

Consultancy Services for Carrying out Feasibility Study, Preparation of Detailed Project Report and providing pre-construction services in respect of 2 laning of **Churachandpur – Tuivai road Section (length = 162 km)** on **NH-102B** (Manipur) on Engineering, Procurement and Construction mode in the state of Manipur. (Package No. NHIDCL/DPR/CT-IJ-TP/Manipur/ 2017)

STAGE: IV

PACKAGE – IVB

DESIGN CH:

130+000 KM

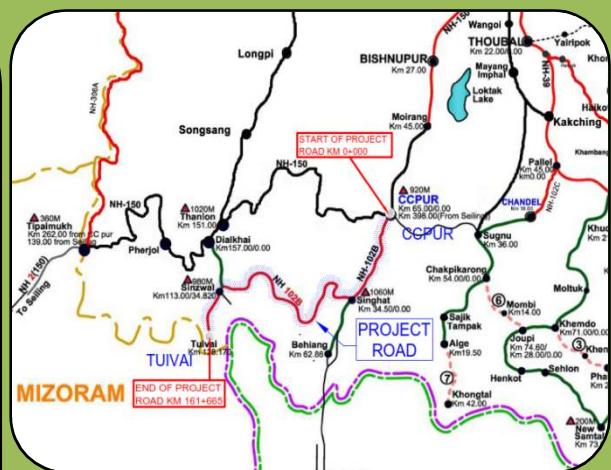
141+029 TO KM

DRAFT DETAILED PROJECT REPORT
VOLUME – V: TECHNICAL SPECIFICATION
VOLUME – VI: RATE ANALYSIS
VOLUME – VII: COST ESTIMATE
VOLUME – VIII: BILL OF QUANTITY



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VOLUME - V

TECHNICAL SPECIFICATION

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Technical Specification

1.1 General

The Technical specifications covering the materials and the workmanship aspects as well as method of measurements and payments are included in this section. These specifications cover the items of civil and non-civil works coming under scope of this document. All work shall be carried out in conformity with the same. The works shall be executed in accordance with good practices followed for achieving high standards of workmanship, thus ensuring safety and durability of the construction. All codes and standards referred to in these specifications shall be the latest thereof unless otherwise stated.

1.1.1. Inclusive Documents

The provisions of special conditions of contract, those specified elsewhere in the tender document, as well as execution drawings and notes, or other specifications issued in writing by the Engineer shall form part of the technical specifications of this project.

The attention of the contractor is drawn to those clauses of codes which require supporting specification either by the Engineer or by 'Mutual agreement between the supplier and purchaser'. In such cases, it is the responsibility of the tenderer /contractor to seek clarification on any uncertainty and obtain prior approval of the Engineer before taking up the supply/construction. In absence of such prior clarification, the Engineer's choice/design will be final and binding on the contractor without involving separately any additional payment.

1.1.2. Defective Works

All defective works are liable to be demolished, rebuilt and defective materials replaced by the contractor at his own cost. In the event of such works being accepted by carrying out repairs etc. as specified by the Engineer the cost of repairs will be borne by the contractor.

1.2 Site Information

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.

1.2.1 Location

The area in which the works are located is in Plain and Mountainous terrain.

Package -IVB (Km 130+000 to Km 141+029) of Churachandpur - Tuivai (NH-102B) road is situated in the district of Churachandpur, Manipur.

1.2.2 General Climatic Conditions

Churachandpur District is one of the 16 districts of Manipur state in north-eastern India. The district is bounded by Senapati district in the north, Bishnupur and Chandel districts in the east, Assam and Mizoram in the west and Myanmar on the south. The total population of the district as per 2011 census is 2,71,274. This district with its headquarters at Churachandpur has been divided into five blocks, i.e. Churachandpur, Thanlon, Henglep, Singhat and Parbung.

1.2.3 Seismic Zone

The works are located in Seismic Zone V as defined in IRC: 6-2000.

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 & Highways, Government of India and published by the Indian Roads Congress (IRC), with a cross reference to relevant Bureau of Indian Standards (BIS) for materials or other aspects not covered by the IRC.

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 particular item of works not already covered in PART-I.

- 2.2.1. A particular clause or a part thereof in "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (FIFTH REVISION, April 2013)" as corrected in the original 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. 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.
- 2.2.3. In so far as Amended/Modified/Added Clause may come in conflict or be inconsistent with any of the provisions of the said Specifications under reference, the Amended/Modified/ Added Clause shall always prevail.
- 2.2.4. 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	100,105,106,107,108,109,110,111, 112,114 and 120
2.	200	Site Clearance	200,201 and 202
3.	300	Earthwork, Erosion Control and Drainage	300,301,304,305,307 and 309
4.	400	Sub-base, Bases (Non-Bituminous) and Shoulder	400,401,404 and 406
5.	500	Bases and Surface Courses (Bituminous)	500, 501, 502, 503, 505, 507, 509, and 516
6.	800	Traffic signs, Markings and	801, 802, 803, 804, 805, 807 and 811

Sr. No.	Section No.	Section Title	Clause No.
		other Road Appurtenances	
7.	900	Quality Control for Road works	901 and 903
8.	1000	Materials for Structures	1007, 1008, 1010, 1012, 1014 and 1015
9.	1500	Form Work	1501,1502,1503,1504,1506, 1507 1508,1509, 1510 and 1513
10.	1600	Steel Reinforcement (Untensioned)	1602,1604,1605, and 1606
11.	1700	Structural Concrete	1705, 1707, 1711, 1716 and 1718
12.	2100	Open Foundations	2106
13.	2200	Substructures	2204 and 2210
14.	2500	River Training Work and Protection Work	2504, 2507 and 2509
15.	2600	Expansion Joints	2602, 2607, 2608, 2609, 2013, 2014, and 2615
16.	2700	Wearing Coat and Appurtenances	2702, 2703, 2704, 2705, 2706, 2708 and 2709

In the absence of any definite provisions on any particular issue in the aforesaid Specifications, reference may be made to the latest codes and specifications of IRC, BIS, BS, ASTM, AASHTO and CAN/CSA in that order. Where even these are silent, the construction and completion of the works shall conform to sound engineering practice as approved by the Engineer.

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

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 (Previously known as 'MOST', Ministry of Surface Transport)
"NHIDCL"	:	National Highway Infrastructure Development Corporation Limited.
"BIS"	:	Bureau of Indian Standards
"WBM"	:	Water Bound Macadam
"WMM"	:	Wet Mix Macadam
"BOQ"	:	Bill of Quantities

CLAUSE 105 SCOPE OF WORK

Sub-Clause 105.3 Delete the text of Clause 105.3 and substitute the following:

"The Contractor shall institute and operate a quality management system complying with SP-47 (Quality systems for road bridges) and SP-57 (Quality system for roads). The quality management system shall be described in a Quality Assurance Plan that shall be submitted to the Engineer for acceptance not later than 28 days after the Letter of Acceptance. The costs associated with preparing, implementing and monitoring the quality management system shall be deemed to be covered in the scope of the work. The Quality Assurance Plan shall cover the following items:

- i) The Contractor's organization and management including:
 - The organization of the Contract, including the line of command and communication links between parties involved in the Contract;
 - Names, roles, responsibilities and authority of principles and key personnel;
 - Control of liaison and meetings with third parties;
 - Identification of the Contractor's staff responsible for overseeing each major activity;
 - Contractor's control of sub-contracts;

- Document control;
 - provide a safe, clear and informative system of road signs
 - Program for submission of method statements;
 - Procedures for the preparation, review and adjustment of programmes for the effective progression of the Works;
 - Procedures for the regular review and recording by the Contractor of the quality of the Works;
 - Control of personal selection based on skill and experience;
 - Management review and audit to monitor and exercise adequate control over the implementation of the quality plan.
- ii) The Contractor's detailed method statements and construction procedures for each major activity whether directly controlled or subcontracted including:
- Plant and materials to be used, safety measures, the requirement for skilled labour and/or special supervision and working space;
 - Delivering, handling and storage of materials;
 - Environmental control in respect of pollution, noise, dust, temperature, working hours, traffic control etc.
 - Hold points i.e. the stages at which checks are necessary before continuing;
 - Enable standards of reliability, durability, accessibility, maintainability, quality control and assurance, and fitness for purpose appropriate to a highway of the character of the Project Highway to be achieved throughout the Contract Period
 - Achieve a high standard in the appearance and aesthetic quality of the Project Highway and achieve integration of the Project Highway with the character of the surrounding landscape through both sensitive design and sensitive management of all visible elements including those on the existing road
 - Ensure adequate safety of the Project Workers on the work site.
 - Work instructions, quality control procedures, compliance testing, inspection procedures and work acceptance procedures.
- iii) The Contractor's construction quality control including;
- A statement of the Contractor's organization for quality control;
 - Control of test laboratories;
 - Control of test, measuring and inspection equipment;
 - Document control;

- Procedure for monitoring and recording the inspection, test and approval status of the Works;
- Procedures for the collation of quality records and provision of copies to the Engineer;
- Procedures for the receipt, examination and verification of certificates of conformity and test results for purchased products.”

Sub-Clause 105.5 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 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 such blasting site should have prior information of operation hours. Workers at blasting site will be provided with ear plugs. Vehicle transporting earth materials will be covered. Water shall be spread to control the dust.

Degraded materials and waste water shall be disposed into the Septic Tank and soak pits etc. 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 land owner will be done with in time period agreed between land owner 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 waste water drainage into river and canals. Seasonal pollution issues may arise when flow of river is slow. To prevent such contamination, waste water generated at camp site will be discharged in soak pits. For human excreta, proper disposal through Septic Tanks or deep trenches will be done.

CLAUSE 106 CONSTRUCTION EQUIPMENT

Add the following sub Para (l) and (m) after sub Para (k)

- 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 107 CONTRACT DRAWINGS

Sub-Clause 107.1 *Add the following after the end of Para*

After careful study of the drawings issued by the employer, the contractor shall where details are not provided or where changes are required due to site conditions, prepare all supplementary and/or additional working drawings based on field/construction information and shall submit the same to the Engineer for approval prior to construction.

CLAUSE 108 SITE INFORMATION

Sub-Clause 108.4 *Add this Sub-clause after the Sub-clause 108.3:*

“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 109.9 *Delete the 2nd and 3rd 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. Levels shall be taken by Automatic levels with precision micrometer staff having least count of 1mm.”

Clause 110 PUBLIC UTILITIES

Replace whole of this Clause 110 with the following:

Clause 110 ENCUMBRANCES IN CONSTRUCTION AREA, INCLUDING TREES AND UTILITIES

Sub- Clause 110.1 The contractor shall be responsible to coordinate with service provider/concerned authorities for cutting of trees, shifting of utilities and removal of encroachments, etc. and making the site unencumbered from the project construction area required for completion of work. This will include initial and frequent follow-up meetings/actions/ discussions, with each involved service provider/concerned authorities. Payment for cutting of trees and shifting of utilities as required by the concerned department shall be made by the Employer.

Sub-Clause 110.2 Drawings scheduling the affected encumbrance such as trees and services like water pipes, sewers, oil pipelines, cables, gas ducts, electricity lines, accessories, telephone poles and OFC cables, etc. including in the contract document shall be verified by the contractor for accuracy of scope.

Sub-Clause 110.3 The Employer will make payments to the respective service provider/authorities for cutting trees and shifting of utilities, wherever required. The contractor shall obtain necessary approval from such Authorities after payments by the Employer and also in cases where payments are not required to be made for such shifting. The Employer will also write to all concerned department/service provider organization for expedite and facilitating cutting of trees, shifting of utilities and removal of encroachments, etc.

Sub-Clause 110.4 Any services and properties affected by the works must be temporarily supported by the Contractor who must also take all measures reasonably required by the various authorities/ persons to protect their services and properties during the execution of the works. It shall be deemed to be part of the Contract and no extra payment shall be made for the same.

Sub-Clause 110.5 The Contractor may be required to carry out certain works for and on behalf of various bodies and he shall also provide, with the prior approval of the Engineer, such assistance to the various bodies as may be authorized by the Engineer.

Sub-Clause 110.6 Payment

For coordinating the work of cutting of trees, shifting of utilities and removal of encroachments, etc. no separate payment will be made and these will be incidental to the work.

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 provisions specified in the Environment Management Plan Report shall be followed as guidelines.

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.”

The Contractor shall be required to carry out all Environmental mitigation measures and monitoring required during execution of works as directed by the Engineer in Charge. It is pointed out that all costs incurred on such measures/ monitoring shall be treated as incidental to the work and shall be deemed to have been included in the cost of item of works covered under the BOQ

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 regarded/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 and the State RCD) 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 1st 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 111.8.2 Air Quality

Add the following text after the end of 1st Para

Construction camps shall have facilities for LPG fuel. The use of firewood shall not be permitted.

Add the following text after the end of last Para

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, SO₂, NO_x, 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

Add the following text after the end of 1st Para

Bore wells installed and used for the project shall be left in good operating condition for the use 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.

Add the following text after the end of last Para

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 of in accordance with the procedures approved by the local regulatory authority.

Sub-Clause 111.10 Control and Disposal of Wastes

Add the following text after the end of last Para

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 111.13 Add the following new Clauses 111.14 to 111.17

Sub-Clause 111.14 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 do not exist, 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 (MORTH) 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 111.15 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.

Sub-Clause 111.16 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 111.17 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.

