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NATIONAL HIGHWAYS AND INFRASTRUCTURE DEVELOPMENT CORPORTION LIMITED
(MINISTRY OF ROAD TRANSPORT & HIGHWAYS)
GOVT. OF INDIA

Consultancy Services for preparation of Feasibility Study and DPR for upgradation of Dergaon Town Section of NH-37 from Km 426.800 to Km. 437.800 in the state of Assam






Detailed Project Report

Volume - V
Technical Specification

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Revision : R2

VOYANTS
PARTNERING VISION

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Technical Specifications

The modifications proposed in this section are intended for improvement, removing ambiguity and to make the specification more user-friendly.

TECHNICAL SPECIFICATIONS

INTRODUCTION

The Works shall be executed in accordance with these Specifications which comprises the following Sections:

Part 1 - General Technical Specifications

Part 2 - Particular Technical Specifications

TECHNICAL SPECIFICATIONS

Part 1- General Technical Specifications

B1.1 Introduction

B1.1.1 Part-1 General Technical Specifications shall comprise the **"Specifications for Road and Bridge Works (Fifth Revision 2013) published by the Indian Roads Congress on behalf of the Government of India, Ministry of Road Transport and Highways (the "MoRT&H specifications").**

B1.1.2 Certain provisions of the MoRT&H Specifications are amended by Section B Part 2 – Particular Technical Specifications of this Specifications. In the event of conflict or discrepancies between the MoRT&H Specifications and the Particular Technical Specifications, the provisions of the Particular Technical Specifications shall prevail.

B1.1.3 Words like ' Contract', 'Contractor', 'Drawings', 'Works', 'Site', and 'Provisional Sum' used in the MoRT&H Specification shall have and shall be deemed to have the same meaning as understood from the definition of these terms in and as included in the Conditions of Contract.

B1.1.4 Words like 'Specifications', 'Technical Specifications', 'General Technical Specifications', 'Particular Technical Specifications' and 'Additional Technical Specifications' shall have and shall be deemed to have the same meaning as per Specifications Section B Part1 and Part 2.

B1.1.5 **These are intended for general guidance. DPR Consultants may customize for their respective project requirements.**

B1.1.6 Copies of the MoRT&H Specifications may be obtained from:

The Secretary General
Indian Roads Congress
Jamnagar House,
Shahjahan Road,
New Delhi
&
Sector 6, R.K. Puram,
Kama Koti Marg, New Delhi

SPECIFICATIONS SECTION B

Part 2 – Particular Technical Specifications

B.2.1 Introduction

B.2.1.1 This Part 2 – Particular Technical Specifications of Section B of the Specifications revises certain clauses of Part 1 – General Technical Specifications.

B2.1.2 All the amendments issued to the MoRT&H's "Specifications for Road and Bridge Works – Fifth Revision", shall apply to the relevant Clauses, otherwise as specified in this section.

B2.1.3 These revisions comprise substitutions, modifications or additions to clauses of the MoRT&H Specifications referred to in Part 1 - General Technical Specifications and accordingly the said specifications so amended shall form part of the Contract.

B2.1.4 In the absence of any definite provisions on any particular issue in the aforesaid specifications, reference may be made to the latest IRC Codes of Practice, IS Specifications along with their amendments or Indian Railway Codes in that order, failing which the construction and completion of works shall conform to sound engineering practice. In the event of ambiguities or inconsistencies arising out of the interpretation of the above, the decision of the Engineer shall be final and binding.

B2.1.5 The following list shows the Clauses of the MoRT&H Specifications, which are modified or added by this Particular Technical Specifications:

Section 100: 105, 106, 108, 109, 110,111 (Replaced as Specifications Section A), 112, 114, 115, 116 and 120
Section 200: 201 and 202
Section 300: 301, 304, 305, 306 and 315
Section 400: 401 and 406
Section 500: 501, 502, 503, 505 and 507
Section 800: 803, 804 and811
Section 900: 902
Section 1000: 1006, 1007, 1008, 1009, 1010, 1012 and 1014
Section 1400: 1402
Section 1500: 1501, 1502 and 1503
Section 1600: 1604, 1605, 1606 and 1607
Section 1700: 1701, 1703, 1705, 1706, 1708, 1709, 1711, 1712, 1713, 1717 and 1719
Section 2000: 2001 and 2005
Section 2200: 2204 and 2210
Section 2300: 2304
Section 2600: 2602
Section 2700: 2702 and 2706

Section 2800: 2802
Section 2900: 2902, 2910 and 2912
Section 3000: 3001, 3003 and 3004

B2.2 SECTION 100 GENERAL.

B2.2.1 CLAUSE 105 SCOPE OF WORK

B2.2.1.1 Sub Clause105.3

Add **the following to the** Sub Clause 105.3
The Contractor shall establish, adhere to, monitor and maintain an adequate quality assurance programme (QA-programme) based on the requirements of EN ISO 9001.

The QA-programme shall cover the quality assurance aspects of all services rendered, all items to be supplied and all construction activities to be performed under the Contract, also including temporary structures and equipment which will influence the quality of the completed works or the progress of the Contract.

The QA-programme shall as a minimum cover subjects listed below:

- Organization and Management Responsibility
- Document and data control
- Construction programme
- Method statements
- Process control
- Working, inspection, testing and documentation procedures
- Safety and emergency procedures
- Control and documentation of purchasing and handling of materials
- Product realization
- Non-conformity and corrective / preventive action
- Measurement, analysis and improvement
- Internal quality audits
- Servicing
- Education and training of staff
- Site Environmental Plan
- Competence / skill requirement for Human resources
- Customer communication

The QA-programme giving the general procedures shall be submitted to the Engineer not later than twenty-eight days after the date of receipt of letter of acceptance. Detailed procedures with respect to specific items of work shall be submitted successively prior to the commencement of such activity.

B2.2.1.2 Sub Clause105.5

Add **the following as** Sub Clause 105.11
Contractor shall take steps to minimize the negative impact of construction operations on environment.

Hot Mix Plants should be located at least 1-2 Km away from the nearest habitation unless otherwise required by statutory requirements. Vehicles and machinery used for road construction are to be regularly maintained to conform to SPCB (State Pollution Control Board) norms. Blasting as per Indian Explosive Act will be adopted. People living near such blasting site should have prior information of operation hours. Workers at blasting site will be provided with earplugs. Vehicle transporting earth materials will be covered. Water shall be spread to control the dust.

The Contractor will make arrangement to clean up the spoil as soon as the work finishes in a stretch. If such sites are located outside the ROW, restoration of the site to a level acceptable to the landowner will be done with in time period agreed between landowner and the Contractor. Spilling of oil and bituminous products during construction phase will be avoided to reduce the chances of contamination of surface as well as ground water. The construction camps shall be situated at places involving least risks of the nature considering the factors like ground slopes, underground water table and shall confirm to local building regulations, as applicable.

Construction camps shall be properly located to avoid contamination of water through wastewater drainage into river and canals. Seasonal pollution issues may arise when flow of river is slow. To prevent such contamination, wastewater generated at campsite will be discharged in soak pits. For human excreta, proper disposal facilities shall be available through Septic Tanks.

B2.2.2 CLAUSE 106 CONSTRUCTION EQUIPMENT

B2.2.2.1 Add the following sub Para (l) and (m) after sub Para (k):

l) Adequate standby equipment including spare parts shall be available.

m) All measuring devices and gauges shall be in good working condition. Measuring devices that can affect product quality shall be calibrated prior to use and at prescribed intervals against certified equipment. Calibration procedures shall be established, maintained and documented and corrective actions taken when results are unsatisfactory. Calibration of all measuring devices and gauges etc., which the Contractor intends to use in the contract, shall be calibrated from a competent/reputed authority/agency and the

frequency of the calibration shall be as directed by the Engineer. Accuracy and fitness of measuring devices shall be ensured by proper maintenance.

B2.2.4 CLAUSE 108 SITE INFORMATION

B2.2.4.1 Add the following as **Sub-clause 108.4:**

Identification of quarry sites, borrow areas and other sources of material is the responsibility of the Contractor. Material to be procured from quarry sites and borrow areas identified by the Contractor and to be used in the works shall be as per specifications for particular items of work. He shall satisfy himself that the required materials are available in adequate quantities and complying with the requirements of specifications. No claims shall be entertained on account of non-availability of materials, and increase in leads, etc.

As far as possible natural sand shall be used for sand/fine aggregates. If natural sand is not available within 100Km or Government has stopped sand mining, the Contractor shall obtain suitable alternative viz. crushed stone, crushed sand, etc. to substitute the natural sand. All alternative sand shall confirm to IS: 383 and tests for conformity shall be carried out as per IS: 2386 (Parts I to VIII). No separate payment will be made on account of non-availability of natural sand, arranging crusher sand and increase in leads, etc. It is the sole responsibility of the Contractor to arrange the quarries, borrow areas etc., on license / lease basis or otherwise, and study in detail before tendering, the scope of taking the quarry on lease. Advance information must be collected by the Contractor regarding the procedure laid down and the consequent delay in arranging the quarries on lease and must make alternative arrangement to procure the quarry products from lease holders. No separate payment will be made for arranging such quarries, borrow areas, etc."

B2.2.5 CLAUSE 109 SETTINGOUT

B2.2.5.1 **Sub Clause109.6 the Last Sentence of the first paragraph shall be** replaced **with following sentences**

The Contractor, in connection with the staking out of the centreline, shall survey the terrain along the road and cross sections at intervals 10m and 5m in Straight and Curve portions respectively as per the following guidelines.

1. Work request shall be given for joint inspection/survey for taking of "Original ground levels of road cross-sections" 7 days in advance before starting of site clearance.
2. Preliminary site clearance such as removal of shrubs and bushes has to be done without disturbing the original ground surface.
3. Joint survey shall be carried out and the "Original Ground levels (OGL)" along the road centre line and cross sections shall be taken jointly.

4. Engineer shall furnish Copy of the approved records of Centre line co-ordinates & OGL field books to the Employer for record.
5. The cost of these surveys, processing of survey data and preparation of cross-section drawings shall be deemed to be included in the rates and prices of items quoted by the Contractor in the Bill of Quantities.

B2.2.5.2 **Sub Clause109.7** Replace **the 1st sentence of the paragraph with the following**

After obtaining approval of the Engineer, work on site clearance can commence and the profile and cross sectional OGLs shall form the basis for measurements and payment.

B2.2.5.3 **Sub Clause109.8**Add **the following paragraph in Sub Clause 109.8 Surveying Equipment and Personnel**

The Contractor shall provide the necessary surveying equipment, accessories, surveyors and labourers required for setting out and related measurements, including making available these to the Engineer and his representatives at different stages of the work. The surveying equipment shall be of high standard of manufacture as approved by the Engineer, in good working condition with adequate numbers and shall include inter alia the following:

i. Precision automatic level with micrometer attachment with tripod and levelling staff reading to 5 mm accuracy by direct observation and to 1 mm accuracy by estimation or better
ii. Theodolite with tripod – Electronically operated with computerized output attachment reading to 20 seconds of angle accuracy or better.
iii. Total Station with 2 spare batteries and a charger, three tripods plus tangents sufficient for a 4 km range, together with an electronic data recorder, 6 data packs and all necessary software for operation.
iv. Precision staffs 4m & 5m type
v. 3 metre straight edge and measuring wedge fitted with handles, wedges 100 mm height and 1 mm accuracy.
vi. Field umbrellas
vii. Ranging rods 50 mm diameter 3 m long straight with a conical metallic shoe at one end and painted alternatively black and white at 300 mm C / C along the length.
viii. Camber templates 2 lane fitted with handles.
ix. Steel tape graduated in metres, centimetres and millimetres
    1. 10 m long
    2. 20m long
    3. 50m long
x. Reference markers and pegs
xi. Safety Jackets (Reflective)
xii. Bump Integrator (Wheel mounted)
xiii. Nails, chalk piece, paints, brushes etc,

The Contractor shall maintain the surveying equipment in good condition during the full duration of works and replace the ones, which get worn out or otherwise become unworkable.

The surveying equipment and related resources shall be provided under the general obligations of the Contractor requiring no separate payment

B2.2.6 CLAUSE 110 PUBLIC UTILITIES

B2.2.6.1 **Sub Clause110.1** Delete the first paragraph of **sub-clause 110.1 and** add **the following**

110.1 The information provided in the bid documents about public utilities like water/oil/gas pipelines, sewers, cables etc. may not be exhaustive, and it shall be the responsibility of the Contractor to ascertain the utilities that are likely to be affected by the works through site investigations and collection of information from the concerned utility owners:

B2.2.6.2 **Sub Clause110.3** Delete **sub-clause 110.3 and** add **the following**

110.3 Any utility likely to be affected by the Contractor's work shall be brought to the notice of the Engineer and such work shall be undertaken only after getting written clearance from the Engineer

B2.2.7 CLAUSE 111 PRECAUTIONS FOR SAFEGUARDING THE ENVIRONMENT

Delete Entire Clause and Sub-Clauses of 111 and replace with the following:

B2.2.7.1 **Sub Clause111.1** Delete **sub-clause 111.1 General and** add **the following sub-clause:**

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

NOISE:

The Contractor shall mitigate against any sustained increase in base line ambient Noise levels at sensitive receptors during construction of work.

All construction operations shall be performed in a manner to minimize noise and vibration. The parameters for noise are detailed below.

- 70 dB (A) for day and night;
- 50 dB (A) for day and 45 dB (A) for night for sensitive receptors

If the noise levels are found to be above these standards and it is determined by the Engineer that these levels are due to the equipment or plant being deployed by the Contractor, he shall undertake, at his own cost measures as approved by the Engineer, to bring these levels down to the specified levels. Blasting should be done as per Indian Explosive Act. People living near such blasting sites shall have prior information of operational hazards. Blasting will not be undertaken at night. Workers at blasting sites will be provided with earplugs. Material haulage roads will be properly regulated.

Labour shall be warned against the hunting of wild life, if any. No archaeological site shall be disturbed.

B2.2.7.2 **Sub Clause111.2** Delete **Sub-clause 111.2 Borrow pits for Embankment Construction and** add **the following sub-clause:**

Borrow pits shall not be dug within the Right-of-Way of the road. Arable lands will not be used for earth borrowing. The Contractor will ensure that proper excavation techniques are used to improve stability and safety of the borrow area. The excavation shall be carried out in such a way that the area does not inundate during monsoons or generate cesspools of water to become mosquito-breeding sites. The borrow pits shall not be left in a condition likely to cause hazard to human or animal life. The stipulations in Clause – 305.2.2 shall govern.

B2.2.7.3 **Sub Clause111.3** Delete **Sub-clause 111.3 Quarry Operations and** add **the following sub-clause:**

The Contractor shall obtain material from licensed quarries only after the consent of the Mining Department or other concerned authorities. The quarry operation shall be undertaken within the purview of the rules and regulations in force. The Contractor shall ensure scheduling the movement of transport carrying material to and from the site during non-peak hours. The trucks carrying all the dusty material, red earth, moorum and fly ash/ pond, ash shall be covered with a tarpaulin and provided with adequate free board to prevent spillage. End boards shall be provided in loaders to prevent spillage.

Stockpiling of material shall be properly planned so as to ensure that no traffic jam takes place on the highway.

B2.2.7.4 Delete **Sub Clause 111.5 and** Add **new Sub Clause111.5** Precautions against Dust

The Contractor shall take all reasonable steps to minimize dust nuisance during the construction of the works. All existing highways and roads used by vehicles of the Contractor or any of his sub-Contractors or suppliers of materials or plant, and similarly any new roads 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 material dropped by the said vehicles or their tyres. Similarly, all dust / or mud or other extraneous material from the works spreading on these highways shall be immediately cleared by the Contractor. 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, the road surface including haul road from Quarries and Plants shall be hosed or watered using suitable equipment to avoid dust pollution. Special care shall be taken to combat dust problem originating from use of fly ash/pond ash.

B2.2.7.5 Delete **Sub Clause 111.6** and Add **new Sub Clause111.6** Pollution from Hot Mix Plant, WMM Plant, Batching Plant & Crusher and Other Construction Machinery

The Contractor shall ensure the use of a relatively new, well maintained hot mix plant (batch type) so that any emission conforms to the CPCB norms and be fitted with a dust extraction unit to avoid prolonged engine powered equipment illness. Hot Mix Plant, WMM plant, Batching Plant & Crusher shall be located more than 500 m from any community or residence. The Contractor has to obtain necessary consent/clearance from State Pollution Control Board to operate Hot Mix Plant, WMM plant, Batching Plant, DG Set & Crusher before commencement of works.

All vehicles, equipment and machinery needed for construction will be regularly maintained to ensure that pollution emission levels conform to CPCB norms. All vehicles should be fitted with silencers.

Construction vehicles, machinery & equipment will move or be stationed in designated areas to avoid compaction of soil to ensure the preservation of the top soil for agriculture.

B2.2.7.6 Delete **Sub Clause 111.7** and Add **new Sub Clause111.7** Road Safety

The Contractor shall provide adequate circuit for traffic flow around construction areas, control speed of construction vehicles through road safety and training of drivers, provide adequate signage, barriers and flag persons for traffic control. If there are traffic jams during construction, measures shall be taken to relieve the congestion with the assistance of local traffic police. Safety of workers undertaking various operations during construction will be ensured by providing helmets, masks, safety goggles, etc. One Qualified Safety Officer and one Safety Supervisor must be available in the Contractor's working team for the entire construction period.

