.2 mm sieve and retained on IS 5.6 mm sieve	0.09 m^3
(B)	For Seal Coat:	

Refer to Clause 513.

TABLE 500-25. QUANTITIES OF EMULSION BINDER

		For 10m^2 area
(B)	**For Seal Coat:**	
	(a) for liquid seal coat:	12 to 14 kg
	(b) for premix seal coat	10 to 12 kg

511.2.4. Construction operations

511.2.4.1. Weather and seasonal limitations : Clause 501.5.1 shall apply except that the minimum air temperature for laying shall be 10°C Cationic bitumen emulsions shall not normally be stored below 0°C.

511.2.4.2. Preparation of surface : The underlying surface on which the premix surfacing is to be laid shall be prepared, in accordance with the requirements of Clause 504.3.2 for a newly primed surface, and in accordance with Clause 507.4.2 where an existing bituminous surface is to be overlaid.

511.2.4.3.Preparation of binder : Before opening, the cationic bitumen emulsion drums shall be rolled at slow speed, to and fro, at least 5 times, for a distance of about 10 metres, to distribute any storage sedimentation.

51 1.2.4.4. Tack coat : A tack coat complying with Clause 503, shall be applied over the surface preparatory to laying of the surfacing where specified in the Contract, or directed by the Engineer.

511.2.4.5.Preparation of premix : Premixing of cationic bitumen emulsion and aggregates can be carried out in a suitable mixer such as cold mixing plant as per IS: 5435 (Revised) or concrete mixer or by pay loaders in exceptional cases where approved by the Engineer. Where specified in the Contract continuous mixing operation shall be done either in batch or continuous hot mix plant suitable for emulsion mixes.

When using concrete mixer for preparing the premix, 0.135 cu.m. (0.09 cu.m. of 13.2 mm size and 0.045 cu.m. of 11.2 mm size) of aggregates per batch shall be used which quantity will cover 5 sq.m. of road surface with 20 mm average thickness.

The aggregates required for one batch shall be prepared adjacent to the mixer.

First the coarse aggregate of 13.2 mm size shall be placed into the mixer followed by 5 to 6.5 kg of Cationic bitumen emulsion and then the **(this line is corrupted in the text is also)** bitumen emulsion. After the materials have been mixed thoroughly, the mix shall be immediately transported to the laying site in suitable vehicles.
Too much mixing shall be avoided.

When mixed manually by shovels, with the approval of the Engineer. 0.06 cu.m. of aggregates can be conveniently mixed in one heap, with appropriate quantity of emulsion. It is preferable to make the aggregates damp before mixing as it reduces the effort required for mixing and also helps to get better coating of aggregates. The 13.2 mm size aggregates and emulsion are mixed first and then the 11.2 mm size aggregates and remaining quantity of emulsion are added and mixed. Too much mixing shall be avoided.

511.2.4.6. Spreading and rolling: The premixed cationic bitumen emulsion and aggregates shall be spread within 10 minutes of applying the tack coat. All levelling, raking, etc. should be completed within 20 minutes of the time of mixing.

The mix should be spread uniformly to the desired thickness, grades and crossfall (camber) making due allowance for any extra quantity required to fill up depressions, if any. The cross

fall should be checked by means of camber boards and irregularities leveled out. Too much raking is to be avoided.

The rolling shall start immediately after laying the premix. A smooth wheeled tandem roller of 8-10 tonnes shall be used, unless other compaction methods are approved by the Engineer, based on the results of laying trials, if necessary. While rolling, wheels of roller should be clean and kept moist to prevent the premix from adhering to the wheels. In no case shall fuel / lubricating oil be used for this purpose. Use of water for this purpose shall be strictly limited to an absolute minimum. Rolling shall commence at the edges and progress towards the centre longitudinally except in the case of super elevated and uni-directional cambered sections where rolling shall be carried out from the lower edge towards the higher edge parallel to the centre line of the road.

After one pass of roller over the whole area, depressions or uncovered spots should be corrected by adding premix material. Rolling shall be continued until the entire surface has been rolled to maximum compaction and all the roller marks eliminated. In each pass of the roller the preceding track shall be overlapped uniformly by at least 1/3 width. Roller(s) shall not stand on newly laid material. Joints both longitudinal and transverse to the road sections laid and compacted earlier, shall be cut vertically to their full depth so as to expose fresh surface which shall be painted with a thin surface coat of binder before the new mix is placed against it.

511.2.4.7. Seal coat: A seal coat, conforming to Clause 510 or Clause 513, as specified in the Contract, shall be applied 4 to 6 hours after laying the premix carpet.

511.2.5. Opening to traffic : Traffic should not be allowed over the premix surface with or without seal coat, for 6 to 8 hours after rolling. In case of single lane roads, traffic shall be allowed onto the surface once it has reached ambient temperature, but speed must be rigorously restricted to not more than 16 km per hour. If any premix material is picked up by vehicle tyres, the spot shall be filled up by new mix. If traffic conditions permit, the road shall not be opened until a full 24 hours after laying.

511.2.6. Surface finish and quality control : The surface finish of construction shall conform to the requirements of Clause 902.

For control of the quality of materials supplied and the works carried out, the relevant provisions of Section 900 shall apply.

511.2.7. Arrangements for traffic : During the period of construction, arrangements for traffic shall be made in accordance with the provisions of Clause 112.

511.2.8. Measurement for payment : Open graded premix carpet shall be measured as finished work, for the area specified to be covered, in square metres at the specified thickness, in cubic metres, or in tonnes weight as specified in the Contract. The area will be the net area covered, and all allowances for wastage and cutting of joints shall be deemed to be included in the rate.

511.2.9. Rate : The contract unit rate for premix carpet and seal coat shall be payment in full for carrying out the required operations including full compensation for all components listed in Clause 501.8.8.2. (i) to (xi).
Bitumen quantities are to be as stated in Table 500-23 for premix, 3.0 Kg per 10 sq.m., for tack coat, 13Kg per 10 sq.m. for liquid seal coat and 11 Kg per 10 sq.m. for premix seal coat. The rate will be adjusted according to actual material used.

1700 . CEMENT CONCRETE

The work shall consist of furnishing and placing structural concrete and incidental construction in accordance with these specifications and in conformity with the lines, grades and dimensions, as shown on the drawings or as directed by the Engineer.

1702. MATERIALS

All materials shall conform to Section 1000 of these Specifications.

1703. GRADES OF CONCRETE

1703.1. The grades of concrete shall be designated by the characteristic strength as given in Table 1700-1, where the characteristic strength is defined as the strength of concrete below which not more than 5 per cent of the test results are expected to fall.

TABLE 1700-1. Specified Characteristics Strength of Concrete

Grade Designation	Specified characteristic Compressive strength of 150 mm cubes at 28 days, in MPa
M 10	10
M 15	15
M 20	20
M 25	25
M 30	30

M 35	35
M 40	40
M 45	45
M 50	50
M 55	55

1704.2.1. Target mean strength

The target mean strength of specimen shall exceed the specified characteristic compressive strength by at least the 'current margin'.

(i) The current margin for a concrete mix shall be determined by the Contractor and shall be taken as 1.64 times the standard deviation of samples test results taken from at least 40 separate batches of concrete of nominally similar proportions produced at site by the same plant under similar supervision, over a period exceeding 5 days, but not exceeding 6 months.

(ii) Where there is insufficient data to satisfy the above, the current margin for the initial design mix shall be taken as given in Table 1700-5:

TABLE 1700–5.

Concrete Grade	Current Margin (MPa)	Target Mean Strength (MPa)
M10 M 15	7 10	17 25
M 20	10	30
M 25	11	36
M 30	12	42
M 35	12	47
M 40	12	52
M 45	13	58
M 50	13	63
M 55	14	69

The initial current margin given in the Table 1700-5 shall be used till sufficient data is available to determine the current margin as per sub-clause (i) above.

TABLE 1700-6. PROPORTIONS FOR NOMINAL MIX CONCRETE

Concrete Grade	Total Quantity of dry aggregate by mass per 50 kg of cement to be taken as the sum of individual masses of fine and coarse	Proportion of fine to Coarse aggregate (by mass)

	aggregates (kg)	
M10	480	1:2
M 15	350	Generally 1:2, subject to upper limit 1:1.5 and lower limit of 1:1.25
M 20	250	Generally 1:2, subject to upper limit 1:1.5 and lower limit of 1:1.25

1704.4. Additional Requirements

Concrete shall meet with any other requirements as specified on the drawing or as directed by the Engineer. Additional requirements shall also consist of the following overall limits of deleterious substances in concrete:

a) The total chloride content of all constituents of concrete as a percentage of mass of cement in mix shall be limited to values given below:

- Prestressed Concrete : 0.1 per cent

- Reinforced concrete exposed to chlorides in service (e.g. structures located near sea coast) : 0.2 per cent

- Other reinforced concrete construction : 0.3 percent

b) The total sulphuric anhydride (SO3) content of all constituents of concrete as a percentage of mass of cement in the mix shall be limited to 4 per cent.

1704.5. Suitability of Proposed Mix Proportions

The Contractor shall submit the following information for the Engineer's approval:

a) Nature and source of each material
b) Quantities of each material per cubic metre of fully compacted concrete
c) Either of the following:
   (i) appropriate existing data as evidence of satisfactory previous performance for the target mean strength, current margin, consistency and water/cement ratio and any other additional requirement(s) as specified.
   (ii) full details of tests on trial mixes.

d) Statement giving the proposed mix proportions for nominal mix concrete.

Any change in the source of material or in the mix proportions shall be subject to the Engineer's prior approval.

1705. ADMIXTURES

Use of admixtures such as superplasticisers for concrete may be made with the approval of the Engineer.

As the selection of an appropriate concrete admixture is an integral part of the mix design, the manufacturers shall recommend the use of any one of his products only after obtaining complete knowledge of all the actual constituents of concrete as well as methodologies of manufacture, transportation and compaction of concrete proposed to be used in the project.

1706. SIZE OF COARSE AGGREGATE

The size (maximum nominal) of coarse aggregates for concrete to be used in various components shall be given as Table 1700-7.

TABLE 1700-7.

Components	Maximum Nominal Size of Coarse Aggregate (mm)
i) RCC well curb	20
ii) RCC/PCC well staining	40
iii) Well cap or Pile Cap Solid type piers and abutments	40
iv) RCC work in girders, slabs, wearing coat, kerb, approach slab, hollow piers and abutments, pier/abutment caps, piles	20
v) PSC work	20
vi) Any other item	As specified by Engineer

Maximum nominal size of aggregates shall also be restricted to the smaller of the following values:

a) 10 mm less than the minimum lateral clear distance between main reinforcements

b) 10 mm less than the minimum clear cover to the reinforcements

1707. CONSTRUCTION JOINTS

Construction joints shall be avoided as far as possible and in no case the locations of such joints shall be changed or increased from those shown on the drawings, except with express approval of the Engineer. The joint shall be provided in a direction perpendicular to the member axis.

Location, preparation of surface and concreting of construction joints shall conform to the additional specifications given in Appendix 1700/1.

1712.1 WATER CURING

Water for curing shall be as specified in Section 1000.

Sea water shall not be used for curing. Sea water shall not come into contact with concrete members unless it has attained adequate strength.

Exposed surfaces of concrete shall be kept continuously in a damp or wet condition by ponding or by covering with a layer of sacks, canvas, Hessian or similar materials and shall be kept constantly wet for a period of not less than 14 days from the date of placing of concrete.

When steam curing is discontinued, the ambient air temperature shall not drop at a rate exceeding 5 degrees Celsius per hour until a temperature of about 10 degrees Celsius above the temperature of the air to which the concrete will be exposed, has been reached.

The concrete shall not be exposed to temperatures below freezing for at least six days after curing.

1712.1. Curing Compounds

Curing compounds shall only be permitted in special circumstances and will require specific approval of the Engineer. Curing compounds shall not be used on any surface which requires further finishing to be applied. All construction joints shall be moist, cured and no curing compound will be permitted in locations where concrete surface are required to be bonded together.

Curing compounds shall be continuously agitated during use. All concrete cured by this method shall receive two applications of the curing compound. The first coat shall be applied immediately after acceptance of concrete finish. If the surface is dry, the concrete shall be saturated with water and curing compound applied as soon as the surface film of water disappears. The second application shall be made after the first application has set. Placement in more than two coats may be required to prevent streaking.

1713 FINISHING

Immediately after the removal of forms, exposed bars or bolts, if any, shall be cut inside the concrete member to a depth of at least 50 mm below the surface of the concrete and the resulting holes filled with cement mortar. All fins caused by form joints, all cavities produced by the removal of form ties other holes and depressions, honeycomb sports, broken edges or corners, and other defects, shall be thoroughly cleaned, saturated with

water, and carefully pointed and rendered true with mortar of cement and fine aggregate mixed in the proportions used in the grade of concrete that is being finished and of as dry 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 pointed shall be kept moist for a period of twenty four hours. Special pre-packaged proprietary mortars shall be used where appropriate or where specified in the drawing.

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.

Immediately on removal of forms, the concrete work shall be examined by the Engineer before any defects are made good.

a) The work that has sagged or contains honeycombing to an extent detrimental to structural safety or architectural appearance shall be rejected.
b) Surface defect of a minor nature may be accepted. On acceptance of such work by the Engineer, the same shall be rectified as directed by the Engineer.

1713 TOLERANCE

Tolerances for dimensions/shape of various components shall be as indicated in these specifications or shown on the drawings or as directed by the Engineer.

1716 TEST AND STANDARD OF ACCEPTANCE

1716.1. Concrete shall conform to the surface finish and tolerance as prescribed in these specifications for respective components.

1716.2. Random sampling and lot by lot of acceptance inspection shall be made for the 28 days cube strength of concrete.

1716.2.1. Concrete under acceptance shall be notionally divided into lots for the purpose of sampling, before commencement of work. The delimitation of lots shall be determined by the following:

(i) No individual lot shall more than 30 cu.m. in volume

(ii) At least one cube forming an item of the sampling representing the lot shall be taken from concrete of the same grade and mix proportions cast on any day.

(iii) Different grades of mixes of concrete shall be divided into separate lots

(iv) Concrete of a lot shall be used in the same identifiable component of the bridge

1716.2.2. Sampling and testing

1. Concrete for making 3 test cubes shall be taken from a batch of concrete at point of delivery into construction, according to procedure laid down in IS : 1199.

2. A random sampling procedure to ensure that each of the concrete batches forming the lot under acceptance inspection has equal chance of being chosen for taking cubes shall be adopted.

3. 150 mm cubes shall be made, cured and tested at the age of 28 days for compressive strength in accordance with IS : 516. The 28-day test strength result for each cube shall form an item of the sample.

1716.2.3. Test specimen and sample strength: Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes such as to determine the strength of concrete at 7 days or for any other purpose.

The test strength of the sample shall be the average of the strength of 3 cubes. The individual variation should not be more that + 15 per cent of the average.

1716.2.4. Frequency: The minimum frequency of sampling of concrete of each grade shall be in accordance with Table 1700-8.

TABLE 1700-8.

Quality of concrete in work, m3	No. of samples
1 – 5	1
6 – 15	2
16 – 30	3
31 – 50	4
51 – and above	4 plus one additional sample for each additional 50 m3 or part thereof

At least one sample shall be taken from each shift of work.

1716.2.5. Acceptance criteria

Compressive Strength

When both the following conditions are met, the concrete complies with the specified compressive strength:

a) The mean strength determined from any group of four consecutive samples should exceed the specified characteristic compressive strength.

b) Strength of any sample is not less than the specified characteristic compressive strength minus 3 MPa.

The quantity of concrete represented by the test results include the batches from which the first and last samples were taken, together with all intervening batches.

Chloride and Sulphate Content

The total chloride and sulphuric anhydride (SO3) content of all the constituents of concrete as a percentage of mass of cement in the mix shall not exceed the values given in this section of the specifications.

1716.3. Density of Fresh Concrete

Where minimum density of fresh concrete is specified, the mean of any four consecutive samples shall not be less than the specified value and any individual sample result shall not be less than 97.5 per cent of the specified value.

