

राष्ट्रीय राजमार्ग एवं अवसंरचना विकास निगम लिमिटेड

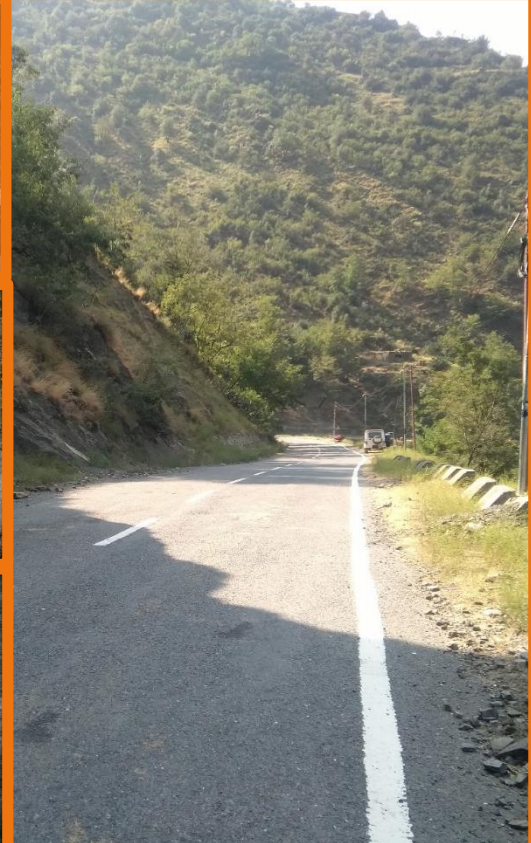
NATIONAL HIGHWAYS & INFRASTRUCTURE DEVELOPMENT CORPORATION LTD.

## FINAL DETAILED PROJECT REPORT

APRIL 2020

CONSULTANCY SERVICES FOR PREPERATION OF DETAILED PROJECT REPORT AND PROVIDING PRE-CONSTRUCTION ACTIVITIES IN RESPECT OF THE FOLLOWING STRETCH ON NH-244 (OLD NH-1B) IN THE STATE OF JAMMU AND KASHMIR.

- (1) SUDHMAHADEV- DRANGA TUNNEL OF APPROX. LENGTH 4.5 KM AND ITS APPROACH ROAD ON CHENANI - SUDHMAHADEV-GOHA ROAD PORTION.
- (2) VAILOO TUNNEL OF APPROX. LENGTH 10.0 KM UNDER SINTHAN PASS AND ITS APPROACH ROAD ON GOHA-KHELLANI- KHANABAL ROAD PORTION.
- (3) ROAD PORTION FROM 82.675 TO 82.925 AT KM 83 ON BATOTE-KISHTWAR ROAD SECTION OF NH-244.
- (4) EXTENDED ROAD SECTION FROM GOHA TO KHELLANI OF 30 KM LENGTH



GOHA - KHELLANI ROAD

PACKAGE-IA (KM 12.850 to KM 20.300)

VOLUME - V - TECHNICAL SPECIFICATIONS

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# TECHNICAL SPECIFICATION

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**Bridge**

## TECHNICAL SPECIFICATIONS

- 1 The Technical Specifications contained herein shall be read in conjunction with the other Bidding Documents as specified in Volume-IX.

### 1.1 Site Information

#### General

- 1.1.1 The information given hereunder and provided elsewhere in these documents is given in good faith by the Employer, but the Contractor shall satisfy himself regarding all aspects of site conditions and no claim will be entertained on the plea that the information supplied by the Employer is erroneous or insufficient.

- 1.1.2 The area in which the works are located is in plain terrain, the project road starts from 33° 1.861'N and 75° 21.618'E and ends at 33° 4.203'N and 75° 27.661'E in the state of Jammu & Kashmir.

### 1.1.3 Climatic Conditions

- 1.1.3.1 The temperature in this region is as under:

- i) During summer months, the temperature varies from 14°C to 30°C.
- ii) During winter months, the temperature varies from -2°C to 10°C.
- iii) The location receives about 300 mm of rain, with January the wettest month.

### 1.1.4 Seismic Zone

The stretch lies in Seismic Zone-IV as defined in Fig. 18 of IRC: 6-2017.

## 2 GENERAL REQUIREMENTS

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

### 2.1 Part-I: General Technical Specifications

The General Technical Specifications shall be the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" (Fifth Revision, April 2013), issued by the Ministry of Road Transport and Highways, Government of India and published by the Indian Roads Congress, henceforth called MORT&H Specifications and deemed to be bound into this document.

### 2.2 Part-II: Supplementary Technical Specifications

The Supplementary Technical Specifications shall comprise of various Amendments/Modifications/ Additions to the "SPECIFICATIONS FOR ROAD AND

BRIDGE WORKS" referred to in Part-I above and Additional Specifications for item of works which are not covered in Part-I.

- 2.2.1 A clause or a part thereof in "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (Fifth Revision April 2013)", referred in Part-I above, where Amended/Modified/Added upon, and incorporated in Part-II, referred to above, such Amendment/Modification/ Addition supersedes the relevant Clause or part of the Clause.
- 2.2.2 The Additional Specifications shall comprise of specifications for item of works which not covered in Part-I.
- 2.2.3 When an Amended/Modified/Added Clause supersedes a Clause or part thereof in the said Specifications, then any reference to the superseded Clause shall be deemed to refer to the Amended/Modified/Added Clause or part thereof.
- 2.2.4 In so far as Amended/Modified/Added Clause may come in conflict or be inconsistent with any of the provisions of the said MORT&H Specifications under reference; the Amended/Modified/Added Clause shall always prevail.
- 2.2.5 The following Clauses in the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (Fifth Revision April 2013)", have been Amended/Modified/Added upon

| Sr. No. | Section No. | Section Title  | Clause No.                               |
|---------|-------------|--|--|
| 1.      | 100         | General  | 102,106,108,109, 111,112,114,115 and 120 |
| 2.      | 200         | Site Clearance                                       | 201 and 202                              |
| 3.      | 300         | Earthwork, Erosion Control and Drainage              | 301,304,305 and 306                      |
| 4.      | 400         | Sub-base, Bases (Non-Bituminous) and Shoulder        | 401and 406                               |
| 4.      | 500         | Bases and Surface Courses (Bituminous)               | 501,505 and 507                          |
| 5.      | 800         | Traffic signs, Markings and other Road Appurtenances | 803 and 806                              |
| 6.      | 2100        | Open Foundations                                     | 2104                                     |

### 2.3 PART-III Specifications for Miscellaneous Works

Technical Specifications for Miscellaneous works shall be the latest "Specifications volume I to VI, 1996 for Civil Works and General Specifications for Electrical Works PART I – INTERNAL, PART – II, EXTERNAL for electric work 1994 as published by the Central Public Works Department (CPWD), Government of India" and deemed to be bound into this document.