B2.2.7.7 Delete **Sub Clause 111.8** and Add new **Sub Clause111.8** Sanitation & Waste Disposal in Construction Camp

The Contractor shall ensure that construction camps are located at a distance of minimum 200m from water sources. Special attention shall be paid to the sanitary conditions of the camps. The Contractor shall ensure that sufficient measures are taken i.e. provision of garbage tanks and sanitation facilities. Waste in septic tanks shall be cleaned periodically. Garbage shall be collected in four empty drums at each construction site and disposed of daily. The Contractor shall provide adequate measures for the health care of workers and arrange their regular medical check-up to ensure that they do not suffer from any communicable disease. At every workplace, good & sufficient water supply will be maintained to avoid waterborne / water related diseases. If any pits are dug at construction / camp sites which are not filled and then may turn into mosquito breeding sites during monsoons shall be filled up properly so that no water accumulates.

B2.2.7.8 Delete **Sub Clause 111.9** and Add new **Sub Clause111.9** Substance Hazardous to Health

The Contractor shall not use or generate any material in the works, which is hazardous to the health of persons, animals or vegetation. Where it is necessary to use some such substance which can cause injury to the health of the workers, the Contractor shall provide suitable protective clothing or appliances to his workers, viz. earplugs, helmets or dust masks.

B2.2.7.9 Delete **Sub Clause 111.10** and Add new **Sub Clause111.10** Damage to Existing road/CD Structures

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

B2.2.7.10 Delete **Sub clause 111.11** and Add new **Sub Clause111.11** Use of Nuclear Gauges

Nuclear gauges shall be used only where permitted by the Engineer. 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. Without written approval, no such equipment shall be used at any level of the work.

B2.2.7.11 Delete **Sub Clause 111.12** and Add new **Sub Clause111.12** Environmental Monitoring

In order to carry out periodic checks, environmental monitoring will be carried out by the Engineer as per schedule and if any parameter is found above the acceptable

standards, mitigation measures / control measures as decided by the Engineer shall be complied with by the Contractor.

B2.2.7.12 Delete **Sub Clause 111.13** and Add new **Sub Clause111.13** Protection of Existing Trees

Some of the existing trees within the right of way are likely to be cut down by the Employer prior to handing over of the site to the Contractor. The Contractor shall take all necessary measures to ensure safety and protection of the remaining trees from any action whatsoever relating to his construction operations in the adjoining areas.

Giant neighbourhood trees recognized locally as important shall be preserved and engineering designs modified to accommodate these wherever possible depending on Engineer's directions.

B2.2.7.13 **Add new Sub Clause111.14** Disposal of Materials outside Work Site

Notwithstanding other relevant provisions in the contract, the excess material generated by dismantling, excavation, waste material and lubricants, used oil, gasoline and other such substance etc., shall be removed from site outside the right of way at regular intervals and site shall kept clean from all such disposable materials. Grease, cotton and other waste construction materials shall be disposed off in shallow pits and periodically burnt in a incinerator constructed at each construction site. Such intervals shall not exceed one month under any circumstances. The selection of the disposal site shall be the responsibility of the Contractor and he shall ensure that the selected site does not result in any claim for damages to the Employer or violation of any existing laws.

This section of Technical Specifications sets out instructions, recommended standards and technical specifications for the design and implementation of EMP mitigation works associated with construction of roads.

Environmental Management Plan has been prepared for the Project road, which needs to be followed during the implementation of the civil works. The key responsibility of the contractor/sub-contractor will be the successful implementation of the EMP. In addition, he will update MoRT&H on the progress of environmental protection and / or enhancement works as envisaged in the EMP. Execution of environmental mitigation measures meeting the requirement of Technical Specifications in conformity with applicable legislation will be the responsibility of the contractor. It shall also be accompanied with relevant documents (statements of compliance, certificates of compliance, test reports, etc.), evidencing their conformity with the statutory regulations.

B2.2.7.13.1 DISPOSAL OF UNSERVICEABLE MATERIALS:

The locations of Disposal sites have to be selected such that:

- Locating the disposal sites is the sole responsibility of the contractor with the approval of Engineer.
- Joint inspection of all disposal sites shall be done by Engineer and Contractor prior to approval.
- No residential area are located downwind side of these locations,
- Disposal sites are located at least 1000 m away from sensitive locations like
- Settlements, Water body notified forest areas, Sanctuaries or any other sensitive locations.
- Disposal sites do not contaminate any water sources, rivers etc for this site should be located away from water body and disposal site should be lined properly to prevent infiltration of water.
- Public perception about the location of debris disposal site has to be obtained before finalizing the location.
- Permission from the Village/local community is to be obtained for the Disposal site selected.
- Contractor will resolve all claims arising out of waste disposal at his own cost.
- Contractor shall utilize the suitable borrow areas, abandoned quarries and other waste land for the debris disposal.
- Contractor needs to plan the disposal in the following way:
  - Identify the disposal area.
  - Prepare a Contractors debris disposal plan with design drawings for each identified area and get it approved by the Engineer.
  - Need to photograph the present land use and condition of the area.
  - Construct all required structures (e.g. retaining wall).
  - The dumpsites filled only up to the ground level with compaction of the debris materials in layers after disposal.
  - The 30 cm top layer of disposal pit shall be provided with good earth suitable for development of vegetation/plantation.
  - After leveling, the site could be suitably rehabilitated by planting local species of grass (turfing), shrubs and other plants as decided by the Engineer.

B2.2.7.13.2 CONSTRUCTION OF WATER RECHARGE PITS:

Storm water recharge pits shall be located such that it should be in the valley of the surface layout nearby cross drainage structures and other water bodies along the project road. Water recharge pits shall be located at a height of 3 m. above the ground water table of the area as per the Central Ground Water Board norms. Recharge pits are constructed by the side of the guiding drains such that all the storm water shall be directed to the recharge pit. Any proposal for change in

number and location recharge pits by the contractor shall be checked and approved by the Engineer.

Pits, trenches, abandoned dug wells, recharge wells or abandoned bore wells shall be connected by the rain water harvesting system with the consent of the respective owner or as approved by the Engineer.

B2.2.7.13.3 CONSTRUCTION OF SILT TRAPS:

Silt fences shall be planned such that each recharge pit will have one silt fence to prevent silt from entering the nearest water bodies and also prevent choking of recharge pit by the silt coming from runoff water and increase the life of recharge pits. Silt fence are mounted in guiding drains at a distance of 3 to 5 M in the upstream direction depending on the gradient of the guiding drains. However any proposal for change in number and location silt fences by the contractor shall be checked and approved by the Engineer. Sand / silt removal facilities such as sand traps, silt traps and sediment basins should be provided to remove sand / silt particles from run-off.

B2.2.7.13.4 SCARIFIED BITUMEN DISPOSAL PITS:

Scarified bitumen generated out of scarification of existing pavement is used for approach roads by mixing it with fresh bitumen or other granular materials to achieve the required strength followed by profiling and compaction.

The left out portion of the scarified bitumen is disposed safely in a clay lined pit or as directed and approved by the Engineer. A typical clay lined bitumen disposal pit with standard dimensions has been worked out. The dimension of the bitumen disposal pit may change provided the clay lining of required thickness is adhered to.

The selection of sites for disposal of scarified bitumen is made on following lines:

- Locating the bitumen disposal sites is the sole responsibility of the contractor with the approval of Engineer.
- Selection of bitumen disposal site is avoided in the quarry regions. If the disposal site is located in the abandoned quarry, region is suitably treatment seal the fractures and fissures.
- Joint inspection of all disposal sites shall be done by Engineer and Contractor prior to approval.
- Disposal sites shall be located at least 1000 m away from sensitive locations like Settlements, Water body notified forest areas, Sanctuaries or any other sensitive locations.
- Disposal sites do not contaminate any water sources, rivers etc for this, site should be located away from water body and disposal site should be lined properly to prevent infiltration of water.

- Public perception about the location of bitumen disposal site has to be obtained before finalizing the location.
- Permission from the Village/local community is to be obtained for the Disposal site selected.
- Contractor will resolve all claims arising out of waste disposal at his own cost. Contractor needs to plan the bitumen disposal in the following way:
  - Identify the disposal area.
  - Prepare a Contractors bitumen disposal plan with design drawings for each identified area and get it approved by the Engineer.
  - Need to photograph the present land use and condition of the area.
  - Construct all required structures (e.g. retaining wall) along with clay lining and measures to prevent the seepage of bitumen leachate.
  - The dumpsites filled only up to the ground level with compaction of the materials in layers after disposal.
  - The 30 cm top layer of disposal pit shall be provided with good earth suitable for development of vegetation/plantation.
  - After leveling, the site could be suitably rehabilitated by planting local species of grass (turfing), shrubs and other plants as decided by the Engineer and the supervision consultant.

B2.2.7.14 PROVISION FOR OIL INTERCEPTORS:

Location of Oil Interceptors shall be considered such that each construction camp having refueling stations, oil and lubricants storage places will have one oil interceptor to stop & separate the floating oils. However the number of interceptors shall be increased as the situation demands or during the accidental spillages with the consent of the Engineer.

B2.2.7.15 ENVIRONMENTAL MONITORING:

Environmental Monitoring of Air, Noise, Water and Soil parameters shall be carried by the contractor as per the consents and latest environmental norms, guidelines and policies of national and state level environmental authorities. The Contractor shall comply by all obligations and make sure that there are no deviations from them or from the Contract.

Environmental standards for Air, Noise and water are outlined below.

Ambient Air Quality Standards (National)

Sl. No.	Pollutants	Time weighted average	Concentration in ambient air		Method of measurement
			Industrial, Residential, Rural & other Areas	Ecologically Sensitive Area (notified by Central Government	
1.	Sulphur Dioxide (SO2) µg/m3	Annual*	50	20	- Improved West and Geake - Ultraviolet Fluorescence
		24 hours**	80	80	
2.	Nitrogen Dioxide (NO2) µg/m3	Annual*	40	30	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
		24 hours**	80	80	
3.	Particulate Matter (size less than 10 µm or PM10 µg/m3	Annual*	60	60	- Gravimetric - TOEM - Beta attenuation
		24 hours**	100	100	
4.	Particulate Matter (size less than 2.5 µm or PM2.5 µg/m3	Annual*	40	40	- Gravimetric - TOEM - Beta attenuation
		24 hours**	60	60	
5.	Ozone (O3) µg/m3	8 hours**	100	100	- UV Photometric - Chemiluminescence - Chemical method
		1 hour **	180	180	
6.	Lead (Pb) µg/m3	Annual*	0.5	0.5	- ASS/ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
		24 hours**	1.0	1.0	
7.	Carbon Monoxide (CO) mg/m3	8 hour	02	02	- Non Dispersive Infra Red (NDIR)
		1 hours**	04	04	- Spectroscopy
8.	Ammonia (NH3) µg/m3	Annual*	100	100	- Chemiluminescence 24

Sl. No.	Pollutants	Time weighted average	Concentration in ambient air		Method of measurement
			Industrial, Residential, Rural & other Areas	Ecologically Sensitive Area (notified by Central Government	
		24 hours**	400	400	- Indophenol blue method
9.	Benzene (C6 H6) µg/m3	Annual*	05	05	- Gas chromatography based on continuous analyser - Adsorption and desorption followed by GC analysis
10.	Bensol (O) Pyrene (BaP) – Particulate phase only ng/m3	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
11.	Arsenic (As) ng/m3	Annual*	06	06	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
12.	Nickel (Ni) ng/m3	Annual*	20	20	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper
*	Annual Arithmetic mean of minimum 104 measurements in a year taken twice a week 24 hourly at uniform interval.				
**	24 hourly/8 hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.				

2. Water quality Standards (IS 10500: 1991)

S. No.	Parameter	Requirement desirable Limit	Remarks
1.	Colour	5	May be extended up to 50 if toxic substances are suspected
2.	Turbidity	10	May be relaxed up to 25 in the absence of alternate
3.	pH	to 8.5	May be relaxed up to 9.2 in the absence

S. No.	Parameter	Requirement desirable Limit	Remarks
4.	Total Hardness	300	May be extended up to 600
5.	Calcium as Ca	75	May be extended up to 200
6.	Magnesium as Mg	30	May be extended up to 100
7.	Copper as Cu	0.05	May be relaxed up to 1.5
8.	Iron	0.3	May be extended up to 1
9.	Manganese	0.1	May be extended up to 0.5
10.	Chlorides	250	May be extended up to 1000
11.	Sulphates	150	May be extended up to 400
12.	Nitrates	45	No relaxation
13.	Fluoride	to 1.2	If the limit is below 0.6 water should be rejected, Max. Limit is extended to 1.5
14.	Phenols	0.001	May be relaxed up to 0.002
15.	Mercury	0.001	No relaxation
16.	Cadmium	0.01	No relaxation
17.	Selenium	0.01	No relaxation
18.	Arsenic	0.05	No relaxation
19.	Cyanide	0.05	No relaxation
20.	Lead	0.1	No relaxation
21.	Zinc	5.0	May be extended up to 10.0
22.	Anionic detergents (MBAS)	0.2	May be relaxed up to 1
23.	Chromium as Cr+6	0.05	No relaxation
24.	Poly nuclear aromatic Hydrocarbons	--	--
25.	Mineral Oil	0.01	May be relaxed up to 0.03
26.	Residual free Chlorine	0.2	Applicable only when water is chlorinated
27.	Pesticides	Absent	--
28.	Radio active	--	--

3. Ambient Noise Quality Standards in respect of Noise

Area code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

Note:-

1. *Day time shall mean from 6.00 a.m. to 10.00 p.m.*
2. *Night time shall mean from 10.00 p.m. to 6.00 a.m.*
3. *Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority*
4. *Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.*

* *dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.*

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: *It is an energy mean of the noise level over a specified period.*

Note: *The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended by the Noise Pollution (Regulation and Control) (Amendment) Rules, 2000 vide S.O. 1046(E), dated 22.11.2000 and by the Noise Pollution (Regulation and Control) (Amendment) Rules, 2002 vide S.O. 1088(E), dated 11.10.2002, under the Environment (Protection) Act, 1986.*

B2.2.7.16 Add new Sub Clause111.15 as follows

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.

B2.2.8 CLAUSE 112 ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

B2.2.8.1 Replace the Sub Clause 112.1 of MORT&H with the following

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 the 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 part of the existing carriageway under improvement, or along a temporary diversion constructed close to the highway. The objective shall be to provide for the proper management of the construction site so that all road users, i.e. pedestrians, cyclists, motor cyclists, animals and animal drawn traffic and vehicular traffic are properly and safely accommodated. Two weeks before taking up any construction or maintenance operation/work, the Contractor shall prepare a Traffic Management Plan for each work zone and submit it to the Engineer for his prior approval. This plan should include inter alia.

(i) A qualified safety officer with support staff to serve as a site safety team
(ii) Provision of traffic safety devices as per IRC SP:55 with the following specifications
  a) Signages of retro-reflective sheet of high intensity grade.
  b) Delineators in the form of cones/drums (300 to 500mm dia and 1000 mm high) made of plastic/rubber having retro-reflective red and white band, at a spacing of 5m along with a reflective tape (red and white band) to be tied in between the gaps of cones/drums. A bulb using solar energy or other source of light is to be placed on the top of the cone/drum for delineation in dark hours and night.
  c) Portable barricades using iron sheet (plain) with adequate iron railing /frame painted with retro-reflective paint in alternate yellow and white stripes.
  d) Pavement markings
  Temporary fence/guard rail
  e) Temporary concrete barriers including special pedestrian barriers
  f) Construction zone signs covering advance warning zone, approach transition zone, work zone, terminal transition zone.
  g) Other regulatory, warning and information signs
  h) Red lanterns or warning lights
  i) Provision of flagmen
(iii) Safety measures for workers engaged including personal Protection equipment
(iv) First Aid and emergency response arrangements
(v) Details and drawings of arrangements in compliance with other sub clauses of this clause.

The Contractor shall ensure that all the traffic management devices as per Traffic Management Plan approved by the Engineer are in position before opening of sites of work.

B2.2.8.2 Replace the Sub Clause 112.2 of MoRT&H with the following

112.2. Passage of Traffic along a part of the Existing Carriageway under improvement

For widening / strengthening of existing carriageway where part width of the existing carriageway is proposed to be used for passage of traffic, treated shoulders shall be **ensured** on the side on which work is not in progress. The shoulder shall consist of at least 150mm thick granular **or stabilized** base course covered with 20 mm thick open graded premix surfacing as per clause 511.1 in a width of at least 1.5m such that the total paved width available for traffic including part of the existing road and treated shoulder is not less than 5.5m and the surface shall be maintained throughout the period during which traffic uses the same to the satisfaction of the Engineer. The continuous length along one side of the road 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 ***sub*** 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.