CLAUSE 112 ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

Sub-Clause 112.2 Passage of Traffic along a part of the Existing Carriageway under Improvement

This clause shall read as under:

For widening and strengthening of the existing carriageway where part width of the existing carriageway is proposed to be used for passage of traffic, paved shoulder in a width of at least 1.5m shall be provided on one side of the existing road with the following minimum requirements to be provided by the contractor:

- i) At least one 5.5m lane to remain open to traffic at all times
- ii) The surface used by the through traffic shall at all times be a firm all weather compacted surface free of pot holes and other defects
- iii) The maximum continuous length over which construction under traffic may take place shall be limited to 750m. However, for longer stretches, passing places shall be provided at every 0.75 km interval with at least 50m length.
- iv) The treatment to paved shoulders shall consist of providing 200 mm thick granular base course grading-I Table 400-1 as per Clause 401 covered by 225 mm thick wet mix macadam layer as per Clause 406 and treated with mix seal surfacing (MSS) type B as per Clause 512.
- v) Construction activity shall be restricted to only one side of the existing road.

Sub-Clause 112.3 Passage of Traffic along a Temporary Diversion

Add the following at the end of this Clause.

Where the new highway crosses or joins with an existing state highway, or an established road or cart track, the highway, road or cart track shall be kept open at all times. In case the Engineer specifically orders to construct and maintain diversion as described below, the same will be paid for.

Sr. No.	Type of Road	Carriageway Width	Unpaved Shoulders Width on each side (m)	Pavement Elements (Compacted)
1.	National Highways & State Highways	7.0 m	2.5	• Earthwork • 200 mm granular sub base (Grading-I of Table 400-1) • 225 mm W.B.M. • Prime coat & Tack Coat • Mix seal surfacing Type B.

Drainage should be provided as directed by the Engineer.

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

Sub-Clause 112.4 Traffic Safety and Control

Add the following Para in the end of Clause 112.4

The Contractor shall be fully responsible for the adequate safety of all site operations and methods of construction.

Persistent breaches of the safety provisions by the Contractor and his employees shall constitute a sufficient cause for action.

The Contractor shall also observe the following additional safety provisions. Before taking up, an agreed phased programmed for providing barricades of the approved design as per drawings and other safety measures shall be drawn in consultation with the Engineer.

- The barricading shall be erected on the side of the carriageway portion/ portion of the carriageway where any construction activity is taken up on or alongside of the existing carriageway.
- Flagmen in adequate numbers shall be provided to marshal the traffic on diversion wherever diversion of traffic is resorted to.
- Proper traffic signage in required numbers shall be provided for the information of road users.
- A safety officer shall be nominated to prepare safety programmed and oversee the safety arrangements at site.

Sub-Clause 112.6 Measurements for payment and rate

Replace this clause by following:

All arrangement for traffic during construction except temporary safety barricade as mentioned hereafter, dismantling and clearing debris, where necessary and providing traffic safety and control devices where necessary shall be considered incidental to the works and shall be contractor's responsibility.

Payment for construction of temporary diversion including temporary cross drainage structures, if required, construction of treated shoulder for traffic during construction shall be measured and paid separately as per relevant item in the BOQ. The temporary diversion shall be dismantled and credit for dismantled material shall be taken as per BOQ.

During construction activity for widening of road on hill side, the contractors shall provide rock fall fencing and deepen and widen the existing hill side drain to arrest the falling materials from coming to road surface. The fencing shall be of type as shown in the drawing or as decided by the engineer for safety of road users and workers. After the completion of the work the temporary fencing shall be shifted or removed according to necessity. All works towards providing fencing shifting of fencing clearing accumulated debris arrested by fencing regularly deepening and widening of existing drain etc. shall be considered incidental to the work.

Temporary safety barricade shall be measured in linear meter. All works in excess of quantitative provisions made in BOQ towards providing temporary safety barricade shall be considered as incidental to work and no extra payment shall be admissible for the excess quantity. The contract unit rate for the temporary safety barricade shall be payment in full for the cost all labour, materials, installation, maintenance or replacement, shifting of temporary units from one location to other and refilling the temporary holes made in the ground. Removing debris and all other incidentals to complete the work in all respect, The contractor shall take back these temporary barricades in full quantities after the completion of the project or earlier as per direction of the Engineer by paying at the rate of 50 % of his quoted rate or Rs. 1000 per meter whichever is more as salvage value to the Employer. Recovery for the salvage value shall be made in the third last interim payment certificate. These temporary units shall not be used in any permanent work in the project.

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.

Add the following as item (xix) to sub-clause 114.2:

The Contractor shall prepare detailed construction drawings for each culvert 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 culverts.

Add the following as item (xx) to sub-clause 114.2

Monthly progress report will be submitted 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, analyses 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 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.

Sub-Clause 114.4 Add the following as Clause 114.4

If any 'work' executed by the Contractor does not meet the specifications, it shall be deemed as rejected. The Engineer, in his sole discretion, may consider a proposal by the Contractor to retain, the element or part of the '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'.

Such corrective measure shall be carried out at the contractor's cost and risk.

CLAUSE 120 FIELD LABORATORY

Sub-Clause 120.1 Scope

Add the following at the end of the clause.

This facility will be provided and maintained by the Contractor, as incidental to work and no separate payment shall be made for this item.

Sub-Clause 120.2 Description

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

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 300 sqm and another 200 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 months 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.

Sub-Clause 120.3 This clause stands deleted.

Sub-Clause 120.4 This clause stands deleted.

Table 100-2 Laboratory Equipment

S. No.	Sub No.	Item, Specifications	Nos. required
A: General			
i)		Balance	
	(a)	5 kg to 20 kg capacity semi -self-indicating Electronic Type –Accuracy 1 gm.	1
	(b)	500 gm. capacity semi self indicating Electronic Type – Accuracy 0.01 gm.	1
	(c)	Chemical balance 100gm capacity - Accuracy 0.0001gm	1
	(d)	Pan balance 5 kg capacity - Accuracy 0.5 gm.	1
	(e)	Platform Scale – 300 kg capacity	1
ii)		Ovens – Electrically operated, thermostatically controlled	
	(a)	From 0°C to 220°C – Sensitivity	1
iii)		Sieves, as per IS 460-1962	
	(a)	IS Sieves 450 mm internal dia. of sieve sets as per BIS of required sieve sizes complete with lid and pan	1 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

S. No.	Sub No.	Item, Specifications	Nos. required
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 0oC to 100oC and metallic thermometers range 300oC	2 Nos. each
viii)		Hot plates 200 mm dia (1500 watt.)	6
ix)		Enamel trays	
	(a)	600 mm x 450 mm x 50 mm	2
	(b)	450 mm x 300 mm x 40 mm	2
	(c)	300 mm x 250 mm x 40 mm	2
	(d)	Circular plates of 250 mm dia.	2
x)		Water Testing Kit	1

Sub-Clause 121.3.2 for Soils and Aggregates

B: For Soils and Aggregates			
i)		Water still, 3 liter/hr. with fittings and accessories	-
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	1 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	2
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.	4
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	1 set

B: For Soils and Aggregates			
		16), and consisting of following:	
	(a)	CBR moulds 150-mm dia – 175-mm ht complete with collar, base plate etc.	6
	(b)	Tripod stands for holding dial gauge holder	4
	(c)	CBR plunger with settlement dial gauge holder	1
	(d)	Surcharge weight 147-mm dia 2.5 kg weight with central hole	6
	(e)	Spacer disc 148-mm dia, 47.7-mm ht. With handle	2
	(f)	Perforated plate (Brass)	2
	(g)	Soaking tank for accommodating 24 CBR moulds	2
	(h)	Proving rings of 1000 kg, 2500 kg and 5000 kg capacity	1 each
	(i)	Dial gauges, 25 mm travel- 0.01 mm/division	2
ix)		Standard Penetration test equipment	1
x)		Nuclear Moisture Density Meter or equivalent	1
xi)		Speedy moisture meter complete with chemicals	1
xii)		Unconfined compression test apparatus	1 set
xiii)		Aggregate Impact Test Apparatus as per IS 2386 (Part 4) 1963	1
xiv)		Los Angeles abrasion Test Apparatus as per IS 2386 (Part 4) 1963	1
xv)		Riffle Box of Slot size of 50mm as per ASTM C-136	1
xvi)		Dynamic Cone Penetrometer	1
xvii)		Hydrometer with high speed stirrer and jars	2 sets
xviii)		Post-hole augur (to BS-812)	3

Sub-Clause 121.3.3 For Bitumen and Bitumen Mixes

C: For Bitumen and Bituminous Mixes			
i)		Constant temperature bath for accommodating bitumen test specimen, electrically operated and thermostatically controlled, 50 liter capacity temp. range ambient 80° C	1
ii)		Penetrometer automatic type, adjustable weight arrangement and	1

C: For Bitumen and Bituminous Mixes			
		needles as per IS. 1203 – 1978	
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 or 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
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

C: For Bitumen and Bituminous Mixes			
xxii)		Apparatus for Separation test for modified bitumen	1

Sub-Clause 121.3.4 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 meter x 1 meter, 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
xiv)		Core cutting machine with 150 mm dia. Diamond cutting edge	1
xv)		Needle vibrator	1
xvi)		Vibrating hammer as per BS specification	1

D: For Cement, Cement Concrete and Materials			
xvii)		Air entrainment meter ASTM C - 231	1
xviii)		0.5 Cft, 1 Cft cylinder for checking bulk density of aggregate with tamping rod	1
ix)		Soundness testing apparatus for cement	1
xx)		Compression testing machine with the provision of flexural attachment and accessories for testing flexural beam	1
xxi)		Chemicals solutions and consumable	As reqd.
xxii)		Chloride Testing kit for chemical analysis of chloride content.	1
xxiii)		ION Exchange kit for rapid determination of sulphate content.	1
xxiv)		Electronic PH meter	1

Sub-Clause 121.3.5 For Control of Profile and Surface Evenness

E: For Control of Profile and Surface Evenness			
i)		Total Station with all accessories	1 No.
ii)		Precision Automatic Level	1 set.
iii)		Distomat or equivalent	1 set.
iv)		Theodolite – Electronically operated with computerised output attachment	1 set.
v)		Precision Staff of 1mm least count	2 Sets.
vi)		3 metre straight edge and measuring wedge	1 set.
vii)		Camber templates 2 lane	
	(a)	Crown type cross-section	1 set.
	(b)	Straight run cross-section	2 sets.
viii)		Steel tape	
	(a)	5 m long	2 Nos.
	(b)	10 m long	2 Nos.
	(c)	20 m long	2 Nos.
	(d)	30 m long	2 Nos.

E: For Control of Profile and Surface Evenness			
ix)	(e)	50 m long	2 Nos.
		Roughometer (Bump Integrator)	1 Set.

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.

The Contractor shall be responsible for the provision of adequately experienced and qualified laboratory staff, in sufficient numbers to be able to meet all testing requirements to the approval of the Engineer, and for the supply of all transportation of staff, testing equipment and samples necessary to allow the testing to be performed in a time scale compatible with the needs of the Site.

Contractor shall arrange to maintain the laboratory in satisfactory manner and will carry stocks of spare equipment and laboratory consumables until the issue of Taking over Certificate.

The contractor shall provide any other equipment required to check quality as per the requirement of specification in addition to the above.

Sub-Clause 120.5 Rate

“This Clause shall be read as under:”

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, back filling 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.

Sub-Clause 201.5 Measurements for Payment

Delete the 2nd sentences in first paragraph and replace as under:

Cutting of trees up to 300 mm in girth measured at 1 meter above ground including removal of stumps and roots and trimming of branches of trees extending above the roadway shall be considered incidental to the clearing and grubbing operations and no separate payment shall be made for the same.

Removal of stumps & roots of trees of girth above 300mm trees cut by other agencies and back filling to required compaction as specified in this clause shall be measured in terms of number separately on the basis of girth size of stumps of trees as given in Bill of Quantities and will be payable. For the purpose of stump removal, girth size shall be measured 150mm above ground.

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 Employer and, the Contractor shall be free to use this material in work or he may sell/dispose of the material to as desired/deemed fit by him, for which he shall quote a rate for rebate against the respective items of BOQ.

Contractor may use dismantled / milled road crushed material on as is where is basis, by suitably modifying the material, or by crushing the material, or by breaking the material, and screening the same, after effecting due rebate in the BOQ, provided it meets the specifications and is approved by the Engineer.

Sub-Clause 202.6 Measurements for Payment

This Clause shall read as:

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

i)	Dismantling brick / stone masonry / plain concrete	cum
	/ reinforced concrete including reinforcement.	
ii)	Dismantling pavement structures such as Sub base	cum
	/ Base Course, Bituminous wearing course,	
	Concrete wearing course	
iii)	Dismantling pipes, guard rails, road kerbs, gutters	..running
	and fencing	metre
iv)	Dismantling Guard Stones/KM	stones/Sign
		Nos

post/Hectometre Stones

v)	Dismantling RCC railing	..running metre
vi)	Dismantling of railing kerb	..running metre
vii)	Dismantling of Stone pitching/ boulder apron/ brick soling/ stone soling	cum

Sub-Clause 202.7 Rates

Add at the end of this sub clause:

The contract unit rates for various items of rebate shall be on the full quantities obtained from dismantling.

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.”

Sub-Clause 301.2.1 Classification

The Para (a) under this clause shall read as under:

“(a) Soil

This shall comprise top soil, turf, sand, silt, loam, clay, mud, black soil, soft shale or loose moorum, a mixture of these and similar material which yields to the ordinary application of pick, spade and stroke/or shovel, rake or other ordinary digging implement, including excavation of unsuitable soil (as described in Clause 305.2). Removal of gravel or any other nodular material having dimension in any one direction not exceeding 75 mm occurring in such strata shall deemed to be covered under this category. Conglomerates and boulders not requiring blasting having maximum dimension in any direction up to 300 mm and excavation of unsuitable soils (as described in clause 305.2) shall also be covered under this category”.