- 2.4 The latest edition till 28 days before the final date of submission of the bid of all specifications / standard shall be applicable.

## SCOPE OF WORKS

The “Works” consist of “Consultancy Services for preparation of Detailed Project Report (DPR) for providing Pre Construction Activities in Sudhmahadev – Dranga Tunnel of approx. length of 4.5 km and its approach roads on Chenani- Sudhmahadev – Goha road position on NH -244 (Old NH-1B) in the state of Jammu & Kashmir. The works shall, inter alias, include the following, as specified or as directed:

### A. Road Works

Site clearance; setting-out and layout; widening of existing carriageway and strengthening including camber corrections; construction of new road/ parallel service road; bituminous pavements remodelling/construction of junctions, intersections, bus bays, lay byes; supplying and placing of drainage channels, flumes, guard posts, guard rails and other related items; construction/extension of cross drainage works, bridges, approaches and other related works; road markings, road signs and kilometre/ hectometre stones; protective works for roads/ bridges; all aspects of quality assurance of various components of works; rectification of the defects in the completed works during the Defect Liability Period; submission of “As built” drawings and any other related documents; and other items of work as may be required to be carried out for completing the works in accordance with the drawings and provisions of the Contract to insure safety.

### B. Other Items

Execution of any other items of work for the construction and completion of the Works in accordance with the provisions of the Contract including all incidental items as well as preparation and submittal of reports, plans as may be required.

During the period of the Contract the right of way and all existing roads shall be kept open for traffic and maintained in a safe and usable condition. Residents along and adjacent to the works are always to be provided with safe and convenient access to their properties . Traffic control and traffic diversions shall be used as necessary to protect the works and maintenance will be carried out as directed by the Engineer and provided in the Contract.

Any other items as required to fulfil all contractual obligations as per the Bid Documents.



## **PART II**

### **SUPPLEMENTARY TECHNICAL SPECIFICATION**

#### **AMENDMENTS/MODIFICATIONS/ADDITIONS TO EXISTING CLAUSES OF GENERAL TECHNICAL SPECIFICATIONS**

#### **SECTION 100 General**

#### **CLAUSE 102 DEFINITIONS**

The following abbreviations shall be added in this Clause:

|          |   |  |
|----------|---|--|
| "MORT&H" | : | Ministry of Road Transport & Highways<br>(Previously known as 'MOST', Ministry of Surface Transport) |
| "NHAI"   | : | National Highways Authority of India   |

#### **CLAUSE 106 CONSTRUCTION EQUIPMENT**

Add the following sub para (g) and (h) after sub para (f)

- Adequate standby equipment including spare parts shall be available.
- 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. Accuracy and fitness of measuring devices shall be ensured by proper maintenance.

#### **CLAUSE 108 SITE INFORMATION**

##### **Sub-Clause 108.4** This clause shall be as follows:

"Identification of quarry sites and borrow areas shall be the responsibility of the Contractor. Materials procured from quarry sites and borrow areas identified by Contractor and to be used in Works must comply with the requirements of quality as stipulated in the Technical Specification for particular items of work."

#### **CLAUSE 109 SETTING OUT**

##### **Sub-Clause 109.8** Delete the 2<sup>nd</sup> and 3<sup>rd</sup> sentences in Clause 109.8 and substitute the following: "Setting out of the road alignment and measurement of angles shall be done by using Total Station."

#### **CLAUSE 111 PRECAUTIONS FOR SAFEGUARDING THE ENVIRONMENT**

##### **Sub-Clause 111.1 General**

Delete the text of Clause 111.1 in its entirety and substitute the following:

“The Contractor shall take all necessary measures and precautions and otherwise ensure that the execution of the Works and all associated operations on site or off-site are carried out in conformity with statutory and regulatory requirements including those prescribed elsewhere in this document.

The Contractor shall take all measures and precautions to avoid any nuisance or disturbance arising for the execution of the Works. This shall wherever possible be achieved by suppression of the nuisance at source rather than abatement of the nuisance once generated. All vehicles deployed for material haulage shall be spillage proof.

Haul roads shall be inspected at least once daily to clear any accidental spillage. In the event of any spoil, debris, wastes or any deleterious substance from the Site being deposited on any adjacent land, the Contractor shall immediately remove all such material at no cost to the Contract and restore the affected area to its original state to the satisfaction of the Engineer.”

#### **Sub-Clause 111.2 Borrow Pits for Embankment Construction**

Delete the text of Clause 111.2 and substitute the following:

“Prior approval shall be sought from the concerned State Authorities, and the Contractor shall comply with all local environmental regulations. For all borrow areas, the actual extent of area/zones to be excavated shall be demarcated with the signboards and the operational areas shall be access controlled.

In the case of borrow from tank beds, a regrade/improvement of the inlet channels (at least up to 100m stretch) shall be undertaken in consultation with the concerned state government departments (the Minor Irrigation department of the State PWD) and local bodies. The Contractor shall ensure that excavation of tank beds is uniform over the entire area and that the finished profile of the bed is smooth.

In the case of borrow from the dry highlands, all borrow areas shall be reinstated by the formation gentle side slopes, re-vegetated and connected to the nearest drainage channel to avoid the formation of pools during/after the rainy seasons.

Plant and machinery used in the borrow areas shall conform to State noise emission regulations. All operation areas shall be water sprinkled to contain dust levels to the National Ambient Air Quality Standards.”