B2.2.8.3 Replace the Sub Clause 112.3 of MoRT&H with the following

Sub Clause112.3 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 5.5 m carriageway and 2.5 m earthen shoulders on each side (total width of roadway 10.5 m) with the following provision for road crust in the 5.5 m width:
(i) 200 mm (compacted) granular or stabilized subbase;
(ii) 225 mm (compacted) granular base course; and
(iii) 20 mm thick open graded premix surfacing as per clause 510.1

The use of fly ash in temporary diversions shall not be permitted.

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

The Contractor shall be responsible for the design of temporary diversions and submit the designs to the Engineer for his approval. If the Contractor finds it necessary to construct part of any diversion outside the Right of Way, the temporary use of additional land shall be arranged for by the Contractor at his own risk and cost. Further as per Conditions of Contract, the Contractor shall indemnify the Employer and the Engineer against any claims or proceedings resulting from the occupancy and use of such areas of additional land. Any roadside trees that have to be removed for the construction of temporary diversions shall be at the responsibility and cost of the Contractor.

B2.2.8.4 Replace the Sub Clause 112.4 of MORT&H with the following

Sub Clause112.4 Traffic Safety and Control

The Contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights .and flagmen as per the Traffic Management Plan submitted by the Contractor and approved by the Engineer, referred to in Sub-Clause 112.1.Beforetaking 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 which is 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 lanterns/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, as directed by the Engineer.

The Provisions made in Bill of Quantities shall be the ceiling for the Contract during the Contract Period. The Additional claims due to damage and theft of the same shall be deemed incidental to works. No extra payment shall be made towards additional quantities for these bill items.

B2.2.8.5 Replace the Sub Clause 112.5 of MoRT&H with the following

Sub Clause 112.5 Maintenance of Diversions and Traffic Control Devices

All the signs, delineators and pavement markings shall be maintained in a clean and bright condition at all times; and adequate lighting and other arrangements shall be maintained for proper visibility during the passage of the work area, till such time they are required *and* as directed by the Engineer. The temporary travelled way shall be kept free of dust by frequent applications of water.

B2.2.8.6 Replace the Sub Clause 112.6 of MORT&H with the following

Sub Clause 112.6 Measurements for Payment and Rate

(i) 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 Contractor's responsibility, **unless provided as a separate payable item in the BOQ.**

(ii) The construction of temporary diversion including temporary cross drainage structures at the site of bridge reconstruction locations as described in Clause 112.3, shall be **payable** and 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.

B2.2.9 CLAUSE 114 SCOPE OF RATES FOR DIFFERENT ITEMS OF WORK

B2.2.9.1 Sub Clause 114.2 Item (ii) of Clause 114.2 shall read as follows:

"A detailed resources based construction programme (using computerized critical path network method) in a form which facilitates control of the progress of the works and consequences of any changes in terms of time. The programme shall also include detailed network activities for the submission and approval of materials, procurement of critical materials and equipment, fabrication of special products/ equipment and their installation and testing and for all activities of the Contractor that are likely to affect the progress of work, etc. including updating all such activities on the basis of decisions taken at the periodic site review meetings or as directed by the Engineer. The Contractor shall submit data via electronic media and hard copy to the Engineer in a form readily compatible with the Engineer's planning system."

B2.2.9.2 Sub Clause 114.2 Add the following as item (xix) for sub-clause 114.2:

"The Contractor shall prepare detailed working drawings for each structure as required, on the basis of the drawings given in Bid Documents and get them

approved by the Engineer. The drawings shall be submitted to the Engineer at least 8 weeks before commencement of construction of the structures".

B2.2.9.3 Sub Clause 114.2 Add the following as item (xx) for sub-clause 114.2:

"Monthly progress report in a format acceptable to the Engineer. The report shall state the progress which has been achieved compared with the planned progress, illustrate delays in proportion to the progress planned, analyze the consequences and state planned corrective measures. Intermediate progress reports may also be required.

The first issue of the detailed construction programme including the detailed description of the system and the procedures shall be submitted to the Engineer for acceptance not later than 28 days after the date of receipt of the letter of acceptance."
The Contractor shall submit to the Engineer for approval & consent, the updated & revised programme at every six months interval or as such as directed by the Engineer. The updated & revised programme shall be submitted showing the actual progress achieved (physical & financial) and the effects of the progress achieved on the timing of the remaining work including any change to the sequence of the activities".

B2.2.9.4 Sub Clause 114.2 Add the following as item (xxi) in Sub-Clause 114.2

Cost of carrying out Topographic Surveys and Auto Level Surveys.

B2.2.9.5 Sub Clause 114.4 Add the following new Sub Clause 114.4

114.4 If any work executed by the Contractor does not meet the specifications, it shall be deemed as rejected. The Engineer, after obtaining approval of employer, may consider a proposal by the Contractor to retain an element or part of such work. The Contractor's proposal shall be supported by calculations, drawings and other data to prove the soundness of the proposal and shall clearly describe the additional measures required to ensure the intended performance of the work. Rectification / remedial work to bring such work to acceptable standard shall be executed by Contractor at his cost.

B2.2.10 Clause 115. METHODOLOGY AND SEQUENCE OF WORK;

B2.2.10.1 Delete **Sub Clause 115.2** and add the following as
Sub Clause 115.2 Submission of Method statement

The Contractor shall submit a method statement. The method statement shall be submitted in two parts.

The General part of the method statement shall describe the Contractor's proposals regarding preliminary works, common facilities, and items that require consideration at the early stage of the contract. The General part shall be issued along with the first issue of the construction programme (refer clause 114.2) and shall include information on:

a) Sources of materials like coarse aggregate and fine aggregate, quantity and quality of materials available in different sources;
b) Sources of manufactured materials like cement, steel, reinforcement, prestressing strands and bearings. Wherever possible the Contractor shall identify at least two sources for each of the items; he shall also submit samples/test certificates of recently manufactured materials for the consideration of the Engineer.
c) Locations of site facilities like batching plant, hot mix plant, aggregate processing plant, etc.
d) Details of facilities/approaches for transportation of personnel, equipment and materials like concrete for construction of pavements, foundations and substructures in river bed.
e) Information on procedures to be adopted by the Contractor for prevention and mitigation of negative environmental impact due to construction activities.
f) Any other information required by the Engineer subsequent to the scrutiny of the method statement submitted along with the Bid.

The general part of the Q.A. Programme shall accompany the method statement.

B2.2.10.2 Delete **Sub Clause 115.3** and add the following as **Sub Clause 115.3**

The special part of the method statement shall be submitted to the Engineer by the Contractor for each important item of work like construction of embankments and subgrade, pavements, pile foundations, concreting, prestressing, repair and rehabilitation of existing structures, concrete superstructure and for any other item as directed by the Engineer. These statements shall be submitted at least 4 weeks in advance of the commencement of the activity or item of work, unless otherwise stipulated in the contract.

The statement shall give information on:

i) Details of personnel both for execution and quality control of the work.
ii) Equipment deployment with details of number of units, capacity, standby arrangements.
iii) Sequence of construction, details of temporary or enabling works like diversions, cofferdams, formwork including specialised formwork for superstructure, details of borrow areas, method of construction of embankment and subgrade, pavements, piles, concreting procedures, details of proprietary processes and products (e.g. details of prestressing systems, proprietary piling systems, bearings, expansion joints etc.) and details of equipment to be deployed. Wherever

necessary, technical literature, design calculations and drawings shall be included in the method statement.
iv) Testing and acceptance procedures including documentation.
v) Special part of the Q.A. Programme referred in clause 105.3 for the particular item of work shall be submitted along with the method statement for the concerned activity.
vi) The Engineer shall examine and approve the method statement or direct the Contractor to re-submit the statement with required modifications. The modified statement shall be submitted within 14 days after receipt of Engineer's comments. The sole responsibility for the safety and adequacy of the methods adopted by the Contractor shall rest on the Contractor irrespective of any approval given by the Engineer.

B2.2.10.3 Delete **Sub clause 115.4** and add the following as
Sub Clause 115.4 Approval of proprietary product/ process/ system

Only proprietary products proven by international usage in comparable projects shall be permitted to be used. Fully authenticated details of licensing and collaboration arrangement shall be submitted by the manufacturer, where relevant. Within 90 days of award of work the Contractor shall submit the following information for all proprietary products for approval by the Engineer.

i) Name of manufacturer of product/ process/ system.
Complete details of the manufacturer of the product/ process/system shall be furnished. Details of projects where similar product/process/ system have been successfully used shall be furnished. Authenticated copies of license/ collaboration agreement shall be furnished.
ii) General features of the product/product process/ system.
Detailed write-up with methods statement shall be furnished for each product/ process/ System. This shall include complete working drawings & installation drawings, technical specifications covering fabrication, materials, system of corrosion, protection etc.
iii) Details of product development and development testing.
iv) Acceptance test and criteria.
Manufacturer shall submit a quality assurance system document. Details of acceptance test and criteria of acceptance shall be furnished in this document.
v) Installation procedure.
vi) Maintenance procedure and schedule.
vii) Warranty proposal.
The Engineer may order any additional tests required under relevant codal specifications for the purpose of accepting the product. The manufacturer shall make the facility for such additional tests available. The charges of these additional tests shall be borne by the Contractor.

B2.2.10 .4 CLAUSE 116 CRUSHED STONE AGGREGATES

B2.2.10.4.1 Delete **the Sub Clause 116** Add **the following**

116. Crushed Stone Aggregates

Where the terms crushed gravel/shingle, crushed stone, broken stone, stone aggregate or aggregate appear in any part of the Tender document, Drawings issued for work, they refer to aggregates obtained through the use of Cone crusher, Vertical Shaft Impactor and vibratory screens of suitable capacity.

B2.2.11 CLAUSE 120 FIELD LABORATORY

B2.2.11.1 Sub Clause 120.2 **Delete** both the paragraphs of Sub-Clause 120.2 and add new paragraphs as follows.

120.2.1 Description

The Contractor shall arrange to provide fully furnished and adequately equipped field laboratory. The field laboratory shall be located in close proximity to the Works site. It shall be provided with electricity supply, electrical wiring and points, all necessary electrical fittings and fixtures; potable water supply including pipes, pumps, storage tanks, plumbing, all necessary fittings and fixtures; septic tank, sewer lines, drains; surfaced access road; fencing and security lighting; security services etc.

The floor space requirement for the field laboratory shall be as indicated in the drawings. It shall include office space for the Materials Engineers, one from the Contractor's side and another from the Engineer's side, space for the installation of equipment, and space for other facilities. The field laboratory shall be fitted complete with laboratory equipment, laboratory tables and cupboards, wash basins, toilet facilities, curing tank around 4m x 2m x 1m in size for the curing of samples, a fume chamber, working platform area of about 1m x 10m against the walls, cupboards above and below the working platform, space for storage of accessories such as sample moulds, space for storage of samples etc. At least 4 racks of slotted angles and M.S. sheets shall also be provided. The furnishing in each of two offices of the Materials Engineers shall include working tables and chairs.

120.2.2 The items of laboratory equipment to be provided by the Contractor shall include, but not be limited to, the following. Notwithstanding, the Contractor shall ensure that the laboratory is adequately equipped for site quality control of materials and Works.

General

(i)	Drying Oven with minimum capacity of 700 litres – Electrically operated, thermostatically controlled, range up to 2000C sensitivity 10C (1.5 watts capacity)	2 Nos.

(ii)	Platform balance 300 kg capacity	1 No.
(iii)	Balance 20 kg capacity – self indicating type	1 No.
(iv)	a) Electronic Balance 5 kg capacity accuracy 0.5 gm	2 Nos.
	b) Electronic Balance 0.2 kg capacity accuracy 0.01 gm	2 Nos.
	c) Electronic Balance 0.5 kg capacity accuracy 0.01 gm	-
(v)	Water bath – electrically operated and thermostatically controlled with adjustable shelves, sensitivity 10C, minimum capacity of 10 liters	1 No.
(vi)	Thermometers:	4 No.
	a) Mercury-in-glass Thermometer range 00 to 2500C	2 No.
	b) Portable dial – type Thermometer with 64mm diameter dial and 650mm long stem, range 50 to 2500c or Digital Asphalt Thermometer and probe	1 No.
(vii)	Gas stove or electric hot plate	2 Nos.
(viii)	Glassware's, spatulas, wire enamel, steel scales, measuring tape, casseroles, karahis, 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: 75mm, 63 mm, 53mm, 45mm, 37.5mm, 26.5mm, 22.4mm, 19.0mm, 13.2 mm, 11.2mm, 10.0mm, 9.5mm, 6.7mm, 5.6mm, 4.75mm, 3.35mm, 2.8mm, 1.4mm, 710microns, 355microns, 180microns, 90microns **200 mm diameter**: 4.75mm, 2.36mm, 2.0 mm, 1.18mm, 600micron, 425 micron, 300micron, 150micron and 75micron	1 set 2 sets
(x)	Kit for Water testing as per Clause 1010	1 set
(xi)	First aid box	2 sets
(xii)	Relevant IS/BS/IRC/ASTM/Asphalt Institute MS series Codes of laboratory testing	1 set
(xiii)	Personal Computer System (IBM/Compaq/HP/DELL) - Intel Pentium Dual Core 2.0 GHz with 400 MHz FSB - Intel Mother Board with Intel 850 Chip set - 1GB SD RAM - 1x 120 GB PCI – IDE Hard Disk - 58 X CD-ROM Drive - 17" TFT Colour Monitor - PS/2 Mouse with pad and Keyboard (107 keys) - Windows 2000 XP Professional preloaded with license - MS-Office 2000, MS-Project, Autocad-2000 preloaded with license - 1x HP DeskJet 1280 Colour Printer	1 No.

For soils and aggregates

(i)	Riffle Box of slot size 50mm as per ASTM C-136	1 No.
(ii)	Atterberg Limits (liquid and plastic limits) determination apparatus as per IS:2720,(Part 4)-1985 a) Casagrande Apparatus b) Cone Penetrometer	 2 sets 2 sets
(iii)	a)Automatic Compactor b) Compaction Test Equipment for Heavy to the requirement of IS-T180 complete with color, base plate and 4.5kg rammer and standard compaction as per IS: 2720 (part 8) c) Wooden Mallets	1 set 2 sets 6 Nos.
(iv)	In-situ Density Test apparatus	
	a) with 10cm diameter sand pouring cylinder, tray, can etc., complete as per IS:2720, (Part 28)-1974	2 sets
	b) with 15cm diameter sand pouring cylinder, tray, can etc., complete to the requirement of ASTM:D 1556 and as per IS:2720, (Part 28)-1974	2 sets
(v)	Speedy Moisture Meter complete with chemicals	1 set
(vi)	Post – hole Auger with extensions, 10cm diameter	1 set
(vii)	Core cutter apparatus 10cm diameter, 10/12cm height, complete with dolly, rammer etc. as per IS:2720, (Part 29)-1975	5 sets
(viii)	Aggregate Impact Value Test apparatus/Los Angeles Abrasion Test apparatus as per IS:2386 (Part -4)or IS:5640 AND IS:2386 (Part-4)	1 set
(ix)	Flakiness and Elongation Test Gauges as per B.S.812	1 set
(x)	Standard measures of 30, 15 and 3 Liters capacity along with standard tamping rod	1 set
(xi)	California Bearing Ratio test apparatus Motorized as per IS:2720, (Part 16)-1987	1 set
(xii)	CBR Moulds, surcharge weight and accessories as per IS: 10074-1982 plus gauges for swell measurement	65 Nos.
(xiii)	Triaxial Tests Equipment with Triaxial Cell, pressure gauge and accessories as per IS: 2720	1 set.
(xiv)	Direct Shear Test as per IS 2720, (Part 13)-1986 and accessories	1 set
(xv)	Sample Extractor to take soil samples from UDS Tubes	1 set.
(xvi)	10% Fines value Test Moulds and Accessories for Aggregates Testing as per BS:812(Part 111)	2 set
(xvii)	Soundness Test Kits including Sodium Sulphate of Magnesium Sulphate as per IS: 383-1970	1 set
(xviii)	100 ml Measuring Jars to conduct Differential Free Swelling Tests as per IS: 2720- Part 40-1977	20 sets
(xix)	Specific Gravity Bottles as per IS:2386 (Part-3)-1963	6 sets

(xx)	Swelling Pressure Test Equipment as per as per IS:2720, (Part 16)-1987	S sets
(xxi)	Aggregate Crushing Strength Tests Moulds as per IS:2720 (Part16)-1987	2 sets
(xxii)	Steel cups to determine Moisture Content	50 Nos.
(xxiii)	Sieve Shaking Machine – Motorized	1 Nos.
(xxiv)	MS / Steel Trays to store samples 1.5 x 1.5 x 1.5 ft 2 x 2 x 2 ft 3 x 3 x 3 ft	10 Nos. 10 Nos. 10 Nos.