Delete “and Conglomerates” from first line of Para b (i)

Delete Para b (iv)

Sub-Clause 301.3.3 Excavation – General

The following paragraph is added to the sub-clause 301.3.3

“Temporary support to the sides of the excavation, necessary to support the foundation of adjoining structures and to prevent any ground movement shall be provided by the Contractor. Where temporary supports are provided these shall be designed & removed such that no ground movement occurs on removal. The Contractor shall submit his proposal in this respect to the Engineer for approval prior to commencement of the excavation”.

Sub-Clause 301.3.7 Excavation of road shoulders/verge/medians for widening of pavement or providing treated shoulders

The title of this Clause shall read as under:

“Excavation of road shoulders/verge & medians for widening of pavement or for providing treated/paved shoulders and medians”.

The first sentence of this Clause shall be replaced as under:

“In works involving widening of existing pavements or providing paved shoulders, the existing shoulders/verge/median shall be removed to its full width and upto top of subgrade. The subgrade material within 0.5m from the lowest part of the pavement crust for widened portion or paved shoulders shall be loosened and re-compacted as per Clause 305 to a density not less than 97% of maximum dry density determined according to IS:2720 (Part 8). Any unsuitable material encountered in this portion of sub-grade shall be removed and replaced with suitable material and compacted in accordance with Clause 305”.

Clause 301.3.11 Use & Disposal of excavated materials

Delete this sub-clause and replace with:

“All the excavated materials shall be the property of the Employer. Suitable material obtained from the excavation of the roadway, shoulders, verges, drain, cross drainage works, etc. shall be used for:

- i) Filling for roadway embankments with all lifts and leads
- ii) Filling existing pits in the right of way as directed by the Engineer, including levelling and spreading with all lifts and leads
- iii) For landscaping of the road as directed by the Engineer, including levelling and spreading with all lifts and leads

Excavated rock shall be available to the contractor for using in the manner as he desires (other than the above items of work) after affording the rebate against the respective items of BOQ.

The contractor shall remove unsuitable and surplus material, which, in the opinion of

the Engineer cannot be used in the works, from site and disposed of at the approved location in accordance with all statutory requirements as approved by the Engineer with all lifts and leads and no extra payment shall be made for the same. Area of dumping shall be arranged by the contractor.

Sub-Clause 301.6 Preparation of Cut Formation

Second Para shall be read as under:

“In rock formation, the rock shall be cut 100mm below the specified elevation of base WMM and the surface irregularities shall be corrected. The gap between rock cut and base of WMM shall be filled with 100mm thick granular sub-base as per grading-I of Table 400-1 of Clause 401. The unsuitable material shall be disposed of in accordance with Clause 301.3.11.”

Sub-Clause 301.8 Measurements for Payment

In first line of first Para add “and drains” after the word “roadway”

Delete the last Para from “works involved.....” and substitute:

“Works involved in excavation for roadway and drains shall be measured in unit indicated below:

• Excavation in all classes of soil including marshy soil	...cum
• Excavation in ordinary rock	...cum
• Excavation in hard rock with or without blasting	...cum
• Preparing Rocky Subgrade	...sqm
• Loosening and re-compacting of sub-grade	...cum

Sub-Clause 301.9 Rates

Sub-Clause 301.9.1

Add extra item after item (vii)

“(viii) The removal from site and disposal of all surplus or unsuitable materials obtained from excavation operations, which, in the opinion of the Engineer cannot be used in the Works, shall also be included in the Contract unit rates.”

Sub-Clause 301.9.2 This Clause shall read as under:

“The contract unit rate for loosening and re-compacting at subgrade level shall include full compensation for loosening to the specified depth, removing the loosened soil outside the roadway excavation rolling the surface below, breaking the clods, spreading the excavated soil in layers, watering where necessary and compacting to the requirements.”

Sub-Clause 301.9.3

Insert “including marshy soil” after words “unsuitable material” in the second line of this sub-clause.

Sub-Clause 301.9.6

Add new Sub Clause after 301.9.5 as under;

The Contract unit rate for rebate of materials obtained from excavation/cutting shall take into account for full compensation to be made by the Contractor who shall be responsible for arranging approval, payment of royalty and complying the requirement of mining department and other authorities of Central / State Government for reuse of materials obtained for rock cutting”.

CLAUSE 304 EXCAVATIONS FOR STRUCTURES

Sub-Clause 304.3.2 Excavation

At the end of 1st paragraph of Clause 304.3.2 insert 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 Physical Requirements:

305.2.1 ***Add at the end of the 1st paragraph of Sub Clause 305.2.1.1 insert the following additional sentence;***

“Use of flyash available from Thermal Power Station located within 100 kms of work may be required. The embankment with flyash shall be executed as per IRC: SP: 58:2001.

Sub-Clause

305.2.1.2 ***Add the following at the end of Sub-Clause:***

“Soils having medium and high swelling potential shall be defined on the basis of 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

305.2.1.4 *Delete second sentence “However, the Engineer Requirements of these Specifications”.*

Sub-Clause

305.2.2.4 **Compaction Requirements**

Delete Table 300-2 and substitute the following:

Table 300-2

Compaction Requirements of Embankment and Subgrade

S. No.	Type of Work/Material	Relative Compaction as %age of maximum laboratory dry density as per IS 2720 (Part 8)
1	Subgrade and earthen shoulders	Not less than 97%
2	Embankment	Not less than 95%
3	High Embankment (Height >6m)	Not less than 97%
4	Expansive clays	Not allowed
5	Design CBR of Subgrade & Shoulder shall be as per Drawing, but not less than 6%	

Replace the last part of Sub-Clause 305.2.2.4 (after Table 300-2) with the following:

The contractor shall at least 7 working days before commencement of construction of embankment and the subgrade; submit the following to the Engineer for approval:

- i) The values of maximum dry density and optimum moisture content obtained in accordance with, IS: 2720 (Part 8) for each fill material proposed to be used in the construction of embankment and subgrade.
- ii) 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.
- iii) The dry density-moisture content-CBR relationships, heavy compactive efforts conforming to the IS 2720 (part 8) for each of the fill material proposed to be used in the sub grade.

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

Sub-Clause Add the following new sub-clause:

“Construction of embankment with flyash / pond ash available from coal or lignite thermal plants as waste materials.

Construction of Embankment using Fly ash / Pond ash shall be carried out complete as per IRC: SP: 58 – 2001”.

Sub-Clause 305.3 Construction Operations

Sub-Clause 305.3.1 Setting Out

Add the words “with minimum 300 mm wider” after the words “sufficiently wider” in the fourth line of the clause.

Sub-Clause Compacting Ground Supporting Embankment/Subgrade

305.3.4 Para 1 of this clause shall be read as

“Where necessary the original ground shall be leveled, 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”.

Add at the end of Para 2

“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 additional carriageway at a depth 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 90% then these are to be compacted after necessary watering so as to achieve not less than 90% of relative compaction”.

“Where necessary to facilitate compaction of the subgrade to 97% relative compaction as stated above, a further depth below the subgrade 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-8)”.

Sub-Clause

305.3.6 Compaction

The second Para of this Clause shall read as under:

“Vibratory roller of not less than 80-100 KN static weight with plain or pad foot drum or pneumatic tyre roller of 300 KN weight having tyre pressure of at least 7 kg/sqcm shall be used for compaction.”

Insert the following sentence before the last sentence of Paragraph 4.

“The co-relation between sand replacement densities and nuclear gauge densities shall be based on trials with minimum 30 coherent density measurements”.

Sub-Clause 305.9 Rates

Sub-Clause 305.9.1

Add “including removal of topsoil after word “materials” appearing in first line of item (v).

Insert “including removal and replacement of marshy soil” after words “unsuitable material” appearing in the second line of item (iii).

Sub-Clause Add new Sub-Clause after Sub Clause 305.9.10 as under;

305.9.11 The contract unit rate for construction of embankment with suitable material obtained from roadway excavation within Right of Way (ROW) shall be payment in full for carrying out the required operation including full compensation for items under Clause 305.9.1 excluding Sub Clause (i) & (x) after the suitable material has been received as provided in Clause 301.”

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."

Sub-Clause 306.5 Rates

This clause shall be deleted.

Clause 309 Surface/Sub-Surface Drains

Sub-Clause 309.2 Surface Drains

Add the following paragraphs after end of the fourth Para of this clause.

“Drains in super-elevations shall be constructed as per drawings. Geotextile membrane if specified for these drains shall conform to Sub-Clause 702 of Section 700”.

“The roadside land between toe of road embankment & drain shall be levelled & sloped towards the drain as per drawing.”

Sub-Clause 309.3 Sub-Surface Drains

Sub-Clause 309.3.1 Scope

The first sentence of this clause should read as:

“Sub-surface drains shall be close jointed perforated pipes, surrounded by granular material laid in a trench to drain the pavement courses.”

Sub-Clause 309.3.2 Materials

Grading requirements for filter material shall conform to Class I of Table 300-3.

Sub-Clause 309.3.2.1 Pipe

The first and second sentences of this clause shall read as:

“Perforated pipes for the drains are of PVC. The size and grade of the pipe to be used is as specified in the drawing.”

Sub-Clause 309.3.4 Laying of Pipe and Backfilling

Delete Para 4 of this clause.

Sub-Clause 309.4 Measurements for Payment

This Clause shall read as:

“Construction of drains shall be measured as finished work in position as below:

a)	Unlined ditch drain		as per Clause 301 Cum
b)	Semi-Circular median drain as shown in the drawing with PCC M20, NP2 pipe, levelling concrete M15 and filter media.		running metre
c)	Open cross-drain in paved median as per drawing with PCC grade M-20 & levelling concrete M-15.		running metre
d)	Paved open/Covered drain		
	(i) Levelling concrete M-15		cum
	(ii) Course rubble masonry		cum
	(iii) Stone pitching grouting with CM 1:3		cum
	(iv) PCC/ RCC grade M-20		cum
	(v) Steel Reinforcement		MT
	(vi) Precast perforated slab		Nos.
	(vii) Catchpits/ inspection chambers		Nos.
	(viii) RCC pipes		running metre
e)	Sub-surface drains		running metre
f)	Iron grating		Nos.

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

General

Sub clause (i) of clause 401.7 stands deleted and remaining sub paras (ii) to (v) are renumbered as (i) to (iv).

Sub clause (i) of clause 405.7 stands deleted and remaining sub paras (ii) to (v) are renumbered as (i) to (iv).

The provision of clause 401.8 (i) to (v) be read as “Clause 401.8 (i) to (iv)” in the sub clauses 402.8, 403.8, 404.7, 407.7 and 408.7

Clause 401 GRANULAR SUB BASE

Sub-Clause 401.2 Materials

Sub-Clause 401.2.1 *Para 1 of this Clause shall be read as under:*

"The material shall be free from organic or other deleterious constituents and conform to the Grading I given in Table 400-1 with the percentage passing 0.075mm size restricted to 5%. The portion of the total aggregate passing 4.75 mm sieve shall have a sand equivalent value of not less than 50 when tested in accordance with the requirement of IS: 2720 (Part – 37).

Delete the eighth sentence beginning with “where the sub-base is laid in two layers as upper sub-base and lower sub-base, the thickness of each layer shall not be less than 150mm”.

Sub-Clause 401.2.2

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.

Sub-Clause *Add new Sub-Clause after Sub Clause 401.3.3 Strength of Sub-base as under:*

It shall be ensured prior to actual execution that the material to be used in the sub-base has a minimum CBR value of 30% and other physical requirements when compacted and finished.

When directed by the Engineer, this shall be verified either by performing CBR tests in the laboratory or by conducting DCP test. The CBR tests shall be conducted on specimen soaked for 4 days and compacted to 98% of the maximum dry density as per IS: 2720 (Part 8).

When decided by the Engineer – Dynamic Cone Penetration (DCP) tests shall be performed in-situ as per TRRL (UK) Road Note No. 31 and in situ CBR calculated by co-relation given by TRRL.

Clause 406 WET MIX MACADAM SUB BASE/BASE

Clause 406.2.1.1 Physical requirement

Delete the second sentence beginning with “If crushed gravel and ending with fractured faces” and add as under:

“If crushed boulders are used, not less than 90% by weight of crushed boulders retained on 4.75 mm sieve shall have at least two fractured faces.

The constituents of the aggregates shall be produced by integrated crushing and screening plant (Impact or Cone type of capacity 200T/hour) 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 also be crusher run screening only.”

Add the following at the end of the paragraph:

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.

From Table 400 – 10 delete at the bottom of the table asterisk and modify as under:

“The aggregate should satisfy both the tests a) Los Angeles Abrasion Value
b) Aggregate Impact value”

Sub-Clause 406.3.4 Spreading of Mix

Substitute 1st sentence of Para 2 of clause 406.3.4.

“The mix shall be spread by a WMM paver”.

Sub-Clause 406.3.5 Compaction

Delete second sentence of Para 1 of Clause 406.3.5.

Clause 409 CEMENT CONCRETE KERB AND KERB WITH CHANNEL

Sub-Clause 409.5 Construction Operations

Sub-Clause 409.5.1 Add at the end of the first sentence “or as shown in the drawings”

Sub-Clause 409.6 Substitute

“Cement concrete kerb/kerb with channel shall be measured in linear metre. Foundation of kerb, where separately provided, shall be measured in cubic metre.”

Clause 409.7 This Clause shall read as under:

The contract unit rates for cement concrete kerb / kerb with channel shall be

payment in full compensation for furnishing all materials, labour, tools equipment for construction and other incidental cost necessary to complete the work. Foundation for kerb, wherever provided, shall be paid separately as per contract.