#### **Sub-Clause 111.3 Quarry Operations**

Delete the text of Clause 111.3 and substitute the following:

“Aggregates shall be sourced only from quarry sites that comply with the local/state environmental and other applicable regulations. Occupational safety procedures/practices for the work force in all quarries shall be in accordance with applicable laws. Quarry and crushing units shall have adequate dust suppression measures, such as sprinklers, in work areas and along all approach roads to the quarry sites. These shall preferable be located on the upwind side.”

### **Sub-Clause 111.5 Pollution from Hot-Mix Plant and Batching Plants**

Delete the 1<sup>st</sup> sentence of Clause 111.5 and substitute the following:

“Bituminous hot mix plant and concrete batching plants shall be located at least one (1) km away from the sensitive receptors (schools, hospitals, etc.) and at least 500m from urban settlements, unless otherwise required by the statutory requirements.”

### **Sub-Clause 111.8.1 Environmental Protection:**

Add the following sentences in the first paragraph of Sub Clause 111.8.1:

Water tankers with suitable sprinkling system shall be deployed along the haulage roads and in the work sites. Water shall be sprinkled regularly all along the routes to suppress airborne dusts from truck/dumper movements particularly on unpaved roads. Actual frequency will be agreed with the Engineer to suit site conditions.”

### **Sub-Clause 111.8.2 Air Quality**

The Contractor shall device and implement methods of working to minimize dust, gaseous and other air-borne emissions and carry out the Works in such a manner as to minimize adverse impacts on the air quality. Construction camps shall have facilities for LPG fuel. The use of firewood shall not be permitted.

The Contractor shall utilize effective water sprays during delivery, manufacture, processing and handling of materials when dust is likely to be created, and to dampen stored materials during dry and windy weather. Stockpiles of friable materials shall be covered with clean tarpaulins, with applications of sprayed

water during dry and windy weather. Stockpiles of materials or debris shall be dampened prior to their movement, except where this is contrary to the Specification.

Any vehicle with an open load-carrying area used for transporting potentially dust-producing material shall have properly fitting side and tail boards. Materials having the potential to produce dust shall not be loaded to a level higher than the side and tail boards and shall be covered with clean tarpaulins in good condition. The tarpaulin shall be properly secured and extend at least 300mm over the edges of the side of the side and tail boards.

The Contractor shall monitor air-quality once weekly in all operational areas under the project and take the necessary steps to comply with the specified requirements. Air quality parameters will include SPM, RPM, SO<sub>2</sub>, NO<sub>x</sub>, HC and CO. operational areas include work sites, haulage roads, hot mix plants, quarries, crushing plants, stockpiles, borrow sites and spoil disposal sites.

### **Sub-Clause 111.8.3 Water Sources and Water Quality**

The Contractor shall provide independent sources of water supply, such as bore wells, for use in the Works and for associated storage, workshop and work force compounds.



Prior approval shall be obtained from the relevant State Authorities and all installations shall follow local regulations. Bore wells installed and used for the project shall be left in good operating condition for the use of NHAI and local communities. The Contractor shall prevent any interference with the supply to or abstraction from and prevent any pollution of water resources (including underground percolating water) as a result of the execution of the Works.

Areas where water is regularly or repetitively used for dust suppression purposes shall be laid to fall to specially constructed settlement tanks to permit sedimentation of particulate matter. After settlement, the water may be re-used for dust suppression and rinsing. The Contractor shall protect all watercourses, waterways, ditches, canals, drains, lakes and the likes from pollution as a result of the execution of the Works. All water and other liquid waste products arising on the Site shall be collected and disposed of at a location on or off the Site and in a manner that shall not cause either nuisance or pollution.

The Contractor shall at all times ensure that all existing stream courses and drains within, and adjacent to, the Site are kept safe and free from any debris and any materials arising from the Works. The Contractor shall not discharge or deposit any matter arising from the execution of the Works into any water except with the permission of the Engineer and the regulatory authority concerned.

Work force camps shall have septic tank and soak away pits. Operational areas like POL storage areas/hot mix plant areas shall comply with local/state environmental regulations and safety procedures. Storage and handling areas shall be impervious and surrounded by an impervious lined drain to catch any accidental spills. Storm water shall be stored in lined holding tanks with oil, grease-tapping facility prior to disposal in to nearby watercourses. The trappings and sludge of holding tanks shall be disposed off in accordance with the procedures approved by the local regulatory authority.

### **Sub-Clause 111.20 Control and Disposal of Wastes**

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

Spilling of oil and bituminous products during construction and transport shall be avoided to reduce the chances of contamination of surface as well as ground water.

Degraded materials shall be disposed of in a manner as approved by the Engineer and wastewater shall be disposed into septic tanks and soak pits etc. The Contractor shall make arrangements to cleanup 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 land owner(s) will be carried out within a time period agreed between landowner(s) and the Contractor. Separators shall be used to separate POL materials from wastewater

prior to discharging to the watercourses or as approved by the Engineer in conformance with directives and guidelines.

Disposal of solid waste materials shall be outlined in a plan for which environmental clearances shall be obtained from State environmental regulatory authorities. Potential locations for solid waste disposal are the natural depressions and borrow areas. The areas used for dumping of uncontaminated debris shall be covered with 300mm soil and shall be planted. Contaminated debris shall be dumped in depressions whose bed must be impervious e.g., stone quarry sites or depressions made impervious with 450mm thick impervious floor apron as per MORT&H Technical Specifications. Each successive 1.0m layers shall be covered with 500mm thick soil layer, and the area will be covered with 300mm thick layer and planted.

### **After Clause 111.12 add the following new Clauses 111.13 to 111.17**

#### **Sub-Clause 111.13 Haulage Roads**

Existing roads used for hauling shall be strengthened and/ or widened by the Contractor in accordance with the requirements for normal and construction traffic. Where such roads are not existing, the Contractor shall construct project specific single lane paved roads in settlement areas and gravel roads in open areas conforming to the Ministry of Road Transport and Highways (MORT&H) specifications.

The alignment of the haulage roads shall be fixed to avoid agricultural land to the extent possible. In unavoidable circumstances, suitable compensation shall be paid to the people whose land will be temporarily acquired for the duration of the operations. The compensation shall cover for loss of income for the duration of temporary acquisition and land restoration. Prior to the construction of the haul roads, topsoil shall be stripped and stockpiled for re-use.