1716.4. Density of Hardened Concrete

Where minimum density of hardened concrete is specified, the mean of any four consecutive samples shall not be less than the specified value and any individual sample result shall not be less than 97.5 per cent of the specified value.

1716.5. Permeability Test

The concrete should pass the following test if it is properly compacted and is not considered permeable.

(i) Prepare a cylindrical test specimen 150 mm dia and 160 mm high

(ii) After 28 days of curing, the test specimen is fitted in a machine such that the specimen can be placed in water under pressure upto 7 bars. A typical machine is shown in Appendix 1700/11.

(iii) At first a pressure of one bar is applied for 48 hours, followed by 3 bars for 24 hours and 7 bars for next 24 hours.

(iv) After the passage of the above period, the specimen is taken out and split in the middle by compression applied on two round bars on opposite sides above and below.

(v) The water penetration in the broken core is to be measured with a scale and the depth of penetration assessed in mm (max. permissible limit 25 mm).

1716.6. If the concrete is not able to meet any of the standards of acceptance as prescribed, the effect of such deficiency on the structure shall be investigated by the Contractor as directed by the Engineer. The Engineer may accept the concrete as sub-standard work. Any additional work required by the Engineer for such acceptance shall be carried out by the Contractor at his cost. In case the concrete is not found to be acceptable after investigation, the Contractor shall remove the rejected concrete forthwith.

1717. MEASUREMENTS FOR PAYMENT

Structural concrete shall be measured in cubic metres. In reinforced or prestressed concrete, the volume occupied by reinforcement or prestressing cables and sheathing shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab.

1718. RATE

The contract unit rate for structural concrete shall cover costs of all materials, labour, tools, plant and equipment required for mixing, transporting and placing in position, vibrating and compaction, finishing and curing as per this section or as directed by the Engineer, including all incidental expenses, sampling and testing, quality assurance and supervision. Unless mentioned separately as an item in the Contract, the contract unit rate for concrete shall also include the cost of providing, fixing and removing formwork required for concrete work as per Section 1500.

Where concrete is found to be acceptable as sub-standard work, the Contractor shall pay a discount over contract unit rate, as decided by the Engineer. For deficiency in compressive strength of concrete when accepted by the Engineer, the reduction in rate may be applied as under:

$$\text{Per cent reduction} = \frac{\text{Design Strength} - \text{Observed Strength}}{\text{Design Strength}} \times 100$$

CLAUSE 3004.2

3004.2. Filling Pot-holes and Patch Repairs

3004.2.1. Scope : This work shall include repair of pot- holes and patching of all types of bituminous pavement.

The work shall include the removal of all failed material, in the pavement courses and, if necessary, below the pavement, until the root cause of the failure is removed; the trimming of the completed excavation to provide firm vertical faces; the replacement of material of at least as high a standard as that which was originally specified for the pavement layer; the painting of tack coat on to the

sides and bases of excavations prior to placing of any bituminous materials and the compaction, trimming
and finishing of the surfaces of all patches to form a smooth continuous surface, level with the surrounding road.

3004.2.2. Materials : All materials used for the pot- hole and patch repair of bituminous surface and underlying layers shall be in accordance with this Specification and shall be of the same type as specified for the original construction. A mix superior to the one on the existing surface may also be used for repair work. An emulsified bitumen / modified bitume n mix compatible with the existing layer shall also be considered appropriate.

The bituminous mixture used for such patch repairs shall be in accordance with the appropriate Clause of these Specifications. Materials to be used for patching shall always be of the same type and standard of construction as, or better than, the material being patched at the same level of construction. Materials used for patching shall never be of lesser bearing capacity nor of a greater porosity than the adjacent previous construction. Non-bituminous material must not be used for patching bituminous materials. Where modified binder is to be used, Clause 521 of these Specifications shall apply.

The grading of aggregates and bitumen content of the mix used for such patch repair shall be in accordance with Clause 501.

3004.2.3. Preparation of the area for pot-hole and patch repair :

Each pot- hole and patch repair area shall be inspected and all loose material removed. The area shall be cut/trimmed either with jac k hammers or with hand tools suitable for the purpose, such that the defective material responsible for the failure is all removed and such that the excavation is of a regular shape.

The edges of the excavation shall be cut vertically. The area shall be thoroughly cleaned with compressed air or any appropriate method approved by the Engineer to remove all dust and loose particles. Layers below the level of the bituminous construction shall be replaced using material of the equivalent specification to the original construction, which shall particularly include the specified standards of compaction. The area for bituminous construction shall be tacked or primed with cutback or emulsion depending upon whether the lower area is bituminous or granular in nature. The sides, however, are to be painted with hot tack coat material.

The prime coat and tack coat shall conform to Clauses 502 and 503 of these Specifications, respectively.

3004.2.4. Backfilling operation : The mixture to be used in bituminous patching shall be either a hot mix or a cold mix in accordance with the appropriate Clauses of these Specifications. Mixing shall be done in a plant of suitable capacity. The bituminous mixture shall be placed in layers of thickness not more than 100 mm (loose) and shall be compacted in layers with roller/plate compactor/hand roller/rammer to the compaction standards defined in the appropriate Clauses of these Specifications. While placing the final layer, the mix shall be spread slightly proud of the surface so that after rolling, the surface shall be flush with the adjoining surface. If the area is large, the spreading and leveling shall be done using hand shovels and wooden straight edges.

During the process of compaction, the surface levels shall be checked using a 3m straight edge.

3004.2.5. Measurement for payment: Filling of pot-holes and patch repair shall be measured in SqM.

3004.2.6. Rate : The contract unit rate for filling of pot- holes and patch repair shall be payment in full for:

(i) furnishing all materials required:

(ii) all works involved including excavation, trimming, back filling with any non-bituminous layers required, tacking, priming with cutback or emulsion, and back filling with bituminous materials;

(iii) all labour, tools, equipment and incidentals to complete the work in accordance with the Specifications.

3004.3. Crack Sealing

3004.3.1. Scope: Crack sealing shall consist of one or more of the following operations as instructed under the Contract:
(i) fog seal
(ii) filling cracks with a binder, or a combination of crusher dust and a binder
(iii) by treating the crack sealing as a patch repair.

3004.3.2. Fog Seal

3004.3.2.1. Scope : Fog seal for use in maintenance work shall conform to the requirements of Clause 518 of these Specifications, and shall consist of an application of emulsified bitumen, without any
aggregate cover for sealing fine hair-cracks or for rejuvenating oxidized bituminous surfaces. Areas having cracks with less than 3mm width shall be considered for this treatment, unless otherwise instructed by the Engineer.

3004.3.2.2. Material: Bituminous emulsion for Fog Seal shall be of a slow setting type. Where modified binder is to be used, Clause 521 of these Specifications shall apply.

3004.3.2.3. Application : The area to be treated with fog seal shall be thoroughly cleaned using compressed air, scrubbers, etc. The cracks shall be cleaned with a compressed air jet to remove all dirt, dust, etc.
The fog seal shall be applied at the rate of 0.5-1.0 litre/sq.m. of emulsion, or as otherwise instructed by the Engineer, using equipment such as a pressure tank, flexible hose and spraying bar or lance. Traffic shall be allowed on to the surface only after the seal has set to a non-tacky and firm condition so that it is not picked up by the traffic.

3004.3.2.4. Measurement for payment: The fog seal work shall be measured in sq.metres, calculated from the dimensions of work instructed in the Contract or by the Engineer.

3004.3.2.5. Rate : The contract unit rate for application of fog seal shall be payment in full for:

(i) supplying of fog seal material and all the operations for applying it; and

(ii) all the labour, tools, equipment and incidentals to complete the work in accordance with this Specification.

3004.3.3. Crack filling

3004.3.3.1. Scope: Crack filling shall be carried out using a binder of a suitable viscosity, normally a slow-curing bitumen emulsion, as instructed by the Engineer. For wider cracks, in excess of an average of 3 mm in width the application of emulsion may be preceded by an application of crusher dust, or other fine material acceptable to the Engineer.

3004.3.3.2. Materials:

Bitumen for use in crack sealing shall be of a slow curing type as instructed by the Engineer. Dust for crack sealing, when used, shall be crusher dust or some other suitable fine material approved by the Engineer, passing the 4.75 mm sieve but with a maximum of 10% passing the 0.075 mm sieve.

3004.3.3.3. Construction:

If dust is to be used it shall be placed in the cracks before the application of binder and the cracks filled to a level approximately 5 mm below road surface level. The surface of the road shall be swept clear of dust prior to the application of binder. Binder shall be poured into the cracks, taking care to minimize spillage. If spillage onto the road surface does occur, dust shall be applied to the excess bitumen until it is blotted up.

3004.3.3.4. Measurement:

Crack sealing shall be paid by the linear metre of crack as instructed by the Engineer.

3004.3.3.5. Payment:

The contract rate for crack sealing shall be payment in full for:
(i) supplying all necessary materials and for the work of applying them;
(ii) all labour, tools, equipment and all incidentals necessary to complete the work according to these Specifications.

3004.3.4. Crack prevention courses:

Clause 522 specifies crack prevention courses. These may be included in substantial maintenance treatments.

CLAUSE 902.
CONTROL OF ALIGNMENT, LEVEL AND SURFACE REGULARITY

902.1. General

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

902.2. Horizontal Alignment
Horizontal alignments shall be reckoned with respect to the centre line of the carriageway as shown on the drawings. The edges of the carriageway as constructed shall be correct within a tolerance of ± 10 mm there from. The 301

corresponding tolerance for edges of the roadway and lower layers of pavement shall be ± 25 mm.

902.3. Surface Levels
The levels of the sub grade 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	Sub grade	+ 20mm -25 mm
2	Sub-base + 10mm (a) Flexible pavement (b) Concrete pavement [Dry lean concrete or Rolled concrete]	 - 20mm + 6 mm - 10mm
3	Base-course for flexible pavement (a) Bituminous course (b) Other than bituminous (i) Machine laid (ii) Manually laid	 + 6 mm - 6mm + 10 mm - 10mm + 15 mm - 15 mm
4	Wearing course for flexible pavement (a) Machine laid (b) Manually laid	 + 6 mm - 6 mm + 10mm - 10mm
5	Cement concrete pavement	- 6mm *

* 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 sub grade, sub base and base courses, measurements of (he surface levels shall be taken on a grid of points placed at 6.25m 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 points spaced at 6.25 m along the length and at 0.5 m from the edges and at the centre 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 straight-edge as desired by the Engineer at the middle of each traffic lane along a line parallel to the centre line 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

Surfaces of carriageways and paved shoulders course.					**Surfaces of lajbjs, service areas and all bituminous base**			
Irregularity	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	3
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 straight-edge when placed parallel with, or at right angles to the centre line of the road at points decided by the Engineer shall be:

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

902.5. Rectification

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

(i) Sub grade; Where the surface is high, it shall be trimmed and suitably compacted Where the same is low, the deficiency shall he corrected by scarifying the lower layer and adding fresh material and recompacting to the required density. The degree of compaction and the type of material to t>e 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 (hat 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.

For cement treated material, when the time elapsed between detection of irregularity and the lime 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 recompacted to the relevant specification. When this time is more than 2hours, 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.

(iv) Water Bound Macadam/Wet Mix Macadam Sub-base/Base: Where the surface is high or low, the lop 75 mm shall be scarified, reshaped with added material as necessary and recompacted to Clause 404. This shall also apply to wet mix macadam to Clause 406.

(v) 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 recompacting 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.

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.

(vi) Dry Lean Concrete Sub-base/Rolled Cement Concrete; The defective length of the course shall be removed up 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 sub grade or layer below shall be corrected by leveling, watering and compacting.

(vli) Cement concrete pavement; The defective areas having surface irregularly exceeding 3 mm but not greater than 6 mm may be rectified by bump cutting or scrabbling 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

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in an approved manner either by cutting grooves (5 mm deep) or roughening the surface by hacking the surface. *IS* high areas in excess 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.

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.

QUALITY CONTROL MANUAL FOR WORKS

GENERAL :

All materials to be used, all methods adopted and all works performed shall be strictly in accordance with requirements of these specification. The Contractor shall set up a field laboratory at locations approved by the Engineer and equip the same with adequate equipment and personnel in order to carry out all required tests and Quality Control Work as per Specification and/ or as directed by the Engineer. The internal layout of the laboratory shall be as per Clause 121 and/ or as directed by the Engineer. The list of equipment and the facilities to be provided shall be got approved from the Engineer in advance.

The contractor's laboratory should be manned by a qualified Materials Engineer/ Civil Engineer assisted by experienced technicians, and the set up should be got approved by the Engineer.

The Contractor shall carry out quality control tests on the materials and work to the frequency stipulated in subsequent paragraphs. In the absence of clear indications about method and or frequency of tests for any item, the instructions of the Engineer shall be followed.

For Satisfying himself about the quality of the materials and work, quality control tests will also be conducted by the Engineer(by himself, by his Quality Control Units or by any other agencies deemed fit by him), generally to the frequency set forth herein under. Additional tests may also be conducted where, in the opinion of the Engineer, need for such tests exists.

The Contractor shall provide necessary co-operation and assistance in obtaining the samples for tests and carrying out the field tests as required by the Engineer from time to time. This may include provision of labour, attendants, assistance in packing and dispatching and any other assistance considered necessary in connection with the tests.

For the work of embankment, sub-grade and pavement, construction of subsequent layer of same or other material over the finished layer shall be done after obtaining permission from the Engineer. Similar permission from the Engineer shall be obtained in respect of all other items of works prior to proceeding with the next stage of construction.

The Contractor shall carry out modifications in the procedure of work, if found necessary, as directed by the Engineer during inspection. Works falling short of quality shall be rectified/ redone by the Contractor at his own cost, and defective work shall also be removed from the site of works by the Contractor at his own cost.

The Cost of laboratory building including service, essential supplies like water, electricity, sanitary services and their maintenance and cost of all equipment, tools, materials, labour and incidentals to perform tests and other operations of quality control according to the Specification requirements shall be deemed to be incidental to the work and no extra payment shall be made for the same. If, however there is a separate item in the Bill of Quantities for setting up of a laboratory and installing testing equipment such work shall be paid for separately.

For testing of samples of soils/soil mixes, granular materials, and mixes, bituminous materials and mixes, aggregates, cores etc., samples in the required quantity and form shall be supplied to the Engineer by the Contractor at his own cost.or bitumen, and aggregates other materials where essential tests are to be carried out at the manufacture's plant or at laboratories other than the site laboratory, the cost of samples, sampling, testing and furnishing of test certificates shall be borne by the Contractor. He shall also furnish the test certificates to the Engineer.

For testing of bituminous mix at site during construction arrangements for supply of samples, sampling, testing and supply of test results shall be made by the Contractor as per the frequency and number of test specified in the Hand book of Quality Control for Construction of Roads & Runways (IRC:SP:11) and relevant IS Codes or relevant clauses of these Specifications, the cost of which shall be borne by the contractor.

The method of sampling and testing of material shall be as required by the "Handbook of Quality Control for Construction of Roads and Runways" (IRC:SP:11) and these MOSST Specifications. Where they are contradicting, the provision in these Specifications shall be followed. Where they are silent, sound engineering practices shall be adopted. The sampling and testing procedure to be used shall be as approved by the Engineer and his decision shall be final and binding on the Contractor.

The materials for construction shall be got approved from the Engineer. The responsibility for arranging and obtaining the required material shall rest with the Contractor who shall ensure smooth and uninterrupted supply of materials in the required quantity during the construction period.

Similarly, the supply of aggregates for construction of road pavement shall be from quarries approved by the Engineer. Responsibility for arranging uninterrupted supply of materials from the source shall be that of the Contractor.