SECTION 500 BASE AND SURFACE COURSES (BITUMINOUS)

General

Sub Para (i) of clauses 501.8.8.2 stands deleted and remaining sub pares (ii) to (x) are renumbered as (i) to (ix).

The provision “clause 401.7 (i) to (v)” be read as “Clause 401.7 (i) to (iv) in the clauses 502.8 & “clause 401.8 (i) to (v)” be read as “Clause 401.8 (i) to (iv) in the clauses 503.8.

Sub-Clause 501.2 Materials

Sub-Clause 501.2.2 Delete “Crushed gravel or other hard material” from First line of Para 1 and replace with “crushed boulders”

Replace word “crushed gravel” in Para 2 with “crushed boulders”

Sub-Clause 501.6 Compaction

Para 2, Line 11; sentence starting with “the intermediate rolling” is replaced by “Intermediate rolling shall be done with a Pneumatic roller of 150-250kN weight having a tyre pressure of at least 0.7Mpa.

Add new Para,

“Rolling shall be continued till the density achieved, satisfied the requirement of Clause 903.4.2.”

Sub-Clause

501.8.8.2 Add the following at the end of Para (viii)

Payment of extra bitumen shall be made on the basis of the prevailing rate of bitumen.

CLAUSE 502 PRIME COAT OVER GRANULAR BASE

Sub-Clause

Add the Sub-Clause 502.2.5 Choice of Primer after 502.2.4

This clause shall be read as under:

The primer shall be medium setting bitumen emulsion and shall be refinery produced. The particular grade to be used for the work shall be got approved by the Engineer.”

CLAUSE 503 TACK COAT

Sub-Clause

503.2 Materials

This clause shall be read as under:

"Binder: The binder used for tack coat shall be medium setting bitumen emulsion and shall be refinery produced. The particular grade to be used for the work shall be got approved by the Engineer."

CLAUSE 505 DENSE GRADED BITUMINOUS MACADAM

Sub-Clause 505.2.1 Bitumen

This Clause shall be read as under:

The binder shall be viscosity grade VG-30 bitumen conforming to IS:73-2006.

Sub-Clause 505.2.2 Coarse Aggregates

Delete "Crushed Gravel or other hard material" from 1nd line of 1st para and replace with "crushed boulders".

Replace word "crushed gravel" in para 2 with "crushed boulders"

Add the following at the end of this clause:

"The constituents of the aggregates shall be produced by integrated crushing and screening plant (Impact or Cone type of capacity 200T/hour) 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 also be crusher run screening only."

Sub-Clause 505.2.3 *Delete the words "or Naturally Occurring Mineral or a Combination of the two" appearing in the first sentence of the clause.*

Sub-Clause 505.2.4 *the first sentence of this clause shall read as "Filler shall consist of finely divided hydrated lime or cement as approved by the Engineer"*

Sub-Clause 505.2.5 Aggregate Grading and Binder Content

From the Table 500 – 8, replace at bottom of the table against Asterisk (*) with the following:

"Aggregate should satisfy both the tests Los Angeles abrasion value and aggregate impact value"

In Table 500-10, the following may be substituted:

Grading	1	2

Layer Thickness	>75mm to 100mm	50-75mm

Sub Clause 505.3 Mix Design

Sub-Clause 505.3.1 Requirement for the Mixture

Add the following requirements to the list of Table 500-11:

Water sensitivity (ASTM D1075): Retained stability (Ratio of Marshal Stability for 24 h Immersion and 30min Immersion in water at 60 degree centigrade temperature) = not less than 75 %

Filler- Bitumen ratio = 0.6 to 1.2 (Filler: passing 75 micron sieve)

Sub-Clause 505.3.3 Insert the following paragraph between the existing paragraphs 3 & 4:

“Mixed design shall be carried out in accordance with the modified Marshal method described in Asphalt Institute Manual MS-2.”

Sub-Clause 505.4.9 Rolling

Add at the end of Para 1

“The rolling shall be continued till the density achieved is at least 98% of that of laboratory Marshall Specimen compacted as detailed in Table 500-11.”

Add the following Sub-clause after Sub-clause 505.4.9

Clause 507 BITUMINOUS CONCRETE

Sub-Clause 507.1 Scope

Add the Following at the end of this clause:

“A site trial shall be performed in accordance with the direction of the Engineer”

Sub-Clause 507.2.1 Bitumen

This Clause shall be read as under:

The bitumen use for the work shall be VG-30 grade conforming to IS:73:-2006.

Sub-Clause 507.2.2 Coarse Aggregates

Add the following as second para:

“The constituents of the aggregates shall be produced by integrated crushing and screening plant (Impact or Cone type of capacity 200T/hour) 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 also be crusher run screening only.”

From the Table 500 – 16, replace at bottom of the table against Asterisk (*) with the following:

“Aggregate should satisfy both the tests Los Angeles abrasion value and aggregate impact value”

Sub-Clause 507.2.4 Filler

This clause shall read as under:

“Filler shall consist of finely divided hydrated lime or cement as approved by the Engineer.”

Sub-Clause 507.3 Mixture Design

Sub-Clause 507.3.1 Requirement for the mixture

Add the following requirements to the list of Table 500-11:

Water sensitivity (ASTM D1075): Retained stability (Ratio of Marshal Stability for 24 h Immersion and 30min Immersion in water at 60 degree centigrade temperature) = not less than 75 %

Swell Test (Asphalt Institute, MS-2, No.2), maximum = 1.5%

Sub-Clause 507.4.9 Add the following additional sub-clause 507.4.9

The bitumen concrete layer shall be laid with sensor paver capable of paving in width 8 to 10 m in single operation.

Sub-Clause 507.9 Rate

Delete the existing Para and replace it with the following:

The contract unit rate shall be for all operations as specified in clause 505.9, except that the rate shall include the provision of modified bitumen at 5.40 percent by weight of total mixture. The variance in actual percentage of modified bitumen used will be assessed and payment adjusted up or down, accordingly. The modified binder, the cost of modifier and its mixing with the bitumen for the preparation of modified bitumen shall not be paid separately and is inclusive of all costs

CLAUSE 516 MASTIC ASPHALT

Sub-Clause 516.2.2 Coarse Aggregate

Delete “Crushed gravel/Shingle or other stones” from the 1st sentence

SECTION 800 TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES

CLAUSE 801 TRAFFIC SIGNS

Sub-Clause 801.2.5 Substrate

2nd sentence of this clause shall read as under:

“The aluminum sheet used for signs shall be 2mm thick.”

Sub- Clause 801.3 Traffic Signs Having Retro-reflective Sheeting

Sub-Clause 801.3.1 General Requirements

The fifth sentence of this clause should read as under:

“The reflective sheeting shall be of High Intensity grade with encapsulated lens.”

Sub-clause Add following in the clause

801.3.8.3 “All the facility information and place identification signs shall have blue (Indian standard colour No. 166: French Blue) background and white letters.”

Sub-Clause Warranty and Durability

801.3.11 the first and second sentences of this clause shall read as under:

“The Contractor shall obtain from the manufacturer a seven-year warranty for satisfactory field performance including stipulated retro-reflectance of the retro-reflective sheeting of high intensity grade and submit the same to the Engineer. In addition, a seven year warranty for satisfactory in-field performance of the finished sign with retro-reflective sheeting of high intensity grade, inclusive of the screen printed or cut-out letters/legends and their bonding to the retro-reflective sheeting shall be obtained from the Contractor/Supplier and passed on to the Engineer.”

Sub-clause 801.4.1 the last sentence of clause shall read as follows

Posts shall be embedded in concrete (M-15) for safeguard against theft. The cost of concrete shall be deemed to be included in the rate of signboard.

Sub-clause 801.4.2 Add following at the end of this clause:

“The sign back shall be painted with two coats of grey colour epoxy paint. The sign post shall be painted in black & white alternate bands with two coats of epoxy paint.”

CLAUSE 802 OVERHEAD SIGNS

Sub-Clause 802.4 Materials for Overhead Sign and Support Structures

Sub-Clause 802.4.2

The last line of this clause “they shall _____ IS specifications” shall read as

“They shall be thoroughly descaled, cleaned, primed along with all other components of signs, except reflective portion. They shall be painted with two coats of epoxy paint. The sign back side shall be painted with grey colour and post shall be painted in black & white alternate bands. The post below ground shall be painted with three coats of red lead paint”.

Sub-Clause 802.4.3 Replace “1.5mm” with 2.0mm” in the fifth line.

Sub-Clause 802.8.1 this clause shall read as under:

“The Structural steel part of the overhead signs shall be measured in tones while the sign board shall be measured in square meters. The excavation for foundation, concrete and reinforcement in foundation shall be paid separately under the respective BOQ items. All other items like painting of structural steel and sign back etc. shall be considered incidental and no separate payment shall be made. The contract unit rate for overhead sign structures shall be payment in full compensation for finishing, all labour, materials, tools, Equipment, fabrication, installation and all other incidental works necessary to complete the work to the specifications”

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.”

Sub-Clause 803.3 Ordinary Road Marking Paint

This Clause shall be deleted.

Sub-Clause 803.5 Reflectorised Paint

This Clause shall be deleted.

803.6.6 Add the following para at the end of Sub-Clause 803.6.6

Line and curves, whether broken or unbroken, shall not consist of chords but shall follow the correct radius.

ii) Faulty Workmanship or Materials

If any materials not complying with the requirements is delivered at the Site or used in the Works, or if any sub-standard work is carried out, such material or work shall be removed, replaced or repaired as required by the Engineer, at the Contractor’s own cost. Rejected traffic markings and paint that has been splashed or has dripped onto the surfacing, kerbs, structures or other such surfaces shall be removed by the Contractor at his own cost, in such a way that the markings of spilt paint will not show up again later.”

CLAUSE 805 DISTANCE INDICATOR POSTS

Sub-Clause 805.3 The first sentence of this clause shall read as under:

“The hectometre/kilometre stones shall be made of concrete of grade as shown in the drawing.”

Sub-Clause 804.3.1 New Clause 804.3 shall be added as follows:

Marker post shall be provided as shown in drawing. The posts shall be embedded in the ground as shown in drawing.

Sub-Clause 804.4 Measurement of Payment

The measurement will be in numbers of 200 meters, kilometers, 5th kilometer stone and marker posts fixed at site.

Sub-Clause 804.5 Rate

The words '/marker posts' shall be inserted after the words '5th kilometer stone' appearing in the clause.

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 reflector, 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 or as shown in the drawings.
- 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 or as shown in the drawings.
- 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 or as shown in the drawings.
- 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 807 BOUNDARY STONES

Sub-Clause 807.1 Scope

Add at the end of Para 1, "The boundary stones shall be of concrete as shown in drawing." The words 'RCD' should be engraved on each stones appropriately.

CLAUSE 811.2 CONCRETE CRASH BARRIER

Sub-Clause 811.2.1.2 *The Clause will be read as below*

"The concrete barriers shall be constructed with grade & concrete as indicated in the drawing and with high yield strength deformed reinforcement conforming to IRC-21"

Sub-Clause 809.6 Rate:

Add at the end of the clause:

"And paid as per respective BOQ items."

CLAUSE 811.3 METAL BEAM CRASH BARRIER

Sub-Clause 811.3.1 Materials

Sub-Clause 811.3.1.1 *this clause shall be read as:*

Metal beam is a "W" profiled corrugated beam in single or double row and single or double faced as specified in the drawing made out of cold roll forming from steel strip of 3 mm thick using steel of grade ST 42 grade conforming to IS:5986 with hot dip galvanised 550 gm per square meter.

The beam after forming shall have formed width of 312 mm and depth of 83 mm and shall have punched holes for fixing as specified in drawings.

The metal crash barrier posts & spacer shall consist 'C' channel section made out of 5 mm thick sheet by cold roll forming process of steel conforming to IS: 2062-1992 Grade 'A' with hot dip galvanised 550 gm per square meter. All bolt, nuts and washers as specified in drawings shall conform to IS: 1367 & IS: 1364 unless otherwise specified and are hot dip galvanized 550 gm per square meter.

The Guard rail reflector shall be made of material and placed in position as shown in drawings. It shall be hot dip galvanized 550 gm per square meter.

Beams to be erected on a radius of 50 m or less shall be shop curved to the appropriate curvature of the installation.

Sub-Clause *Add at the end of this Clause*

811.3.1.4 The size of the concrete foundation block for embeddings the guard posts and grade of concrete shall be as shown in the drawing.

Sub-Clause 811.3.3 Installation of Posts

The sub-clause 811.3.3.1, 811.3.3.2, 811.3.3.3 and 811.3.3.4 are replaced as below:

The guard posts shall be embedded in the concrete footing of size and the grade of concrete along with the depth of the embedment of post as indicated in the drawing.

Clause 811.3.3.5 Add “and end section” in first line after “posts”.

Sub-Clause 811.3.7 Measurements for Payment

Sub-Clause 811.3.7.1 the 2nd sentence "Terminals/ Anchors of various types shall be paid by numbers" is deleted.

Sub-Clause 811.3.7.2 the first sentence will be substituted as below:

“No separate measurement for payment shall be made for Terminals/Anchors of various types required for the work. The cost of these elements will be deemed to be included in the rate quoted by the contractor.”

Sub-Clause 811.3.7.3 the words “or backfilling” shall be substituted as “and concreting”

Sub-Clause 811.3.8 Rate

Add “and drawings” at the end of last sentence of Clause.