Material dumping sites shall be access controlled to prevent the unauthorized entry of the people, grazing cattle and stray animals.

Haulage roads shall be reinstated upon completion of hauling for the use of local communities.”

#### **Sub-Clause 111.14 Equipment and Vehicles used for the Works**

Equipments and vehicles deployed for the construction activities shall not be older than 5 years. Equipments used for road and bridge works shall be based on new technology and shall generate noise and pollutants not exceeding the limits specified by the relevant State Authorities. Vehicles and machineries used for road and bridge works are to be regularly maintained to conform to the National Air Quality Standards. Blasting, if any, will be carried out using small charges.

### **Sub-Clause 111.15 Noise Control**

The Contractor shall consider noise as an environmental constrain in the planning and execution of the Works.

The Contractor shall take all necessary measures so that the operation of all mechanical equipment and construction processes on and off the site shall not cause any unnecessary or excessive noise, taking in to account applicable environmental requirements. The Contractor shall use all necessary measures and shall maintains all plant and silencing equipment in good conditions so as to minimize the noise emission during construction works.

Any member of the work force likely to be exposed to beyond their threshold noise levels shall be provided with protective equipment, such as earplugs, and shall be rotated every four hours.

Construction operations shall be limited to daytime hours only, particularly in the settlement areas.

### **Sub-Clause 111.16 Vibration Control**

The Contractor shall take measures during construction activities to control the movement of the work force and construction machinery/equipment, and to avoid/minimize activities, which produce vibrations.

### **Sub-Clause 111.17 Measurement**

Monitoring of Air/Water/Noise and Soil quality shall be paid as per numbers of samples tested. For Compliance of all other provisions made in this Clause 111, it shall be deemed to be incidental to the work and no separate measurement shall be made. The Contractor shall be deemed to have made allowance for such compliance with these provisions in the preparations of his prices for items of work included in the Bills of Quantities and full compensation for such compliance shall be deemed to be covered by them.”

## **CLAUSE 112 ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION**

### **Sub-Clause 112.4 Traffic Safety and Control**

Last line of Para 5 shall be read as under:

“The signs shall be of approved design and of reflector type.” **Add**

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

“Before commencement of any construction, the Contractor shall prepare and submit details of the arrangements for passing traffic during construction, design of barricades, signs, markings, lights, flags etc. conforming and satisfying the requirements of the “Guidelines on Safety in Road Construction Zones” of IRC: SP 55-2001 and get the same approved by the Engineer.

### **Sub-Clause 112.6 Measurement for Payment and Rates**

- a) The provision of treated shoulder including construction of temporary cross drainage structures, if required, 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 Contractor's responsibility.
- b) The Construction of temporary diversion including temporary cross drainage structures as described in sub clause 112.3, shall be measured in linear meter and the unit contract rate shall be inclusive of full compensation for construction (including supply of material, labor, tools, etc.), maintenance as per sub clause 112.5, final dismantling, and disposal.
- c) All Traffic safety and control devices during construction as per sub clause 112.4 including providing, erecting and maintaining barrier, signs, markings, flags, lights and providing flag men etc. is included in item rate.

## **CLAUSE 114 SCOPE OF RATES FOR DIFFERENT ITEMS OF WORK**

### **Sub-Clause 114.2 Item (ii) of Clause 114.2 shall read as follows:**

A detailed resource-based construction programme including resources planning using computerized critical path network method/PERT 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 to the Engineer in a form readily compatible with Engineer's planning system.

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 three 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

## **CLAUSE 115 METHODOLOGY AND SEQUENCE OF WORK**

The Clause shall be substituted as follows:

### **Sub-Clause 115.1 Submission of Method Statement**

The Contractor shall submit methods statement within 28 days after the date of letter of acceptance. The methods statement shall be submitted in two parts.

The General part of the methods 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 furnished 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, bitumen reinforcement, prestressing strands and bearings. Wherever possible the Contractor shall identify at least two sources for each of the items; he shall also submit 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, crushing plant etc.
- d) Details of facilities/approaches for transportation of men, equipment and materials for construction of pavements, foundations and substructure in riverbed, and plan for free traffic flow and safe drainage.
- 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 method statement

The General part of the Q.A. Programme shall accompany the methods statement under sub-clause 105.3.

The Special part of the methods statement shall be submitted to the Engineer by the Contractor for each important item of work like construction of embankments and subgrade, pavements, pile/well foundations, concreting, prestressing, repair and rehabilitation of existing structures, concrete superstructure, dismantling of structures and pavement and for any other item as directed by the Engineer.

These statements 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 specialized formwork for superstructure, details of borrow areas, method of construction of embankment and subgrade, pavements, piles, wells, concreting procedures,



details of proprietary process 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 methods 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 methods statement for the concerned activity.
- vi) Engineer shall examine and approve the methods statement or direct the Contractor to resubmit the statement with required modifications. The modified statement shall be submitted within 14 days of 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.

#### **Sub-Clause 115.2 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 and name 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 has 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 statements 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 instruct any additional tests for the purpose of accepting the product. The charges of these additional tests shall be borne by the Employer only in case the product satisfies the specifications.

## **CLAUSE 120**

## **FIELD LABORATORY**

### **Sub-Clause 120.2**

### **Description**

Replace the words “indicated in the drawings” in the first sentence of second paragraph of this Clause with the words “per provisions indicated in this Clause and at a location approved by the Engineer.”

Replace “electric supply etc.” to the second sentence of first paragraph by “including uninterrupted power supply etc.”.

Delete the first sentence of second paragraph “The floor space in the drawing” and substitute the following:

“The floor space required for the field laboratory shall be not less than 200 sqm.

“The fourth sentence of second paragraphs “The furnishing.....In Table 100-2” shall read as under.

“A good semi furnished office accommodation shall be provided to the Material Engineers of the Supervision Team as per the direction of the Engineer.”

Add the following at the end of this Clause:

“There shall also be provided a concrete paved area, for storing samples adjacent to the laboratory, of about 100 sqm and another 75 sqm shall be suitably roofed with open sides giving protection against sun and rain.

Within 14 (fourteen) days of the commencement date, the Contractor shall prepare and submit a layout plan and details of the laboratory building and make/supplier of the equipment to the Engineer for his approval.