For bitumen and bituminous mixes

(i)	Bitumen penetrometer automatic type including adjustable weight arrangement, and needles to the requirements of AASHTO : T – 49	1 Set
(ii)	Ring and Ball Apparatus as per IS : 1205 – 1978	1 Set
(iii)	Apparatus for Determination of Ductility Test as per IS 1208 –1978	1 Set
(iv)	Asphalt Institute Vacuum Viscometer as per IS : 1206 (Part II) –1978	1 Set
(v)	BS U–Tube Modified Reverse Flow Viscometer IS : 1206 (PartIII) –1978	1 Set
(vi)	Thin Film Oven Test apparatus to the requirements of AASHTO: T-179, including accessories	1 Set
(vii)	Constant temperature bath for accommodating bitumen test specimen, electrically operated, and thermostatically controlled, stainless steel interior, 50 litre capacity, temperature range ambient to 80° C	1 No.
(viii)	Riffle box – small size	1 No.
(ix)	Centrifuge type motorized bitumen extraction apparatus to the requirements of AASHTO : T - 164 with stock of solvent &filter paper	1 Set
(x)	Marshall compaction apparatus to the requirements of AASHTO: 245 as per ASTM T 1559-62 and complete with electrically operated automatic loading unit, compaction pedestal, heating unit, head breaking assembly, flow meter, load transfer bar, specimen moulds 100 mm diameter with base plate, collars, specimen extractor, compaction hammer 4.53kg x 457 mm fall(excluding constant temperature bath)	1 Set
(xi)	Core cutting machine with 15 cm diameter cutting cylinders with diamond cutting edge (including spares)	1 Set
(xii)	Vacuum pump and 3 specific gravity bottles	1 Set
(xiii)	Split Air Conditioner (Carrier make of 1.5 Tonne capacity with Temperature control facility) for Bitumen Lab in	1 No.

	Laboratory building	
(xiv)	Apparatus of Determination of Specific Gravity Tests as per IS:1202-1978	2 Nos.
(xv)	Water Soaking Tank (8 x 6 x 4 ft)	2 Nos.
(xvi)	Apparatus for Determination of Loss on Heating IS : 1212-1978	1 Set
(xvii)	Bitumen laboratory mixer planetary action, 2 litre capacity, including required accessories electrically operated and fitted with heating jacket	1 No.
(xviii)	Dial type thermometer reading 0-200° C range, accuracy 2°C	2 Nos.
(xix)	Pensky – Martens closed Tester for testing flash and fire point as per IS : 1209 – 1978	1 Set
(xx)	Apparatus for Determination of water content (Dean and Shark Method) IS : 1211-1978	1 Set
(xxi)	Viscosity Meter	1 No

For cement and cement concrete

(i)	Vicat apparatus for testing setting times with plungers as per IS- 269-1968	1 set
(ii)	Soundness testing apparatus for cement (Le Chatlier's principle)	1 Set
(iii)	Slump testing apparatus as per IS:1199	4 sets
(iv)	Apparatus for Chemical Composition tests as per IS 8112-1989& IS 12269	1 set
(v)	Chemicals solutions and consumables	As reqd.
(vi)	Chloride testing kit for chemical analysis of chloride content	1 No.
(vii)	ION exchange kit for rapid determination of sulphate content	1 No.
(viii)	Water still	1 No.
(ix)	Concrete permeability apparatus	1 Set
(x)	Compression and Flexural strength testing machine of 200tonne capacity with additional dial for flexural testing and adequate numbers of 15cm cube moulds, 15cm X 15cm X75cm beam moulds, compacting hammer and other necessary accessories. As per IS 456	1 No.
(xi)	Needle Vibrator	2 Nos.
(xii)	Vibrating hammer for vibrating dry mix as for Dry Lean Cement concrete sub-base	1 No.
(xiii)	15 x 15 x15 cms Moulds for testing CC cubes	30 Nos.
(xiv)	7 x 7 x 7 cms Moulds to tests Cement Mortar	10 Nos.
(xv)	Apparatus of Determination of Specific gravity as perIS:8112-1989	1 No.

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

120.2.3 Equipment for Control of Profile and Surface evenness

120.2.3. For control of Profile and Surface evenness

(i)	String line arrangement for paving with sensor pavers	1 No.
(ii)	Z-250 profilometer or MERLIN for Calibrating Bump Integrator	1 No.
(iii)	Towed Fifth Wheel Bump Integrator or Equivalent	1 No.
(iv)	Camber templates 2-lane/3-lane straight run cross-section as approved by the Engineer	4 Sets.
(v)	Theodolite/Auto level for checking levels on completed pavement layers	As reqd

B2.2.11.2 **Add** new sub clause 120.2.4 as follows

120.2.4 Mobile Laboratory:

In addition to the field laboratory, the Contractor shall also provide a mobile laboratory should there be a requirement or should he choose to work in two separate Sections of the Works. The mobile laboratory shall be suitably equipped for conducting all necessary field quality control testing.

B2.2.11.3 Add the following as new **Sub Clause 120.6**

There shall not be separate payment with respect to costs associated with the setting up, operation and maintenance of the laboratory. The Contractor shall allow in his rates and prices for the setting up of the field laboratory including the land, building, utility services & connections, fittings, fixtures, furniture, laboratory equipment, external works, security fences, and all ancillary items; and operation and maintenance of the laboratory including utility services charges, consumables, security, and all ancillary items.

B2.2.12 CLAUSE 122 PLANTING OF TREE SAPLINGS AND SHRUBS

Add **new clause 122 Planting of Tree Saplings and Shrubs**

122.1 Scope
The work shall consist of providing, planting, protecting and maintaining roadside tree saplings and shrubs, all as described in these specifications.

122.2 Materials

122.2.1 Compost: shall be of well-decayed vegetable matter obtained in the dry state from sources approved by the Engineer. The compost shall be free from earth, stone, brickbats or other extraneous material and shall all pass a 16mm sieve before use.

122.2.2 Farmyard Manure: shall be well-decayed animal waste, free from earth, stone, brickbats or other extraneous material.

122.2.3 Oil Cake (Neam, Castor or Groundnut): shall be the residue after the extraction of oil and shall be free of other extraneous material.

122.2.4 Topsoil or agricultural soil: shall be organic soil of loamy texture free from kanaka, moorum, shingle, or other extraneous material and from clods or lumps of sizes bigger than 75mm. It shall have a pH value ranging between 6 to 8.5.

122.2.5 Tree Saplings: shall be at least three year old and shall consist of hardy indigenous tree species. Details of tree saplings proposed for use (species and proportion) shall be submitted to the Engineer for approval.

122.2.6 Shrubs: shall be local indigenous species suitable for hedge formation. Details of shrubs proposed for use (species and proportion) shall be submitted to the Engineer for approval.

122.2.7 Tree guards: shall be made of mild steel and shall be 500mm inside diameter, made up as follows:

(i) Uprights, 3 No., 2.0m long with an additional 5cm foot at one end at right angles, forming an L shape. To be made with 25x25x3mm angle section.
(ii) Framing rings, 3 No., 500mm inside diameter, in two sections, which can be bolted together (to allow future removal). To be made from 25x5mm flat section and suitable bolts and nuts.
(iii) Vertical bars, 15 No., 1.55m long by 6mm diameter.

The three uprights shall be equally spaced round the circumference, with the feet facing outwards, and shall be held in place by welding them inside the three framing rings, the rings being at heights of 700mm, 1200mm and 1700mm respectively above the feet of the uprights. The vertical bars shall also be welded to the inside of the rings, equally spaced around their circumference, with the top of each bar level with the top of the uprights. The entire tree guard shall be given two coats of paint over a prime coat, using paint of a brand and shade approved by the Engineer.

122.3 Planting Tree Saplings

Planting of tree saplings shall only commence, with the agreement of the Engineer, when the weather conditions are suitable and disturbance by other construction activities is unlikely to occur. Tree saplings shall be planted, wherever possible, in a line on both sides of the road, at an average rate of 100 trees per km. Where there are roadside ditches the tree line shall be located beyond the ditches. The exact position of the tree line at each location shall be agreed with the Engineer and the proposed position of individual trees staked out and approved. For each tree sapling a hole 600mm diameter and 450mm deep shall be excavated. Any stones, roots and foreign matter in the excavated material shall be removed and disposed of and the rest saved for reuse after breaking up any clods greater than 75mm diameter. Topsoil or agricultural soil, in quantities required to replace discarded material, shall be brought and stacked at site by the Contractor.

In the bottom of each hole a 1:1 mixture of farmyard manure and oil cake shall be placed in a layer 50mm thick. The tree sapling shall be held in the center of the hole with the root bulb touching the bottom layer and the hole loosely back-filled around the sapling to about half the remaining depth of the hole. The backfill shall consist of the excavated soil plus added topsoil if required, first mixed with compost in the ratio of 10:1 by loose volume. A tree guard shall then be carefully lowered over the sapling into the hole and forced down into the loose backfill until it is firmly seated. The rest of the hole shall then be backfilled and the backfill copiously watered to cause it to settle and bed down. The final level of the backfill shall be between 50mm and 75mm below ground level.

122.4 Planting Shrubs

Planting of shrubs shall only commence, with the agreement of the Engineer, when weather conditions are suitable, disturbance by other construction activities is unlikely to occur and work on the new tree line has been completed. Where there is sufficient space within the Road Reserve behind the tree line a band of shrubs shall be planted at the rate of approximately 800 shrubs per km in order to eventually form a hedge to discourage intrusion into the road reserve. The position and layout of the band of shrubs shall be agreed with the Engineer. Shrub planting will be done in excavated holes of size appropriate to the type of shrub and the holes firmly back filled with excavated soil from which all stones, roots and foreign matter has been removed.

122.5 Maintenance

Trees saplings and shrubs shall be maintained until a Taking-Over Certificate has been issued by the Client for the section of road concerned. Maintenance shall include watering and weeding as and when necessary, protection, damage repair and replacement of all defective saplings and shrubs with others of similar species

and age, all as instructed by the Engineer. Saplings and shrubs that become defective during the Defects Liability period shall be replaced by the Contractor.

122.6 Measurements

Planting of trees and shrubs shall be measured by number.

122.7 Rate

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

B2.2.13 CLAUSE 123 AS-BUILT DRAWINGS

Add **new clause 128 As-Built Drawings**

The Contractor shall prepare and submit to the Engineer "As-Built" drawings of the Construction Works covering every component, upon completion. The "as-built" drawings shall be prepared in A2 size. 2 sets of A2 size bound hardcopies on polyester film of quality to be approved by the Engineer and 1 set of electronic files on CD shall be submitted to the Engineer. Where the Construction Works is in Sections, "As-Built" drawings shall be submitted for each Section as the Construction Works are completed for that Section. All costs associated with the preparation and submission of "As-Built "drawings including the production of the stipulated number of sets of hardcopies and electronic files shall be deemed to be included in the rates and prices of items quoted by the Contractor in the Bill of Quantities.

B2.3 SECTION 200 SITE CLEARANCES.

B2.3.1 CLAUSE 201 CLEARING AND GRUBBING

B2.3.1.1 **Sub Clause 201.1** Delete **all Paragraphs in Sub-Clause 201.1 and** add **the following Paragraph.**

This work shall consist of cutting, removing and disposing of all materials such as trees of girth up to 300mm, bushes, shrubs, stumps, roots, grass, weeds, top soil (all types of soils) not exceeding 150mm in thickness, rubbish etc., which in the opinion of the Engineer are unsuitable for incorporation in the works, from the area of road land containing road embankment, berms, drains, cross-drainage structures, junctions, bus bays, truck parking areas and such other areas as may be specified on the drawings or by the Engineer. It shall include necessary excavation by harrow discs or any other suitable equipment, back filling the excavated area up to a maximum depth of 150mm and also complete backfilling of pits resulting from uprooting of trees and stumps by suitable/approved soil and making the surface in proper grade by suitable equipment and compacted by power roller to required

compaction as per Section 300, handling, salvaging, and disposal of cleared soil / materials. The work also includes keeping the cleared material in stock pile within the ROW not less than 500m in distance, keeping the stock pile till completion of bituminous work, re-using the top soil in turfing and disposal of unsuitable material.

Clearing and grubbing shall be performed in advance of earthwork operations and in accordance with the requirements of these specifications. Areas as well as depth requiring clearing and grubbing shall be determined by the Engineer. The Contractor shall ensure free flow of surface water / run-off in to the drains by way of clearing the topsoil between earthen shoulder edge / embankment edge and inner edge of the drain.

If the topsoil is more than 150 mm in thickness and not exceeding 500 mm, then the additional thickness shall be graded off / removed to the required slope or as directed by the engineer and the cost for the additional cut is to be considered as incidental to the Clearing and Grubbing work. **Clearing and grubbing work shall be considered incidental in Road way excavation and drains and shall not be measured and shall be deemed to have been included in the rates quoted for the earth work excavation.**

B2.3.1.2 **Sub Clause 201.3** Delete **3rdParagraph in Sub-Clause 201.3 and** add **the following**

All Excavations below original ground level arising out of the clearing and grubbing and also for removal of trees, stumps, etc., shall be filled with suitable material and compacted thoroughly so as to make the surface fit for the next layers in accordance with the section 300 of Specifications

B2.3.1.3 **Sub Clause 201.5** Delete **1st sentence in the 1st Paragraph in Sub-Clause201.5 and** add **the following sentence.**

Clearing and grubbing for road embankment, drains and cross drainage structures shall be measured as areas in plan basis in terms of hectares

Delete Last sentence in the 1st Paragraph in Sub-Clause 201.5 and add **the following sentence**

Cutting including removal of foundations of sign boards, hoarding boards, concrete posts, kilometer /hectometer stones, boundary stones, back filling to required compaction up to general original ground level and of any pits shall be measured and paid in respective item of BOQ

B2.3.1.4 **Sub Clause 201.6 Delete** second sentence in the **in Sub-Clause201.6.1 and** add **the following sentence.**

These will also include removal of stumps of trees less than 300 mm in girth as well as stumps of any girth size left over after cutting of trees carried out by another agency either before execution or during execution, excavation and back filling to required density, where necessary and handling, salvaging, piling and disposing of the cleared materials with all lifts up to a lead of 1000 m.

B2.3.2 CLAUSE 202 DISMANTLING CULVERTS, BRIDGES AND OTHERSTRUCTURES/PAVEMENTS

B2.3.2.1 Sub Clause 202.3 Dismantling of Pavement – Add at the end of 2nd paragraph as follows"

"The existing bituminous pavement surface, base and sub-base courses shall be removed by ripping, pavement breaker or any other suitable equipment, or any other suitable means as approved by the Engineer.

Dismantling of existing base, sub-base and surface courses shall be measured by taking cross-sections at 200 m intervals before dismantling by making 30 cm wide trench in full width and depth and computing the volumes in cum by the method of average cross-sectional areas".

B2.3.2.2 **Sub Clause 202.4** Delete **the Sub Clause 202.4 and** add **the following202.4 back Filling**

Holes and depressions caused by dismantling operations encountered in the alignment shall be backfilled with Granular material/**Sand** and compacted to required density as directed by the Engineer

B2.4 SECTION 300 EARTHWORK, EROSION CONTROL ANDDRAINAGE

B2.4.1 CLAUSE 301 EXCAVATION FOR ROADWAY AND DRAINS

B2.4.1.1 **Sub Clause 301.1** Scope

Insert the following between the words "roadway" and "side drains" in the second line: "road shoulders/paved shoulders, junctions, busbays, truck parkings"

B2.4.1.2 **Sub Clause 301.2 Delete sentence (d) and** add **the following**

(d) Hard Rock (requiring controlled blasting)

Hard rock requiring blasting as described under (c) but where blasting would damage abutting structures like building, bridge foundations, etc. and excavation has to be carried out by controlled blasting without causing any detrimental damage to nearby structures and in accordance with Additional Technical Specifications A-4. The excavated material shall be stacked with all leads and lifts to the place shown and as directed by the Engineer and shall be handed over to the Authorities as directed by the Engineer.

B2.4.1.3 Sub Clause 301.3 Delete **Sub-clause 301.3.7 and** add **the following**

301.3.7 In works involving widening of existing pavements or providing paved shoulders, the existing paved shoulders/hard shoulder/earthen shoulders/verge/median shall be removed to required width and to levels as shown on drawings or as indicated by the Engineer, preparation of cut formation as per clause 305 supporting subgrade/embankment. Method of benching shall be followed with each successive top layer of existing pavement crust cut at least 250 mm wider than the bottom layer. While doing so care shall be taken to see that no portion of the existing pavement designated for retention is loosened or disturbed. If the existing pavement gets disturbed or loosened, it shall be dismantled and cut to a regular shape with side vertical and the disturbed/loosened portion be removed completely and re-laid as directed by the Engineer, at the cost of the Contractor.

Existing material to a depth of 500mm or more below the bottom of the sub base shall be checked for the following criteria in order to retain the same material as sub grade below the sub base layer

1. 4 day soaked CBR in compliance with specification shall not be less than the design CBR as stipulated in drawings

2. The relative density of the existing subgrade material shall comply with the specified density requirement as given in Table 300-2 of MoRT&H specifications

If the existing material having 4 day soaked CBR value more or equal to design CBR value and does not comply with the density requirement, then the same shall be loosened to a depth of 500mm and compacted in layers in accordance with the requirements Clause of 305 Any unsuitable material encountered in this portion of subgrade shall be removed and replaced with suitable material and compacted in accordance with Clause 305.

B2.4.1.4 Sub-clause 301.3.11 add **the following paragraph after the 1st paragraph**

All Environmentally hazardous material viz. dismantled/scarified existing bituminous layers and existing road base material mixed with bituminous layer obtained due to excavation shall be disposed by environmentally acceptable

practice in accordance with the Implementation of Environmental Management Plan as per contract.