Defective Material:

All materials which the Engineer/ his representative has determined as not confirming to the requirements of the Contract shall be rejected whether in place or not; they shall be removed immediately from the site as directed. Materials, which have been subsequently corrected, shall not be used in the work unless approval is accorded in writing by the Engineer. Upon failure of the Contractor to comply with any order of the Engineer/ his representative given under this clause, the Engineer his representative shall have authority to cause the removal of rejected material and to deduct the removal cost thereof from any payments due to the Contractor.

Imported Materials :

At the time of submission of tenders, the Contractor shall furnish a list of materials/finished products manufactured, produced or fabricated outside India which he proposes to uses in the work. The Contractor shall not be entitled to extension of time for acts or events occurring outside India and it shall be the Contractor's responsibility to make timely delivery to the job site of all such materials obtained from outside India.

The materials imported from outside India shall conform to the relevant Specifications of the Contract. In case where materials/ finished products are not covered by the Specifications in the Contract, the details of Specifications proposed to be followed and the testing procedure as well as laboratories/establishments where tests are to be carried out shall be specifically brought out and agreed to in the Contract.

Seal and Signature of the Bidder

DRY LEAN CONCRETE & PAVEMENT QUALITY CONCRETE (PQC)

601. DRY LEAN CEMENT CONCRETE SUB-BASE

601.1. Scope

601.1.1. The work shall consist of construction of dry lean concrete subbase for cement concrete pavement in accordance with the requirements of these Specifications and in conformity with the lines, grades and cross-sections shown on the drawings or as directed by the Engineer. The work shall include furnishing of all plant and equipment, materials and labour and performing all operations, in connection with the work, as approved by the Engineer.

601.1.2. The design parameters of dry lean concrete sub-base, viz., width, thickness, grade of concrete, details of joints, if any, etc. shall be as stipulated in the Contract drawings.

601.2. Materials

601.2.1. Source of materials: The Contractor shall indicate to the Engineer the source of all materials with relevant test data to be used in the lean concrete work sufficiently in advance and the approval of the Engineer for the same shall be obtained at least 45 days before the scheduled commencement of the work. If the Contractor later proposes to obtain the materials from a different source, he shall notify the Engineer for his approval at least 45 days before such materials are to be used.

601.2.2. Cement: Any of the following types of cement may be used with prior approval of the Engineer;

(i)	Ordinary Portland Cement	IS : 269
(ii)	Portland Slag Cement	IS : 455
(iii)	Portland Pozzolana Cement	IS :1489

If the sub grade is found to consist of soluble sulphates in a concentration more than 0.5 per cent, cement used shall be sulphate resistant and shall conform to IS : 6909.

Cement to be used may preferably be obtained in bulk form. It shall be stored in accordance with stipulations contained in Clause 1014 and shall be subjected to acceptance test prior to its immediate use.

601.2.3. Aggregates:

601.2.3.1. Aggregates for lean concrete shall be natural material complying with IS : 383. The aggregates shall not be alkali reactive. The limits of deleterious materials shall not exceed the requirements set out in IS : 383. In case the Engineer considers that the aggregates are not free from dirt, the same may be washed and drained for at least 72 hours before batching, as directed by the Engineer.

601.2.3.2. Coarse aggregate: Coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone or crushed gravel and shall be devoid of

pieces of disintegrated stone, soft, flaky, elongated, very angular or splintery pieces. The maximum size of the coarse aggregate shall be 25 mm. The coarse aggregate shall comply with Clause 602.2.4.2.

601.2.3.3. Fine aggregate: The fine aggregate shall consist of clean, natural sand or crushed stone sand or a combination of the two and shall conform to IS : 383. Fine aggregate shall be free from soft particles, clay, shale, loam, cemented particles, mica, organic and other foreign matter. The fine aggregate shall comply with Clause 602.2.4.3.

601.2.3.4. The coarse and fine aggregates may be obtained in either of the following manner:

(i) In separate nominal sizes of coarse and fine aggregates and mixed together intimately before use.

(ii) Separately as 25 mm nominal single size, 12.5 mm nominal size graded aggregates and fine aggregate of crushed stone dust or sand or a combination of these two.

The material after blending shall conform to the grading as indicated in Table 600-1.

Table 600-1. AGGREGATE GRADATION FOR DRY LEAN CONCRETE

Sieve designation	Percentage passing the sieve by weight
26.50 mm	100
19.00 mm	80–100
9.50 mm	55-75
4.75 mm	35-60
600.00 micron	10-35
75.00 micron	0-8

601.2.4. Water: Water used for mixing and curing of concrete shall be clean and free from injurious amounts of oil, salt, acid, vegetable matter or other substances harmful to the finished concrete. It shall meet the requirements stipulated in IS : 456.

601.2.5. Storage of materials: All materials shall be stored in accordance with the provisions of Clause 1014 of these Specifications and other relevant IS Specifications. All efforts must be made to store the materials in proper places so as to prevent their deterioration or contamination by foreign matter and to ensure their satisfactory quality and fitness for use in the work. The storage place must also permit easy inspection, removal and storage of materials. All such materials even though stored in approved go downs must be subjected to acceptance test immediately prior to their use. The requirement of storage yard specified in Clause 602.2.9. shall also be applicable.

601.3. Proportioning of Materials for the Mix

601.3.1. The mix shall be proportioned with a maximum aggregate cement ratio of 15:1. The water content shall be adjusted to the optimum as per Clause 601.3.2. for facilitating compaction by rolling. The strength and density requirements of concrete shall be determined in accordance with Clause 601.6 by making trial mixes.

601.3.2. Moisture content: The right amount of water for the lean concrete in the main work shall be decided so as to ensure full compaction under rolling and shall be assessed at the time of rolling the trial length. Too much water will cause the lean concrete to be heaving up before the wheels and picked up on the wheels of the roller and too little will lead to inadequate compaction, a low in-situ strength and an open-textured surface.

The optimum water content shall be determined and demonstrated by rolling during trial length construction and the optimum moisture content and degree of compaction shall be got approved from the Engineer. While laying in the main work, the lean concrete shall have a moisture content between the optimum and optimum +2 per cent, keeping in view the effectiveness of compaction achieved and to compensate for evaporation losses.

601.3.3. Cement content: The minimum cement content in the lean concrete shall not be less than 150 kg/cu.m. of concrete. If this minimum cement content is not sufficient to produce concrete of the specified strength, it shall be increased as necessary without additional cost compensation to the Contractor.

601.3.4. Concrete strength: The average compressive strength of each consecutive group of 5 cubes made in accordance with Clause 903.5.1.1. shall not be less than 10 MPa at 7 days. In addition, the minimum compressive strength of any individual cube shall not be less than 7.5 MPa at 7 days. The design mix complying with the above Clauses shall be got approved from the Engineer and demonstrated in the trial length construction.

601.4. Sub grade

The sub grade shall conform to the grades and cross sections shown on the drawings and shall be uniformly compacted to the design strength in accordance with these Specifications and Specification stipulated in the Contract. The lean concrete sub base shall not be laid on a sub grade softened by rain after its final preparation; surface trenches and soft spots, if any, must be properly back-filled and compacted to avoid any weak or soft spot. As far as possible, the construction traffic shall be avoided on the prepared sub grade. A day before placing of the sub-base, the sub grade surface shall be given a fine spray of water and rolled with one or two passes of a smooth wheeled roller after a lapse of 2-3 hours in order to stabilize loose surface. If Engineer feels it necessary, another fine spray of water may be applied just before placing sub-base.

601.5. Construction

601.5.1. General: The pace and programme of the lean concrete sub base construction shall be matching suitably with the programme of construction of the cement concrete pavement over it. The sub-base shall be overlaid with cement concrete pavement only after 7 days after sub-base construction.

601.5.2. Batching and mixing: The batching plant shall be capable of proportioning the materials by weight, each type of material being weighed separately in accordance with Clause 602.9.3.2. The cement from the bulk stock shall be weighed separately from the aggregates. The capacity of batching and mixing plant shall be at least 25 per cent higher than the proposed capacity for the laying arrangements. The batching and mixing shall be carried out preferably in a forced action central batching and mixing plant having necessary automatic controls to ensure accurate proportioning and mixing. Other types of mixers shall be permitted subject to

demonstration of their satisfactory performance during the trial length. The type and capacity of the plant shall be got approved by the Engineer before commencement of the trial length. The weighing balances shall be calibrated by weighing the aggregates, cement, water and admixtures physically either by weighing in the large weighing machine or in a weigh bridge. The accuracy of weighing scales of the batching plant shall be within ± 2 per cent in the case of aggregates and +1 per cent in the case of cement and water.

The design features of Batching Plant should be such that the shifting operations of the plant will not take very long time when they are to be shifted from place to place with the progress of the work.

601.5.3. Transporting: Plant mix lean concrete shall be discharged immediately from the mixer, transported directly to the point where it is to be laid and protected from the weather by covering the tippers/dumpers with tarpaulin during transit. The concrete shall be transported by tipping trucks, sufficient in number to ensure a continuous supply of material to feed the laying equipment to work at a uniform speed and in an uninterrupted manner. The lead of the batching plant to paving site shall be such that the travel time available from mixing to paving as specified in Clause 601.5.5.2 will be adhered to.

601.5.4. Placing: Lean concrete shall be laid/placed by a paver with electronic sensor. The equipment shall be capable of laying the material in one layer in an even manner without segregation, so that after compaction the total thickness is as specified. The paving machine shall have high amplitude tamping bars to give good initial compaction to the sub-base.

The laying of the two-lane road sub base done either in full width or lane by lane. Preferably the lean concrete shall be placed and compacted across the full width of the road, by constructing it in one go or in two lanes running forward simultaneously. Transverse and longitudinal construction joints shall be staggered by 500-1000 mm and 200-400 mm respectively from the corresponding joints in the overlaying concrete slabs.

601.5.5. Compaction

601.5.5.1. The compaction shall be carried out immediately after the material is laid and levelled. In order to ensure thorough compaction which is essential, rolling shall be continued on the full width till there is no further visible movement under the roller and the surface is closed. The minimum dry density obtained shall be 97 per cent of that achieved during the trial length construction vide Clause 601.7. The densities achieved at the edges i.e 0.5 m from the edge shall not be less than 95 percent of that achieved during the trial construction vide Clause 601.7.

601.5.5.2. The spreading, compacting and finishing of the lean concrete shall be carried out as rapidly as possible and the operation shall be so arranged as to ensure that the time between the mixing of the first batch of concrete in any transverse section of the layer and the final finishing of the same shall not exceed 90 minutes when the concrete temperature is above 25 and below 30 degree Celsius and 120 minutes if less than 25 degree Celsius. This period may be reviewed by the Engineer in the light of the results of the trial run but in no case shall it exceed 2 hours. Work shall not proceed when the temperature of the concrete exceeds 30 degree Celsius. If necessary, chilled water or addition of ice may be resorted to for bringing down the temperature. It is desirable to stop concreting when the ambient temperature is above 35^{o} C. After compaction has been completed, roller shall not stand on the compacted surface for

the duration of the curing period except during commencement of next day's work near the location where work was terminated the previous day.

601.5.5.3. Double drum smooth-wheeled vibratory rollers of minimum 80 to 100 kN static weight are considered to be suitable for rolling dry lean concrete. In case any other roller is proposed, the same shall be got approved from the Engineer, after demonstrating its performance. The number of passes required to obtain maximum compaction depends on the thickness of the lean concrete, the compatibility of the mix, and the weight and type of the roller etc., and the same as well as the total requirement of rollers for the job shall be determined during trial run by measuring the in-situ density and the scale of the work to be undertaken.

601.5.5.4. In addition to the number of passes required for compaction there shall be a preliminary pass without vibration to bed the lean concrete down and again a final pass without vibration to remove roller marks and to smoothen the surface.

Special care and attention shall be exercised during compaction near joints, kerbs, channels, side forms and around gullies and manholes. In case adequate compaction is not achieved by the roller at these points, use of plate vibrator shall be made, if so directed by the Engineer.

601.5.5.5. The final lean concrete surface on completion of compaction and immediately before overlaying, shall be well closed, free from movement under roller and free from ridges, low spots, cracks, loose material, pot holes, ruts or other defects. The final surface shall be inspected immediately on completion and all loose, segregated or defective areas shall be corrected by using fresh lean concrete material laid and compacted as per Specification. For repairing honeycombed surface, concrete with aggregates of size 10 mm and below shall be spread and compacted. It is necessary to check the level of the rolled surface for compliance. Any level/thickness deficiency should be corrected after applying concrete with aggregates of size 10 mm and below after roughening the surface. Similarly the surface regularity also should be checked with 3 m straight edge. The deficiency should be made up with concrete with aggregates of size 10 mm and below.

601.5.5.6. Segregation of concrete in the dumpers shall be controlled by premixing each fraction of the aggregates before loading in the bin of the batching plant, by moving the dumper back and forth while discharging the mix on it and other means. Even paving operation shall be such that the mix does not segregate.

601.5.6. Joints: Contraction and longitudinal joints shall be provided as per the drawing.

At longitudinal or transverse construction joints, unless vertical forms are used, the edge of compacted material shall be cut back to a vertical face where the correct thickness of the properly compacted material has been obtained.

601.5.7. Curing: As soon as the lean concrete surface is compacted, curing shall commence. One of the following two methods shall be adopted:

(a) The initial curing shall be done by spraying with liquid curing compound. The curing compound shall be white pigmented or transparent type with water retention index of 90 per cent when tested in accordance with BS 7542. Curing

compound shall be sprayed immediately after rolling is complete. As soon as the curing compound has lost its tackiness, the surface shall be covered with wet hessian for three days.

(b) Curing shall be done by covering the surface by gunny bags/hessian, which shall be kept continuously moist for 7 days by sprinkling water.

601.6. Trial Mixes

The Contractor shall make trial mixes of dry lean concrete with moisture contents like 5.0, 5.5, 6.0, 6.5 and 7.0 per cent using cement content specified and the specified aggregate grading but without violating the requirement of aggregate-cement ratio specified in Clause 601.3.1. Optimum moisture and density shall be established by preparing cubes with varying moisture contents. Compaction of the mix shall be done in three layers with vibratory hammer fitted with a square or rectangular foot as described in Clause 903.5.1.1. After establishing the optimum moisture, a set of six cubes shall be cast at that moisture for the determination of compressive strength on the 3rd and the seventh day. Trial mixes shall be repeated if the strength is not satisfactory either by increasing cement content or using higher grade of cement. After the mix design is approved, the Contractor shall construct a trial section in accordance with Clause 601.7.

If during the construction of the trial length, the optimum moisture content determined as above is found to be unsatisfactory, the Contractor may make suitable changes in the moisture content to achieve a satisfactory mix. The cube specimens prepared with the changed moisture content should satisfy the strength requirement. Before production of the mix, natural moisture content of the aggregate should be determined on a day-to-day basis so that the moisture content could be adjusted. The mix finally designed should neither stick to the rollers nor become too dry resulting in raveling of surface.

601.8. Tolerances for Surface Regularity, Level, Thickness, Density and Strength

The tolerances for surface regularity, level, thickness, density and strength shall conform to the requirements given in Clause 903.5. Control of quality of materials and works shall be exercised by the Engineer in accordance with section 900.

601.9. Traffic

No heavy commercial vehicles like trucks and buses shall be permitted on the lean concrete sub-base after its construction. Light vehicles if unavoidable may, however, be allowed after 7 days of its construction with prior approval of the Engineer.

601.10. Measurements for Payment

The unit of measurement for dry lean concrete pavement shall be the cubic metre of concrete placed, based on the net plan areas for the specified thickness shown on the drawings or as directed by the Engineer.

601.11 Rate

The Contract unit rate payable for dry lean concrete sub-base shall be payment in full for carrying out the required operations including full compensation for all labour, materials and equipment, mixing, transport, placing, compacting, finishing, curing, testing and incidentals to complete the work as per Specifications, all royalties, fees, storage and rents where necessary and all leads and lifts.

602. CEMENT CONCRETE PAVEMENT

602.1. Scope

602.1.1 The work shall consist of construction of cement concrete pavement in accordance with the requirements of the Specifications and in conformity with the lines, grades and cross sections shown on the drawings. The work shall include furnishing of all plant and equipment, materials and labour and performing all operations in connection with the work, as approved by the Engineer.