The field laboratory to be provided under the Contract shall be handed over to the Engineer in finished and fully equipped condition not later than 2 months after the receipt of Notice to Commence Work, and the field laboratory with all equipment/ instrument shall be to the entire satisfaction of the Engineer. During the 2-month period starting from the Notice to Commence work, the laboratory tests shall be performed in another laboratory proposed by the Contractor and approved by the Engineer.

## Laboratory Equipment

### General

The items of laboratory equipment shall be provided in the field laboratory depending upon the items to be executed as per Table mentioned below instead of Table 100-2 shown in MORTH:

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

The equipment and instruments shall be new and shall be quality certified by Bureau of Indian Standards (BIS).

| Sr. No.           | Sub No.  | Item, Specifications  | Nos. required |
|-------------------|--|---|---------------|
| <b>A: General</b> |  |   |               |
| (i)               | <b>Balance</b>   |   |               |
|                   | (a)  | 7 kg to 10 kg capacity semi -self indicating Electronic Type –Accuracy 1 gm   | 2             |
|                   | (b)  | 500 gm capacity semi-self-indicating Electronic Type – Accuracy 0.01 gm   | 2             |
|                   | (c)  | Chemical balance 100gm capacity - Accuracy 0.0001gm   | 1             |
|                   | (d)  | Pan balance 5 kg capacity - Accuracy 0.5 gm   | 2             |
|                   | (e)  | Platform Scale – 300 kg capacity  | 1             |
|                   | (f)  | Triple Beam balance-25kg capacity Accuracy 1gm  | 2             |
| (ii)              | <b>Ovens – Electrically operated, thermostatically controlled</b>  |   |               |
|                   | (a)  | From 100°C to 220°C – Sensitivity   | 2             |
| (iii)             | <b>Sieves, as per IS 460-1962</b>  |   |               |
|                   | (a)  | IS Sieves 450 mm internal dia. of sieve sets as per BIS of required sieve sizes complete with lid and pan   | 2 set         |
|                   | (b)  | IS sieve 200 mm internal dia. (brass frame and steel or brass wire cloth mesh) consisting of sieve sets of required sieve sizes complete with lid and pan | 2 set         |
| (iv)              | Sieve shaker capable of taking 200 mm and 450 mm dia. Sieves electrically operated with time switch assembly (As per BIS)  |   | 1             |
| (v)               | 200 tones compression testing machine  |   | 1             |
| (vi)              | Stop watches 1/5 sec. Accuracy   |   | 2             |
| (vii)             | Glassware comprising of Beakers, Pipettes, dishes, measuring cylinders (100 to 1000 cc capacity) glass rods and funnels, glass thermometers range 0°C to 100°C and metallic thermometers range 300°C |   | 1 Dozen each  |
| (viii)            | Hot plates 200 mm dia (1500 watt)  |   | 6             |
| (ix)              | <b>Enamel trays</b>  |   |               |

| Sr. No. | Sub No. | Item, Specifications   | Nos. required |
|---------|---------|--|---------------|
|         | (a)     | 600 mm x 450 mm x 50 mm  | 10            |
|         | (b)     | 450 mm x 300 mm x 40 mm  | 10            |
|         | (c)     | 300 mm x 250 mm x 40 mm  | 6             |
|         | (d)     | Circular plates of 250 mm dia.                                     | 6             |
| (x)     |         | Water Testing Kit  | 1             |
| (xi)    |         | First Aid Box  | 1             |
| (xii)   |         | Spatula Set of 100 and 200 long                                    | 3             |
| (xiii)  |         | Digging Tools (pixels, shovel, fork etc.)                          | As reqd.      |
| (xiv)   |         | Miscellaneous tools (sledge hammer, lump hammer, wooden pegs etc.) | As reqd.      |
| (xv)    |         | Maximum and Minimum Thermometer                                    | 2 Set         |
| (xvi)   |         | Rain Gauge   | 1 Set         |
| (xvii)  |         | Timer 0-60 minutes with alarm & 1/5 sec accuracy.                  | 3 Sets        |

| <b>B: For Soils and Aggregates</b> |     |  |        |
|------------------------------------|-----|--|--------|
| (i)                                |     | Water still, 3 liter/hr with fittings and accessories  | 1      |
| (ii)                               |     | Liquid limit device with Casagrande and ASTM grooving tools as per IS: 2720  | 1      |
| (iii)                              |     | Sampling pipettes fitted with pressure and suction inlets, 10 ml Capacity  | 2 set  |
| (iv)                               |     | Compaction apparatus (Proctor) as per IS: 2720 (Part 8) complete with collar, base plate and hammer  | 1 set  |
| (v)                                |     | Modified AASHTO compaction apparatus as per IS. 2720 (Part 7) 1980 or Heavy Compaction Apparatus as per IS complete with collar, base plate and hammer                                 | 1 set  |
| (vi)                               |     | Sand pouring cylinder with conical funnel and tap and complete as per IS 2720 (Part 28) 1980 including modified equipment  | 4      |
| (vii)                              |     | Sampling tins with lids 100 mm dia x 75 mm ht ½ kg capacity and miscellaneous items like moisture, tins with lid (50 grams) etc  | 12     |
| (viii)                             |     | Lab CBR testing equipment for conducting CBR testing, load frame with 5 Ton capacity, electrically operated with speed control as per IS: 2720 (Part 16), and consisting of following: | 1 set  |
|                                    | (a) | CBR moulds 150-mm dia – 175-mm ht complete with collar, base plate etc.  | 24     |
|                                    | (b) | Tripod stands for holding dial gauge holder  | 24     |
|                                    | (c) | CBR plunger with settlement dial gauge holder  | 1      |
|                                    | (d) | Surcharge weight 147-mm dia 2.5 kg weight with central hole  | 48     |
|                                    | (e) | Spacer disc 148-mm dia, 47.7-mm ht. With handle  | 3      |
|                                    | (f) | Perforated plate (Brass)   | 24     |
|                                    | (g) | Soaking tank for accommodating 24 CBR moulds   | 1 each |
|                                    | (h) | Proving rings of 1000 kg, 2500 kg and 5000 kg capacity   | 10     |