Unsuitable and surplus material, which, in the opinion of the Engineer cannot be used in the works, shall be removed from site by the Contractor and disposed of at the nearest dip or other approved location with all lifts and leads in accordance with contract Provisions.

B2.4.1.5 Sub Clause 301.6 Preparation of Cut Formation

B2.4.2 CLAUSE 304 EXCAVATION FOR STRUCTURES

B2.4.2.1 Sub Clause 304.3 Delete **the words "or cut slopes to a safer angle or both" from 5th line of the 1st paragraph in Sub-clause 304.3.2 and** add **the following paragraph at the end**

As the existing open foundations are close by, no cut slopes will be permitted for the excavation of the new foundation trenches. **The length and width of excavation for open foundations shall be as per the detailed drawings issued for construction any additional width and length shall be deemed as incidental.** In case where new foundations are not joined with the existing foundations cofferdams to the sufficient depth shall be driven around the new foundation and the excavation shall proceed.

Delete **the words "Lean Concrete (1:3:6 nominal mix)" in paragraphs 2 and 3in Sub-clause 304.3.4 and Substitute with the following words in place of the above**
"Concrete M15 Grade"

B2.4.3 CLAUSE 305 EMBANKMENT CONSTRUCTION

B2.4.3.1 Sub Clause 305.1 add **for construction of roadway, junctions, Bus Bays and Truck Parking** at the end of first sentence **in Sub Clause 305.1.1.**

B2.4.3.2 Sub Clause 305.2 Delete **sentence (e) in Sub-clause** 305.2.1.1 **and** add **the following sentence**

(e) Clayey soils and other soils having liquid limit exceeding 40 and plasticity index exceeding 18;

B2.4.3.3 Delete **the Sub-clause** 305.2.1.2 **and** add **the following Sub Clause**

305.2.1.2 Expansive soils such as CH, MH or OH 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 in construction of any subgrade or embankment

B2.4.3.4 Delete **the Sub-clause** 305.2.1.4 **and** add **the following Sub Clause**

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. The maximum particle, size shall not be more than two-thirds of the compacted layer thickness. **The material to be used in Subgrade should satisfy the requirement of 4 day soaked design CBR of 7%, when tested as per IS:2720 (Part 16) at 97% maximum dry density (IS: 2720 (Part 8)-1983)**

B2.4.3.5 Sub Clause 305.2.1.5 Delete the table 300.1 below 305.2.1.5 and add the following table

Sl. No.	Type of Work	Engineering Properties of sample remoulded as per IS 2720 (Part 8)
		Max dry density (gm/cc)
1.	Embankment upto 3meters height, not subjected to extensive flooding	Not less than 1.65
2.	Embankment exceeding 3meters height or embankments of any height subject to long periods of inundation.	Not less than 1.75
3.	Subgrade and earthen shoulders/verge/backfill	Not less than 1.85

Replace the note (2) below the Table 300-1 by the following.

The material to be used in the Subgrade shall have a 4-day soaked CBR as specified, when compacted to the density requirements of Table 300-2, not less than the design CBR stipulated in the drawings.

B2.4.3.6 Clause 305.2.2.2 BORROW MATERIALS

Replace the Para 1 of this Clause by the following:

"No borrow area shall be made available by the Employer for this work. The arrangements for the source of supply of the material for embankment and subgrade as well as compliance to the different environmental requirements in respect of excavation and borrow area as stipulated, from time, by the Ministry of Environmental and Forest Government of India and the local bodies, as applicable shall be the sole responsibility of the Contractor".

B2.4.3.7 Delete **last sentence" It shall be ensured that the subgrade material … … … … … … … … design CBR value of the subgrade" in 1st paragraph (page-66) in Subclause**305.2.2.4**and** add **the following sentence**

"When compacted to the density requirements of Table 300-2, the material used for the construction of the Subgrade and shoulder fill shall have a 4-day soaked CBR as specified, not less than the design CBR stipulated in the drawings**.**

B2.4.3.8 **Sub Clause 305.3** Delete **the 1st paragraph in Sub-clause 305.3.4 and** add **the following paragraph**

305.3.4. Compacting ground supporting embankment/subgrade: Where necessary the original ground shall be levelled, scarified, mixed with water and then compacted by rolling to facilitate placement of first layer of embankment so as to achieve minimum dry density as given in Table 300-2.

B2.4.3.9 Add **the following paragraph at the end of 2nd Paragraph in Sub Clause 305.3.4**

Backfilling layers in pits, trenches and below the original ground are to be compacted to the relative natural ground density. The natural ground density shall be determined by conducting field density tests at three widely spaced locations along the central line of the proposed carriageway at a depth in between 0.5m to 1.0m. Samples of natural ground are collected at each location, and are tested in accordance with IS: 2720 (Part 8). The relative density (i.e. the percentage of the field dry density to the laboratory maximum dry density) is assessed for each sample, and the greatest relative density obtained is selected as the "natural ground density". If the natural ground density is less than 85% then these are to be compacted after necessary watering so as to achieve not less than 85% of relative compaction".

Where necessary to facilitate compaction of the subgrade to 97% relative compaction as stated above, a further depth of maximum thickness of 0.2m shall be loosened, watered and compacted in accordance with Sub Clause 305.3.5 and 305.3.6 to not less than 95% of dry density determined in accordance with IS: 2720(Part-I).

B2.4.3.10 **Sub Clause 305.3.6** Delete the first sentence of second paragraph under **Sub-clause 305.3.6 and** add **the following paragraph**

Vibratory roller of not less than 8-10 tonne static weight with plain or pad foot drum or pneumatic tyre roller of 15-30 tonne weight having tyre pressure of at least 7 kg/sq.cm shall be used for compaction.

B2.4.3.11 Sub Clause 305.4.3 Delete **Sub-clause 305.4.3 and** add **the following paragraph**

305.4.3 Earthwork over existing road surface

Where the embankment/ subgrade 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 500 mm of the top of new subgrade, the existing surface 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. After scarification, the ground shall be prepared in accordance with Sub-Clause 305.3.4.
(ii) If the existing road surface is of granular or bituminous type and lies more than 500mm below the top of new subgrade, the existing surface shall be permitted to stay in place without any modification.
(iii) If the existing road surface is of cement concrete type and lies within 1 m of the top of new subgrade, the same shall be removed completely.

B2.4.3.12 Sub Clause 305.5 Delete the entire paragraph in Sub-clause 305.5 and add the following paragraph

305.5 Plying of Traffic

No vehicular traffic of any kind shall be permitted to use the prepared surface of the embankment and/or subgrade except the construction equipment/machinery and trucks/dumpers carrying the materials, required for the next layer of construction.

B2.4.3.13 Sub Clause 305.7 Subgrade Strength Delete Sub Clause 305.7.1 and replace with the following paragraph

It shall be ensured prior to actual execution that the borrow material or material brought from road way excavation to be used in sub-grade has a CBR not less than the design CBR specified in the Drawings when tested on specimens compacted at 97% MDD and soaked in water for 4 days.

B2.4.3.14 Sub Clause 305.8.1 Delete the contents **in Sub-clause 305.8.1 and** add **the following paragraph**

Earth embankment/sub-grade construction shall be measured separately by taking cross sections at intervals after clearing and grubbing and if necessary compaction of original ground before the embankment work starts and after its completion and computing the volumes of earthwork in cubic metres by the method of average end areas basis

B2.4.3.15 Sub Clause 306.4 Add the following paragraph at the end in Sub-clause 306.4

However, all temporary sedimentation and pollution control works shall be deemed as incidental to the earthwork and other items of work and, as such, no separate payment shall be made for the same

B2.4.4 CLAUSE 315 LINED SIDE DRAINS

B2.4.4.1 Add **the following as new Clause 315**
Lined side drains shall be constructed true to the drawings

B2.5 SECTION 400 SUB-BASES, BASES (NON-BITUMINOUS) AND SHOULDERS

B2.5.1 CLAUSE 401 GRANULAR SUB-BASE

B2.5.1.1 Sub Clause 401.1 Delete **the** Sub-Clause 401.1 **and** add **the following Sub Clause**

401.1. Scope

This work shall consist of laying and compacting well-graded material on prepared subgrade along the roadway and also at locations of junctions, in accordance with the requirements of the Specifications. The material shall be laid in one or more layers as granular sub-base. The GSB layer shall be extended upto the proposed road embankment side slopes. The granular sub-base material shall be prepared in a mechanical mixing plant and laid in uniform layers with mechanical paver or motor grader, and compacted with vibratory power rollers to lines, grades and cross-sections shown on the drawings or as directed by the Engineer.

B2.5.1.2 Sub Clause 401.3 Add **the following paragraphs at the end of the 1st paragraph of Sub-Clause 401.3.1: Preparation of Subgrade**

Where the existing pavement is to be overlaid by a granular base/ sub-base and embankment (i.e. new subgrade depth) of less than 500 mm total thickness then the pavement shall be scarified in accordance with Sub Clause 501.8.3.2. Where the existing pavement contains multiple bituminous layers the scarification shall be to the underside of the lowest bituminous layer. The Contractor will verify that all bituminous layers have been removed using appropriate methods approved by the Engineer. The bituminous surfacing material removed from the existing pavement may be used in other parts of the works as directed by Engineer provided it complies with the relevant specification clauses.

After scarification and removal to the satisfaction of the Engineer of the bitumen surface from the existing pavement to be overlaid, the surface shall be lightly sprinkled with water if necessary and rolled with three passes of an 8-10 Ton smooth wheeled roller. The existing pavement shall then be proof rolled with a 8 tonne single drum vibrating roller in the presence of the Engineer who shall determine of the surface for overlay.

B2.5.1.3 **Sub Clause 401.5**Add **the following sentence at the end of the Sub-Clause 401.5**

No vehicular traffic of any kind shall be permitted to use the finished surface of the Granular Sub-Base except the construction equipment/machinery and trucks/dumpers carrying the materials, required for the next layer of construction.

B2.5.2 CLAUSE 406 WET MIX MACADAM SUB-BASE/BASE

B2.5.2.1 **Sub Clause 406.1** Delete **the** Sub-Clause 406.1 **and** add **the following Sub Clause 406.1. Scope**

This work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared subgrade/sub-base/base or existing pavement as the case may be in accordance with the requirements of these Specifications along the roadway, at junctions, busbay locations and truck parking areas. The material shall be laid by paver finisher in two uniform layers as necessary to lines, grades and cross-sections shown on the approved drawings or as directed by the Engineer.

The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be increased up to 150 mm upon approval of the Engineer.

B2.5.2.2 **Sub Clause 406.2 Under** Sub-Clause 406.2.1.1 **Physical requirements**

Delete **2nd Sentence in 1st Paragraph in the Sub Clause 406.2.1.1 and replace with the following Sentence**

The constituents of the aggregates shall be produced by a multiple stage crushing and screening plant (Impact or Cone type of Crusher) and, unless otherwise instructed by the Engineer, crushing shall be carried out in at least two stages. The fraction of material passing through 4.75mm sieve shall be crusher run screening only.

B2.5.2.3 Add **the following Paragraph at the end of 1st Paragraph in the Sub Clause 406.2.1.1**

Soundness test shall be carried out in accordance with IS: 2386 (Part- 5), 1963. The average loss of weight of coarse aggregate after 5 cycles shall not exceed 12% when tested with sodium sulphate and 18% when tested with magnesium sulphate as specified in IS: 383-1970

B2.5.2.4 **Sub-Clause 406.2.1.2** Delete **the sentence below table 400-13 "Materials finer than ……." and** add **the following in place of the deleted sentence**

Materials passing 425 micron sieve when tested according to IS: 2720 (part-5) shall have Plasticity Index ZERO (i.e. NON-PLASTIC).

B2.5.2.5 Delete **the words" IS 2386 (part-1)" in Table 400 – 13, under the column head "Test Method", in the row numbered as 2. Combined Flakiness and Elongation Index (Total)**

B2.5.2.6 Add **the words" IS 2386 (part – 1) – 1963 as amended in 1991" in place of the above deleted word.**

B2.5.2.7 **Sub Clause 406.3 Delete the 1st sentence of 2nd paragraph in Sub-Clause 406.3.4 and add the following in place of the deleted sentence.**

The mix shall be laid by paver finisher. Motor graders shall be used, subject to the approval of the Engineer, in work operations for remedying high and low spots.

B2.5.2.8 **Sub Clause 406.3** Delete **the 1st Paragraph in Sub-Clause 406.3.5 and** add **the following Paragraph**

406.3.5. Compaction: After the mix has been laid to the required thickness, grade and cross fall/camber the same shall be uniformly compacted to the full depth with suitable roller. For a compacted single layer of up to 150 mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 kN or equivalent capacity roller. The speed of the roller shall not exceed 5 km/h.

B2.5.2.9 **Sub Clause 406.3** Delete **7th paragraph of Sub Clause 406.3.5. and add the following**

Rolling shall be continued till the density achieved over the full thickness of the material laid is at least 98% of the maximum dry density as determined by the method outlined in IS:2720 (part 8) and satisfies the requirements of Sub Clause 903.3.

B2.5.2.10 **Sub Clause 406.4** Delete **all Paragraphs in Sub-Clause 406.4 and** add **the following Paragraph**

406.4. Opening to Traffic

No vehicular traffic of any kind shall be permitted to use the finished surface of the Wet Mix Macadam except the construction equipment/machinery and trucks/dumpers carrying the materials, required for the next layer of construction.

B2.6 SECTION 500 BASE AND SURFACE COURSES (BITUMINOUS)

B2.6.1 CLAUSE 501 GENERAL REQUIREMENTS FOR BITUMINOUS PAVEMENT LAYERS

B2.6.1.1 **Sub Clause 501.2** Delete **the 1st Paragraph in Clause 501.2.2 and** add **the following in place of above**

501.2.2. Coarse Aggregates: The coarse aggregates shall consist of crushed rock and shall be obtained through the use of cone crusher, vertical shaft impactor and vibratory screens of suitable capacity. They shall be clean, hard, and durable, of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter. Where the Contractor's selected source of aggregates have poor affinity for bitumen, as a condition for the approval of that source, the bitumen shall be treated with approved anti-stripping agents, as per the manufacturer's recommendations, without additional payment. Before approval of the source the aggregates shall be tested for stripping.

B2.6.1.2 **Sub Clause 501.3 Para 1, Line 1, replace the word, "Adequate Capacity" with "Hot mix plant of** Batch Mix **type of minimum capacity of 100 T per hour."**

B2.6.1.3 **Sub Clause 501.6** Delete the **last two sentences in 2nd Paragraph in Clause 501.6 and** add **the following in place of above**

The intermediate rolling shall be done with a smooth wheeled tandem vibratory roller of 8-10 tonne weight followed by a pneumatic tyred roller of 12-15 tonnes weight having nine wheels, with a tyre pressure of at least 5.6 kg /sq. cm. The finish rolling shall be done with 8 -10 tonnes smooth wheeled tandem rollers

B2.6.1.4 Delete the **last two sentences in last Paragraph in Clause 501.6 and** add **the following in place of above**

Only minimum required moisture to prevent adhesion between the wheels of rollers and the bituminous mix should be used. Surplus water shall not be allowed to fall on the bituminous layer during rolling on the partially compacted pavement layer.

B2.6.1.5 **Sub Clause 501.6** Add **the following paragraph at the end of the Clause 501.6**

First set of rolling operations or the break down rolling using heavy rollers should be started as soon as possible after the paver has laid sufficient length of the bituminous mix and the mix has just cooled enough to prevent formation of waves

during the rolling operation. After the break down rolling, the intermediate rolling operations may be carried out using vibratory rollers or pneumatic tyred rollers, or both. The final rolling and finishing may be carried out using smooth wheeled tandem roller, until the roller marks are not formed. Final rolling should be completed before the temperature of the bituminous mixes fall below 100^0C.

B2.6.2 CLAUSE 502 PRIME COAT OVER GRANULAR BASE

B2.6.2.1 Sub Clause 502.2 Delete all **the Paragraphs and Sub-Clauses in Clause 502.2 and** add **the following in place of above**

502.2 Materials

502.2.1 Primer: The choice of a bituminous primer shall depend upon the porosity characteristics of the surface to be primed as classified below:

(i) Surfaces of low porosity
(ii) Surfaces of medium porosity; such as wet mix macadam, water bound macadam and cement stabilised soil base,
(iii) Surfaces of high porosity; such as a gravel base.

502.2.2 Primer viscosity: The type and viscosity of the primer shall comply with the requirements of IS: 8887, as sampled and tested for bituminous primer in accordance with these standards. Guidance on viscosity and rate of spray is given in Table 500-3.

B2.6.2.2 **502.2.3 Choice of primer:** The primer shall be bitumen emulsion, complying with IS: 8887 of a type and grade CSS-1 or as directed by the Engineer. The use of medium curing cutback MC-70 as per IS 217 shall be restricted only for emergency applications as directed by the Engineer.

B2.6.2.3 **502.2.4.5 Tack Coat:** Over the primed base course layer, tack coat shall be applied, if required, only as per the instructions of the Engineer.