602.1.2. The design parameters, viz., thickness of pavement slab, grade of concrete, joint details etc. shall be as stipulated in the drawings.

602.2. Materials

602.2.1. Source of materials: The Contractor shall indicate to the Engineer the source of all materials to be used in the concrete work with relevant test data sufficiently in advance, and the approval of the Engineer for the same shall be obtained at least 45 days before the scheduled commencement of the work. If the Contractor later proposes to obtain materials from a different source, he shall notify the Engineer for his approval, at least 45 days before such materials are to be used with relevant test data.

602.2.2. Cement: Any of the following types of cement capable of achieving the design strength may be used with prior approval of the Engineer, but the preference should be to use at least the 43 Grade or higher.

i) Ordinary Portland Cement, 33 Grade IS : 269.

ii) Ordinary Portland Cement, 43 Grade IS : 8112.

iii) Ordinary Portland Cement, 53 Grade IS : 12269.

If the soil around has soluble salts like sulphate in excess of 0.5 per cent, the cement used shall be sulphate resistant and shall conform to IS : 12330.

Guidance may be taken from IS: SP: 23, Handbook for Concrete Mixes for ascertaining the minimum 7 days strength of cement required to match with the design concrete strength. Cement to be used may preferably be obtained in bulk form. If cement in paper bags are proposed to be used, there shall be bag-splitters with the facility to separate pieces of paper bags and dispose them of suitably. No paper pieces shall enter the concrete mix. Bulk cement shall be stored in accordance with Clause 1014. The cement shall be subjected to acceptance test just prior to its use.

602.2.3. Admixtures: Admixtures conforming to IS : 6925 and IS : 9103 shall be permitted to improve workability of the concrete or extension of setting time, on satisfactory evidence that they will not have any adverse effect on the properties of concrete with respect to strength, volume change, durability and have no deleterious effect on steel bars. The particulars of the admixture and the quantity to be used, must be furnished to the Engineer in advance to obtain his approval before use. Satisfactory performance of the admixtures should be proved both on the laboratory concrete trial mixes and in trial paving works. If air entraining admixture is used, the total quantity of air in air-entrained concrete as a percentage of the volume of the mix shall be 5 ± 1.5 per cent for 25 mm nominal size aggregate.

602.2.4. Aggregates

602.2.4.1. Aggregates for pavement concrete shall be natural material complying with IS : 383 but with a Los Angeles Abrasion Test result not more than 35 per cent. The limits of deleterious materials shall not exceed the requirements set out in IS : 383.

The aggregates shall be free from chert, flint, chalcedony or other silica in a form that can react with the alkalies in the cement. In addition, the total chlorides content expressed as chloride ion content shall not exceed 0.06 per cent by weight and the total sulphate content expressed as sulphuric anhydride (SO_3) shall not exceed 0.25 per cent by weight.

602.2.4.2. Coarse aggregate: Coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone or crushed gravel and shall be devoid of pieces of disintegrated stone, soft, flaky, elongated, very angular or splintery pieces. The maximum size of coarse aggregate shall not exceed 25 mm for pavement concrete. Continuously graded or gap graded aggregates may be used, depending on the grading of the fine aggregate. No aggregate which has water absorption more than 2 per cent shall be used in the concrete mix. The aggregates shall be tested for soundness in accordance with IS : 2386 (Part-5). After 5 cycles of testing the loss shall not be more than 12 per cent if sodium sulphate solution is used or 18 percent if magnesium sulphate solution is used.

Dumping and stacking of aggregates shall be done in an approved manner. In case the Engineer considers that the aggregates are not free from dirt, the same may be washed and drained for at least 72 hrs before batching as directed by the Engineer.

602.2.4.3. Fine aggregate: The fine aggregate shall consist of clean natural sand or crushed stone sand or a combination of the two and shall conform to IS : 383. Fine aggregate shall be free from soft particles, clay, shale, loam, cemented particles, mica and organic and other foreign matter. The fine aggregate shall not contain deleterious substances more than the following:

Clay lumps	4.0 percent
Coal and lignite	1.0 percent
Material passing IS Sieve No. 75 micron	4.0 percent

602.2.5. Water: Water used for mixing and curing of concrete shall be clean and free from injurious amount of oil, salt, acid, vegetable matter or other substances harmful to the finished concrete. It shall meet the requirements stipulated in IS : 456.

602.2.6. Mild steel bars for dowels and tie bars: Reinforcing steel for concrete pavements shall comply with the requirements of IS : 432,

IS : 1139 and IS : 1786 as appropriate.

All steel shall be clean and free from mill scale, loose rust and oil.

Tie bars shall be Grade S 415 and dowels shall be Grade S 240 in accordance with IS.

Dowels shall be straight, one-piece and cut accurately to length. Ends of dowels shall be square and free from burrs.

602.2.7. Premoulded joint filler: Joint filler board for expansion joints which are proposed for use only at some abutting structures like bridges and culverts shall be of 20-25 mm thickness within a tolerance of ± 1.5 mm and of a firm compressible material and complying with the requirements of IS :1838, or BS Specification Clause No. 2630 or Specification for Highway Works, Vol .I Clause 1015. It shall be 25 mm less in depth than the thickness of the slab within a tolerance of ± 3 mm and provided to the full width between the side forms. It shall be in suitable lengths which shall not be less than one lane width. Holes to accommodate dowel bars shall be accurately bored or punched out to give a sliding fit in the dowel bars.

602.2.8. Joint sealing compound: The joint sealing compound shall be of hot poured, elastomeric type or cold polysulphide type having flexibility, resistance to age hardening and durability. If the sealant is of hot poured type it shall conform to AASHTO M282 and cold applied sealant shall be in accordance with BS 5212 (Part 2).

602.2.9. Storage of materials: All materials shall be stored in accordance with the provisions of Clause 1014 of the Specifications and other relevant IS Specifications. All effort must be made to store the materials in proper places so as to prevent their deterioration or contamination by foreign matter and to ensure their satisfactory quality and fitness for the work. The platform where aggregates are stock piled shall be levelled with 15 cm of watered, mixed and compacted granular sub-base material. The area shall have slope and drain to drain off rain water. The storage space must also permit easy inspection, removal and storage of the materials. Aggregates of different sizes shall be stored in partitioned stack-yards. All such materials even though stored in approved go downs must be subjected to acceptance test as per Clause 903 of these Specifications immediately prior to their use.

602.3. Proportion of Concrete

602.3.1. After approval by the Engineer of all the materials to be used in the concrete, the Contractor shall submit the mix design based on weighed proportions of all ingredients for the approval of the Engineer. The mix design shall be submitted at least 30 days prior to the paving of trial length and the design shall be based on laboratory trial mixes using the approved materials and methods as per IS : 10262 (Recommended Guidelines for Mix Design) or on the basis of any other rational method agreed to by the Engineer. Guidance in this regard can also be obtained from IS : SP : 23 Handbook on Concrete Mixes. The target mean strength for the design mix shall be determined as indicated in Clause 903.5.2. The mix design shall be based on the flexural strength of concrete.

602.3.2. Cement content: The cement content shall not be less than 350 kg per cu.m. of concrete. If this minimum cement content is not sufficient to produce in the field, concrete of the strength specified in the drawings/design, it shall be increased as necessary without

additional compensation under the Contract. The cement content shall, however, not exceed 425 kg per cu.m. of concrete.

602.3.3. Concrete strength

602.3.3.1. While designing the mix in the laboratory, correlation between flexural and compressive strengths of concrete shall be established on the basis of at least thirty tests on samples. However, quality control in the field shall be exercised on the basis of flexural strength. It may, however, be ensured that the materials and mix proportions remain substantially unaltered during the daily concrete production. The water content shall be the minimum required to provide the agreed workability for full compaction of the concrete to the required density as determined by the trial mixes or other means approved by the Engineer and the maximum free water cement ratio shall be 0.50.

602.3.3.2. The ratio between the 7 and 28 day strengths shall be established for mix to be used in the slab in advance, by testing pairs of beams and cubes at each stage on at least six batches of trial mix. The average strength of the 7 day cured specimens shall be divided by the average strength of the 28 day specimens for each batch, and the ratio 'R' shall be determined. The ratio 'R' shall be expressed to three decimal places.

If during the construction of the trial length or during normal working, the average value of any four consecutive 7 day test results falls below the required 7 day strength as derived from the value of 'R', then the cement content of the concrete shall, without extra payment, be increased by 5 per cent by weight or by an amount agreed by the Engineer. The increased cement content shall be maintained at least until the four corresponding 28 day strengths have been assessed for its conformity with the requirements as per Clause 602.3.1. Whenever the cement content is increased, the concrete mix shall be adjusted to maintain the required workability.

602.3.4. Workability

602.3.4.1. The workability of the concrete at the point of placing shall be adequate for the concrete to be fully compacted and finished without undue flow. The optimum workability for the mix to suit the paving plant being used shall be determined by the Contractor and approved by the Engineer. The control of workability in the field shall be exercised by the slump test as per IS : 1199.

602.3.4.2. The workability requirement at the Batching Plant and paving site shall be established slump tests carried during trial paving. These requirements shall be established from season to season and also when the lead from Batching plant site to the paving site changes. The workability shall be established for the type of paving equipment available. A slump value in the range of 30 ± 15 mm is reasonable for paving works but this may be modified depending upon the site requirement and got approved by the Engineer. These tests shall be carried out on every truck/dumper at Plant site and paving site initially when the work commences but subsequently the frequency can be reduced to alternate trucks or as per the instructions of the Engineer.

602.3.5. Design mix

602.3.5.1. The Contractor shall carry out laboratory trials of design mixes with the materials from the approved sources to be used. Trial mixes shall be made in presence of the Engineer or his representative and the design mix shall be subject to the approval of the Engineer. They shall be repeated if necessary until the proportions that will produce a concrete which complies in all respects with this Specification, and conforms to the design/drawings have been determined.

602.3.5.2. The proportions determined as a result of the laboratory trial mixes may be adjusted if necessary during the construction of the trial length. Thereafter, neither the materials nor the mix proportions shall be varied in any way except with the written approval of the Engineer.

602.3.5.3. Any change in the source of materials or mix proportions proposed by the Contractor during the course of work shall be assessed by making laboratory trial mixes and the construction of a further trial length unless approval is given by the Engineer for minor adjustments like compensation for moisture content in aggregates or minor fluctuations in the grading of aggregate.

602.4. Sub-base

The cement concrete pavement shall be laid over the sub-base constructed in accordance with the relevant drawings and Specifications contained in Clause 601. If the sub-base is found damaged at some places or it has cracks wider than 10mm, it shall be repaired with fine cement concrete or bituminous concrete laying separation layer. Prior to laying of concrete it shall be ensured that the separation membrane as per Clause 602.5 is placed in position and the same is clean of dirt or other extraneous materials and free from any damage.

602.5. Separation Membrane

A separation membrane shall be used between the concrete slab and the sub-base. The separation membrane shall be a primer seal produced and placed in accordance with Sub-Clause 508.4.

602.6. Joints

602.6.1. The location and type of joints shall be as shown in the drawing. Joint shall be constructed depending upon their functional requirement as detailed in the following paragraphs. The location of the joints should be transferred accurately at the sire and mechanical saw cutting of joints done as per stipulated dimensions. It should be ensured that the full required depth of cut is made from edge to edge of the pavement. Transverse and longitudinal joints in the pavement and sub-base shall be staggered so that they are not coincident vertically and are at least 1 m and 0.3 m apart respectively. Sawing of joints shall be carried out with diamond studded blades soon after the concrete has hardened to take the load of the sawing machine and personnel without damaging the texture of the pavement. Sawing operation could start as early as 6-8 hours depending upon the season.

602.6.2. Transverse joints

602.6.2.1. Transverse joints shall be contraction and expansion joints constructed at the spacing described in the Drawings. Transverse joints shall be straight within the following tolerances along the intended line of joints which is the straight line transverse to the longitudinal axis of the carriageway at the position proposed by the Contractor and agreed to by the Engineer, except at road junctions or roundabouts where the position shall be as described in the drawings:

(i) Deviations of the filler board in the case of expansion joints from the intended line of the joint shall not be greater than ± 10 mm.

(ii) The best fit straight line through the joint grooves as constructed shall be not more than 25 mm from the intended line of the joint.

(iii) Deviations of the joint groove from the best fit straight line of the joint shall not be greater than 10 mm.

(iv) Transverse joints on each side of the longitudinal joint shall be in line with each other and of the same type and width. Transverse joints shall have a sealing groove which shall be sealed in compliance with Clause 602.11.

602.6.2.2. Contraction joints: Contraction joints shall consist of a mechanical sawn joint groove, 3 to 5 mm wide and 1/4 to 1/3 depth of the slab ± 5 mm or as stipulated in the drawings and dowel bars complying with Clause 602.6.5 and as detailed in the drawings.

The contraction joints shall be cut as soon as the concrete has undergone initial hardening and is hard enough to take the load of joint sawing machine without causing damage to the slab.

602.6.2.3. Expansion joints: The expansion joints shall consist of a joint filler board complying with Clause 602.2.7 and dowel bars complying with Clause 602.6.5 and as detailed in the drawings. The filler board shall be positioned vertically with the prefabricated joint assemblies along the line of the joint within the tolerances given in Clause 602.6.2.1 and at such depth below the surface as will not impede the passage of the finishing straight edges or oscillating beams of the paving machines. The adjacent slabs shall be completely separated from each other by providing joint filler board. Space around the dowel bars, between the sub-base and the filler board shall be packed with a suitable compressible material to block the flow of cement slurry.

602.6.3. **Transverse construction joint:** Transverse construction joints shall be placed whenever concreting is completed after a day's work or is suspended for more than 30 minutes. These joints shall be provided at the regular location of contraction joints using dowel bars. The joint shall be made butt type. At all construction joints, steel bulk heads shall be used to retain the concrete while the surface is finished. The surface of the concrete laid subsequently shall conform to the grade and cross sections of the previously laid pavement. When positioning of bulk head/stop-end is not possible, concreting to an additional 1 or 2 m length may be carried out to enable the movement of joint cutting machine so that joint grooves may be formed and the extra 1 or 2 m length is cut out and removed subsequently after concrete has hardened.

602.6.4. Longitudinal joint

602.6.4.1. The longitudinal joints shall be saw cut as per details of the joints shown in the drawing. The groove may be cut after the final set of the concrete. Joints should be sawn to at least 1/3 the depth of the slab ± 5 mm as indicated in the drawing.

602.6.4.2. Tie bars shall be provided at the longitudinal joints as per dimensions and spacing shown in the drawing and in accordance with Clause 602.6.6.

602.6.5. Dowel bars

602.6.5.1. Dowel bars shall be mild steel rounds in accordance with Clause 602.2.6 with details/dimensions as indicated in the drawing and free from oil, dirt, loose rust or scale. They shall be straight, free of irregularities and burring restricting slippage in the concrete. The sliding ends shall be sawn or cropped cleanly with no protrusions outside the normal diameter of the bar. The dowel bar shall be supported on cradles/dowel chairs in pre-fabricated joint assemblies positioned prior to the construction of the slabs or mechanically inserted with vibration into the plastic concrete by a method which ensures correct placement of the bars besides full re-compaction of the concrete around the dowel bars.

602.6.5.2. Unless shown otherwise on the drawings, dowel bars shall be positioned at mid depth of the slab within a tolerance of ± 20 mm, and centered equally about intended lines of the joint within a tolerance of ± 25 mm. They shall be aligned parallel to the finished surface of the slab and to the centre line of the carriageway and to each other within tolerances given hereunder, the compliance of which shall be checked as per Clause 602.10.7.

(i) For bars supported on cradles prior to the laying of the slab:

  (a) All bars in a joint shall be within ± 3 mm per 300 mm length of bar

  (b) 2/3rd of the bars shall be within ± 2mm per 300 mm length of bar

  (c) No bar shall differ in alignment from an adjoining bar by more than 3 mm per 300 mm length of bar in either the horizontal or vertical plane

  (d) Cradles supporting dowel bar shall not extend across the line of joint i.e. no steel bar of the cradle assembly shall be continuous across the joint.