SECTION 900 QUALITY CONTROL FOR ROAD WORKS

Clause 901 GENERAL

Sub-Clause 901.1 This clause shall read as under:

"All materials to be used, all methods adopted and all works performed shall be strictly in accordance with the requirements of these Specifications. The Contractor shall set up a field laboratory at locations approved by the Engineer and equip the same with adequate equipment and personnel in order to carry out all required tests and Quality Control work as per Specifications and/or as per Clause 121 and/or as directed by the Engineer. The list of laboratory equipment and the facilities to be provided shall be as per Clause 121 and shall be got approved from the Engineer in advance."

Sub-Clause 901.5 This Clause shall read as under:

"The Contractor shall provide necessary cooperation and assistance in obtaining the samples for tests and carrying out the field tests as required by the 'Engineer' from time to time. This shall include provision of laboratory, equipment, transport, consumables, personnel, including labour, attendants, assistance in packing and dispatching and any other assistance considered necessary in connection with the tests."

Clause 903 QUALITY CONTROL TESTS DURING CONSTRUCTION

Sub-Clause 903.4 Tests on Bituminous Constructions

Sub-Clause 903.4.1 Add at the end of this Clause:

“The density test shall be carried out by 100 mm diameter core cutter machine on Dense Bituminous Macadam and Bituminous Concrete as per the frequency specified”.

In Table 900-4, Serial No. 5 for Dense Graded Bituminous Macadam /Bituminous Concrete, modify the ‘Frequency (Minimum)’ values for Item No. (vi), (viii) and (xvi) as under:

S. No.	Type of Construction	Test	Frequency (Minimum)
5	Dense Bituminous Macadam/ Bituminous Concrete	(vi) Sand Equivalent Test	Three tests on aggregates for each 400 t of mix subject to two tests per plant per day.
	Dense Bituminous Macadam/ Bituminous Concrete	(viii) Polished Stone Value (PSV)	Initially one set of three representative specimens for each source of supply. Subsequently when warranted by changes in the quality of aggregates.
	Dense Bituminous Macadam/ Bituminous Concrete	(xvi) Density of Compacted Layer	One tests per 250 m ² area subject to the condition that 10% of density tests shall be done on the edges.

Note:

Add the following note at the end

- The laboratory and field tests shall be performed on materials and works at the frequency values indicated against each. The Supervision Personnel shall ensure that there are no deviations in this regard.
- The Contractor shall prepare a detailed manual for Quality Assurance including the methodology for the respective tests, the data formats and the methodology for the analysis and interpretation of test results based on the reference Standards and Practices indicated in the Technical Specifications and obtain the approval of the Engineer.

Add the following Sub-Clause 903.4.4 & 903.4.5

Sub-Clause 903.4.4 Characteristics to be tested on completed Bituminous Layers

The characteristics to be tested on completed bituminous layers are:

Relative compaction

Layer thickness

For testing the above characteristics, the following sampling criteria shall apply:

a) Random Sampling

When testing any lot, or an isolated section, which is obviously defective or exhibits abnormal variation of the characteristics under consideration, all samples shall be taken in a random pattern.

b) Lot Size

The lot size shall normally be a section laid and compacted in one process and for which essentially the same materials had been used. Where production is on a continuous basis, a lot shall normally mean one-day production and shall not exceed two full days production. However, the Engineer for investigating compliance with the specifications may order a lot of any smaller size, if:

- The factors affecting the characteristics under investigation exhibit abnormal variation within the normal lot size
- The area is obviously defective or of poorer quality than that of the rest;
- The rate of production is very high.

Sub-Clause 903.4.5 Add new clause

“Bituminous mix shall be spread with paver fitted with electronic sensing device and string line arrangement (supported by steel pegs @ 5m apart) on either side of paving width for automatic levelling, surface evenness and profile control. Use of string line is compulsory to provide signal to the electronic sensing device fitted with a Paver Finisher”.

Bituminous works shall be tested immediately after laying/finishing for:

- a) Thickness (compacted) measured by extracting cores and shall be dealt in accordance with Specifications Section 900.
- b) Density (compaction) test as performed on the extracted cores
- c) Workmanship test by measuring roughness of the finished layer by duly calibrated Towed Fifth Wheel Bump Integrator
- d) **Workmanship Test: Roughness measured longitudinally**

The finished bituminous layers (DBM and BC) shall be tested for workmanship (immediately before allowing traffic) by measuring roughness, longitudinally, separately for each lane with the Calibrated Towed Fifth Wheel Bump Integrator. Calibration of Bump Integrator device shall be carried out using the procedure recommended in the World Bank Technical Publication No. 46. The measured roughness shall **not** exceed a value of 2000 mm/km for finished DBM and BC layers.

Note: Contractor shall arrange the core extraction machine at his cost and shall take cores of the executed bituminous works jointly with Engineer without any extra cost.

Sub-Clause 903.5 Quality Control Tests for Road Constructions

Sub-Clause 903.5.2 Pavement Concrete

Sub-Clause 903.5.2.1 Sampling and testing of beam and cube specimens

Replace first para (“At least for compliance.”) with:

“One each day’s work, at least six pairs of beams for flexural strength and six pairs of cubes for compressive strength shall be cast of concrete delivered to the paving plant as long as the total daily production is less than 300m³. For daily productions over 300m³, two additional beams and two additional cubes shall be cast of each 100m³, (or part thereof). Each pair of beams and cubes shall be from different deliveries of concrete. All specimens shall be transported in an approved manner to prevent any damage to the specimen. From each pair of beams and cubes one specimen shall be tested at 7 days and one at 28 days. The groups of beams specimens from each day’s production tested at 28 days shall be used for assessing the strength for compliance with the strength requirements. The groups of beam specimens from each day’s production tested at 7 days shall be used for early indication of the 28 days strength as described in Clause 603.3.3.2. The flexural strength test results shall prevail over compressive strength tests results for compliance.”

Sub-Clause 903.5.2.2 Replace 1st para with following:

“Where the 28 days strength requirements are not met; or where in the opinion of the Engineer the quality of the concrete or its compaction is suspect, the actual strength of the concrete in the slab shall be ascertained by carrying out tests on six cores cut from the concrete at such locations. The cores shall be 150 mm diameter, shall be saw cut in both ends to provide a specimen height of 300 mm $\pm$ 5mm and shall be tested for compressive strength. The concrete will be acceptable if:

- The average compressive strength of the six cores when corrected to 28 days strength using the factors given in Table 900-5 or an age-strength relationship for the actual mix determined by the Contractor and approved by the Engineer – is at least the average compressive strength of the cores tested from the trial length, refer Clause 602.10.5.5;
- None of the cores show considerable honeycombing”.

Delete fourth para (“In order..... test beams.”).

Delete fifth para (“The standard deviation.....the requirements.”)

Delete sixth para (“An individual.....is substandard.”)

Add at the end of seventh paragraph (“Beams shall..... and cubes required.”)

“The Engineer may permit a reduction in the number of beams and cubes required when previous test results have shown satisfactory strength and when he is satisfied with the variation in quality of the mix.”

Delete ninth para (“The flexural.....they were taken.”).

Delete eleventh para (“Should the concrete.....flexural strength.”)

Delete twelfth para (“The equivalent ----- obtained from Table 900-5).”

Sub-Clause

903.5.2.2 In-situ density

Add as Para 5 of this clause:

“This Clause is not applicable for cement concrete kerb and kerb with channel”.

Sub-Clause

903.5.2.5 Summary of Control Tests.

In Table 900-6, item 5 (i) “Strength of concrete”, change test frequency to:

“On each day’s work, at least six pairs of beams and six pairs of cubes for total daily production less than 300 m³. Two additional beams and two additional cubes for each 100 m³ (or part thereof) in excess of 300m³.”

Sub-Clause

903.5.2.5 Summary of Control Tests in Table 900-6, item 5(ii) “(core strength on hardened concrete”, change test frequency to:

“As per Clause 903.5.2.1”.

Sub-Clause 903.5.2.6 Add the following new Clause:

Temperature Measurements

“The temperature development in the concrete slab during hardening shall be recorded for each day’s production. The temperature shall be measured in the middle (vertically) of the slab at a horizontal distance of at least 1000 mm from any free edge. The temperature shall be measured using a thermometer that shows maximum temperatures. From each day’s production three thermometers shall be installed, at commencement, in the middle of production and at completion of placing concrete. Measurements shall be recorded for 3 days after placing of the concrete.”

SECTION 1000 MATERIALS FOR STRUCTURES

CLAUSE 1007 COARSE AGGREGATES

Delete “crushed gravel, natural gravel or a suitable combination thereof or other approved inert material” in the third and fourth line of first para and replace with “or crushed boulders. For this purpose, boulder greater than average dimension of 300 mm shall only be used”

Add the following at the end of Para 2.

“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 employed 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.

CLAUSE 1008 SAND/FINE AGGREGATES

Delete from the 2nd line the word "crushed gravel" and from the 3th line "gravel" in Para 2.

Add the following at the end of the clause:

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

Clause 1010 WATER

In Para (C) the permissible limit for Chlorides (Cl) shall be read as "250 mg/lit for structures having length more than or equal to 30 m."

In case of structures of lengths 30m and below, the permissible limits of chlorides may be increased up to 500mg/ltr.

Clause 1012 CONCRETE ADMIXTURES

Sub-Clause 1012.1 General

Add the following at the end

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.

2. Storing

- A. Shelf life
- B. Max. & Min. allowable temperature
- C. Other instructions (e.g. requirements of stirring)

3. Dosage

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

Clause 1012.3.1 Information Required From the Manufacturer

Paragraph 1 shall read as follows:

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:

Add the following at the end of the para h

- i. pH value and colour.
- j. If two or more admixtures have to be used in one mix, their compatibility.
- k. Latest date of test and name of test laboratory.

Add the following at the end of the clause:

After selecting a few acceptable brands and types of admixture based on the manufacturer's data/technical literature, independent acceptance tests should be carried out for the same using the approved combination of cement/sand/aggregates intended for use in the project. After establishing the basic acceptability using strength criteria (compression and tensile strengths) a number of trial mixes be designed using different proportions of admixtures/cement/water etc. to establish the data bank on the behavior 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.

Retrial should be conducted with change in source/type of cement.

Workmanship

The dosage should be finalized 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.

Clause 1014 STORAGE OF MATERIALS

Sub-Clause 1014.3 Aggregates

The following shall be added to this Clause:

"Aggregates shall be stored or stockpiled in such a manner that segregation of fine and coarse sizes will be avoided and also 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."

CLAUSE 1015 TESTS AND STANDARDS OF ACCEPTANCE

Add the following as Para 3:

"Independent testing of pre-stressing steel shall be carried out by the Contractor for each consignment from each source at site in the laboratory approved by the Engineer before use. The tests shall be carried out for the properties as listed in clause 7.2.1 of BS- 5896:1980. These tests are in addition to the tests carried out by the Manufacturer."

CLAUSE 1104 MATERIALS

Sub-Clause 1104.2 The first sentence of this clause is amended as follows:

Concrete to be used in Cast-in-situ piles shall be of grade as per BOQ or as directed by the Engineer.

SECTION 1500 FORMWORK

CLAUSE 1501 DESCRIPTION

The Clause shall read as below.

The Contractor shall prepare a formwork mobilization and utilization plan and submit the plan for Engineer's approval at least 28 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 mobilization 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.

CLAUSE 1502 MATERIALS

This Clause shall read as under:

"All materials shall comply with the requirements of IRC-87.

Material and components used for formwork shall be examined for damage or excessive deterioration before use/reuse and shall be used only if found suitable after necessary repairs.

Only steel formwork shall be used. The steel used for forms shall be of such thickness that the forms remain true to shape. All bolts should be countersunk. The use of approved internal steel ties or plastic spacers shall be permitted. Structural steel tubes used as support for forms shall have a minimum wall thickness of 4 mm."

Clause 1503 DESIGN OF FORMWORK

Sub-Clause 1503.1 *Add at the end of this Sub-clause*

“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 sub-strata”.

Sub-Clause 1503.2 The following shall be added at the end of this Clause:

“The work of formwork shall not commence without approval of the Engineer”

CLAUSE 1504 WORKMANSHIP

Sub-Clause 1504.1 *Add the following at the end of Clause 1504.1*

“The loading from the formwork shall be distributed to the soil or the permanent works below (e.g. pile cap) in such a manner that any total or differential settlement is within acceptable limits. Subsoil characteristics shall be taken into account while designing the staging to avoid untoward failures. All the pipes etc. used for staging shall be free from kinks, bends etc.”

CLAUSE 1506 PRECAUTIONS

Add the following as items of this clause:

Adequate support against sideway and lateral loads due to construction operations and wind shall be provided.

In case cantilevers are supported directly from the ground, the supports for cantilevers shall be removed simultaneously with main supports only after approval for the same from the Engineer.

Forms shall be rigid and of adequate section to reduce deflections. Forms shall have sufficient rigidity to resist horizontal pressures caused by flowing concrete resulting from use of superplasticisers. The formwork shall resist the lateral pressure caused due to fast rate of placement by concrete pumps.

CLAUSE 1507 PREPARATION OF FORMWORK BEFORE CONCRETING

Add at the end of last para :

“Concreting shall not commence without approval of the Engineer”

CLAUSE 1508 REMOVAL OF FORMWORK

Add the following as para 7 Clause. 1508.

For prestressed units, the side forms shall be released, as early as possible and the soffit forms shall permit without restraint deformation of the member, when prestress is applied. Form supports and forms for cast in situ members shall not be removed until sufficient prestress has been applied to carry the dead load and any formwork supported by the member and anticipated construction loads.