B2.6.2.4 Sub Clause 502.8 Rate

B2.6.3 CLAUSE 503 TACK COAT

B2.6.3.1 Sub Clause 503.4 Delete **all Paragraphs in** Sub-Clause 503.4.1 **and add the following in place of above**

503.4.1 Equipment: The tack coat distributor shall be a self-propelled or towed bitumen pressure sprayer, equipped for heating and spraying the material uniformly at the specified temperature and rate of spread. Hand spraying of small areas, inaccessible to the distributor, or in narrow strips, shall be sprayed with a pressure hand sprayer, or as directed by the Engineer.

B2.6.3.2 Sub Clause 503.4.3 and add the following

Where the material to receive an overlay is a freshly laid bituminous layer that has not been subjected to traffic or contaminated by dust, tack coat is not mandatory where the overlay is completed within two days and shall be as directed by the Engineer.

The tack coat laying work should be planned in such a manner that not more than the required tack coat for the day's operation only should be placed on the surface.

B2.6.4 CLAUSE 505 DENSE GRADED BITUMINOUS MACADAM

B2.6.4.1 Sub Clause 505.1 Delete the entire paragraph and add **the following paragraph.**

Sub Clause 505.1.Scope

This clause specifies the construction of Dense Graded Bituminous Macadam, (DBM), for use mainly, but not exclusively, in base/binder and profile corrective courses. DBM is also intended for use as road base material. This work shall consist of construction in a single or multiple layers of DBM on a previously prepared base or sub-base along the entire length of the road including junctions, bus bays and truck parking areas. The thickness of a single layer shall be 50mm to 100mm.

B2.6.4.2 Sub Clause 505.2 Delete **the** Sub Clause 505.2.1 **and** add **the following paragraph.**

505.2.1 Bitumen: The bitumen shall be paving bitumen of Viscosity Grade complying with Indian Standard Specification for Paving bitumen, IS: 73-2006, and of the Viscosity Grade indicated in Table 500-10 or as decided by the Engineer appropriate to the region, traffic, rainfall and other environmental conditions. Guidelines for selection of bitumen are given in Table A4-1 and Table A4-2 in the amended Appendix – 4 to the MORT&H Specifications.

B2.6.4.3 Delete the words "crushed gravel or other hard material" from the 1st sentence of 1st paragraph of the Sub Clause 505.2.2

B2.6.4.4 Delete **2nd Paragraph from** Sub Clause 505.2.2

B2.6.4.5 Sub Clause 505.2 Delete **the entire paragraphs in** Sub-Clause 505.2.4 **and** add **the following paragraph.**

505.2.4 Filler: Filler shall consist of finely divided mineral matter such as hydrated lime or Portland cement. At least 2.0% by weight of total mineral aggregates in the mix shall be hydrated lime or Portland cement as approved by the

Engineer. The filler shall be free from organic impurities and shall be **non-plastic**. Hydrated lime or Portland cement is not required when the aggregate consists of limestone. The lime or cement used as filler material should be in finely powdered form with 100% passing 0.6mm sieve, 95 to 100% passing 0.3mm sieve and 85 to 100% passing 0.075mm sieve.

Where the aggregates fail to meet the requirements of the water sensitivity test in table 500-8, then 2% by total weight of aggregate, of hydrated lime shall be added without additional cost.

B2.6.4.6 Following changes **are to be made to the** Sub-Clause 505.2.5

i) In the gradation **Table 500-10**, the percent weight of aggregates passing 0.075mm sieve for Grading 1 and 2 may be modified as 4 – 8% (instead of 2 – 8%).
ii) A minimum of 2% by weight of total aggregate shall be filler material consisting of hydrated lime or Portland cement.

B2.6.4.6A **Sub Clause 505.2.5.**In **Table 500-10, t**he Bitumen grade shall be read as VG-30.

B2.6.4.7 **Sub-Clause 505.3.5**Delete the last sentence in the second paragraph and add

The density achieved in the field trial as well as during normal compaction in the field shall not be less than 99 percent of laboratory Marshall specimen, compacted with 75 blows on each side.

B2.6.5 CLAUSE 507 BITUMINOUS CONCRETE (BC)

B2.6.5.1 **Sub Clause 507.1** Delete the entire paragraph and add **the following paragraph.**

This clause specifies the construction of Bituminous Concrete, for use in wearing and profile corrective courses. This work shall consist of construction in a single or multiple layers of bituminous concrete on a previously prepared bituminous bound surface along the entire length of the road including junctions, bus bays and truck parking areas.

B2.6.5.2 **Sub Clause 507.2** Delete **the Sub Clause 507.2.1 and** add **the following Sub Clause 507.2.1**

507.2.1 Bitumen: The Polymer Modified Bitumen (PMB -40) shall be paving bitumen of as per IS 15462: 2004and product application as per IRC SP 53:2002for Paving bitumen, IS: 73-2006, and of the Viscosity Grade and design mix indicated in Table 500-17 or as decided by the Engineer appropriate to the region, traffic, rainfall and other environmental conditions.

Specification / Property	PMB 40
Softening Point, ^{0}C (min)	60
Penetration at 25^{0}C	30-50
Elastic Recovery of half thread, % (min)	70
Separation, Difference in softening point, ^{0}C (Max)	3

Usage	Viscosity (poise)	Temperature range, ^{0}C
Binder at mixing	Max 2	165 – 185
Mix at mixing plant	Max 4	140 – 160
Mix at laying site	Max 5	130 – 150

B2.7. CLAUSE 801 TRAFFIC SIGNS

B2.8 CLAUSE 802 OVERHEAD SIGNS

B2.9. CLAUSE 803 ROAD MARKINGS

B2.9.1. Sub Clause 803.2 Delete **the entire** Sub-Clause 803.2 **and** add **the following Sub Clause**

803.2. Materials

Road markings shall be of hot applied thermoplastic compound, or reflectorized paint as specified in the item and the material shall meet the requirements as specified below.

B2.9.2 Sub Clause 803.3 Delete **the entire** Sub-Clause 803.3

B2.9.3 Sub Clause 803.6 Delete **the** Sub-Clause 803.6.1 **and** add **the following Sub Clause**

803.6.1. The road marking shall be done with the appropriate road-marking machine as approved by the Engineer. For locations where painting cannot be done by machine, approved manual methods shall be used with prior approval of the Engineer. The Contractor shall maintain control over traffic while painting operations are in progress so as to cause minimum inconvenience to traffic compatible with protecting the workmen.

B2.9.5 CLAUSE 804 RAISED REFLECTIVE PAVEMENT MARKERS (RPM)

B2.9.5.1 **Sub Clause 804.2.2** At the end of **Sub Clause 804.2.2** add the following
Reflective panels are electronically welded to the plastic body.

The marker body shall be produced in neutral white or yellow colour. The colour of the retro reflective element shall be as specified in the drawing.

Sub Clause 804.3 Delete the entire content in **Sub Clause 804.3** and add the following

The height, width and length shall be as indicated in the drawing or as directed by the Engineer and in no case should not exceed 20mm, 130mm and 105mm respectively. The slope of retro-reflecting surface shall preferably be within the limit of 35+/-5 degree to base.

The area of retro-reflecting surface shall not be less than 13.0 sqcm.

Sub Clause 804.4 Optical Performance

Sub Clause 804.4.1 Unidirectional and bi-directional studs

B2.9.6 CLAUSE 811 CRASH BARRIER

B2.9.6.1 **Sub Clause 811.1**

Delete **the entire** Sub Clause 811.1 **and** add **the following**
Sub Clause 811.1 This work shall consist of construction, provision and installation of concrete crash barrier at the edges of bridges of dimensions as shown in drawings or as directed by the Engineer.

B2.9.6.2 **Sub Clause 811.2 CONCRETE CRASH BARRIER**

Sub Clause 811.2.1.1 Delete **the entire** Sub-Clause 811.2.1.1**and** add **the following Sub Clause 811.2.1.1**Concrete barriers shall be constructed with M-40 grade concrete and with TMT bars satisfying requirements of High Yield Strength Deformed Bars (Grade designation S 500) conforming to IS: 1786.

B2.9.6.3 **Sub Clause 811.3 METAL BEAM CRASH BARRIER**

B2.9.6.3.1 **Sub Clause 811.3.1**Delete **the entire** Sub-Clause 811.3.1.1**and** add **the following Sub Clause**

811.3.1.1 Metal beam is a "W" profiled corrugated beam as specified in drawings made from cold rolled steel strip of 3.0 mm thick using high strength steel of IS:5986 Fe 510 grade and have properties as under:

Ultimate Tensile Strength (Min.): 483 Mpa.
Yield stress (Min.): 345 Mpa.
Elongation (Min.) in 50mm: 12%

The beam after forming shall have formed width of 330 mm and depth of 83 mm and shall have punched holes for fixing as specified in drawings. The metal beam crash barrier will be provided with trapezoidal reflectors at regular intervals.

The metal crash barrier post is made from cold rolled steel channel of 5 mm thickness and of steel conforming to IS: 5986 grade Fe.360 as specified in drawings.

The spacer is made of cold rolled steel channel with cross section and material same as that of post.

All bolt nuts and washers as specified in drawings shall conform to IS: 1367 & IS:1364 unless otherwise specified and are hot dip galvanised.

B2.9.6.3.2 **Sub Clause 811.3.1.3**Delete **the entire** Sub-Clause 811.3.1.3**and** add **the following**

Sub Clause811.3.1.3. Concrete for bedding and anchor assembly shall conform to Section 1700of these Specifications. The size of the concrete foundation block for embedding the posts and grade of concrete shall be as shown in the drawing.

B2.9.6.3.3 **Sub Clause 811.3.3**Delete **the entire** Sub-Clause 811.3.3.5**and** add **the following**

Sub Clause811.3.3.5. Posts for metal beam guardrails on bridges shall be bolted to the structure as detailed in the drawings. The anchor bolts shall be set to proper location and elevation with templates and carefully checked.

B2.9.6.3.4 **Sub Clause 811.3.7**Delete **the entire** Sub-Clause 811.3.7.1**and** add **the following Sub Clause**

811.3.7.1. Metal beam railing barriers will be measured by linear metre of completed length as per plans and accepted in place.

B2.9.6.3.5 Delete **the entire** Sub-Clause 811.3.7.2**and** add **the following Sub Clause**

811.3.7.2. No separate measurement for payment shall be made for Terminals /Anchors of various types required for the work. The cost of these elements shall be deemed to be included in the rate quoted by the Contractor. Furnishing and placing anchor bolls and/or devices for guard rail posts on bridges shall be considered incidental to the construction and the costs thereof shall be included in the price for other items of construction

B2.9.6.3.6 **Sub Clause 811.3.8**Add **the following words at the end of the last sentence in** Sub-Clause 811.3.8
"and drawings."

B2.10 SECTION 900 QUALITY CONTROL FOR ROAD WORKS

B2.10.1 CLAUSE 902 CONTROL OF ALIGNMENT, LEVEL AND SURFACE REGULARITY

B2.10.1.1 **Sub Clause 902.4** Add **the following paragraph at the bottom of the** Sub-Clause 902.4

The Contractor shall, as directed by the Engineer, check the roughness of the surface layer with a roughometer (also known as a Bump Integrator), in the presence of the Engineer or his representative, before approval of the surface layer of any section for payment. The Roughometer shall be calibrated before carrying out any test run on the project roads, with any suitable system (e.g. Merlin wheel) to produce standard test results. The Contractor shall, at his own cost, calibrate Roughometer using a calibration system acceptable to the Engineer, to be available on site as and when required. Roughness shall be checked along the wheel paths in 3 trial runs and the Contractor shall submit an average roughness value at 100m intervals in a standard format to the Engineer. The average Roughness value per kilometer of a tested section (length not less than 500 m) shall satisfy the following criteria depending on the type of surface, failing which, the Contractor shall rectify the surface at defective locations at his own cost to the satisfaction of the Engineer, to give a acceptable riding surface.
Acceptable Roughness criteria:

Type of Surface	**Roughness Value (BI)**
Bituminous Concrete	Max. 2000 mm/km
Premix bituminous carpet	Max. 3000 mm/km

B2.11 SECTION 1000 MATERIALS FOR STRUCTURES.

B2.11.1 CLAUSE 1006 CEMENT

B2.11.1.1 Add **the following to Clause 1006**

Each delivery of cement to Site shall be accompanied by a certificate confirming that the cement complies with the requirements of the relevant standards and the Contractor shall forward a copy of this certificate to the Engineer within 24 hours of the delivery to Site.

Notwithstanding the provision of such certificates the Engineer may require independent tests to be carried out on the cement stored on Site, or require relevant tests to be carried out to determine its suitability for use in the Works as required

by IS:269, IS:8112 or IS:12269. The Contractor shall arrange for samples to be provided either direct from the manufacturer or from the cement stored on Site, as may be determined by the Engineer. Cement that has been stored on Site for a period in excess of three months shall be re-tested before its use. The cost of providing such samples and re-testing shall be borne by the Contractor.

B2.11.2 CLAUSE 1007 COARSE AGGREGATES

B2.11.2.1 Delete **the following from 3rd and 4th lines of 1st paragraph "Crushed gravel …….inert material"**

B2.11.2.2 Add **the following at the end of 2nd Paragraph**
"Costs of all tests shall be borne by the Contractor"

Add **the following at the end of the Clause**
Integrated stone crusher with Primary and Secondary (Cone or Impact Type)crushers shall be deployed for getting proper size and grading of coarse aggregates. The alkali aggregate reactivity should be measured and reported for getting approval for the source aggregates at the beginning of the work using methods given in IS: 2386. The tests may be repeated if the source or the type of rock being exploited for winning aggregates, changes.

B2.11.3 CLAUSE 1008 SAND/FINE AGGREGATES

Add **the following paragraph at the end of the clause**

The alkali aggregate reactivity should be measured and reported for getting approval for the source.

B2.11.4 CLAUSE 1009 STEEL

B2.11.4.1 Sub Clause1009.2: Add the following sentence at the end of the Sub Clause) Stress relieved low relaxation seven-ply strand for prestressed concrete - IS:14268

B2.11.4.2 Sub Clause1009.3: Replace **the following in the** Table 1000.3IS: 1786 High Yield Strength Deformed bars (HYSD)With IS: 1786 Thermo mechanically treated (TMT) High yield strength deformed bars(HYSD)

Any other reference to "HYSD**" bars in the specifications shall be read as "**TMT**" bars.**

B2.11.5 CLAUSE 1010 WATER

B2.11.5.1 Delete **all paragraphs in Clause 1010 and** substitute **the following paragraphs**

Water used for mixing and curing shall be clean and free from injurious amounts of oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel.

In case of doubt regarding development of strength, the suitability of water for making concrete shall be ascertained by the compressive strength and initial setting time tests.
The sample of water taken for testing shall represent the water proposed to be used for concreting, due account being paid to seasonal variation. The sample shall not receive any treatment before testing other than that envisaged in the regular supply of water proposed for use in concrete. The sample shall be stored in a clean container previously rinsed out with similar water.

Average 28 days compressive strength of at least three 150 mm concrete cubes prepared with water proposed to be used shall not be less than 90 per cent of the average of strength of three similar concrete cubes prepared with distilled water.

The cubes shall be prepared, cured and tested in accordance with the requirements of IS: 516.

The initial setting time of test block made with the appropriate cement and the water proposed to be used shall not be less than 30 minutes and shall not be more than + 30 minutes from the initial setting time of control test block prepared with the same cement and distilled water. The test blocks shall be prepared and tested in accordance with the requirements of IS: 4031 (part 5).

The pH value of water shall be not less than 6. Potable water is generally considered satisfactory for mixing concrete. As a guide the following concentrations represent the maximum permissible values:

a) To neutralize 100 ml sample of water, using phenolphthalein as an indicator, it should not require more than 5 ml of 0.02 normal NaOH. The details of test are given in 8.1 of IS:3025 (Part 22).

b) To neutralize 100 ml sample of water, using mixed indicator, it should not require more than 25 ml of 0.02 normal H_2SO_4. The details of test shall be given in Clause 8 of IS:3025 (Part 23).

Permissible limits for solids shall be as follows:

PERMISSIBLE LIMITS FOR SOLIDS

	Tested as per	**Permissible Limit**
Organic	IS 3025 (Pt. 18)	200 mg/lit
Inorganic	IS 3025 (Pt. 18)	3000 mg/lit
Sulphates (as SO3)	IS 3025 (Pt. 28)	400 mg/lit
Chlorides (as Cl)	IS 3025 (Pt. 32)	2000mg/lit for concrete work not containing embedded steel and 500mg/lit for prestressed / reinforced concrete work.
Suspended matter	IS 3025 (Pt. 17)	2000 mg/lit

Mixing or curing of concrete with seawater is not permitted because of presence of harmful salts in seawater.

Water found satisfactory for mixing is also suitable for curing concrete. However, water used for curing should not produce any objectionable stain or unsightly deposit on the concrete surface. The presence of tannic acid or iron compounds is objectionable.

B2.11.6 CLAUSE 1012 CONCRETE ADMIXTURES

B2.11.6.1 **Sub Clause 1012.3.1:** Add **the following at the end of paragraph 1 of** Clause1012.3.1

Admixtures shall not impair the durability of concrete; they shall not combine with the ingredients to form harmful compounds or endanger the protection of reinforcement against corrosion. Only chloride free admixtures shall be used.