(ii) For all bars inserted after laying of the slab:

  (a) Twice the tolerance for alignment as indicated in (i) above

602.6.5.3 Dowel bars, supported on cradles in assemblies, when subject to a load of 110 N applied at either end and in either the vertical or horizontal direction (upwards and downwards and both directions horizontally) shall conform to be within the following limits:

(i) Two-thirds of the number of bars of any assembly tested shall not deflect more than 2 mm per 300 mm length of bar

(ii) The remainder of the bars in that assembly shall not deflect more than 3 mm per 300 mm length of bar.

602.6.5.4.The assembly of dowel bars and supporting cradles, including the joint filler board in the case of expansion joints, shall have the following degree of rigidity when fixed in position:-

(i) For expansion joints, the deflection of the top edge of the filler board shall be not greater than 13 mm, when a load of 1.3 kN is applied perpendicular to the vertical face of the joint filler board and distributed over a length of 600 mm by means of a bar or timber packing, at mid depth and midway between individual fixings, or 300 mm from either end of any length of filler board, if a continuous fixing, is used. The residual deflection after removal of the load shall be not more than 3 mm.

(ii) The joint assembly fixings to sub-base shall not fail under the 1.3 kN load applied for testing the rigidity of the assembly but shall fail before the load reaches 2.6 kN

(iii) The fixings for contraction joint shall not fail under 1.3 kN load and shall fail before the load reaches 2.6 kN when applied over a length of 600 mm by means of a bar or timber packing placed as near to the level of the line of fixings as practicable.

(iv) Fixings shall be deemed to fail when there is displacement of the assemblies by more than 3mm with any form of fixing, under the test load. The displacement shall be measured at the nearest part of the assembly to the centre of the bar or timber packing.

602.6.5.5 The free portion of dowels shall be painted with two coats of bituminous emulsion. The unpainted portion of the dowels shall be located in the initially placed concrete slab.

602.6.5.6. For expansion joints, a closely fitting cap 100 mm long consisting of waterproofed card board or an approved synthetic material like PVC or GI pipe shall be placed over the sheathed end of each dowel bar. An expansion space at least equal in length to the thickness of the joint filler board shall be formed between the end of the cap and the end of the dowel bar by using compressible sponge. To block the entry of cement slurry between dowel and cap it may be taped.

602.6.6. Tie bars

602.6.6.1. Tie bars in longitudinal joints shall be deformed steel bars of strength 415 MPa complying with IS:1786 and in accordance with the requirements given below. The bars shall be free from oil, dirt, loose rust and scale.

602.6.6.2. Tie bars projecting across the longitudinal joint shall be protected from corrosion for 75 mm on each side of the joint by a protective coating of bituminous paint with the approval of the Engineer. The coating shall be dry when the tie bars are used.

602.6.6.3. Tie bars in longitudinal joints shall be made up into rigid assemblies with adequate supports and fixings to remain firmly in position during the construction of the slab. Alternatively, tie bars at longitudinal joint may be mechanically or manually inserted into the plastic concrete from above by vibration using a method which ensures correct placement of the bars and recompaction of the concrete around the tie bars.

602.6.6.4 Tie bars shall be positioned to remain within the middle third of the slab depth as indicated in the drawings and approximately parallel to the surface and approximately perpendicular to the line of the joint, with the centre of each bar on the intended line of the joints within a tolerance of ± 50 mm, and with a minimum cover of 30 mm below the joint groove.

602.7. Weather and Seasonal Limitations

602.7.1. Concrete during monsoon months: When concrete is being placed during monsoon months and when it may be expected to rain, sufficient supply of tarpaulin or other water proof cloth shall be provided along the line of the work. Any time when it rains, all freshly laid concrete which had not been covered for curing purposes shall be adequately protected. Any concrete damaged by rain shall be removed and replaced. If the damage is limited to texture, it shall be retextured in accordance with the directives of the Engineer.

602.7.2. Concreting in hot weather: No concreting shall be done when the concrete temperature is above 30 degree Centigrade. Besides, in adverse conditions like high temperature, low relative humidity, excessive wind velocity, imminence of rains etc., if so desired by the Engineer, tents on mobile trusses may be provided over the freshly laid concrete for a minimum period of 3 hours as directed by the Engineer. The temperature of the concrete mix on reaching the paving site shall not be more than 30^{o}C. To bring down the temperature, if necessary, chilled water or ice flakes should be made use of.

No concreting shall be done when the concrete temperature is below 5 degree Centigrade and the temperature is descending.

602.8. Side Forms, Rails and Guide wires

602.8.1 Side forms and rails: All side forms shall be of mild steel of depth equal to the thickness of pavement or slightly less to accommodate the surface regularity of the sub-base. The forms can be placed on series of steel packing plates or shims to take care of irregularity of sub-base. They shall be sufficiently robust and rigid to support the weight and pressure caused by a paving equipment. Side forms for use with wheeled paving machines shall incorporate metal rails firmly fixed at a constant height below the top of the forms. The forms and rail shall be firmly secured in position by not less than 3 stakes/pins for each 3m length so as to prevent movement in any direction. Forms and rails shall be straight within a tolerance of 3 mm in 3m and when in place shall not settle excess of 1.5 mm in 3 m while paving is being done. Forms shall be cleaned and oiled immediately before each use. The forms shall be bedded on a continuous bed of low moisture content lean cement mortar or concrete and set to the line and levels shown on the drawings within tolerances ± 10 mm and ± 3 mm respectively. The bedding shall not extend under the slab and there shall be no vertical step between adjacent forms of more than 3 mm. The forms shall be got inspected from the Engineer for his approval before 12 hours on the day before the construction of the slab and shall not be removed until at least 12 hours afterwards.

602.8.2. At all times sufficient forms shall be used and set to the required alignment for at least 200 m length of pavement immediately in advance of the paving operations, or anticipated length of pavement to be laid within the next 24 hrs whichever is more.

602.8.3. **Use of guide wires**

602.8.3.1. Where slip form paving is proposed, a guide wire shall be provided along both sides of the slab. Each guide wire shall be at a constant height above and parallel to the required edges of the slab as described in the contract/drawing within a vertical tolerance of ± 3 mm. Additionally, one of the wires shall be kept at a constant horizontal distance from the required edge of the pavement as indicated in the contract/drawing within a lateral tolerance of ± 10 mm.

602.8.3.2. The guide wires shall be supported on stakes not more than 8 m apart by connectors capable of fine horizontal and vertical adjustment. The guide wire shall be tensioned on the stakes so that a 500 gram weight shall produce a deflection of not more than 20 mm when suspended at the midpoint between any pair of stakes. The ends of the guide wires shall be anchored to fixing point or winch and not on the stacks.

602.8.3.3. The stack shall be positioned and the connectors maintained at their correct height and alignment from 12 hours on the day before concreting takes place until 12 hours after finishing of the concrete. The guide wire shall be erected and tensioned the connectors at any section for at least 2 hours before concreting that section.

602.8.4. The Contractor shall submit to the Engineer for his approval of line and level, the stakes and connectors which are ready for use in the length of road to be constructed by 12 hours on the working day before the day of construction of slab. Any deficiencies noted by the Engineer shall be rectified by the Contractor who shall then re-apply for approval of the affected stakes. Work shall not proceed until the Engineer has given his approval. It shall be ensured that the stakes and guide wires are not affected by the construction equipment when concreting is in progress.

602.9. Construction

602.9.1 General: A systems approach may be adopted for construction of the pavement, and the Method Statement for carrying out the work, detailing all the activities including indication of time-cycle, equipment, personnel etc., shall be got approved from the Engineer before the commencement of the work. The above shall include the type, capacity and make of the batching and mixing plant besides the hauling arrangement and paving equipment. The capacity of paving equipment, batching plant as well as all the ancillary equipment shall be adequate for a paving rate of at least 300 m in one day.

602.9.2. Batching and mixing: Batching and mixing of the concrete shall be done at a central batching and mixing plant with automatic controls, located at a suitable place which takes into account sufficient space for stockpiling of cement, aggregates and stationary water tanks. This shall be, however, situated at an approved distance, duly considering the properties of the mix and the transporting arrangements available with the Contractor.

602.9.3. Equipment for proportioning of materials and paving

602.9.3.1. Proportioning of materials shall be done in the batching plant by weight, each type of material being weighed separately. The cement from the bulk stock may be weighed separately from the aggregates and water shall be measured by volume. Wherever properly graded aggregate of uniform quality cannot be maintained as envisaged in the mix design, the grading of aggregates shall be controlled by appropriate blending techniques. The capacity of batching and mixing plant shall be at least 25 per cent higher than the proposed capacity of the laying/paving equipment.

602.9.3.2. Batching plant and equipment:

(1) General- The batching plant shall include minimum four bins, weighing hoppers, and scales for the fine aggregate and for each size of coarse aggregate. If cement is used in bulk, a separate scale for cement shall be included. The weighing hoppers shall be properly sealed and vented to preclude dust during operation. Approved safety devices shall be provided and maintained for the protection of all personnel engaged in plant operation, inspection and testing. The batch plant shall be equipped with suitable non-resettable batch counter which will correctly indicate the number of batches proportioned.

(2) Bins and hoppers- Bins with minimum number of four adequate separate compartments shall be provided in the batching plant.

(3) Automatic weighing devices- Batching plant shall be equipped to proportion aggregates and bulk cement by means of automatic weighing devices using load cells.

(4) Mixers- Mixers shall be pan type, reversible type or any other mixer capable of combining the aggregates, cement, and water into a thoroughly mixed and uniform mass within the specific mixing period, and of discharging the mixture, without segregation. Each stationary mixer shall be equipped with an approved timing device which will automatically lock the discharge lever when the drum has been charged and release it at the end of the mixing period. The device shall be equipped with a bell or other suitable warring device adjusted to give a clearly audible signal each time the lock is released. In case of failure of the timing device, the mixer may be used for the balance of the day while it is being repaired, provided that each batch is mixed 90 seconds or as per the manufacturer's recommendation. The mixer shall be equipped with a suitable non-resettable batch counter which shall correctly indicate the number of batches mixed.

The mixers shall be cleared at suitable intervals. The pickup and throw-over blades in the drum or drums shall be repaired or replaced when they are worn down 20 mm or more. The Contractor shall (1) have available at the job site a copy of the manufacturer's design, showing dimensions and arrangements of blades in reference to original height and depth, or (2) provide permanent marks on blade to show points of 20 mm wear from new conditions. Drilled holes of 5 mm diameter near each end and at mid point of each blade are recommended. Batching Plant shall be calibrated in the beginning and thereafter at suitable interval not exceeding 1 month.

(5) Control cabin- An air-conditioned centralized control cabin shall be provided for automatic operation of the equipment.

602.9.3.3. Paving equipment: The concrete shall be placed with an approved fixed form or slip paver with independent units designed to (i) spread, (ii) consolidate, screed and float-finish, (iii) texture and cure the freshly placed concrete in one complete pass of the machine in such a manner that a minimum of hand finishing will be necessary and so as to

provide a dense and homogeneous pavement in conformity with the plans and Specifications. The paver shall be equipped with electronic controls to control/sensor line and grade from either or both sides of the machine.

Vibrators shall operate at a frequency of 8300 to 9600 impulses per minute under load at a maximum spacing of 60 cm. The variable vibration setting shall be provided in the machine.

602.9.3.4. Concrete saw: The Contractor shall provide adequate number of concrete saws with sufficient number of diamond-edge saw blades. The saw machine shall be either electric or petrol/diesel driven type. A water tank with flexible hoses and pump shall be made available in this activity on priority basis. The Contractor shall have at least one standby saw in good working condition. The concreting work shall not commence if the saws are not in working condition.

602.9.4. Hauling and placing of concrete

602.9.4.1. Freshly mixed concrete from the central batching and mixing plant shall be transported to the paver site by means of trucks/tippers of sufficient capacity and approved design in sufficient numbers to ensure a constant supply of concrete. Covers shall be used for protection of concrete against the weather. The trucks/tippers shall be capable of maintaining the mixed concrete in a homogeneous state and discharging the same without segregation and loss of cement slurry. The feeding to the paver is to be regulated in such a way that the paving is done in an uninterrupted manner with a uniform speed throughout the day's work.

602.9.4.2. Placing of concrete

Concrete mixed in central mixing plant shall be transported to the site without delay and the concrete which, in the opinion of the Engineer, has been mixed too long before laying will be rejected and shall be removed from the site. The total time taken from the addition of the water to the mix, until the completion of the surface finishing and texturing shall not exceed 120 minutes when concrete temperature is less than 25^{o}C and 90 minutes when the concrete temperature is between 25^{o}C to 30^{o}C. Trucks/tippers delivering concrete shall not run on plastic sheeting nor shall they run on completed slabs until after 28 days of placing the concrete. The Paver shall be capable of paving the carriageway as shown in the drawings, in a single pass and lift.

602.9.4.3. Where fixed form pavers are to be used, forms shall be fixed in advance as per Clause 602.8 of the Specifications. Before any paving is done, the site shall be shown to the Engineer, in order to verify the arrangement for paving besides placing of dowels, tie-bars etc., as per the relevant Clauses of this Specification. The mixing and placing of concrete shall progress only at such a rate as to permit proper finishing, protecting and curing of the pavement.

602.9.4.4. In all cases, the temperature of the concrete shall be measured at the point of discharge from the delivery vehicle.

602.9.4.5. The addition of water to the surface of the concrete to facilitate the finishing operations will not be permitted except with the approval of the Engineer when it shall be applied as a mist by means of approved equipment.

602.9.4.6. If considered necessary by the Engineer, the paving machines shall be provided with approved covers to protected the surface of the slab under construction from direct sunlight and rain or hot wind.

602.9.4.7. While the concrete is still plastic, its surface shall be brush textured in compliance with Clause 602.9.8 and the surface and edges of the slab cured by the application of a sprayed liquid curing membrane in compliance with Clause 602.9.9. After the surface texturing, but before the curing compound is applied, the concrete slab shall be marked with the chainage at every 100 m interval.

602.9.4.8. As soon as the side forms are removed, edges of the slabs shall be corrected wherever irregularities have occurred by using fine concrete composed of one part of cement to 3 parts of fine chips and fine aggregate under the supervision of the Engineer.

602.9.4.9. If the requirement of Clause 902.4. for surface regularity fails to be achieved on two consecutive working days, then normal working shall cease until the cause of the excessive irregularity has been identified and remedied.

602.9.5. Construction by fixed form paver

602.9.5.1. The fixed form paving train shall consist of separate powered machines which spread, compact and finish the concrete in a continuous operation.

602.9.5.2. The concrete shall be discharged without segregation into a hopper spreader which is equipped with means for controlling its rate of deposition on to the sub base. The spreader shall be operated to strike off concrete up to a level requiring a small amount of cutting down by the distributor of the spreader. The distributor of spreader shall strike off the concrete to the surcharge adequate to ensure that the vibratory compactor thoroughly compacts the layer. If necessary, poker vibrators shall be used adjacent to the side forms and edges of the previously constructed slab. The vibratory compactor shall be set to strike off the surface slightly high so that it is cut down to the required level by the oscillating beam. The machine shall be capable of being rapidly adjusted for changes in average and differential surcharge necessitated by changes in slab thickness or cross fall. The final finisher shall be able to finish the surface to the required level and smoothness as specified, care being taken to avoid bringing up of excessive mortar to the surface by overworking.

602.9.6. Construction by slip form paver

602.9.6.1. The slip form paving train shall consist of power machine which spreads, compacts and finishes the concrete in a continuous operation. The slip form paving machine shall compact the concrete by internal vibration and shape it between the side forms with either a conforming plate or by vibrating and oscillating finishing beams. The concrete shall be deposited without segregation in front of slip form paver across the whole width and to a height which at all times is in excess of the required surcharge. The deposited concrete shall be struck off to the necessary average and differential surcharge by means of the strike off plate or a screw auger device extending across the whole width of the slab. The equipment for striking-off the concrete shall be capable of being rapidly adjusted for changes of the average and differential surcharge necessitated by change in slab thickness or cross fall.