Clause 1509RE-USE OF FORMWORK

This Clause shall read as under:

"After forms are stripped, all materials shall be examined for any damage and damaged pieces, if any, shall be removed either as rejected or for rectification if possible. The materials found fit to be reused shall be thoroughly cleaned. Holes bored through sheathing for form ties shall be plugged by driving in common corks or foamed plastics. Patching plaster may also be used to fill small holes. After cleaning and before re-fixing, each formwork shall be got approved from the Engineer.

Formwork and staging shall be so used as to ensure quality of the exposed surface. However, if in the opinion of the Engineer, any particular panel/member has become unsatisfactory for use at any stage, the same will be rejected and removed from site.

All bent steel props shall be straightened before reuse. The maximum deviation from straightness shall not exceed 1/600 of length. However the maximum number of users shall be limited to 20 times since only steel formwork is to be used .The maximum permissible axial loads in used props shall be suitably reduced depending upon their condition."

CLAUSE 1510 SPECIALISED FORMWORK

Replace the words 'slip-form work' by 'climbing formwork' in the first sentence of this clause.

The first sentence of Para 2 of this clause shall read as follows:

Slip forming is not permitted.

Replace the word "plywood" by "marine plywood" in the fifth paragraph of this clause.

Clause 1513 RATE

Add the following at the end of the first para:

"The unit rate shall also include all costs for preparation of erection scheme, designs of false work and formwork and their approval."

SECTION 1600 STEEL REINFORCEMENT (UN-TENSIONED)

CLAUSE 1602 GENERAL

Paragraph 2 of Clause 1602 shall read as follows:

"Reinforcements shall be thermo mechanically treated (TMT) deformed bars of grade Fe 415/ Fe 500 conforming to IS: 1786 as Specified in the drawings. Only uncoated steel shall be used as reinforcement unless specified."

CLAUSE 1604 BENDING OF REINFORCEMENT

Para 1 shall be read as follows:

The reinforcement shown on the drawings shall be considered merely symbolic representations of the shape and position and shall not be used by the Contractors to justify any deviation from the stipulated requirements. Bar bending schedules and any supplementary drawings as may be required shall be furnished by the Contractor and got approved by the Engineer before start of work. The bending schedules shall state the number, shape and length of bar and weight in respect of each type. System of bar referencing should be coherent and systematic. A separate bar bending schedule shall be prepared for auxiliary bars like spacers, chairs etc.

CLAUSE 1605 PLACING OF REINFORCEMENT

Paragraph (c) (i) of Clause 1605 shall be read as follows:

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.

Add the following as sub Para (f) to this Clause:

Tolerances:

1. Tolerance of cover: Deviation shall not exceed + 10 mm No negative tolerance is allowed.
2. Tolerance in position: Tolerance for deviation from the positions shown in the drawings shall not exceed the following:

Structural depth d (mm)	Tolerance (mm)
d < 1000	<10
1000 < d < 2000	< 0.01d
2000 < d	< 20

CLAUSE 1606 BAR SPLICES

Sub-Clause 1606.1 *First sentence of Clause 1606.1 shall read as follows:*

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

Add the following as paragraph 2 of Clause 1606.1:

The location of joints in continuous reinforcing bars, not shown in drawings, shall be submitted to the Engineer for acceptance. If nothing contrary has been specified, the number of bars to be joined in any cross-section shall not exceed one-third of the total.

Sub-Clause 1606.2 Welding

Sub-Clause Add the following at the end of the paragraph:

1606.2.1 “In prestressed concrete members, when welding of untensioned reinforcement is permitted by the Engineer, it shall be carried out before insertion of the prestressing tendons/sheathing.”

SECTION 1700 STRUCTURAL CONCRETE

CLAUSE 1703 GRADES OF CONCRETE

Sub-Clause 1703.2 This Sub-Clause shall be replaced with the following:

“The lowest grades of concrete in bridges and corresponding minimum cement contents and water-cement ratios shall be maintained as indicated in Table 1700-2 and 1700-3.”

TABLE 1700-2 for all major bridges (bridges with total length 60m and above, ROBs, Flyovers, Grade Separators) and minor bridges (bridges with total length less than 60 m & Underpasses)

A) Minimum cement content and maximum water cement ratio

Structural Member	Min. cement content (kg/cum)		Max. water cement ratio	
	Major Bridges	Minor Bridges	Major Bridges	Minor Bridges
PCC Members	360	310	0.45	0.45
RCC Members	400	400	0.40	0.40
PSC Members	400	400	0.40	0.40

B) Minimum strength of concrete

Member	Major Bridges	Minor Bridges
PCC Members	M30	M20
RCC Members	M35	M25
PSC Members	M40	-

TABLE 1700-3 For culverts and other incidental structures:

A) Minimum cement content and maximum water cement ratio

Structural Member	Min. cement content (kg/cum)	Max. water cement ratio
PCC Members	310	0.45
RCC Members	400	0.40

B) Minimum strength of concrete

Member	Grade
PCC Members	M20
RCC Members	M25

Notes:

1. The minimum cement content is based on 20mm aggregate (nominal max. size). For 40mm and larger size aggregates, it may be reduced suitably but the reduction shall not be more than 10 per cent.
2. For under water concreting, the cement shall be increased by 10 per cent.

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.

Clause 1704 PROPORTIONING OF CONCRETE

Add the following at the end of this Clause:

"In proportioning concrete, the quantity of both cement and aggregate shall be determined by weight. Where the weight of cement is determined by accepting the manufacturer's weight per bag, a reasonable number of bags shall be weighed separately to check the net weight. Where cement is weighed from bulk stock at site and not by bag, it shall be weighed separately from the aggregates. Water shall either be measured by volume in calibrated tanks or weighed. All measuring equipment shall be maintained in a clean and serviceable condition. Their accuracy shall be periodically checked.

It is most important to keep the specified water-cement ratio constant and at its correct value. To this end, moisture content in both fine and coarse aggregates shall be determined as frequently as possible; frequency for a given job being determined by the Engineer according to the weather conditions. The amount of mixing water shall then be adjusted to compensate for variations in the moisture content. The determination of moisture content in the aggregates shall be done as per IS: 2386 (Part III). Suitable adjustments shall also be made in the weight of aggregates to allow for the variation in weight of aggregates due to variation in their moisture content."

Sub-Clause 1704.4 Additional Requirements

In Para (a) substitute "0.06%" for "0.1%"; "0.06%" for "0.2%"; and "0.1%" for "0.3%" for the three items respectively.

Clause 1705 ADMIXTURES

This Clause shall read as under:

"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 affect the steel or concrete shall not be permitted.

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

Clause 1706 SIZE OF COARSE AGGREGATE

Table 1700-7 shall be modified as given below :

Components	Maximum nominal size of Coarse aggregate (mm)
a) RCC Well Curb.	20
b) RCC / PCC well steining, PCC below foundations and approach slab, annular filling around foundations.	40
c) Well cap or pile cap; solid wall type abutments, piers, median walls, splayed wing walls and their foundations.	40
d) RCC works in T-beam and slab / solid slab / voided slab and box girder superstructure, wearing coat, kerb, crash barrier, approach slab, dirt walls, coping on masonry wing walls, hollow abutments and piers, pier / abutment caps, pedestals, dirt walls, piles, all components of counter fort type abutments, columns, cantilever return walls etc.	20
e) All PSC works	20
f) Any other item	As specified by the Engineer

Clause 1707 EQUIPMENT

Para 1 of this Clause shall read as under:

“Unless specified otherwise, equipment for production, transportation and compaction of concrete shall be as under:

- For production of concrete: Batching and mixing of the concrete shall be done in a concrete batching and mixing plant fully automatic of a minimum capacity of 30 cum/hour. The plant shall be approved by the Engineer.
- In special cases for culverts, the Engineer may allow mixing of concrete by a diesel or electrically operated mechanical mixer with integrated weigh batching facility having a capacity of 500 litres and automatic water measuring system.

Paragraph 3 of this clause shall read as follows:

“The accuracy of measuring devices shall fall within the following limits:

Measurement of Cement ± 1% of the quantity of cement in each batch.

Measurement of Water ± 1% of the quantity of water in each batch.

Measurement of Aggregate $\pm$ 2% of the quantity of Aggregate in each batch.

Measurement of Admixture $\pm$ 1% of the quantity of Admixture in each batch.

Paragraph 3(b) & 3(c) shall remain unchanged.

CLAUSE 1711 CONCRETING IN EXTREME WEATHER

Sub -Clause 1711.2 Hot Weather Conditions

Add the following at the end of paragraph 1 of the above clause:

Where the Contractor proposes to use ice to cool the concrete or mixing water or any of the ingredients, the Contractor shall provide a refrigeration plant to avoid use of contaminated ice.

Placement of concrete shall not be permitted when day temperature exceeds 40°C.

Clause 1712 PROTECTION AND CURING

Sub-Clause 1712.2 Water Curing

Add the following at the end of Para 1:

Water sprinklers or perforated pipes shall be used for curing of concrete for all major bridges, ROB's and grade separators. Such arrangement must be in place & tested before concreting for its proper functioning and shall 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.

CLAUSE 1716 TOLERANCES

Add the following at the end of Clause:

"In the absence of any information in drawings or specifications, for particular cases, the following limitations shall apply.

Dimension (mm) 'a'	Tolerances (mm) '$\delta_a = (a_{\text{nominal}} - a_{\text{actual}})$'
$a \leq 200$	$ \delta_a < 5$
$200 < a \leq 2000$	$ \delta_a < 3.5 + 0.0075a$
$2000 < a$	$ \delta_a < 16.5 + 0.001a$

CLAUSE 1718 MEASUREMENT FOR PAYMENT

The clause may be read as under :

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

continuously through and the beam as the portion below the slab. In the case of RCC/PSC voided slab the deduction shall be made for the volume of void.

SECTION 1800 PRE-STRESSING

CLAUSE 1801 GENERAL

Add the following as the last paragraph of this clause:

Prestressing system shall conform to FIP Recommendation "Recommendations of acceptance of post-tensioning systems", June 1993.

CLAUSE 1802 MATERIALS

Sub-Clause 1802.2 Sheathing

Sub-Clause 1802.2.1 The second and third sentences of Para 6 shall be read as follows:

"The joint between the end of coupler and the duct shall be sealed with heat shrink tape to prevent penetration of slurry during concreting. The couplers of adjacent ducts should be staggered at least 300mm apart."

Add the following at the end of Para 6:

Couplers and splices shall be larger in diameter than ducts joined.

Sub-Clause 1802.2.3 This clause may be read as under:

Pull-in or push-in of prestressing stands shall be mechanized.

Strands shall not be placed in the ducts before concreting. The ducts shall be sealed at the ends by plastic caps to prevent water from entering.

Cables shall be threaded after concreting. In such cases a temporary tendon shall be inserted in the sheathing, or the sheathing shall be stiff ended by other suitable method during concreting. The sheathing supports shall be such as to prevent floatation of empty cable duct during concreting.

Add the following as additional Sub-clause

Sub-Clause 1802.2.4 Corrugated HDPE sheathing ducts

When high-density polyethylene (HDPE) sheathing ducts are specified, the material for the ducts shall be with more than 2 percent carbon black to provide resistance to ultraviolet degradation and shall have the following properties:

Specific Density	:	0.954 g/cm ³ at 23 °C
Yield Stress	:	18.0 N/mm ²
Tensile Strength	:	21.0 N/mm ²
Shore Hardness D-3 sec. Value	:	60

-15 sec. Value : 58

Notch impact strength at 23 °C : 10 KJ/m²

- 40 °C : 4 KJ/m²

Coefficient of Thermal Expansion for

20 °C - 80 °C : 1.50 x 10⁻⁴ KJ/m²

The thickness of the wall shall be 2.3 ± 0.3 mm as manufactured and 1.5 mm after loss in the compression test, for duct size upto 160 mm OD.

The ducts shall be corrugated on both sides. The ducts shall transmit full tendon strength from the tendon to the surrounding concrete over a length not greater than 40 duct diameters.

These ducts shall be joined by adopting any one or more of the following methods, as convenient to suit the individual requirements of the location, subject to the satisfactory pressure tests, before adoption.

Screwed together with male and female threads.

Joining with thick walled HDPE shrink couplers with glue. This can also be used for connection with trumpet, etc.

Welding with electro fusion couplers. The joints shall be able to withstand an internal pressure of 0.5 bar for 5 minutes as per test procedure given in Appendix-1A of IRC: 18 - 2000.

Sub-Clause 1802.3 Anchorages

Heading of the clause shall be "Anchorages and Tendon couplers"

Sub-Clause 1802.3.1 The word "Anchorages" shall be replaced by the words "Anchorages and couplers" in sentence 1 of the paragraph.

Add the following after the words "furnished to the Engineer" in sentence 3 of paragraph 1 of this clause:

"Couplers which connect two tendons to form a continuous tendon, should be tested in the same way as anchorages formed by mechanical means."

CLAUSE 1803 TESTING OF PRESTRESSING STEEL AND ANCHORAGE

Add following Paragraphs to the section.

All samples shall be representative of the lot and in the case of wire or strand shall be taken from the same master roll. At least 5.0m length shall be selected from each lot for testing. Also two anchorage assemblies, complete with distribution plates of each size or types to be used, shall be tested. Testing of anchorage - cable assemblies shall be carried out in accordance with procedures in FIP document "Recommendations for the acceptance of Post Tensioning systems", June 1993.

The frequency of such tests should be as follows:

- 1) For acceptance of the tendon at the stage of submission of tendons, the manufacturers certificate together with the data of previously conducted and most recent test results of "Acceptance Testing" is acceptable subject to further testing as given below.
- 2) Acceptance Testing for the works
 - a) Static load test for tendon-anchorage assembly

A series of three tests using the proposed combination of anchorage systems and the prestressing strand/wire/bars. All the tests should meet the following requirements.