B2.11.6.2 Delete **the paragraph 2 in Sub-clause 1012.3.1 and a**dd **the following paragraph**

For all admixtures being used the packing shall be marked with the name of the supplier/manufacturer, brand name (name of product) and main effect. A certificate for the admixture in question shall be submitted. The certificate shall include the following information:
A. General
a) Chemical name of the active component in the admixture.

b)Values of dry material content, ash content and relative density of admixture, which can be used for uniformity tests.
c) Chloride ion content expressed as a percentage of weight of cement.
d) pH value and colour.
e) Normal side effects e.g. whether the admixture leads to air entrapment at recommended dosage and if so to what extent.
f) Side effects when overdosed
g) If two or more admixtures have to be used in one mix, their compatibility
h) Increase in risk of corrosion to reinforcements and
i) Embodiments due to the use of admixture.
j) Latest date of test and name of test laboratory.

B. Storing
a) Shelf life
b) Max. & min. allowable temperature
c) Other instructions (e.g. requirements of stirring)

C. Dosage
Maximum and minimum to be specified as a percentage of weight of cement.

B2.11.6.3 Add **the following paragraphs at the end of the** Sub-clause 1012.3.1

After selecting a few acceptable brands & types of admixture based on the manufacturer's data/technical literature, independent acceptance tests should be carried out for the same using the approved combinations of cement/sand/aggregates intended for use in the Project. After establishing the basic acceptability using strength criteria (compression & tensile strengths) a number of trial mixes be designed using different proportions of admixtures/cement/water etc. to establish the data bank on the behaviour of the admixture for the project site conditions. A spectroscopic signature of accepted product should be obtained and preserved for comparison for acceptance of the production lots.
Retrials should be conducted with change in source/type of cement.

Workmanship

The dosage should be finalised on the basis of field trial and special mechanical devices should be used for dispensing the admixture in the batching / mixing plant. No addition of admixture after dosage is permitted (including addition in transit mixers).

Manufacturer's experts should be available for consultation/trouble-shooting of problems associated with their product. The conditions of storage, shelf life etc., as specified by the manufacturer should be strictly observed. The manufacturer's

Quality Assurance Plan during process of production should be obtained and filed for reference/record.

B2.11.7 CLAUSE 1014 STORAGE OF MATERIALS

B2.11.7.1 Sub Clause 1014.3: Add **the following to the Sub-clause 1014.3**

Aggregates shall be stored or stockpiled in their respective size in such a manner that the various sizes will not become intermixed before proportioning. They shall be stored, stockpiled and handled in such a manner that will prevent contamination by foreign materials.

B2.12 SECTION 1400 STONE AND CONCRETE BLOCK MASONRY

B2.12.1 CLAUSE 1402 MATERIALS

B2.12.1.1 REPLACE **the Clause with the following Clause**

1402. MATERIALS

Stone to be used, besides quarry stone, shall be obtained by dressing the boulders of average diameter not less than 300 mm and at least five faces shall be chiselled.

All other materials used in stone masonry shall confirm to Section 1000 except cement mortar, which shall confirm to clause 1304.

B2.13 SECTION 1500 FORMWORK

B2.13.1 CLAUSE 1501 DESCRIPTION

REPLACE **the Clause with the following Clause**

1501. DESCRIPTION

The Contractor shall prepare a formwork mobilization and utilization plan and submit the plan for Engineer's approval at least 21 days before the commencement of construction of structures. The requirement of formwork shall be worked out considering the overall construction program of all the structures to be cast in one or more stages, as specified in the drawings. The plan shall take into account the time required for erection of formwork, retention in position, stripping, and removal and subsequent use in the next and subsequent structures. Notwithstanding Engineer's approval of mobilisation plan, if due to any reason, Contractor has to arrange additional formwork, to meet the requirements of the construction program, it shall be done by the Contractor without any extra cost to the Employer.

B2.13.2 CLAUSE 1502 MATERIALS

Delete **the last sentence in 1st paragraph**
Delete **the word "**or timber**" in 1st line of 2nd paragraph**

B2.13.3 CLAUSE 1503 DESIGN OF FORMWORK

B2.13.3.1 Sub Clause 1503.1: Add **the following to the Sub-clause 1503.1**
For distribution of load and load transfer to the ground through staging, an appropriately designed base plate must be provided which shall rest on firm substratum

B2.14 SECTION 1600 STEEL REINFORCEMENT (UNTENSIONED)

B2.14.1 CLAUSE 1604 BENDING OF REINFORCEMENT

Add **the following paragraph at the end of the Clause 1604**
The separate bar bending schedule shall be prepared for auxiliary bars like spacers chair etc. Bar bending shall be done as per IS 2502.

B2.14.2 CLAUSE 1605 PLACING OF REINFORCEMENT

Delete **item (i) in paragraph c) in Clause 1605 and** add **the following paragraph in place of the above**

(i) Cover blocks shall be made of concrete or cement mortar with the same durability properties as the surrounding concrete and with the same type of constituents. In visible surfaces, the cover blocks shall be of the same colour and texture as the surrounding concrete. The Contractor's proposal for cover blocks shall be submitted to the Engineer for acceptance

B2.14.3 CLAUSE 1606 BAR SPLICES

B2.14.3.1 Sub Clause 1606.1: Delete **the first sentence in** Sub Clause 1606.1 **and** replace with **the following sentence**

To the extent possible, all reinforcement shall be furnished in full lengths as indicated in drawings.

B2.14.3.2 Add **the following paragraph at the end of the** Sub-clause 1606.1

The length of bars more than Standard (generally taken as 12m), in such cases lapping of bars (not shown in drawings) shall be submitted to the Engineer for approval.

B2.14.3.3 Sub Clause 1606.2: Add **the following at the end of the Sub Clause 1606.2.1**

In prestressed concrete members, when welding of un-tensioned reinforcement is permitted by the Engineer, it shall be carried out before insertion of the pre-stressing tendons.

B2.14.4 CLAUSE 1607 TESTING AND ACCEPTANCE

B2.14.4.1 Add **the following two paragraph at the end of second paragraph in Clause 1607**

The reinforcement steel shall be from main/major Producers as approved by Ministry of Steel Government of India and no re-rolled steel from Induction Furnace route shall be supplied and used.

In case of procurement of steel from units other than the ministry of steel approved main/major producers specific approval of Engineer, in charge is required. For which credential verification shall be undertaken regarding the fact that these units are conversion agent of ministry of steel approved main/major producer for steel bars with clean track record of performance. The procurement of steel from conversion agent shall satisfy the following minimum requirements:

(a) Certificate from the conversion agent that he had used the billets supplied by ministry of steel approved main/major producer with production of co-related documents i.e invoice/T.C need to be submitted along with each consignment document.

(b) In case of steel units having captive raw material manufacturing facility, facilities other than manufacturing technology satisfying clause 4.1 of IS 1786:2008 i.e open hearth, electric, duplex, basic oxygen process or combination of these processes, approval will not be accorded. If any manufacturing facility through Induction furnace route, it would not be considered for approval under any circumstances.

(c) Certificate regarding continuity of the BIS license and agreement with the ministry of steel approved Main/Major producers being its authorized conversion agent during the currency of supply contract.

(d) The sampling and testing shall be laid down as per IS 1786:2008.Every consignment bar shall be inspected before assembling on the work and defective brittle or burnt bar and cracked ends of bars shall be discarded.

B2.15 SECTION 1700 STRUCTURAL CONCRETE

B2.15.1 CLAUSE 1701 DESCRIPTION

B2.15.1.1 Add **the following paragraph after the first paragraph**

The Contractor shall obtain prior approval from the Engineer for the method of mixing, batching and casting of pre-cast concrete members (girders, slabs) as per drawings. Quality control and quality assurance shall be complied at every stage from mixing, batching to casting. Arrangements shall be made for proper curing of pre-cast concrete members. Suitable arrangements shall be made for transportation, handling and erection of pre-cast concrete members in their final position as shown in the drawings or as directed by the Engineer. Care shall be taken while handling, transporting and erection of the pre-cast concrete members, so that they are not damaged.

B2.15.2 CLAUSE 1703 GRADES OF CONCRETE

B2.15.2.1 **Sub Clause 1703.2:** Delete **all the paragraphs and Tables in** Sub-clause 1703.2 **and** add **the following in place of the above**

1703.2. The lowest grades of concrete in bridges and corresponding minimum cement contents and water-cement ratios shall be maintained as indicated in the following Tables.

(A) For bridges with pre-stressed concrete or those with total length more than 60 m or those that are built with innovative design/construction.

Structural Member	**Minimum grade of concrete and Conditions of Exposure**		**Min. Cement content for all exposure conditions (kg/cu m)**	**Maximum water cement ratio conditions of exposure**	
	Moderate	Severe		Moderate	Severe
a)PCC members	M25	M30	360	0.45	0.45
b)RCC members	M30	M35	400	0.45	0.40
c)PSC Member	M35	M40	400	0.40	0.40

B) For bridges other than those mentioned in Table A for culverts and other incidental construction

Structural Member	Minimum grade of concrete and Conditions of Exposure		Min. Cement content for exposure conditions (kg/cu m)		Maximum water cement ration conditions of exposure	
	Moderate	Severe	Moderate	Severe	Moderate	Severe
a)PCC members	M15	M20	250	310	0.50	0.45
b)RCC members	M20	M25	310	400	0.45	0.40

Notes: -

1. Moderate – conditions other than 'severe'
The minimum cement content is based on 20mm size aggregates. For larger size aggregates it may be reduced suitably by not more than 10 percent similarly for smaller size aggregates, it may be suitably increased, but not more than 10 percent.
2. For under water concreting the cement shall be increased by 10% more than that required to develop the strength for the same mix placed in dry. However it shall not fall below the minimum cement content specified in above table.
3. Severe conditions of exposure shall mean alternate wetting and drying due to sea spray, alternate wetting and drying combined with freezing and buried in soil having corrosive effect.
4. Moderate conditions of exposure shall mean other that those mentioned in (iii) above.

The cement content shall be as low as possible but not less than the quantities specified above. In no case shall it exceed 540 kg/cum of concrete.

B2.15.2.2 **Sub Clause 1703.4:** Add **the following at the end of the** Sub-clause 1703.4
The concrete mixes leaner than M15 shall be called as nominal mix concrete.

"**Nominal mix concrete** is that concrete for which, concrete is not to be designed by tests and in which the proportions of materials are in accordance with the drawing and the specification Clause mentioned below:

i. All the materials for this concrete shall conform to section 1000 of Part I of General Technical Specification.
ii. Minimum cement content and maximum water cement ratio for above said nominal mix concrete shall conform to Clause 1703.2 Table 1700-3(A) of Part I of General Technical Specification.

iii. Mixing of above said nominal mix concrete shall conform to Clause 1708 of Part I of General Technical Specification

iv. Transporting, Placing and Compaction of above said nominal mix concrete shall conform to Clause 1709 of Part I of General Technical Specification".

B2.15.3 CLAUSE 1705 ADMIXTURES

Delete **all the paragraphs in Clause 1705 and** add **the following paragraphs**

Duly tested admixtures/additives conforming to IS: 6925 and IS:9103 (without replacement of cement) may be used subject to satisfactory proven use, with the approval of the Engineer. Admixtures generating Hydrogen or Nitrogen and containing chlorides, nitrates, sulphides, sulphates and any other material liable to adversely affect the steel or concrete shall not be permitted.

The general requirements, physical and chemical requirements shall be as per Clause 1012.

B2.15.4 CLAUSE 1706 SIZE OF COARSE AGGREGATE

Replace the value 40 with 20 in the TABLE 1700 – 7 under the column "Maximum Nominal Size of Coarse Aggregate (mm)" in the row numbered as iii)"Well cap or Pile cap, Solid type piers and abutments"

B2.15.5 CLAUSE 1708 BATCHING, MIXING, TRANSPORTING, PLACING AND COMPACTION

Sub Clause 1708.3 Mixing Concrete

B2.15.5.1 Add **the following paragraph at the end of Clause 1708.3.1**

The Contractor shall take precautions during periods of high wind to prevent cement being blown away during the process of batching and mixing.

B2.15.5.2 SUB CLAUSE 1708.5PLACING OFCONCRETE

Add **the following paragraph at the end of fourth paragraph**

For Placing Concrete with Pumps: Pipelines from the pump to the placing area should be laid out with a minimum of bends. For large concrete placements stand by pumps shall be available. Suitable valves (air release valves, shutoff valves etc.)shall be provided as per the site needs. The pumping of concrete shall be preceded by a priming mix to lubricate the pump and pipeline. A rich mix of creamy consistency shall be required for lubricating the pipelines. Continuous pumping shall be done to the extent possible. After concrete has been placed, the pipelines and all related equipment shall be cleaned immediately. A plug sponge ball shall be inserted in the end near the pump and shall be forced through the line

by either water or air pressure. Pipes for pumping should not be made from materials, which can harm concrete; aluminium alloy pipelines shall not be used.

B2.15.6 CLAUSE 1709 CONSTRUCTION JOINTS

B2.15.6.1 Add **the following paragraph at the end**

The number of joints shall be kept as minimum as possible and their construction should be simple. They should be either horizontal or vertical, because concreting sloping surfaces are unsatisfactory.

Where concrete is placed in vertical members e.g. walls and columns the Contractor shall form construction joints horizontally or, in the case if sloping members, at right angles to the axis of the member. He shall form construction joints at locations such that their visual impact is minimised, and shall place concrete in a continuous operation without breaks between construction joints.

The Contractor shall take care when erecting the formwork for subsequent pours to ensure that no leakage can occur at the construction joint.

B2.15.7 CLAUSE 1711 ADVERSE WEATHER CONDITIONS

B2.15.7.1 Sub Clause 1711.3: Add **the following as new** Sub-Clause 1711.3

1711.3. Wet Weather Conditions: The Contractor shall not carry out any concreting operations during periods of continuous heavy rain. The Contractor shall protect concrete after pouring from detrimental effects of wet weather.

B2.15.8 CLAUSE 1712 PROTECTION AND CURING

B2.15.8.1 Add **the following at the end of the 1st paragraph**

Wherever possible, use of water sprinklers or perforated pipes should been couraged for curing of concrete. Such arrangement must be maintained for a minimum period of 14 days after concreting. Approved concrete curing compounds should be preferred where water curing cannot be done reliably

B2.15.9 CLAUSE 1713 FINISHING

B2.15.9.1 Add **the following to Clause 1713**

The Contractor shall rectify any defects in the finish of the concrete exposed when formwork is removed in the following manner:

(i) Bulges and ridges shall be removed by careful chipping or tooling and the surface rubbed with a grinding stone;

(ii) Honeycombed and other defective areas shall be chipped out, the edges being cut as straight as possible and perpendicular to the surface, or slight undercut to provide a key at the edge of the patch;

(iii) Shallow patches shall be treated with a coat of thin grout composed of one part of cement and one part of sand then filled with mortar of the same mix as the one used in the parent concrete. The mortar shall be placed in layers of not more than 10mm thick and the surface of each layer roughened to provide a key for the subsequent layer. The final layer shall be finished to match the surrounding concrete by floating, rubbing or rolling on formed surfaces by pressing the form material against the patch while the mortar is still plastic;

(iv) Where necessary formwork shall be provided to contain concrete in large voids, such patches shall be treated with epoxy to provide an effective bond between the fresh concrete and the hardened concrete;

(v) Remedial work to defective concrete shall be cured in a like manner as the parent concrete, to the satisfaction of the Engineer.

B2.15.10 CLAUSE 1717 TESTS AND STANDARDS OF ACCEPTANCE

B2.15.10.1 Sub Clause 1717.7.6:Add the following to Sub-Clause 1717.7.6

Any concrete which gives results below the specified limits in relevant codes or becomes severely damaged due to cracking or shows excessive honey-combing and exposure of reinforcement or exhibits any fault which, in the opinion of the Engineer, so seriously impairs its function that it cannot be accepted as substandard work, shall be declared defective concrete. Such concrete shall be cut out, removed and replaced by fresh concrete of the specified quality at the Contractor’s cost to the satisfaction of the Engineer.

In case of doubt regarding grade of concrete used, either due to poor workmanship or based on results of cube crushing strength, tests of concrete on the basis of any or all of the following shall be carried out. The Engineer shall be the final authority for interpreting the results of all these tests and the Contractor shall carry out these tests at his own cost if the tests reveal that the concrete fails to meet the requirements of the Contract.

Core Tests

The points from which cores are to be taken and the number and size of cores required shall be instructed by the Engineer and it shall be representative of the whole of the concrete being investigated. In no case, however, shall fewer than three cores be tested. Cores shall be prepared and tested as described in IS: 516.

Concrete in the member represented by the core tests shall be considered acceptable if the average equivalent strength of 85% of the corresponding specified grade of concrete is achieved. The Contractor shall make good the areas from which the cores were taken to the satisfaction of the Engineer.

Other non-destructive tests

The Engineer may instruct non-destructive tests such as rebound hammer tests or ultrasonic tests.

B2.15.11 CLAUSE 1719 RATE

B2.15.11.1 Add **the following paragraph at the end of 2 paragraph to clause 1719**

For pre-cast concrete members, the contract unit rate in addition to above shall also include the cost of all materials, labour, tools and plant required to transport and place these members in their final position as shown on the drawings and as directed by the Engineer.