602.9.6.2. The level of the conforming plate and finishing beams shall be controlled automatically from the guide wires installed as per Clause 602.8 by sensors attached at the four

corners of the slip form paving machine. The alignment of the paver shall be controlled automatically from the guide wire by at least one set of sensors attached to the paver. The alignment and level of ancillary machines for finishing, texturing and curing of the concrete shall be automatically controlled relative to the guide wire or to the surface and edge of the slab.

602.9.6.3. Slip-form paving machines shall have vibrators of variable output, with a maximum energy output of not less than 2.5 KW per metre width of slab per 300 mm depth of slab for a laying speed upto 1.5 m per minute or pro-rata for higher speeds. The machines shall be of sufficient mass to provide adequate reaction during spreading and paving operations on the traction units to maintain forward movements during the placing of concrete in all situations.

602.9.6.4. If the edges of the slip formed slab slump to the extent that the surface of the top edge of the slab does not comply with the requirements of Clause 602.14, then special measures approved by the Engineer shall be taken to support the edges to the required levels and work shall be stopped until such time as the Contractor can demonstrate his ability to slip form the edges to the required levels.

602.9.7. Construction by hand-guided method: Areas in which hand-guided methods of construction become indispensable shall be got approved by the Engineer in writing in advance. Such work may be permitted only in restricted areas in small lengths. Work shall be carried out by skilled personnel as per methods approved by the Engineer. The acceptance criteria regarding level, thickness, surface regularity, texture, finish, strength of concrete and all other quality control measures shall be the same as in the case of machine laid work.

602.9.8. Surface texture

602.9.8.1. After the final regulation of the slab and before the application of the curing membrane, the surface of concrete slab shall be brush-textured in a direction at right angles to the longitudinal axis of the carriageway.

602.9.8.2. The brushed surface texture shall be applied evenly across the slab in one direction by the use of a wire brush not less than 450 mm wide but longer brushes are preferred. The brush shall be made of 32 gauge tape wires grouped together in tufts spaced at 10 mm centres. The tufts shall contain an average of 14 wires and initially be 100 mm long. The brush shall have two rows of tufts. The rows shall be 20 mm apart and the tufts in one row shall be opposite the centre of the gap between tufts in the other row. The brush shall be replaced when the shortest tuft wears down to 90 mm long.

602.9.8.3. The texture depth shall be determined by the Sand Patch Test as described in Clause 602.12. This test shall be performed at least once for each day's paving and wherever the Engineer considers it necessary at times after construction as under:

Five individual measurements of the texture depth shall be taken at least 2 m apart anywhere along a diagonal line across a lane width between points 50 m apart along the pavement. No measurement shall be taken within 300 mm of the longitudinal edges of a concrete slab constructed in one pass.

602.9.8.4. Texture depths shall not be less than the minimum required when measurements are taken as given in Table 600-2 nor greater than a maximum average 1.25 mm.

TABLE : 600-2 Texture Depth

	Time of Test	Number of Measurements	Required Texture Depth (mm)	
			Specified Value	Tolerance
1.	Between 24 hours and 7 days after the const., of the slab or until the slab is first used by vehicles.	An average of 5 measurements	1.00	∀0.25
2.	Not later than 6 weeks before the road is opened to public traffic.	An average of 5 measurements	1.00	+0.25 -0.35

602.9.8.5. After the application of the brushed texture, the surface of the slab shall have a uniform appearance.

602.9.8.6. Where the texture depth requirements are found to be deficient, the Contractor shall make good the texture across the full lane width over length directed by the Engineer, by retexturing the hardened concrete surface in an approved manner.

602.9.9. Curing

602.9.9.1. Immediately after the surface texturing, the surface and sides of the slab shall be cured by the application of approved resin-based aluminized reflective curing compound which hardens into an impervious film or membrane with the help of a mechanical sprayer.

Curing compounds shall contain sufficient flake aluminum in finely divided dispersion to produce a complete coverage of the sprayed surface with a metallic finish. The compound shall become stable and impervious to evaporation of water from the surface of the concrete within 60 minutes of application and shall be of approved type. The curing compounds shall have a water retention efficiency index of 90 per cent in accordance with BS Specification No. 7542.

602.9.9.2. The curing compound shall not react chemically with the concrete and the film or membrane shall not crack, peel or disintegrate within three weeks after application. Immediately prior to use, the curing compound shall be thoroughly agitated in its containers. The rate of spread shall be in accordance with the manufacturer's instructions checked during the construction of the trial length and subsequently whenever required by the Engineer. The mechanical sprayer shall incorporate an efficient mechanical device for continuous agitation and mixing of the compound during spraying.

602.9.9.3. In addition to spraying of curing compound, the fresh concrete surface shall be protected for at least 3 hours by covering the finished concrete pavement with tents as described in Clause 602.7.2, during adverse weather conditions as directed by the Engineer. After three hours, the pavement shall be covered by moist hessian and the same shall then be kept damp for a minimum period of 14 days after which time the hessian may be removed. The hessian shall be kept continuously moist. All damaged/torn hessian shall be removed and replaced by new hessian on a regular basis.

602.9.9.4. The Contractor shall be liable at his expense to replace any concrete damaged as a result of incomplete curing or cracked on a line other than that of a joint.

602.9.10 Reinforcement

Reinforcement shall be in accordance with Sub-Clause 602.2.6. Reinforcement shall be placed prior to pouring of the concrete using wiring and bar chairs, in the arrangement indicated in the drawings. The wiring and bar chairs shall be sufficient to prevent distortion of the reinforcement during placement of the concrete.

602.10. Trial Length

602.10.1.

602.10.2. The Contractor shall demonstrate the materials, plant, equipment and methods of construction that are proposed for concrete paving, by first constructing a trial length of slab, at least 60 m but not more than 300 m long for mechanized construction and at least 30 m long for hand guided methods. If the first trial is unsatisfactory, the Contractor shall have to demonstrate his capability to satisfactorily construct the pavement in subsequent trials.

602.10.3. The trial length shall be constructed in two parts over a period comprising at least part of two separate working days, with a minimum of 30 m constructed each day for mechanised construction and a minimum of 15 m on each day for hand guided construction. The trial length shall be constructed at a similar rate (speed, around 1m/hr) to that which is proposed for the main work.

602.10.4. Transverse joints and longitudinal joints of each type that are proposed for dowel-jointed unreinforced concrete slabs in the main work shall be constructed and assessed in the trial length. If in the trial length the construction of expansion joint and longitudinal joint is not demonstrated, the first 2 expansion joints and at least the first 150 m of longitudinal construction joint for mechanized paving in the main work, shall be considered as the trial length for these joints.

602.10.5. The trial length shall comply shall the Specification in all respects, with the following additions and exceptions:

602.10.5.1. Surface levels and regularity

(i) In checking for compliance with Clause 903.5 the levels shall be taken at intervals at the locations specified in this Clause along any line or lines parallel to the longitudinal centre line of the trial length.

(ii) The maximum number of permitted irregularities of pavement surface shall comply with the requirements of Clause 902.4. Shorter trial lengths shall be assessed pro-rata based on values for a 300 m length.

602.10.5.2. Joints

(iii) Alignment of dowel bars shall be inspected as described in Clause 602.10.7 in any two consecutive transverse joints. If the position or alignment of the dowel bars at one of these joints does not comply with Clause 602.6.5, if that joint remains the only one that does not comply after the next 3 consecutive joints of the same type have been inspected, then the method of placing dowels shall be deemed to be satisfactory. In order to check sufficient joints for dowel bar alignment without extending the trial length unduly, the Contractor may, by agreement with the Engineer, construct joints at more frequent joint intervals than the normal spacing required in the Contract.

(iv) If there are deficiencies in the first expansion joint that is constructed as a trial, the next expansion joint shall be a trial joint. Should this also be deficient, further trial expansion joints shall be made as part of the trial length which shall not form part of the permanent works, unless agreed by the Engineer.

602.10.5.3. Density

(v) Density shall be assessed as described in Clause 602.3.3. from at least 3 cores drilled from each part of the trial length.

602.10.5.4. Position of tie bars

(vi) Compliance with Clause 602.6.6 for the position and alignment of tie bars shall be checked by drilling additional cores from the slab unless they can be determined from cores taken for density.

602.10.6. Approval and acceptance

602.10.6.1. Approval of the materials, plant, equipment and construction methods shall be given when a trial length complies with the Specification. The Contractor shall not proceed with normal working until the trial length has been approved and any earlier defective trial lengths have been removed, unless that can be remedied to the satisfaction of the Engineer. If the Engineer does not notify the Contractor of any deficiencies in any trial length within 10 days after the completion of that trial length, the Contractor may assume that the trial length, and the materials, plant, equipment and construction methods adopted are acceptable.

602.10.6.2. When approval has been given, the materials, plant, equipment and construction methods shall not thereafter be changed, except for normal adjustments and maintenance of plant, without the approval of the Engineer. Any changes in material, plant, equipment and construction methods shall entitle the Engineer to require the Contractor to lay a further trial length as described in this Clause to demonstrate that the changes will not adversely affect the permanent works.

602.10.6.3. Trial lengths which do not comply with the Specification, with the exception of areas which are deficient only in surface texture and which can be remedied in

accordance with Clause 602.9.8.6 shall be removed immediately upon notification of deficiencies by the Engineer and the Contractor shall construct a further trial length.

602.10.7. Inspection of dowel bars

602.10.7.1. Compliance with Clause 602.6.5. for the position and alignment of dowel bars at construction and expansion joints shall be checked by measurements relative to the side forms or guide wires.

602.10.7.2 When the slab has been constructed, the position and alignment of dowel bars and any filler board shall be measured after carefully exposing them in the plastic concrete across the whole width of the slab. When the joint is an expansion joint, the top of the filler board shall first be exposed sufficiently in the plastic concrete to permit measurement of any lateral or vertical displacement of the board. During the course of normal working, these measurements shall be carried out in the pavement section at the end of day=s work by extending slab length by 2 m. After sawing the transverse joint groove, the extended 2 m slab shall be removed carefully soon after concrete has set to expose dowels over half the length. These dowels can be tested for tolerances.

602.10.7.3 If the position and alignment of the bars in a single joint in the slab is unsatisfactory then the next two joints shall be inspected. If only one joint of the three is defective, the rate of checking shall be increased to one joint per day until the Engineer is satisfied that compliance is being achieved. In the event of non-compliance in two or more successive joints, the Contractor shall revert to the construction of fresh trial lengths and make any necessary alteration to concrete mix, paving plant or methods until the dowel bar position and alignment are satisfactory.

602.10.7.4. After the dowel bars have been examined, the remainder of the concrete shall be removed over a width of 500 mm on each side of the line of the joint and reinstated to the satisfaction of the Engineer. The dowels shall be inserted on both sides of the 1 m wide slab by drilling holes and grouting with epoxy mortar. Plastic sheath as per Clause 602.6.5.5 shall be provided on dowels on one of the joints. The joint groove shall be widened and sealed as per Clause 602.11.

602.11. Preparation and Sealing of Joint Grooves

602.11.1. General

All transverse joints in surface slabs shall be sealed using sealants described in Clause 602.2.8. Joints shall not be sealed before 14 days after construction.

602.11.2. Preparation of joint grooves for sealing

602.11.2.1. Joint grooves usually are not constructed to provide the minimum width specified in the drawings when saw cut joints are adopted. They shall be widened subsequently by sawing before sealing. Depth/width gauges shall be used to control the dimension of the groove.

602.11.2.2. If rough arises develop when grooves are made, they shall be ground to provide a chamfer approximately 5 mm wide. If the groove is at an angle up to 10 degree from the perpendicular to the surface, the overhanging edge of the sealing groove shall be sawn or ground perpendicular. If spelling occurs or the angle of the former is greater than 10 degrees, the joint sealing groove shall be sawn wider and perpendicular to the surface to encompass the defects up to a maximum width, including any chamfer, of 35 mm for transverse joints and 20 mm for longitudinal joints. If the spelling cannot be so eliminated then the arises shall be repaired by an approved thin bonded arris repair using cementations materials.

602.11.2.3. All grooves shall be cleaned of any dirt or loose material by air blasting with filtered, oil-free compressed air. If need arises the Engineer may instruct cleaning by pressurized water jets. Depending upon the requirement of the sealant manufacture, the sides of the grooves may have to be sand blasted to increase the bondage between sealant and concrete.

602.11.2.4 The groove shall be cleaned and dried at the time of priming and sealing.

602.11.2.5. Before sealing the temporary seal provided for blocking the ingress of dirt, soil etc., shall be removed. A highly compressible heat resistant paper-backed deboning strip as per drawing shall be inserted in the groove to serve the purpose of breaking the bond between sealant and the bottom of the groove and to plug the joint groove so that the sealant may not leak through the cracks. The width of debonding strip shall be more than the joint groove width so that it is held tightly in the groove. In the case of longitudinal joints, heat resistant tapes may be inserted to block the leakage through bottom of the joint.

602.11.3. Sealing with sealants

602.11.3.1. When sealants are applied, an appropriate primer shall also be used if recommended by the manufacturer and it shall be applied in accordance with their recommendation. The sealant shall be applied within the minimum and maximum drying times of the primer recommended by the manufacturer. Priming and sealing with applied sealants shall not be carried out when the naturally occurring temperature in the joint groove to be sealed is below 7^{o}C.

602.11.3.2. If hot applied sealant is used it shall be heated and applied from a thermostatically controlled, indirectly heated preferably with oil jacketed melter and pourer having recirculating pump and extruder. For large road projects, sealant shall be applied with extruder having flexible hose and nozzle. The sealant shall not be heated to a temperature higher than the safe heating temperature and not for a period longer than the safe heating period, as specified by the manufacturer. The dispenser shall be cleaned out at the end of each day in accordance with the manufacturer=s recommendations and reheated material shall not be used.

602.11.3.3 Cold applied sealants with chemical formulation like polysulphide may be used. These shall be mixed and applied within the time limit specified by the manufacturer. If primers are recommended they shall be applied neatly with an appropriate brush. The Movement Accommodation Factor (MAF) shall be more than 10 per cent

602.11.3.4. The sealants applied at contraction phase of the slabs would result in bulging of the sealant over and above the slab. Therefore, the Contractor in consultation with the Engineer, shall establish the right temperature and time for applying the sealant.

Thermometer shall be hung on a pole in the site for facilitating control during the sealing operation.

602.11.3.5. Sealant shall be applied, slightly to a lower level than the slab with a tolerance of 5 ∀ 2 mm.

602.11.3.6. During sealing operation, it shall be seen that no air bubbles are introduced in the sealant either by vapors or by the sealing process.

602.11.4. Testing of applied sealants: Manufacturer's certificate shall be produced by the Contractor for establishing that the sealant is not more than six months old and stating that the sealant complies with the relevant standard as in Clause 602.2.8. The samples shall meet the requirement of AASHTO M 282 for hot applied sealant or BS 5212 : (Part- 2) for cold applied sealant.

602.12. Measurement of Texture Depth - Sand Patch Method

602.12.1. The following apparatus shall be used:

(i) A cylindrical container of 25 ml internal capacity

(ii) A flat wooden disc 64 mm diameter with a hard rubber disc, 1.5 mm thick, stuck to one face, the reverse face being provided with a handle.

(iii) Dry natural sand with a rounded particle shape passing a 300 micron IS sieve and retained on a 150 micron IS sieve.

602.12.2. Method: The surface to be measured shall be dried, any extraneous mortar and loose material removed and the surface swept clean using a wire brush both at right angles and parallel to the carriageway. The cylindrical container shall be filled with the sand, tapping the base 3 times on the surface to ensure compaction, and striking off the sand level with the top of the cylinder. The sand shall be poured into a heap on the surface to be treated. The sand shall be spread over the surface, working the disc with its face kept flat in a circular motion so that the sand is spread into a circular patch with the surface depressions filled with sand to the level of peaks.