Residual deformations of anchorage components after the test should confirm the reliability of the anchorage.

The increase in the displacements between the anchorage components as well as between the prestressing steel and anchorage components should not be disproportionate to the increase in tendon force.

The above relative displacements during the 0.8F_{pk} load stage should stabilize within the first thirty minutes of the load duration of 1 hour.

The mode of failure of tendon should be by the fracture of the prestressing steel. Failure of the tendon should not be induced by the failure of anchorage components.

The measured anchorage efficiency should be:

(Refer CEB/FIP Guidelines for details).

The total elongation ϵ_u in free length of the tendon under the load F_{tu} should be $\epsilon_u \geq 2\%$

- b) Dynamic load test with tendon/ anchorage assembly

This test is to be carried out for every new combination of type of anchorage and tendons. A series of three successful tests shall be carried out for acceptance of the systems. This test is considered as essential for both unbonded and bonded cables as per FIP document.

Requirements:

Each test result should meet the following requirements

- Fatigue failure of anchorage components should not occur.
- The minimum fatigue strength of post-tensioning system should be $\Delta\sigma_p \text{ min} = 80 \text{ MPa}$
- The fatigue strength is defined as the stress range ($\Delta\sigma_p$), which is endured for 2 million cycles without failure of more than 5% of the initial cross-section of

the tested tendon at beginning of the test.

Clause 1804 WORKMAN SHIP

Sub-Clause 1804.3.1 Post-tensioning

The following para shall be inserted between the 5th and 6th para.

“The steel sheaths or duct formers shall be suitably tied to secondary reinforcement or to properly locate withdrawable through-shutter bolts, precast concrete blocks or similar effective means, in such a manner that they do not give rise to excessive friction when the steel is being tensioned.”

Sub-Clause 1804.5 Insert following Para after Para 1

Mixture of water-soluble oil such as Dromas - B and Water is to be flushed through empty metallic ducts before threading of cables, and after threading of cable at frequency of at least once in a month. The layer of oil formed on sheathing / prestressing steel shall be fully flushed out by using clean water before final grouting by cement grout.

CLAUSE 1806 TENSIONING EQUIPMENT

Add the following at the end of Para 2:

“Jack and Pump shall be calibrated by an approved laboratory prior to use and then at intervals not exceeding three months.

A standby set of jack, pumps and pressure gauges shall always be available at site where prestressing is in progress.”

Add the following at the end:

“Before initial use & subsequently at suitable intervals the pre-stressing equipment shall be checked to determine any variation from the normal values during use.

SO far as these variations depend upon external influence (e.g. temperature in the case of oil jacks) they shall be taken into account”

CLAUSE 1807 POST TENSIONING

Add the following at the end of Para 5 of this clause:

“Parallel measurement by load cell in combination with direct reading of Pressure gauge shall be preferred. In any case such parallel measurements by load cell shall be made for at least 10% of the cables stressed during any tensioning operation.”

Add the following at the end of this Clause:

“The Contractor shall submit fabrication drawings, detailing prestressing cables, anchorages, couplers, chairs and supports, templates or forms holding anchorage assemblies etc. for Engineer's approval at least one month before commencement

of work in superstructure. Stressing schedules shall be prepared by the Contractor and submitted to Engineer for approval.”

CLAUSE 1808 GROUTING OF PRE-STRESSED TENDONS

Add new Para at the end of Clause as under:

“Where directed by the Engineer the Contractor shall perform full-scale site test to determine the adequacy of grout mix, equipment and grouting method. The Contractor shall submit a method statement detailing the test procedure.

Special Attention is directed to Appendix 1800 / III of the Standard Specifications. Contractor shall arrange for testing of all grout components and of the mix, prior to the start of grouting and whenever the source of any component is changed, to ensure that the grout is free of anything that could promote shrinkage or cracking of the grout or corrosion in the tendons. Further samples of grout and its components shall be obtained for each day of grouting at each site where grouting is carried out and a full chemical analysis shall be performed on the samples.”

CLAUSE 1815 RATE

Add at end of Para 4:

Cost of fixing anchorages / sheathing for dummy cables and future prestressing cables shall be incidental to work and shall not be measured / paid extra. No additional cost shall be payable for stressing of cables for compensation of short fall of prestress or for any other reason.

CLAUSE 1816 JOINTS IN CONSTRUCTION WITH PRE-CAST-UNIT

Add new clause:

“Joints between a series of precast concrete units which are to be prestressed together by post-tensioning shall be such as to ensure even transfer of compression from one unit to another.

Whatever be the method of jointing, the holes of the prestressing steel shall be accurately made and shall meet one another in true alignment at ends. Jigs shall always be used. Care shall be taken to ensure that the jointing material does not enter the duct or press the sheath against the prestressing steel.

Jointing by application of mortar on the face of a unit and then placing another unit against it shall not be permitted.

Suitability and effectiveness of the method should be got confirmed from a suitably designed mock-up.”

SECTION 2000 BEARINGS

CLAUSE 2001 DESCRIPTION

Add the following as paragraph 2 of this clause:

“Within 90 days of award, 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. The Contractor shall provide the bearings only from the manufacturers approved and enlisted by the Department. In addition to routine testing of the materials and bearings at manufactures premises, the Contractor shall arrange at his own cost testing of random samples of 1 % (Minimum 1 no. of each type) of bearings from independent agencies, other than manufactures’ own facilities, duly approved by the Engineer. The bearings shall be selected by the Engineer / his authorised representative and duly sealed in his presence for dispatch to the independent agency.”

CLAUSE 2004 SPECIAL BEARINGS

The clause shall read as follows:

Sub-Clause 2004.1 Spherical Bearings: Spherical Bearings shall conform to the requirements of sections 9.1 and 9.2 of BS 5400. However materials of bearing elements may conform to Indian Standards nearest to the specifications stated in the above sections of BS: 5400.

Clause 2005 ELASTOMERIC BEARINGS

Sub-Clause 2005.4 Acceptance Specifications

In Para 5, substitute the words "Engineer or his authorised representative" for the word "Inspector".

Sub-Clause 2005.3.5 Inspection Certificate

Substitute the words "Engineer or his authorised representative" for the word "Inspector".

Sub-Clause 2005.4.6 Quality Control Certificate

Delete the words “/Inspector” in the third paragraph.

CLAUSE 2006 POT BEARINGS

The clause shall read follows:

“Pot Bearings shall conform to the requirements of IRC: 83 (Part III)-2002. Mild steel to be used for components of the bearings shall comply with Grade B of IS: 2062.”

Sub-Clause 2006.1 General

Sub-Clause 2006.1.2 *Add after 2nd sentence “Provisions of IRC83 (Part III) shall be applicable for POT, POT cum PTFE, PIN and Metallic Guide Bearings”*

ADD new Clause 2009 as under and the existing Clauses 2009 and 2010 are

renumbered as 2010 and 2011 respectively :

CLAUSE 2009 “Tar Paper bearing shall be reinforced bitumen laminated Kraft paper conforming to IS-1398”.

Clause 2010 **MEASUREMENTS FOR PAYMENT**

Add the following after Para 2:

"Tar Paper bearings shall be measured in square meters."

SECTION 2100 **OPEN FOUNDATIONS**

CLAUSE 2106 **TOLERANCES**

Reference to Tolerance shall be made to Clause 1716.

SECTION 2200 **SUB-STRUCTURE**

CLAUSE 2204 **PIERS AND ABUTMENTS**

Sub-Clause 2204.2 replaced as follows:

"Slip forming will not be allowed."

Add new Sub-Clause 2204.7 at the end of clause:

"Wherever 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 areas. No payment will be made for these operations as per Clause 304.5.1."

Sub-Clause 2210 **Rate**

This Clause shall read as follows:

"The contract unit 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."

The necessary material (thermocole, bituminous fibrous board or equivalent material) and labour, tools etc. required for maintaining 20 / 40 mm gap between faces of various structures (old / new) wherever required / as shown in drawing shall be incidental to work and shall not be measured / paid separately.

SECTION 2300 **CONCRETE SUPER-STRUCTURE**

Clause 2305 **PRESTRESSED CONCRETE CONSTRUCTION**

Sub-Clause 2305.2 **Box Girder**

Add the following at the end of paragraph 1:

"Contractor shall, in his methods statement, indicate the location of construction

joints for Engineer's approval."

Add new sub clause 2305.5 as under:

Sub-Clause 2305.5 PSC Solid Slab

Casting of the slab shall be done in a single stage without construction joints.

The portions of deck near expansion joints shall be cast along with Reinforcements and embedments for expansion joints.

The deck slab shall be finished rough, but true to lines and levels as shown in drawings. Bearings shall be set as shown in drawings.

Sub-Clause 2504.2.2 Filter Media

Add after 1st Para:

"The material for filter media behind abutment shall conform to general guide lines given in Appendix 6 of IRC-78 (Standard Specification and Code of Practice for Road Bridges – Section-II)."

Clause 2507 CURTAIN WALL AND FLEXIBLE APRON

Replace Sub-clause 2507.1 and modify sub-clause 2507.2 as under:

Sub-Clause 2507.1 Curtain Wall

The rigid flooring shall be enclosed by curtain walls (tied to the wing walls) with a minimum depth below floor level on up-stream side and downstream side as indicated in the drawings. The curtain wall shall be in cement concrete M-20 grade. The rigid flooring shall be continued over the top width of the curtain wall.

Sub-Clause 2507.2 Flexible Apron

First sentence under this sub-clause shall read as under:

"Flexible apron of thickness indicated in the drawing, comprising loose stone boulder (weighing not less than 40 kg) shall be provided beyond curtain wall for a minimum distance of 3.0 m on upstream side and 6.0 m on downstream side"

Sub-Clause 2509 Add new Para in the end of the Clause;

"Filter media and cement concrete bedding, wherever required, shall be measured in cubic metre and paid separately as per contract."

SECTION 2600 EXPANSION JOINTS

Clause 2602 GENERAL

Add the following at the end of the clause.

"The expansion joints shall be procured only from those manufacturers/ suppliers of expansion joints who are empanelled with MOSRT&H. The MOSRT&H (formerly, Ministry of Surface Transport) had issued modified interim specifications for

expansion joints vide letter dated 31/03/97 and revised vide letter No. RW/NH-34059/1/96 - S&R dated 30th Nov, 2000 and corrigendum of same circular dated 15th Jan., 2001 which shall be adopted. These specifications are reproduced below.”

TABLE R-1 SUITABILITY CRITERIA FOR ADOPTION OF DIFFERENT TYPES OF EXPANSION JOINTS

Sl. No.	Type of Expansion	Suitability for Adoption Joint	Expected Service Life	Special Consideration
1.	Buried Joint	Simply supported spans upto 10 metres	10 Years	Only for deck with bituminous/ asphaltic wearing coat. Steel plate may need replacement, if found corroded or distorted at the time of relaying/ renewal of wearing coat.
2.	Filler Joint	Fixed end of simply supported spans with insignificant movement or simply supported spans not exceeding 10 metres.	10 Years	The sealant and joint filler would need replacement if found damaged.
3.	Asphaltic Plug Joint	Simply supported spans for right or skew (upto 20 degree), moderately curved or wide deck with maximum horizontal movement not exceeding 25 mm. Ambient temperature should be in the range of 5 degree to 50 degree Celsius.	10 Years	Only for decks with bituminous/ asphaltic wearing coat. Not suitable for bridge with longitudinal gradient more than 2 % and cross camber/ super-elevation exceeding 3%. Not suitable for curved spans and spans resting on yielding supports.
4.	Compression Seal Joint* (Chloroprene Seal & Cell Foam Seal)	Simply supported or continuous spans right or skew (upto 30 degree), moderately curved with maximum horizontal movement not exceeding 40 mm.	10 Years	Chloroprene/ Closed Foam Seal may need replacement during service.
5.	Elastomeric Slab Seal	Simply supported or continuous spans, Right or skew (less	10 Years	Liable to excessive wear and tear under high traffic intensity.

	Joint*	than 20 degree), moderately curved with maximum horizontal movement upto 50 mm		Not suitable for bridges located in heavy rainfall area and spans resting on yielding support.
6.	Single strip seal joint*	Moderate to large simply supported, cantilever/ continuous construction having right, skew or curved deck with maximum horizontal movement up to 70 mm	25 Years	Electrometric seal may need replacement during service.
7.	Modular Strip/ Box Seal Joint	Large to very large continuous/ cantilever construction with right, skew or curved deck having maximum horizontal movement in excess of 70 mm	25 Years	Electrometric seal may need replacement during service.
8.	Special Joints for special conditions	For bridges having wide decks and large span length involving complex movements/ rotations in different directions/ planes, provision of special type of modular expansion joints such as Swivel joists joints may be made.	25 Years	Electrometric seal may need replacement during service. Provision of these joints may be made with prior approval of the Ministry.

* These are proprietary items for which 10 years warranty shall be insisted upon from the suppliers. The contractor shall submit all relevant information as per clause 115.1

Clause 2608 Add the following Sub-Clause after the end of This Clause

Sub-Clause 2608.3

Installation

- (a) The Expansion joint shall be installed by the manufacturer/ Supplier.
- (b) The block out for the joint shall be marked and constructed to the dimensions as indicated in the drawing or recommended by the

manufacturer/ supplier.