| <b>B: For Soils and Aggregates</b> |     |  |
|------------------------------------|-----|--|
|                                    | (i) | Dial gauges, 25 mm travel- 0.01 mm/division                      |
|                                    | (j) | <b>Aluminium Tis</b>   |
|                                    |     | 50x30m   |
|                                    |     | 55x35m   |
|                                    |     | 70x45m   |
|                                    |     | 70x50m   |
|                                    |     | 80x50m   |
| (ix)                               |     | Standard Penetration test equipment                              |
| (x)                                |     | Nuclear Moisture Density Meter or equivalent                     |
| (xi)                               |     | Speedy moisture meter complete with chemicals                    |
| (xii)                              |     | Unconfined compression test apparatus                            |
| (xiii)                             |     | Aggregate Impact Test Apparatus                                  |
| (xiv)                              |     | Aggregate Impact Test Apparatus as per IS 2386 (Part 4) 1963     |
| (xv)                               |     | Los Angeles abrasion Test Apparatus as per IS 2386 (Part 4) 1963 |
| (xvi)                              |     | Riffle Box of Slot size of 50mm as per ASTM C-136                |

| <b>C: For Bitumen and Bituminous Mixes</b> |  |             |
|--|--|-------------|
| (i)  | Constant temperature bath for accommodating bitumen  | 2           |
|  | test specimen electrically operated and thermostatically controlled, 50-liter capacity temp. range ambient 80o C   |             |
| (ii)                                       | Penetrometer automatic type, adjustable weight arrangement and needles as per IS. 1203 – 1978  | 2           |
| (iii)                                      | Solvent extraction or centrifuge type apparatus complete (AASHTO, T-164) with extraction thimbles with stocks of solvent and filter paper  | 1           |
| (iv)                                       | Laboratory mixer including required accessories about .02 cum capacity electrically operated fitted with heating jacket  | 1           |
| (v)  | Marshall compaction apparatus automatically operated as per ASTM 1559-62 T and complete with electrically operated loading unit, compaction pedestal heating head assembly, dial micrometer and bracket for flow measurement, load transfer bar, specimen mould 100 mm dia. (4 in) with base plate, collars, specimen extractor, compaction hammer 4.53 kg (10 lb.) x457 mm (18 in) fall | 1 set       |
| (vi)                                       | Distant Reading Digital Thermometer for Measuring Temperatures in Asphaltic Mixes  | As required |
| (vii)                                      | Riffle Box   | 1           |
| (viii)                                     | Automatic Asphalt Content Gauge [Nuclear are equivalent]   | 1           |
| (ix)                                       | Thin film Oven test apparatus to the requirement of AASHTO T 179, including accessories  | 1           |
| (x)  | Ring Ball Apparatus as per IS 1205- 1978   | 1           |
| (xi)                                       | Asphalt Institute Vacuum Viscometer as per IS 1206(part II) – 1978   | 1           |
| (xii)                                      | BS U- Tube Modified Reverse Floro Viscometer IS 1206(Part III) – 1978  | 1           |



**C: For Bitumen and Bituminous Mixes**

|         |   |   |
|---------|---|---|
| (xiii)  | Apparatus for Determination of Ductility Test as per IS 1208 – 1978                     | 1 |
| (xiv)   | Pen Sky – Martars closed Tester for testing flash and fire point as per IS 1209 – 1978. | 1 |
| (xv)    | Apparatus for Float Test – IS – 1210 – 1978   | 1 |
| (xvi)   | Apparatus for Determination of water content (Dean and Shark Method) IS – 1211 – 1978   | 1 |
| (xvii)  | Apparatus for Determination of Loss on Heating IS – 1212-1978.                          | 1 |
| (xviii) | Apparatus of Determination of specified Gravity IS- 1202-1978                           | 1 |
| (xix)   | Core cutting machine with 100mm dia. Diamond cutting Edge                               | 1 |
| (xx)    | Apparatus for Elastic Recovery test for Modified Bitumen                                | 1 |
| (xxi)   | Apparatus for Storage Stability test for Modified Bitumen                               | 1 |
| (xxii)  | Apparatus for Separation test for modified bitumen                                      | 1 |

**D: For Cement, Cement Concrete and Materials**

| D: For Cement, Cement Concrete and Materials |   |  |             |
|--|---|--|-------------|
| (i)  | Water still   |  | 1           |
| (ii)   | Vicat needle apparatus for setting time with plungers, as per IS. 269-1967                                    |  | 1           |
| (iii)  | Moulds  |  |             |
|  | (a)   | 150 mm x 300 mm ht cylinder with capping component   | As required |
|  | (b)   | 150mmx150 mm x150mm cubical for compressive strength | As required |
|  | (c)   | 150mmx100 mm x600mm beam for flexural strength       | As required |
| (iv)   | Concrete permeability apparatus   |  | 1           |
| (v)  | High frequency mortar cube vibrator for cement testing  |  | 1           |
| (vi)   | Concrete mixer power driven, 1 cu ft capacity   |  | 1           |
| (vii)  | Variable frequency and amplitude vibrating table size 1 metre x 1 metre, as per the relevant British Standard |  | 1           |
| (viii)                                       | Flakiness & Elongation test apparatus   |  | 2each       |
| (ix)   | Aggregate impact test apparatus as per IS 2386 (Part 4) 1963  |  | 2           |
| (x)  | Los Angeles abrasion apparatus as per IS. 2386 (Part 4) 1963  |  | 1           |
| (xi)   | Flow table as per IS 712-1973   |  | 1           |
| (xii)  | (a)   | Equipment for slump test                             | 2           |
|  | (b)   | Compaction factor test equipment                     | 1           |
| (xiii)                                       | Equipment for determination of specific gravity for fine and coarse aggregate as per IS 2386 (Part 3) 1963    |  | 2           |