602.12.3. The diameter of the patch shall be measured to the nearest 5 mm. The texture depth of concrete surface shall be calculated from 31000/(DxD) mm where D is the diameter of the patch in mm.

602.13. Opening to Traffic

No vehicular traffic shall be allowed to run on the finished surface of a concrete pavement within a period of 28 days of its construction and until the joints are permanently sealed. The road may be opened to regular traffic after completion of the curing period of 28 days and after sealing of joints is completed including the construction of shoulder, with the written permission of the Engineer.

602.14. Tolerance for Surface Regularity, Level, Thickness and Strength

The tolerances for surface regularity, level, thickness and strength shall conform to the requirements given in Clause 903.5. Control of quality of materials and works shall be exercised by the Engineer in accordance with Section 900.

602.15.1. Measurements for Payment

602.15.1 Cement Concrete pavement shall be measured as a finished work in square metres with specified thickness. The volume to be paid for will be calculated on the basis of thickness and plans shown on the project drawings and adjusted for the deficiency in thickness. No additional payment shall be made for extra thickness of the slab. The full payment will be made to this item after 28 days strength of the concrete is found to be satisfactory.

The unit for measurement for concrete pavement shall be the cubic metre of concrete placed, based on the net plan areas for the specified thickness shown on the Drawings or directed by the Engineer. The rate shall include all provisions of this Specification and shall include the provision of all materials including polythene film, concrete, stock piling, mixing, transport, placing, compacting, finishing, curing together with all formwork, and including testing and submission of test certificates and records. No deduction shall be made in measurement for openings provided that the area of each is less than 0.5 sq.m. The unit rate as entered in the Bill of Quantities shall also include the full costs of contraction, expansion, construction, and longitudinal joints. It shall also include joint filler, keys, caulking rod, debonding strip, sealant primer, joint sealant.

602.15.2. Pavement thickness

All precautions and care shall be taken to construct pavement having uniform thickness as called for on the plans.

Thickness of the cement concrete pavement shall be calculated on the basis of level data of the cement concrete pavement and the underlying sub-base taken on a grid of 5 m x 3.5 m or 6.25 m x 3.5 m, the former measurement being in longitudinal direction.

A day=s work is considered as a ‘lot’ for calculating the average thickness of the slab. In calculating the average thickness, individual measurements which are in excess of the specified thickness by more than 10 mm shall be considered as the specified as thickness plus 10 mm.

Individual areas deficient by more than 25 mm shall be verified by the Engineer by ordering core cutting and if in his opinion the deficient areas warrant removal, they shall be removed and replaced with concrete of the thickness shown on the plans.

When the average thickness for the lot is deficient by the extent shown in Table 600-3, the Contract unit price will be adjust as per this Table..3

TABLE 600-3 PAYMENT ADJUSTMENT FOR DEFICIENCY IN THICKNESS

Deficiency in the average thickness of day=s work	Per cent of Contract unit price payable
Up to 5mm	100
6 –10 mm	87
11-15 mm	81
16 – 20 mm	75
21 –25 mm	70

In the stretch where deficiency of average thickness is more than 25 mm, the section whose thickness is deficient by 26 mm or more is identified with the help of cores. Such slabs shall be removed and reconstructed at the cost of the Contractor. During such rectification work, care shall be taken to replace full slab and to the full depth.

602.16. Rate

The Contract unit rate for the construction of the cement concrete shall be payment in full for carrying out the operations required for the different items of the work as per these Specifications including full compensation for all labour, tools, plant, equipments, testing and incidentals to complete the work as per Specifications, providing all materials to be incorporated in the work including all royalties, fees, storage, rents where necessary and all leads and lifts.

The separation membrane shall be measured and paid in accordance with Sub-Clause 508.4.14, 508.4.15 and 508.4.16. Reinforcement, dowel bars and tie rods shall be measured in tonnes. The Contract unit rate for reinforcement shall include dowel bars, tie rods and all items included in Clause 1609.

3. ROLLED CEMENT CONCRETE BASE

603.1. Scope

603.1.1. The work shall consist of construction of rolled concrete base course for cement concrete pavement in accordance with the requirements of these Specifications and in conformity with the lines, grades and cross sections shown on the drawings or as directed by the Engineer. The work shall include furnishing of all plant and equipment, material and labour and performing all operations in connection with the work, as approved by the Engineer.

603.1.2. The design parameters of rolled cement base course viz., width, thickness, grade of concrete, details of joints, if any, etc. shall be as stipulated in the contract drawings.

603.2. Materials

603.2.1. Source of materials: The Contractor shall indicate to the Engineer the source of all materials to be used in the lean concrete work with relevant test data sufficiently in advance and the approval of the Engineer for the same shall be obtained at least 60 days before the scheduled commencement of the work. If the Contractor later proposes to obtain the materials from a different source, he shall notify the Engineer for his approval at least 60 days before such materials are to be used.

603.2.2. Cement: Any of the following types of cement may be used with prior approval of the Engineer.

(i)	Ordinary Portland Cement	IS : 269, 8112 or 12269
(ii)	Portland Slag Cement	IS : 455
(iii)	Portland Pozzolana Cement	IS : 1489

If the sub grade is found to consist of soluble sulphates in a concentration more than 0.5 per cent, cement used shall be sulphate resistant and shall conform to IS : 12230. Cement to be used may preferably be obtained in bulk form. It shall be stored in accordance with stipulations contained in Clause 1014 and shall be subjected to acceptance test prior to its immediate use.

603.2.3. Aggregates:

603.2.3.1. Aggregates for lean concrete shall be natural material complying with IS : 383. The aggregates shall not be alkali reactive. The limits of deleterious materials shall not exceed the requirements set out in IS : 383. In case the Engineer considers that the aggregates are not free from dirt, the same may be washed and drained for at least 72 hours before batching as directed by the Engineer.

603.2.3.2. Coarse aggregate: Coarse aggregates shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone or crushed gravel and shall be devoid of pieces of disintegrated stone, soft, flaky, elongated, very angular or splintery pieces. The maximum size of the coarse aggregate shall be 25 mm. The coarse aggregate shall comply with the Clause 602.2.4.2.

603.2.3.3. Fine aggregate: The fine aggregate shall consist of clean natural sand or crushed stone sand or a combination of the two and shall conform to IS : 383. Fine aggregate shall be free from soft particles, clay, shale, loam, cemented particles, mica, organic and other foreign matter. The fine aggregate shall comply with the Clause 602.2.4.3.

603.2.3.4 The coarse and fine aggregates may be obtained in either of the following manner:-

(i) In separate nominal sizes of coarse and fine aggregates and mixed together intimately before use.

(ii) Separately as 25 mm nominal single size, 12.5 mm nominal size graded aggregate and fine aggregate of crushed stone dust or sand or a combination of these two.

The material after blending shall conform to the grading as indicated in Table 600-4 below:

TABLE 600-4. AGGREGATE GRADATION FOR DRY LEAN CONCRETE

Sieve Designation	Percentage Passing the sieve by weight
37.5 mm	100
19.0 mm	80-100
9.5 mm	55 –80
4.75 mm	35 –60
600 micron	10 – 35

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 (hat 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, Sub grade 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)]: 2 tests per 4500 cubic metres of soil.

b) Plasticity Test [IS: 2720 (Part-5)]: Each type to be tested, 2 tests per 4500 cub. metres of soil.

c) Density Test [IS: 2720 (Part 8)]: Each soil type to be tested, 2 tests per 4500 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 subgradc on soaked/unsoaked samples [IS: 2720 (Part-16)]: One CBR test for every 4500 cu. m. atleast 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 6 (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 shall be atleast 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.Theevaluation 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 stabilised soil and distribution of stabiliser content shall be subject to the condition that the mean value is not less than the specified value plus:

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

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 :

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

901 GENERAL

901.1 All materials to be used, all methods to be adopted and all works to be performed shall be strictly in accordance with the requirements of these Specifications. The Contractor shall set up a field laboratory at locations approved by the Engineer and equip the same with adequate equipment and personnel in order to carry out Quality Control for works and all the required tests as per Specifications and/or as directed by the Engineer. The provision and maintenance of the laboratory shall be as per Clause 120 and/or as directed by the Engineer. The list of equipment and the facilities to be provided shall be got approved from the Engineer in advance.

901.2 The Contractor's laboratory shall be manned by a qualified Materials Engineer/Civil Engineer assisted by experienced technicians, and the set-up should be got approved by the Engineer.

901.3 The Contractor shall carry out quality control tests on the materials and work to the frequency stipulated in subsequent paragraphs. In the absence of clear indications about method and or frequency of tests for any item, the instructions of the Engineer shall be followed.

901.4 For satisfying himself about the quality of the materials and work, quality control tests will also be conducted by the Engineer (by himself, by his Quality Control Units or by any other agencies deemed fit by him), generally to the frequency set forth hereunder. Additional tests may also be conducted where, in the opinion of the Engineer, need for such tests exists.

901.5 The Contractor shall provide necessary co-operation and assistance in obtaining the samples for tests and carrying out the field tests as required by the Engineer from time to time. This shall include provision of laboratory equipment, transport, consumables, personnel including labour attendants, assistants in packing and dispatching and any other assistance considered necessary in connection with the tests.

901.6 For the work of embankment, subgrade and pavement, construction of subsequent layer of same or other material over the finished layer shall be done after obtaining permission from the Engineer. Similar permission from the Engineer shall be obtained in respect of all other items of works prior to proceeding with the next stage of construction.

901.7 The Contractor shall carry out modifications in the procedure of work, if found necessary, as directed by the Engineer. Works falling short of quality shall be rectified/ redone by the Contractor at his own cost, and defective work shall also be removed from the site of works by the Contractor at his own cost.

901.8 The cost of laboratory building including essential supplies like water, electricity, sanitary services and their maintenance and cost of all equipment, tools, materials,

labour and incidentals to perform tests and other operations of quality control according to the Specification requirements shall be deemed to be incidental to the work and no payment shall be made for the same. If, however, there is a separate item in the Bill of Quantities for setting up of a laboratory and installing testing equipment, such work shall be paid for separately.

901.9 For testing of soils/soil mixes, granular materials and mixes, bituminous materials and mixes, cement concrete materials and mixes, aggregates, cores etc., samples in the required quantity and form shall be supplied by the Contractor at his own cost.

901.10 For cement, bitumen, steel, emulsion, road marking paint, sign boards, geo-synthetics and similar other materials where essential tests are to be carried out in the presence of Engineer at the manufacturer's plants or at laboratories other than the site laboratory, the cost of samples, sampling, testing and furnishing of test certificates shall be borne by the Contractor.

Manufacturer's test certificate together with invoice or delivery challan shall be furnished for every lot of supply apart from tests to be conducted at site laboratory for prime properties of the material like cement, bitumen, etc. Where facilities for testing of materials are not available at site laboratory the same shall be tested at an outside laboratory in the presence of the Engineer. For specialized items such as sign boards, road marking paint, etc. the Engineer may order for third party test from an approved laboratory.

901.11 The method of sampling and testing of materials shall be in accordance with the requirements of the relevant Indian Standards and these Specifications. Where they are contradicting, the provisions in these Specifications shall be followed. Where they are silent, sound engineering practices shall be adopted. The sampling and testing procedure to be used shall be as approved by the Engineer and his decision shall be final and binding on the Contractor. The cost of all tests shall be borne by the Contractor.

901.12 The materials for embankment construction shall be got approved from the Engineer. The responsibility for arranging and obtaining the land for borrowing or exploitation in any other way shall rest with the Contractor who shall ensure smooth and uninterrupted supply of materials in the required quantity during the construction period.

Similarly, the supply of aggregates and other materials for construction shall be from sources approved by the Engineer. Responsibility for arranging uninterrupted supply of materials from the source shall be that of the Contractor.

901.13 Defective Materials

All materials which the Engineer has determined as not conforming to the requirements of the Contract shall be rejected whether in place or not; they shall be removed immediately

from the site as directed. Materials, which have been subsequently corrected, shall not be used in the work unless approval is accorded in writing by the Engineer. Upon failure of the Contractor to comply with any instruction of the Engineer, the Engineer shall have authority to cause the removal of rejected material and to deduct the removal cost thereof from any payments due to the Contractor.

901.14 Imported Materials

The Contractor shall furnish a list of materials/finished products manufactured, produced or fabricated outside India which he proposes to use in the work. The Contractor shall not be entitled to extension of time for acts or events occurring outside India and it shall be the Contractor's responsibility to make timely delivery to the job site of all such materials obtained from outside India.

The materials imported from outside India shall conform to the relevant Specifications of the Contract. In case where materials/finished products are not covered by the Specifications in the Contract, the details of laboratories/establishments where tests are to be carried out shall be specifically brought out and agreed to in the Contract.

The Contractor shall furnish to the Engineer a certificate of compliance of the tests carried out. In addition, certified mill test reports clearly identified in the lot of materials shall be furnished at the Contractor's cost.

902 CONTROL OF ALIGNMENT, LEVEL AND SURFACE REGULARITY

902.1 General

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

902.2 Horizontal Alignment

Horizontal alignment shall be reckoned with respect to the centre line of the carriageway as shown on the drawings. The edges of the carriageway as constructed shall be correct within a tolerance of ± 10 mm therefrom. The corresponding tolerance for edges of the roadway and lower layers of pavement shall be ± 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

902.4 Surface Regularity of Pavement Courses

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

	Surfaces of Carriageways and Paved Shoulders				Surfaces of Laybys, Service Areas and all Bituminous Base Courses			
Irregularity	4 mm		7 mm		4 mm		7 mm	
Length (m)	300	75	300	75	300	75	300	75
Number of Surface Irregularities on National Highways/ Expressways*	15	9	2	1	40	18	4	2
Number of Surface Irregularities on 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 straight-edge when placed parallel with, or at right angles to the centre line of the road at points decided by the Engineer shall be:

for pavement surface (bituminous and cement concrete)	3 mm
for bituminous base courses	6 mm
for granular sub-base/base courses	8 mm
for sub-bases under concrete pavements	10 mm
for subgrade	15 mm

902.5 Rectification

Where the surface regularity of subgrade and the various pavement courses fall outside the specified tolerances in Clause 902.4, the Contractor shall be liable to rectify these in the manner described below and to the satisfaction of the Engineer.

i) **Subgrade:** Where the surface is high, it shall be trimmed and suitably compacted. Where the same is low, the deficiency shall be corrected by scarifying the lower layer and adding fresh material and recompacting to the required density. 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.

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 recompacted as per 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.

iv) **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 recompacted as per Clause 404 in the case of Water Bound Macadam and to Clause 406 in the case of Wet Mix Macadam.

v) **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 recompacting as per specifications. Where the surface is high, the extra thickness in the affected layer shall be removed and replaced with fresh material and compacted to Specifications.

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.

vi) **Dry Lean Concrete Sub-Base:** The defective length of the course shall be removed to full depth and replaced with material conforming to **Clause 601**. The area treated shall be at least 3 m long, not less than 1 lane width and extend to the full depth. Before relaying the course, the disturbed subgrade or layer below shall be corrected by levelling, watering and compacting.

vii) **Cement Concrete Pavement:** The defective areas having irregularity exceeding 3 mm but not greater than 6 mm when tested with a 3 metre long straight edge may be rectified by scrabbling 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 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.

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 cost.

902.6 Riding Quality

The riding quality of bituminous concrete wearing surface, as measured by a standard towed fifth wheel bump integrator, shall not be more than 2000 mm per Km.

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 Clauses for the relevant items of work.

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.