B2.16 SECTION 2000 BEARINGS

B2.16.1 CLAUSE 2001 DESCRIPTION

B2.16.1.1 Add **the following paragraph at the end of the Clause 2001**

Within 180 days of award of work, the Contractor shall submit detailed specifications, designs and drawings including installation drawings and maintenance manual, for the approval of the Engineer. Designs shall also include review and modifications of designs and drawings of bearing pedestals and other elements required for installation. The installation of bearings shall be carried out under the supervision of the manufacturer of the bearings.

B2.16.2 CLAUSE 2005 ELASTOMERIC BEARINGS

B2.16.2.1 Add **the following to Sub-Clause 2005.1**

Polymer identification test shall be carried out as per ASTM D-3677 by infrared spectro photometry and the spectra shall be comparable to a reference sample of polychloropene.

B2.16.2.2 Sub Clause 2005.2: Add the following after the first line of second paragraph of Sub-Clause2005.2

The mould shall be kept at a uniform temperature for 15 (fifteen) minutes to ensure effective vulcanisation of the bearing.

B2.16.2.3 Sub Clause 2005.4: Delete the word "Inspector" in the 1st line of 5th paragraph in Sub-Clause 2005.4 and replace with **"Engineer or his authorized representative"**

B2.16.2.4 Delete **the last paragraph in** Sub-Clause 2005.4.3.1 **and** add **the following paragraph**

The test specifications and acceptance criteria shall conform to those given in Appendix 2 of IRC: 83 (Part II), by **replacing** the Fig. 11. "Determination of elastic modulus" **with** the figure published in the journal "INDIAN HIGHWAYS", April1998.

B2.17 CLAUSE 2100 OPEN FOUNDATIONS

B2.18 SECTION 2200 SUB-STRUCTURE

B2.19 CLAUSE 2204 PIERS AND ABUTMENTS

B2.19.1. Add **the following paragraph at the end of Clause 2204.6**

Where necessary suitable cofferdams or other means shall be provided to exclude water from the construction area the Contractor shall provide necessary pumping equipment for dewatering in working areas.

B2.19.2 CLAUSE 2210 RATE

B2.19.2.1 Delete **the entire paragraph in Clause 2210 and** add **the following paragraph**

The contract rate for masonry, concrete and reinforcement in substructure shall include all works as given in respective sections and cover the cost of incidental items like providing cofferdams, dewatering, providing special formwork, where necessary, and all other items for furnishing and providing substructure as mentioned in this section

B2.20 SECTION 2300 CONCRETE SUPERSTRUCTURE

B2.20.1 CLAUSE 2304 REINFORCED CONCRETE CONSTRUCTION

B2.20.1.1 Sub Clause 2304.2: Delete **the 1st paragraph in Sub-clause 2304.2 and** add **the following paragraph**

Pre-cast RCC T beam and in-situ construction, as applicable shall be permitted

B2.21 SECTION 2600 EXPANSION JOINTS.

B2.21.1 CLAUSE 2602 GENERAL.

B2.21.1.1 Add **the following to Clause 2602.4**

The Contractor shall not incorporate any expansion joints into the Works without the approval of the Engineer. Such approval shall be dependent upon the Contractor submitting inspection certificates issued by the inspection authority or any other body acceptable to the Engineer certifying that the expansion joints components have been inspected and tested as per the Drawings and Specification. All inspection and testing charges including cost of material shall be borne by the Contractor.

The Contractor shall ensure that the manufacturer has adequate testing facilities to enable the expansion joints to be tested at the place of manufacture. The expansion joints and accessories thereof shall be subjected to all the specified tests on both the raw materials as well as the finished product by the Engineer or his authorized representative at the manufacturer's works.

The Contractor shall ensure that an original copy of documentary evidence regarding the source of imported "elastomer" and other ingredients is provided by the manufacturer. The inspection agency shall ensure that the joints are manufactured by using the consignment of imported "elastomer" and other ingredients. The test certificate for the steel sections to be provided by the manufacturer shall be submitted to the Engineer by the Contractor.

B2.22 SECTION 2700 WEARING COAT AND APPURTENANCES

B2.22.1 CLAUSE 2702 WEARING COAT

B2.22.1.1 Sub Clause 2702.1: Delete **all the paragraphs in Sub-clause 2702.1. and** add **the following paragraphs**

Bituminous wearing coat shall comprise the following:

i) 65 mm thick asphaltic concrete wearing coat in two layers, one of 40 mm thickness and other of 25 mm thickness as per Clause 512

B2.22.2 CLAUSE 2706 WEEP HOLES

B2.22.2.1 Delete **the entire paragraph in Clause 2706 and** add **the following paragraph**

Weep holes shall be provided in solid plain concrete / reinforced concrete brick or stone masonry abutments, wing walls, return walls as shown in the drawing or as directed by the Engineer to drive moisture from the back filling. Weep holes shall be provided with 100mm dia PVC (6 Kg/cm2) pipe and shall extend through the full width of concrete with slope of about 1 vertical: 20 horizontal towards the draining face.

The spacing of weep holes shall generally be 1 m in either direction or as shown in the drawing with the lowest at about 150 mm above the low water level or ground level whichever is higher or as directed by the Engineer

B2.23 SECTION 2800 REPAIR OF STRUCTURES

B2.23.1 Add **following new Sub-Clause 2802.6**

B2.23.1.1 **2802.6 Repairs and Rehabilitation:** In addition to the existing Clauses, following points shall be noted and shall be adopted wherever applicable or as directed by the Engineer for repairs and rehabilitation of Bridges.

Chipping

Chip off loose, weak and unsound concrete from structural members using chisels and hammers. Electrical/pneumatically operated chisels which also to be used wherever required up to average depth. The loose concrete behind reinforcement should be carefully removed and corroded reinforcement shall not be bent nor damaged during the chipping operation. Care shall be taken to avoid damage to any part of existing structure. Only loose concrete shall be taken out.

All the chipped off, dismantled materials shall be disposed off. Materials/debris falling must be arrested using suitable arrangements to avoid harm to working personnel or others.

The Contractor at his cost shall restore damages caused to any component of the bridge structure/service lines during the chipping operation.

Surface Preparation

Removal of corrosion scales on corroded reinforcement bars should be done manually using sharp tools such as chisels to scrap rust scales from the surface without displacing/ damaging the reinforcement. There after use wire brushes to clean the surface of bars. Since the brush would not be access behind the bars use emery papers to clean exposed surface as well as areas with difficult access. Rotary wire brushes, shaft type rotary wire brushes to be used where ever required.

Exposed concrete surfaces shall be cleaned with wire brushes/rotary wire brushes to remove all loose material, dust, dirt, oil etc. finally use oil free air blast to clean the surface.

Providing additional reinforcement

Wherever the reinforcement is reduced by corrosion, compensating extra reinforcement is to be provided along the existing steel by welding with a weld length of 25mm and living gap of 100mm alternatively. Where ever the reinforcement is totally corroded leaving its two ends open, welding shall be carried out upto required length from both sides. And 100mm length anchorage's in the form of shear connectors of 12 mm size shall be drilled and fixed along the additional reinforcement at 300 mm c/c and welded. The anchorages shall be fixed using epoxy grouts as per manufacture's specifications.

Anti- corrosive reinforcement treatment for exposed reinforcement bars

Reinforcing bars shall be coated with an anti corrosive coating of 120 microns DFT confirming to ASTM-B- 117 (salt spray 100 hours) as per manufacturer's specifications.

Epoxy bonding agent for concrete

Structural grade bonding agents of epoxy base conforming to ASTM-C-81-82(6.9N/mm2)bond strength shall be used for all structural repairs, for bonding between old and new concrete. The bonding agent should remain in tacky state prior to placing of fresh concrete. Material shall be applied as per manufacture's specification for properties of epoxy bonding agent.

Application of Super Plasticized Micro silica repair mortar

Application of Microsilica and Fiber blended repair mortar is done as per manufacture's specification. The above mix is to be applied by trowel and finished smooth without excessive finishing. In one application 25mm of thickness is to be built up. Subsequent layers to be done with one bond coat of cement slurry. This should be covered with burlap and cure by spraying periodically with water for 10days and allow to dry for next 5 days.

Polymer modified mortar

All honey combed/exposed concrete surfaces of structural members shall be applied with cement based polymer modified mortar which can be prepared at site using OPC, polymer, aggregates, as per manufactures specification. The polymer modified mortar shall be applied after priming the surface with non-re-emulsifiable latex based bonding agent conforming to ASTM-1059 Type II.

Anti corrosive& Anti carbonation protective coating to concrete surface

Concrete shall be coated with anti corrosive and anti carbonation protective coating.

Treatment of cracks and honey combed areas in structural members

For Cement grouting

Drill hole 14mm dia. in the concrete for a depth of 100mm and clean the holes with oil free air blast. Fix 12mm dia aluminium nozzles of 100mm depth for a depth of 50mm into the hole using fixing compounds as per manufactures specification.

Cementitious Polymer grouts for cracks

Cementations Polymer grouts shall be injected into the prefixed cement grouting nozzles with pressure not exceeding 5kgs/cm2 till the nozzles refuses to take further grout. All the honeycombed areas where ever polymer modified mortar has been applied shall be grouted with cementations polymer grouts as per manufacturer specifications.

B2.24 SECTION 2900 PIPE CULVERTS

B2.24.1 CLAUSE 2902 MATERIALS

B2.24.1.1 Add **the following paragraphs to Clause 2902**

Where pipe culverts are required on temporary diversions and access roads (side roads) the Contractor shall use reinforced cement concrete pipes NP3 grade (as per IS: 458 – 1971).

Pipe culverts on the main highway shall be constructed using NP4 (as per IS: 458 – 1971) pipes as specified in Clause 1013 of the General Technical Specification.

B2.24.2 CLAUSE 2910 MEASUREMENT FOR PAYMENT

B2.24.2.1 Add **the following paragraph to Clause 2910**

Pipe culverts constructed on temporary diversions shall not be measured separately for payment purposes.

B2.25 CLAUSE 2912 ADD NEW CLAUSE 2912

B2.25.1 Add **the following Clause 2912**

B2.25.1.1 **2912 Stone pitching for earth fill:** Stone pitching shall be carried out as per guidelines of IRC: 89 and as per Tech. Spec. Clause 306 for the side slopes on the earth fill portions as indicated in the drawings.

B2.26 SECTION 3000 MAINTENANCE OF ROAD

B2.26.1 CLAUSE 3001: GENERAL

B2.26.1.1 **Delete all paragraphs of the clause 3001 and add the following**

3001.1 Scope

The Contractor shall be responsible for Initial Rectification of each section of the project roads as described below. Initial Rectification for the entire length of the project road shall be carried out as per 3001.2 within 6 months after the issue of notice to proceed to work. It involves repairs to the extent necessary to put the road in a safe and reasonable condition for the passage of traffic.

When the Contractor starts the execution of works on any of the milestones /sections of the Contract, the Contractor becomes responsible at his own cost for providing and maintaining an adequate motorable roadway for traffic through that section / milestone until the section is completed and a Taking-Over Certificate is issued by the Client.

3001.2. Initial Rectification

3001.2.1 Tasks: The entire project road will be inspected jointly by the Engineer and the Contractor immediately after the commencement of the Contract and details of the Initial Rectification work required shall be agreed. Initial Rectification tasks shall include the following as appropriate:

(i) Pavement Reinstatement of failed areas as per clause 3004.1
(ii) Pothole Repair and Patching as per clause 3004.2
(iii) Shoulder and Verge repairs as per clause 3003.
(iv) Restoration of Rain Cuts, if they are considered to be a danger by the Engineer, as per clause 3002.
(v) Culvert cleaning
(vi) Side Ditch and Drain cleaning, including making sure that the outfalls from these ditches and drains are functioning adequately.

3001.2.2 Measurement for Payment and Rates

Initial Rectification for all the milestones / sections of the project road shall be incidental to the Works and shall be responsibility of the Contractor and at his own cost.

B2.26.2 CLAUSE 3003: MAINTENANCE OF EARTHEN SHOULDER

B2.26.2.1 **Delete** all paragraphs of **Sub-Clause 3003.1** and **add** the following paragraphs in place of above

3003.1. Scope

The work of maintenance of earthen shoulder shall include making up the irregularities/loss of material on shoulder to the required level by adding fresh approved soil and compacting it with appropriate equipment or to strip excess soil from the shoulder surface as per the requirement of this Specification.

During the execution by the Contractor of the Works in any of the milestones /sections of the Contract, the maintenance of earthen shoulders in all milestones /sections shall be incidental to the Works and shall be responsibility of the Contractor and at his own cost.

B2.26.2.2 Delete all paragraphs of Sub-Clauses 3003.4 and 3003.5

B2.26.3 CLAUSE 3004: BITUMINOUS WORK IN CONNECTION WITH MAINTENANCE AND REPAIR

B2.26.3.1 **Delete all the paragraphs of Clause 3004.2 and add the following in place of above**

3004.2 Filling Potholes and Patch Repairs

3004.2.1 Scope

The work shall consist of cleaning out potholes in the pavement surface, trimming the sides of the holes and compacting the base, applying prime and tack coat, filling with specified materials and compacting as and when instructed by the Engineer. The location, extent and depth of each pothole to be patch repaired shall be as instructed by the Engineer. If the Engineer observes poor performance of the patch repairs prior to the onset of the monsoon season, the Contractor shall redo the work at his own cost to improve the performance. Pothole repair work shall be started immediately after issuing a notice to proceed to work and shall be completed within 3 months period.

During the execution by the Contractor of the Works for any of the milestones/sections of the Contract, the repair of potholes in that milestone/ section shall be considered incidental to the Works and shall be the responsibility of the Contractor and at his own cost. In the case of milestone/ sections not as yet commenced, the Contractor shall be paid for carrying out pothole repair and when instructed by the Engineer.

3004.2.2. Preparation

Potholes shall be cleaned out to a firm base and patches shall be excavated to the size and depth instructed by the Engineer. In both cases the sides shall be trimmed to give a rectangular shape with vertical sides. The area shall be thoroughly cleaned with compressed air or other appropriate method as approved by the Engineer to remove all dust and loose particles. The bottom of the pothole shall be thoroughly compacted.

3004.2.3 Filling

Potholes shall be filled with compacted Water Bound Macadam (WBM) complying with Clause 404 and surfaced with a 20mm Open graded Pre-mix Surfacing (PMS) complying with Clause 511. A prime coat complying with Clause 502 shall be applied to the WBM surface and a tack coat complying with Clause 503 shall be applied to the existing bituminous sides of the hole before placing the PMS. For shallow potholes, depth less than 30mm, the patching work shall be carried out using PMS as necessary. For potholes depth upto 100mm Patching work shall be carried out using 75mm thick WBM(GIII)/WMM and 20mm thick PMS, For pothole depth more than 100mm 150mm WBM(GIII)/WMM in two layers and 20mm thick PMS shall be used for patching. The materials shall be placed in layers and shall be compacted in layers with roller / plate compactor / hand roller / rammer to the compaction standards defined in the appropriate clauses of the specifications.

While placing the final layer (PMS), 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 levelling 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.

B2.26.4 Replace Appendix 4 of MoRT&H Specification with the following Guidelines for selection of viscosity grade bitumen

The type and grade of bitumen to be used shall be specified in the Contract. Modified bitumen is suitable for use in very heavy trafficked roads in very hot climate.

Both the highest daily mean air temperature and the lowest daily mean air temperatures mentioned in Tables A4-1and A4-2 can be obtained for the weather station nearest to the project site from the Indian Meteorological Organization (IMO). The IMO has data on daily mean high temperature for all 365 days in a year for all weather stations based on historical records of the last 30-40 or more years. This daily mean high temperature on a specific day is the same as daily "normal" high temperature for that day as usually reported in some newspapers. The highest of the 365 daily mean high air temperatures (which usually occurs in May or June) is used in Tables A4-1 and A4-2. Likewise, the lowest daily mean air temperature (which usually occurs in January) can also be obtained from the IMO.

Since these are mean temperatures based on the average of 30-40 years data, these temperatures are significantly lower than the absolute maximum temperatures, which may have occurred in a specific year.

Table A4-1 Selection Criteria for Viscosity-graded (VG) Paving Bitumens Based on Climatic Conditions

	Highest Daily Mean Air Temperature, °C		
Lowest Daily Mean Air Temperature, More than -10°C	**Less than 20°C VG-10**	**20 to 30°C VG-20**	**More than 30°C VG-30**
	VG-10	**VG-10**	**VG-20**

Table A4-2 Selection Criteria for Grade of Modified Bitumen

Lowest Daily Mean Air	**Highest Daily Mean Air Temperature, °C**		
	Less than 20°C	**20 to 30°C**	**More than 30°C**
	Grade of Modified Bitumen		
More than -10°C	**PMB/NRMB 120 CRMB 50**	**PMB/NRMB 70 CRMB 55**	**PMB/NR PMB 40 CRMB 60**
-10°C or lower	**PMB/NRMB 40 CRMB 50**	**PMB/NRMB 120 CRMB 55**	**PMB/NR MB 70**

PMB = Polymer modified bitumen
NRMB= Natural rubber modified bitumen
CRMB= Crumb rubber modified bitumen