**D: For Cement, Cement Concrete and Materials**

|         |   |          |
|---------|---|----------|
| (xiv)   | Flexural attachment to compression testing machine                              | 1        |
| (xv)    | Core cutting machine with 150 mm dia. Diamond cutting edge                      | 1        |
| (xvi)   | Needle vibrator   | 1        |
| (xvii)  | Vibrating hammer as per BS specification  | 1        |
| (xviii) | Air entrainment meter ASTM C - 231  | 1        |
| (xix)   | 0.5 Cft, 1 Cft cylinder for checking bulk density of aggregate with tamping rod | 1        |
| (xx)    | Soundness testing apparatus for cement  | 1        |
| (xxi)   | Flexural Beam testing machine with accessories                                  | 1        |
| (xxii)  | Chemicals solutions and consumable  | As reqd. |
| (xxiii) | Chloride Testing kit for chemical analysis of chloride content.                 | 1        |
| (xxiv)  | ION Exchange kit for rapid determination of sulphate content.                   | 1        |

**E: For Control of Profile and Surface Evenness**

|        |  |         |
|--------|--|---------|
| (i)    | Digital Level complete with all accessories                              | 2 sets  |
| (ii)   | Distomat or equivalent   | 2 Nos.  |
| (iii)  | Theodolite – Electronically operated with computerized output attachment | 2 sets  |
| (iv)   | Total Station with all accessories                                       | 2 sets  |
| (v)    | Towed Fifth Wheel Bump Indicator   | 1 set   |
| (vi)   | 3meter straight edge and measuring wedge                                 | 2 sets  |
|        | Camber templates 2 lane  |         |
| (vii)  | String line Arrangement with paver and sensor powers                     | 1       |
|        | (a) Crown type cross-section   | 2 sets  |
|        | (b) Straight run cross-section   | 2 sets  |
| (viii) | Steel tape   |         |
|        | (a) 5 m long   | as reqd |
|        | (b) 10 m long  | as reqd |
|        | (c) 20 m long  | as reqd |
|        | (d) 30 m long  | as reqd |
|        | (e) 50 m long  | As reqd |
|        | (e) 50 m long  | As reqd |
| (ix)   | Precision Staff  | 3 Sets  |

**Note:** The laboratory set-up must be complete including a set of reference standards, adequately staffed and operational to the satisfaction of the Engineer not later than 2 months from the date of receipt of Notice to commence the works.

### **Sub-Clause 120.3      Ownership**

This Clause shall read as under:

“Land for the laboratory shall be provided by the Contractor.”

### **Sub-Clause 120.4      Maintenance**

This Clause shall read as under:

“The Contractor shall arrange to maintain the field laboratory including sample store yards in a satisfactory manner until the issue of Taking over Certificate for the whole work. Maintenance includes all activities described in Clause 120.4 and maintenance of equipment and running of the same including chemicals and consumables.”

### **Sub-Clause 120.5      Rate**

The construction, supply, installation, maintenance, and operation including all consumables like chemicals & reagents etc., and all other expenses involved in connection thereto for the field laboratory shall be incidental to the work, and shall not be paid for separately.

**SECTION 200 Site Clearance****CLAUSE 201 CLEARING AND GRUBBING****Sub-Clause 201.1 Scope**

Replace with following Para:

This work shall consist of cutting, excavating, removing, and disposing of all materials such as trees of girth up to 300 mm, bushes, shrubs, stumps, roots, grass weeds, rubbish etc. and top soil up to 150 mm, which in the opinion of Engineer is unsuitable for incorporation in the work including draining out stagnant water if any from the area of road land, drain, cross drainage structure and other area as specified in the drawing or instructed by Engineer. It shall include necessary excavation by harrow discs or any other suitable equipment, backfilling of the pits by suitable soil, resulting from uprooting of trees & stumps and making the surface in proper grade by suitable equipment and compacted by power roller to required compaction as per Clause 305.3.4. The work also includes handling, salvaging and disposal of cleared material. Clearing and grubbing shall be performed less than one month in advance of earthwork operation and in accordance with requirement of these specifications.

**CLAUSE 202 DISMANTLING CULVERTS, BRIDGES AND OTHER STRUCTURES/ PAVEMENTS****Sub-Clause 202.5 Disposal of Materials**

The first paragraph of the sub clause shall read as below:

All materials obtained of dismantling/milling shall be the property of the Contractor for which he shall quote a rate for rebate in BOQ Bill No. 1, and the Contractor shall be free to use this material in work, or he may sell/dispose the material to as desired / deemed fit by him.

The existing pavement crust shall be reused as indicated below:

Contractor shall be free to use dismantled / milled material, as is where is basis, or by suitably modifying the material, or by crushing the material, or by breaking the material, and screening the same, provided it meets the specifications and is approved by the Engineer.

**SECTION 300 Earthwork, Erosion Control and Drainage****CLAUSE 301 EXCAVATION FOR ROADWAY AND DRAINS****Sub-Clause 301.1 Scope**

Add the following as second paragraph under this clause:

“The work shall also include excavation for channel training at culverts/bridges, excavation of existing shoulders and medians for purposes of widening the pavement and excavation of existing embankment for reconstruction to specification.”

**CLAUSE 304 EXCAVATION FOR STRUCTURES****Sub-Clause 304.3.2 Excavation**

At the end of 1<sup>st</sup> paragraph of Clause 304.3.2 inserts the following additional sentences:

“The Contractor shall ensure the stability and structural integrity of adjacent existing foundations and structures and if necessary shall, at his own expense, install temporary or permanent sheet piles, coffer dams, shoring or similar as support or protection to the satisfaction of the Engineer.”

**CLAUSE 305 EMBANKMENT CONSTRUCTION****Sub-Clause 305.2 Material and General Requirements****Sub-Clause 305.2.1 Physical Requirements:****Sub-Clause 305.2.1.2 Add the following after second paragraph:**

“Soils having medium and high swelling potential shall be defined based on Liquid Limit, Plastic Limit, Shrinkage Limit, Gradation, Free swelling Index, Field dry Density and Field Moisture Content and types of Clay minerals present in the soil and as directed by the Engineer. The location and the extent of these soils with medium to high swelling potential should be defined as directed by the Engineer.”

**Sub-Clause 305.2.2.2 Borrow Materials**

Para 1 of this Clause shall read as under:

” No borrow area shall be made available by the Employer for this work. The arrangement for the source of supply of the material for embankment and sub-grade as well as compliance to the different environmental requirements in respect of excavation and borrow areas as stipulated, from time to 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.”