Table 900-3 : Control Tests and their Minimum Frequency for Sub-Bases and Bases (Excluding Bitumen Bound Bases)

S. No.	Type of Construction	Test		Frequency (min.)
1)	Granular	i)	Gradation	One test per 400 cu.m
		ii)	Atterberg limits	One test per 400 cu.m
		iii)	Moisture content prior to compaction	One test per 400 cu.m
		iv)	Density of compacted layer	One test per 1000 sq.m
		v)	Deleterious constituents	As required
		vi)	CBR	As required
2)	Lime/Cement Stabilised Soil Sub-base	i)	Quality of lime/ cement	One test for each consignment subject to a minimum of one test per 5 tonnes
		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	One set of two tests per 500 sq.m
		vi)	Density of compacted layer	One set of two tests per 500 sq.m
		vii)	Deleterious constituents	As required
3)	Water Bound Macadam	i)	Aggregate Impact Value	One test per 1000 cu.m of aggregate
		ii)	Grading of aggregate	One test per 250 cu.m
		iii)	Combined Flakiness and Elongation Indices	One test per 500 cu.m of aggregate
		iv)	Atterberg limits of binding material	One test per 50 cu.m of binding material
		v)	Atterberg limits of screenings	One test per 100 cu.m of aggregate
4)	Wet Mix Macadam	i)	Aggregate Impact Value	One test per 1000 cu.m of aggregate
		ii)	Grading of aggregate	One test per 200 cu.m of aggregate
		iii)	Combined Flakiness and Elongation Indices	One test per 500 cu.m of aggregate
		iv)	Atterberg limits of portion of aggregate passing 425 micron sieve	One test per 200 cu.m of aggregate
		v)	Density of compacted layer	One set of three tests per 1000 sq.m

Table 900-4 : Control Tests for Bituminous Works and their Minimum Frequency

S. 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	Three tests per day
2)	Seal Coat/Surface Dressing	i)	Quality of Binder	Same as mentioned under Serial No. 1
		ii)	Aggregate Impact Value or Los Angeles Abrasion Value	One test per 200 cu.m of each source and whenever there is change in the quality of aggregate
		iii)	Combined Flakiness and Elongation Indices	One test per 100 cu.m of aggregate for each source and whenever there is change in the quality of aggregate
		iv)	Stripping value of aggregates (Immersion Tray Test)	One test of each source and whenever there is change in the quality of aggregate
		v)	Water absorption of aggregate	-do-
		vi)	Water sensitivity of mix	-do-
		vii)	Grading of aggregate	Two tests per day
		viii)	Soundness (Magnesium Sulphate/ Sodium Sulphate)	One test for each source and whenever there is change in the quality of aggregate
		ix)	Polished stone value (not applicable for SAM/SAMI)	-do-
		x)	Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	At regular intervals
		xi)	Rate of spread of materials	Same as mentioned under Serial No. 1
		(xii)	Percentage of fractured faces (When gravel is used)	One test per 100 cu.m of aggregate
3)	Open-graded Premix Surfacing/Close-graded Premix Surfacing	i)	Quality of binder	Same as mentioned under Serial No. 1
		ii)	Aggregate Impact Value or Los Angeles Abrasion Value	Same as mentioned under Serial No. 2
		iii)	Combined Flakiness and Elongation Indices	Same as mentioned under Serial No. 2
		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

S. No.	Type of Construction	Test		Frequency (min.)
		viii)	Soundness(Magnesium Sulphate and Sodium Sulphate)	Same as mentioned under Serial No. 2
		ix)	Polished stone value	Same as mentioned under Serial No. 2
		x)	Temperature of binder at application	At regular interval
		xi)	Binder content	Two tests per day per plant
		xii)	Percentage of fractured faces	Same as mentioned under Serial No. 2
4)	Bituminous Macadam	i)	Quality of binder	Same as mentioned under Serial No. 1
		ii)	Aggregate Impact Value or Los Angeles Abrasion Value	Same as mentioned under Serial No. 2
		iii)	Combined Flakiness and Elongation Indices	One test per 350 cu.m for each source
		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 Sulphate/ Sodium Sulphate)	Same as mentioned under Serial No. 2
		ix)	Percentage of fractured faces	Same as mentioned under Serial No. 2
		x)	Binder content	Same as mentioned under Serial No. 3
		xi)	Control of temperature of binder and aggregate for mix and of the mix at the time of laying and rolling	Same as mentioned under Serial No. 2
		xii)	Density of Comp layer	One test per 700 sq.m area
		xiii)	Rate of spread of Mixed Material	At regular intervals
5)	Dense Bituminous Macadam/Bituminous Concrete	i)	Quality of binder	Number of samples per lot and tests as per IS:73 or IRC:SP:53, IS:15462
		ii)	Aggregate Impact Value/ Los Angeles Abrasion Value	One test per 350 cu.m of aggregate for each source and whenever there is change in the quality of aggregate
		iii)	Flakiness and Elongation Indices	One test per 350 cu.m of aggregate for each source and whenever there is change in the quality of aggregate
		iv)	Soundness test (Sodium or Magnesium Sulphate test)	One test for each source and whenever there is change in the quality of aggregate
		v)	Water absorption of aggregates	One test for each source and whenever there is change in the quality of aggregate

S. No.	Type of Construction	Test		Frequency (min.)
		vi)	Sand equivalent test	One test for each source and whenever there is change in the quality of aggregate
		vii)	Plasticity Index	One test for each source and whenever there is change in the quality of aggregate
		viii)	Polished stone value	One test for each source and whenever there is change in the quality of aggregate
		ix)	Percentage of fractured face	One test per 350 cu.m of aggregate when crushed gravel is used
		x)	Mix grading	One set for individual constituent and mixed aggregate from dryer for each 400 tonnes of mix subject to minimum of two tests per day per plant
		xi)	Stability and voids analysis of mix including theoretical maximum specific of loose mix	Three tests for stability, flow value, density and void contents for each 400 tonnes of mix subject to minimum of two tests per day per plant
		xii)	Moisture Susceptibility of mix (AASHTO T283)	One test for each mix type whenever there is change in the quality or source of coarse or fine aggregate
		xiii)	Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	At regular intervals
		xiv)	Binder content	One set for each 400 tonnes of mix subject to minimum of two tests per day per plant
		xv)	Rate of spread of mix material	After every 5th truck load
		xvi)	Density of Compacted layer	One test per 700 sq.m area
6)	Sand Asphalt Base course	i)	Quality of binder	Same as mentioned under Serial No. 2
		ii)	Aggregate Impact Value or Los Angeles Abrasion Value	Same as mentioned under Serial No. 2
		iii)	Sand equivalent test	Same as mentioned under Serial No. 2
		iv)	Plasticity Index	Same as mentioned under Serial No. 5
		v)	Mix grading & binder content	Same as mentioned under Serial Nos. 2 and 3
		vi)	Stability of Mix	Same as mentioned under Serial No. 5
		vii)	Control of temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling	Same as mentioned under Serial No. 2
		viii)	Thickness of layer	Same as mentioned under Serial No. 5
		ix)	Density of Compacted layer	Same as mentioned under Serial No. 5

S. No.	Type of Construction	Test		Frequency (min.)
7)	Slury seal and Micro surfacing	i)	Quality of Aggregate Sand Equivalent Value Water Absorption Soundness Test (Sodium/ Magnesium Sulphate Test)	One per source/ site
		ii)	Quality of Emulsion	One per lot of 20 t as per IS:8887
		iii)	Aggregate Moisture	Two per day
		iv)	Aggregate Gradation	Two per day at site
		v)	Binder Content	Two per lane per Km
		vi)	Calibration of Machine	Once per Project
		vii)	Quantity of Slurry (By weight of aggregate)	Daily (Travel time of Machine)
8)	Stone Matrix Asphalt	i)	Quality of binder	Number of samples per lot and tests as per IS:73 or IRC:SP:53, IS:15462
		ii)	Aggregate Impact Value/ Los Angeles Abrasion Value	One test per 100 cu.m of aggregate
		iii)	Flakiness and Elongation Indices	One test per 100 cu.m of aggregate
		iv)	Soundness Test (Sodium and Magnesium Sulphate Test)	One test for each method for each source and whenever there is change in the quality of aggregate
		v)	Water absorption of aggregate	One test for each source and whenever there is change in the quality of aggregate
		vi)	Sand equivalent test	One test for each source
		vii)	Plasticity Index	One test for each source
		viii)	Polished stone value	One test for each source
		ix)	Percent of fractured faces	One test per 50 cu.m of aggregate when crushed gravel is used
		x)	Mix grading	One set for individual constituent and mixed aggregate from dryer for each 400 tonnes of mix subject to minimum of two tests per day per plant
		xi)	Air voids and VMA analysis of mix including theoretical maximum specific gravity of loose mix	Three tests per day
		xii)	Moisture Susceptibility of mix (AASHTO T 283)	One test for each mix type whenever there is change in the quality or source of coarse or fine aggregate
		xiii)	Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	At regular intervals

S. No.	Type of Construction	Test		Frequency (min.)
		(xiv)	Binder content	One set for each 400 tonnes of mix subject to minimum of two tests per day per plant
		(xv)	Rate of spread of mix material	After every 5th truck load
		(xvi)	Density of compacted layer	One test per 250 sq.m area
9)	Mastic asphalt	i)	Quality of binder	Same as mentioned under Serial No. 5
		ii)	Aggregate Impact Value and Los Angeles Abrasion Value	Same as mentioned under Serial No. 5
		iii)	Combined Flakiness and Elongation Indices	Same as mentioned under Serial No. 5
		iv)	Stripping value	Same as mentioned under Serial No. 2
		v)	Water Sensitivity of mix	Same as mentioned under Serial No. 5
		vi)	Grading of aggregates	Two tests per day per plant on the individual constituent and mixed aggregates from the dryer
		vii)	Water absorption of aggregates	Same as mentioned under Serial No. 5
		viii)	Soundness (Magnesium Sulphate/ Sodium Sulphate)	Same as mentioned under Serial No. 5
		ix)	Percentage of fractured faces	Same as mentioned under Serial No. 5
		x)	Binder content and aggregate grading	Same as mentioned under Serial No. 3
		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 check of layer thickness
		xiii)	Hardness number	Minimum two tests per day
10)	Recycled Material Grading of aggregate			Two tests per day
11)	Cold Mixes			All tests as per S. No.5
12)	Quality of Modified Binder			Number of samples per lot and tests as per IS:15462.
13)	Geotextiles			The requirements of Section 700 shall apply

Note : Daily, weekly, monthly reports on test results shall be prepared indicating the location of sampling and testing, deviation from the specified values for materials and works and remedial action taken in respect of removal of defective work shall certified be prepared by the Contractor. The test record shall be certified by the Engineer that these tests were done in his presence and testing carried as per prescribed methodology.

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 for every 3000 cum for each source:

a) Sand Content [IS:2720 (Part-4)]: 2 tests per 3000 cu.m of soil.

b) Plasticity Test [IS:2720 (Part-5)]: Each type to be tested, 2 tests.

c) Density Test [IS:2720 (Part-8)]: Each soil type to be tested, 2 tests.

d) Deleterious Content Test [IS:2720 (Part-27)]: As and when required by the Engineer.

e) Moisture Content Test [IS:2720 (Part-2)]: Two tests.

f) CBR Test on materials to be incorporated in the subgrade on soaked/ unsoaked samples [IS:2720 (Part-16)] : One CBR test (average of three specimens) 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 set of ten measurements of density for each 3000 sq.m of compacted area, or closer as required to yield the minimum number tests 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. If non-destructive tests are carried out, the number of tests shall be doubled. If considerable variations are observed between individual density results, the minimum number of tests in one set of measurement shall be increased. The acceptance criteria shall be subject to the condition that the mean density is not less than the specified density plus:

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

However, for earthwork in shoulders (earthen) and in the subgrade, at least one set of ten density measurements shall be taken for every 2000 sq.m for the compacted area 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.

Rajkot Urban Development Authority

Name of work:-

CONSTRUCTION OF ROAD FROM ANANDPAR BUS STAND TO AHMADABAD NATIONAL HIGHWAY (ANANDPAR MAIN ROAD) AT ANANDPAR VILLAGE IN RUDA

:: SCHEDULE - B ::

BILL OF QUANTITIES

Name of Work :- Construction of road from Anandpar bus stand to Ahmadabad National highway (Anandpar main road) at Anandpar village in Ruda					
Estimate-1:- Road Work					
Item No	**Quantity**	**Description of Item**	**Rate**	**Unit**	**Amount**
1	-	Dismantling structures (superstructure, substructure, foundation and other miscellaneous structures) and pavements including disposing of resulting materials and/or salvaging useful materials complete as per Technical Specification Clause 202 and section 2800 :	-	-	-
	840.00	a) a) Dismantling of Super Structure and using useful material in Foundation	276.00	CUM	231840.00
2	2321.55	Excavation of Foundation in Soft Rock from 0.0 mtr. to 1.50 mtr depth including lifting and laying in 90 mtr. lead area as instructed	220.80	Cum	512598.24
3	3794.00	Excavation of Foundation in Hard Murrum from 0.0 mtr. to 1.50 mtr depth including lifting and laying in 90 mtr. lead area as instructed	103.50	CUM	392679.00
4	2672.00	Supply & Laying of Soft Murrum	240.00	CUM	641280.00
5	2252.00	Construction of granular sub-base by providing close graded material, mixing in a mechanical mix plant at OMC, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density complete (Grade-I)	742.00	CUM	1670984.00
6	2213.00	Construction of dry lean cement concrete Sub- base over a prepared sub-grade with coarse and fine aggregate conforming to IS: 383, the size of coarse aggregate not exceeding 25 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per table 600-1, cement content not to be less than 150 kg/ cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, laid with a paver with electronic sensor, compacting with 8-10 tonnes vibratory roller, finishing and curing	2195.00	CUM	4857535.00

7	4290.00	Cement Concrete Pavement M-45 Construction of un-reinforced, dowel jointed, plain cement concrete pavement over a prepared sub base with 43 grade cement @ 400 kg per cum, coarse and fine aggregate conforming to IS 383, maximum size of coarse aggregate not exceeding 25 mm, mixed in a batching and mixing plant as per approved mix design, transported to site, laid with a fixed form or slip form paver, spread, compacted and finished in a continuous opeproportion including provision of contraction, expansion, construction and longitudinal joints, joint filler, separation membrane, sealant primer, joint sealant, debonding strip, dowel bar, tie rod, admixtures as approved, curing compound, finishing to lines and grades as per drawing	5091.00	CUM	21840390.00
8	100.00	VFZP;LP;LP :5G 5F.5 VF.PV[;P D]HAGF :8Fg00" WZFJTF V[GP5LPv# S,F; 5F.5 :8Fg00" ,\AF.GF GLR[D]HA 0FIFP GF SM,Z HM.g8 JF/F4 TDFD 8[1F4 lJDF4 8=Fg;5M8=[XG4 ,M0L\U VG,M0L\U ;FY[:8MZ VYJF ;F.8 5Z 5CM\RTF SZJF ;FY[T[DH H~ZL .g;5[SXG SZFJL VF5JF ;FY[;%,FI SFD TYF H~ZL X64 JF8F s;LPDMP 5|P !o! YLf SZL4 T[DH ,F.G ,[J, VG[U|[0DF\ H~ZL X6 ;FY[,[.\U4 HM.g8L\U4 SIMZL\U SZJF ;lCT Sd5,L8P PPP;NZPPP3__ DLPDLP 0FIFPGF V[GP5LPv# S,F; 5F.5	855.00	Rmt.	85500.00
9	670.00	Thermoplast painting work on CC Roads size 15-35 cm width including primer, material & labour	372.00	Sqmt	249240.00
10	350.00	Supply & Fixing of center Cat-eye	255.00	Nos.	89250.00
11	3715.00	Fixing of CC Precast Road Divider stone 0.50 x 0.35 x 0.18 cm including required material and labour (with colour)	171.00	Nos.	635265.00
				TOTAL AMOUNT RS:-	**3,12,06,561.00**

I am / we are willing to carry out the above mentioned work at…….. % (in figures)…….. (in words) percentage below /above the rates mentioned in Schedule B as above

Seal & Signature of Contractor:

Dy.Ex.Engineer
Rajkot Urban Development Authority

Director(Projects)
Rajkot Urban Development Authority