### **Sub-Clause 305.2.2.4 Compaction Requirements**

In Clause 305.2.2.4 delete Table 300-2 and substitute the following:

**Table 300-2**  
**Compaction Requirements of Embankment and Subgrade**

| <b>Sr. No.</b> | <b>Type of Work/Material</b>  | <b>Relative Compaction as %age of maximum laboratory dry density as per IS 2720 (Part 8)</b> |
|----------------|---|--|
| 1              | Subgrade and earthen shoulders  | Not less than 97%  |
| 2              | Embankment  | Not less than 95%  |
| 3              | Expansive clays   | Not allowed  |
| 4              | Design CBR of Subgrade & Shoulder has been taken 8. The borrow earth used for subgrade material must satisfied the requirement of the design CBR of 8 % |  |

Para 2 of this Clause given below Table 300-2 shall read as under:

The contractor shall at least 21 working days before commencement of construction of embankment and the subgrade; submit the following to the Engineer for approval:

- The values of maximum dry density and optimum moisture content obtained in accordance with IS: 2720 (Part 8) for each fill material proposed to be used in the construction of embankment and subgrade.
- The graphs of Density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined.
- The dry density-moisture content-CBR relationships, heavy compactive efforts conforming to the IS 2770 (part 8) for each of the fill material proposed to be used in the subgrade.

The above information shall form the basis for compaction only upon its approval by the Engineer.”

### **Sub-Clause 305.3 Construction Operations**

#### **Sub-Clause 305.3.4 Compacting Ground Supporting Embankment/Subgrade**

Para 1 of this clause shall be read as

“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.

**Sub-Clause 305.8 Measurement for Payment**

Substitute Clause 305.8.1 shall be read as

"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 and areas."

**CLAUSE 306 SOIL EROSION AND SEDIMENTATION CONTROL**

**Sub-Clause 306.4 Measurements for Payment**

Substitute Clause 306.4 as follows:

"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."

## **SECTION 400 Sub-Bases, Bases (Non-Bituminous) and Shoulders**

### **CLAUSE 401 GRANULAR SUB BASE**

#### **Sub-Clause 401.1 Scope**

Add the following at the end of this Clause:

“A site trial shall be performed in accordance with Clause 901.16.”

#### **Sub-Clause 401.2.2 Physical Requirements**

Add at the end of this clause as under:

The Contractor shall, at least 21 working days before the commencement of the construction of the sub-base course, submit to the Engineer, the results for approval of the laboratory testing on the physical properties defined above. The construction of the sub-base course shall be taken up only upon the Engineer’s approval of the material.

Grading I of table 400-1 shall be adopted at site.

### **CLAUSE 406 WET MIX MACADAM SUB BASE/BASE**

#### **Sub-Clause 406.4 Opening to Traffic**

The Clause shall be read as follows:

No vehicular traffic of any kind shall be allowed on the finished wet mix macadam surface.

**SECTION 500      Base and Surface Courses (Bituminous)****Sub-Clause 501.2      Materials****Sub clause 501.2.1 Binder**

Binder of VG-30 grade shall be used or if available viscosity grade of bitumen shall be used in accordance with IS:73

**Sub-Clause 501.2.2** Delete “Crushed gravel or other hard material” from first Line of Para 1.”  
Para 3 is deleted.

**CLAUSE 505      DENSE BITUMINOUS MACADAM****Sub-Clause 505.2.1      Bitumen**

Binder of VG-30 grade shall be used or if available viscosity grade of bitumen shall be used in accordance with IS:73.

**CLAUSE 507      BITUMINOUS CONCRETE****Sub-Clause 507.2.1      Bitumen**

Binder of CRMB-60 grade shall be used.

**SECTION 800 Traffic Signs, Markings and Other Road Appurtenances**

**CLAUSE 803 ROAD MARKINGS**

**Sub-Clause 803.2 Materials**

This clause shall read as under:

“Road markings shall be hot applied thermoplastic compound and the materials shall meet the requirements as specified in Clause 803.4.

The road markings shall be laid in one layer with appropriate road marking machine approved by the Engineer. Before the road-marking machine is used on the permanent works, the satisfactory working of the machine shall be demonstrated on a suitable site, which is not part of the permanent works. The rate of application shall be checked and adjusted as necessary before application on a large scale is commenced, and thereafter daily.”

**CLAUSE 806 ROAD DELINATORS**

**Sub-Clause 806.2 This clause shall read as follows:**

a) Triangular Object Marker shall be 300mm side with four red reflectors, made out of 2mm thick aluminum sheet, face to be fully covered by high intensity grade white retro reflective sheeting of encapsulated lens type as per clause 801. The background/ border/ symbols shall be made by screen-printing of desired colour as per sign details. The sign plate shall be fixed with 6mm dia. aluminium rivets on MS angle iron frame. The angle iron frame shall be made with angle of size 40mmx40mmx5mm. The sign shall be fixed with nut-bolts & welding on MS pipe 50mm dia (NB-MW) and 500mm high.

b) Rectangular hazard marker 600mm x 300mm made out of 2mm thick aluminum sheet, face to be fully covered by high intensity grade white retro reflective sheeting of encapsulated lens type. The background/ border/ symbols shall be made by screen-printing of desired colour as per sign details. The sign plate shall be fixed with 6mm dia aluminium rivets on MS angle iron frame. The angle iron frame shall be made with angle of size 40mmx40mmx5mm. The sign shall be fixed to 80mm dia (NB-MW) MS pipe.

c) Roadway Indicators shall be 1000mm high made with 100 mm dia. NB medium weight MS pipe. One reflector of high intensity grade retro reflective sheeting with encapsulated lens shall be provided on top of the reflector. The white & red reflector shall be provided alternatively of 40mm width, so that total width of reflector shall be 120mm. A wire mesh cover of 150mm height shall be provided on top.

d) All components of signs & supports shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy paint. The sign backside shall be with grey colour and post shall be white colour/ alternate white & black bands. The post below ground shall be painted with three coats of red lead.



**Clause 2100****Open Foundation****Sub-Clause 2104.1 Preparation of Foundation**

Please add the following as a last para-

Considering the soil SBC as per Geotechnical report, 1 m of depth below the founding level of bridges shall be removed and replaced with granular sand. The cost of the excavation and sand shall be made from respective items.