- (c) The recess for the block out shall thoroughly cleaned of any loose or foreign material wire brushing and air blowing and dried with hot compressed air.
- (d) The recess in the deck slab, if required, shall be repaired with epoxy mortar and cleaned and dried again.
- (e) The foam caulking/backing rod shall be placed about 25 mm down in the joint opening.
- (f) The aggregate shall be washed, cleaned and heated to a temperature between 170°-180°C prior to placement.
- (g) The binder shall be preheated to temperature of 170 – 190° C before application.
- (h) While sealing the joint opening with preheated binder, care shall be taken that the binder does not spill on to the joint surface of the deck.
- (i) The joint shall not be installed when the ambient temperature goes below + 5 deg. C or above + 35 deg.C. or while it is raining/ snowing. (Planning for installation must taken into account the weather condition).
- (j) When clement weather resumes, the joint installation may be continued after the upper layer and/or exposed surface of the partially completed joint has been re-prepared by heating and/ or coating with binder as necessary.

Sub-Clause 2608.4 Handling and Storage

All the aggregates and binder shall be pre-bagged and clearly marked. All the material shall; be stored on concrete platform at 150 mm above the ground in covered enclosures to avoid contamination.

Clause 2608.5 Tests and Standard of Acceptance

The material shall be tested in accordance with these specifications and shall meet prescribed criteria. The manufacture/ supplier shall furnish the requisite certificates from the recognized testing laboratory of India or abroad.

The work shall conform to these specifications and shall meet the prescribed standards of acceptance.

The clause 2609 be replaced fully as below:

Clause 2609

COMPRESSION SEAL JOINT

Clause 2609.1

Compression seal joint seal joint shall consist of steel armoured nosing at two edges of the joint gap suitably anchored to the deck concrete and a performed chloroprene elastomer or closed cell foam joint sealer compressed and fixed in to the joint gap with special adhesive binder.

Clause 2609.2

Material

(a) Steel nosing

The steel nosing shall be of angle section ISA 100 x 100 conforming to weldable structural steel as per IS:2062. The thickness of legs shall not be less than 12 mm. The top face of the angle shall be provided with Bleeder holes of 12 mm diameter spaced at a maximum 100 mm centers so as to ensure that there are no voids in the concrete beneath the angle.

(b) Anchorage

The anchorage steel shall conform to IS:2062 or equivalent. The steel nosing shall be anchored to the deck by reinforcing bars, headed studs or bolts or anchor plates cast in concrete or a combination of anchor plate and reinforcing bars, headed studs or bolts. Anchor bars, studs or bolts shall engage the main structural reinforcement of the deck and in case of anchor plates or anchor loops this shall be achieved by passing transverse bars through the loops or plates.

The minimum thickness of anchor plate shall be 12 mm. Total cross sectional area of bars, studs or bolts on each side of the joint shall not be less than 1600 mm sq. per metre length of the joint and the center to center spacing shall not exceed 250 mm. The ultimate resistance of anchorages shall not be less than 600 KN/m in any direction.

(c) Corrosion Protection

All steel section shall be protected against corrosion by hot dip galvanizing or any other approved anticorrosive coating with a minimum thickness of 100 micron.

(d) Joint Seal

- i) The sealing element shall be a performed continuous chloroprene or closed cell foam seal with high tear strength, insensitive to soil, gasoline and ozone. It shall have high resistance to aging and ensure water tightness. The seal should be vulcanised in a single operation for the full length of the joint required for carriageway, kerbs and footpaths, if any. The seal shall cater for a horizontal

movement upto 40 mm and vertical movement of 3 mm.

- ii) The physical properties of chloroprene/ closed cell foam sealing element shall conform to the following:

Chloroprene Seal

Shall be performed extruded multi web cellular section of chloroprene of such a shape as to promote self-removal of foreign material during normal service operations. Chloroprene of joint seal shall conform to clause 915.1 of IRC:83 (Part – II) and satisfy the properties stipulated in Table – 2 Strip Seal Element Specification of these specifications except in respect of the working movement range of the sealing element which shall be as specified in Clause 2.4.1 above.

Closed Cell Foam Seal

Shall be of performed non extruded non cellular section made from low density closed cell, crossed linked ethylene vinyl acetate, polyethylene copolymer that is physically brown using nitrogen. The material shall possess properties as indicated in **Table. 1**:

Table – 1

	Property	Specified Value
i)	Density	41.7 – 51.3 Kg/ cum
ii)	Compression Set on 25 mm	50 percent compression samples (ASTM D3575) for 22 hours at 23 degree Celcius, 2 hour recovery; 13 percent set.
iii)	Working temperature	-70 to +70 deg C.
iv)	Water absorption (total immersion for 3 months) (ASTM D3575)	0.09766 Kg/ sqm
v)	Tensile strength	0.8 Mpa
vi)	Elongation at break (ASTM D3575)	195 +/-20 percent

(e) Lubricant cum Adhesive

The type and application of material used in bonding the performed joint seal to the steel nosing and concrete shall be as recommended by the manufacturer / supplier of the seal system.

Sub-Clause 2609.3 Handling and Storage

- (a) The expansion joint material shall be handled with care and stored under

cover. All joint material and assemblies shall be protected from damage and assemblies shall be supported to maintain true shape and alignment during transportation and storage.

Sub-Clause 2609.4 Installation

- (a) The expansion joint shall be installed by the manufacturer/ supplier or their authorized representative, who will ensure compliance of installation procedure and instructions.
- (b) The dimension of the joint recess and the width of the gap shall conform to the approved drawings.
- (c) Anchoring steel shall be welded to the main reinforcement in the deck maintaining the level and alignment of the joint.
- (d) Concreting of pocket/ recess shall be done with great care using proper mix conforming to same grade as that of the deck concrete but not less than M30 grade in any case. The water cement ratio shall not be more than 0.40. If needed, suitable admixtures may be used to achieve the workability. The width of pocket shall not be less than 300 mm on either side of the joint. Care shall also be taken to ensure efficient bonding between already cast/ existing deck concrete and the concrete in the joint recess.
- (e) At the time of installation, joint shall be clean and dry and free from spalls and irregularities, which might impair a proper joint seal.
- (f) Concrete or metal surfaces shall be clean, free of rust, laitance, oils, dirt, dust or other deleterious materials.
- (g) The lubricant cum Adhesive shall be applied to both faces of the joint and joint seal prior to installation in accordance with the manufacturer's instructions. The joint seal shall be compressed to the specified thickness for the rated joint opening and ambient temperature at the time of installation, which shall be between +5 to 35°C.
- (h) The joint seal shall be installed without damage to the seal. Loose fitting or open joints shall not be permitted.

Sub-Clause 2609.5 Acceptance Criteria

- (a) All steel elements shall be furnished with corrosion protection system.
- (b) For the joint seal the acceptance test shall conform to the requirements stipulated in Para above. The manufacturer/ supplier of this type of joint shall produce a test certificate to this effect conducted in a recognized laboratory in India or abroad.
- (c) Prior to acceptance 25 percent of the completed and installed joints, subject to a minimum of one joint, shall be subjected to water tightness test. Water shall be continuously ponded along the entire length for a minimum period of 4 hours for a depth of 25 mm above the highest point

of deck. The width of ponding shall be at least 50 mm beyond the anchorage block of the joint on either side. The depth of water shall not fall below 25 mm anytime during the test. A close inspection of the underside of the joint shall not reveal any leakage.

CLAUSE 2613 TEST AND STANDARDS OF ACCEPTANCE

The clause 2613 be replaced fully as Below

“The materials shall be tested in accordance with these specifications and shall meet the prescribed criteria. The manufacturer / supplier shall furnish the requisite certificates from the recognized testing laboratory of India or abroad.

The work shall conform to these specifications and shall meet the prescribed standards of acceptance.”

CLAUSE 2614 Measurement for payment

The clause 2614 be replaced fully as below

The expansion joint shall be measured in running metres. For filled joints, the rate per running metre shall include the cost of sealant for the depth provided in this drawing. The expansion joint shall be measured along the width of the deck slab from one end to the other including length through footpaths and parapets.

CLAUSE 2615 RATE

The clause 2615 be replaced fully as below

The contract unit rate shall include the cost of all material, labour, equipment and other incidental charges for fixing the joints complete in all respects as per these specifications in the case of Bridge Contractor supplying the expansion joint. If the manufacturer supplies the expansion joint directly to the Engineer, the cost of installation, handling and fixing shall be borne by the Bridge Contractor.

SECTION 2700 WEARING COAT AND APPURTENANCES

CLAUSE 2702 WEARING COAT

Sub-Clause 2702.1 Bituminous Wearing Coat

"Asphaltic concrete wearing coat shall be constructed in thickness as shown in drawings"

CLAUSE 2703 RAILINGS AND CRASH BARRIER

Sub-Clause 2703.3 Cast-in-Situ Railings and parapets

Last sentence of paragraph 3 shall be replaced by the following.

"Location of construction joints shall be determined in advance and approved by Engineer."

Add the following additional clauses:

Sub-Clause 2703.5 Concrete crash barrier for bridges

Sub-Clause 2703.5.1 General

This work shall consist of construction, provision and installation of concrete crash barrier on the bridge deck / approach slab / approaches at locations and of dimensions as shown on the drawings or as directed by the Engineer.

Sub-Clause 2703.5.2 Materials

All materials shall conform to Section 1000-Materials for Structures as applicable, and relevant Clauses in Section 1600 shall govern the steel reinforcement. The concrete barriers shall be constructed either by the "cast-in-place with fixed forms" method or the "extrusion or slip form" method or a combination thereof at the Contractor's option with the approval of the Engineer. Where "extrusion or slip form" method is adopted, full details of the method and literature shall be furnished.

Grade of concrete for crash barrier shall be as per BOQ or as directed by Engineer.

An expansion joint with Polysulphide Joint sealants and bituminous fiberboard shall be provided in the crash barriers at the location of expansion joints/ gaps on the bridge, approaches etc.

Sub-Clause 2703.5.3 Construction Operations

The location of crash barrier shall be strictly adhered to as shown on the drawing and as directed by the Engineer. Concrete crash barriers shall present a smooth, uniform appearance in their final position, conforming to the horizontal and vertical lines shown on the plans or as ordered by the Engineer and shall be free of lumps, sags or other irregularities. The top and exposed faces of the barriers shall conform to the specified tolerances, as defined in Clause 809.4, when tested with 3 m straight edge, laid on the surface.

The concrete crash barrier or precast shall be given two coats of cement paint or aqua based paint as directed by the Engineer of approved brand and shade.”

Sub-Clause 2703.5.4 Tolerance

The overall horizontal alignment of crash barrier and rails shall not depart from the road alignment by more than ± 30 mm, nor deviate in any two successive lengths from straight by more than 6 mm and the faces shall not vary more than 12 mm from the edge of a 3 m straight edge. Barriers shall be at the specified height as shown in the plans above the edge of the nearest adjacent carriageway or shoulder, within a tolerance of ± 30 mm.

Sub-Clause 2703.5.5 Measurements for Payment

All barriers will be measured in cubic metres of concrete completed for the barriers including approach and departure ends. The sealing of opening in crash barrier at expansion joints with polysulphide rubber joint sealant and bituminous fibreboard as per sub- clause 2703.6 shall be incidental to work. The reinforcement in barriers shall be measured and paid separately in relevant item of B.O.Q. The painting over crash barrier shall be measured in square meter and paid separately.

Sub-Clause 2703.5.6 Rate

The Contract unit rate shall include full compensation for furnishing all labour, materials, tools, equipment and incidental costs necessary for doing all the work involved in constructing the concrete barrier complete in place in all respects as per these Specifications.

Sub-Clause 2703.6 Polysulphide Rubber Joint Sealant

Polysulphide Joint sealants with bituminous fiberboard shall be provided in the Expansion Joints/ gaps in Crash Barriers.

Before application it shall be ensured that the top of the bituminous fiberboard and the concrete faces are dry, sound, free from dirt, grease and other loose foreign matter. A thin coat of primer shall be applied on concrete faces with a brush to air dry before applying sealant. The components of the sealant i.e. base and hardener shall be mixed in a slow speed mixed sealant till uniform color is obtained. Placement of the mechanical mixer shall be done with either cartridge or fully enclosed gun barrels within 30 minute of mixing. Manufacturer’s recommendation shall be followed.

The sealing compound shall be two packs, low modulus of elasticity Polysulphide elastomer having bituminous ingredients such as Cico T-680 or equivalent with following properties of the cured compound.

Tensile strength	-	0.4 MPa $\pm$ 10%
Modulus of elasticity	-	At 100% elongation: 0.15 MPa
Elongation	-	Elongation at break 550%
Hardness	-	Shore‘A’ hardness 22 $\pm$ 3

@ 25°C

Operating temperature	-	-20°C to + 80°C
Shrinkage	-	Less than 1%
Permanent dynamic	-	± 25%

Movement capability

Polysulphide material shall be approved by the Engineer prior to procurement.

Measurements for Payments

Cost for providing Polysulphide Joint sealants and bituminous fiberboard in the Expansion Joints in Crash Barriers shall be deemed to be included in the unit rate of Crash Barrier and shall not be measured separately.

Clause 2706 WEEP HOLE

This clause shall read as under:

"Weep holes shall be provided in solid plain concrete/reinforced concrete/brick 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 100 mm dia PVC pipe of approved thickness 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 1m 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."

CLAUSE 2708 MEASUREMENTS FOR PAYMENT

Replace in Clause 2708- sub-clause ii, "running meters" by "running meters/ cubic meters as per unit provided in BOQ".

CLAUSE 2709 RATE

The second paragraph shall be read follows:

"The contract unit rate of parapets and railings shall include the cost of all labour, materials tools and plant required for completing the unit in accordance with specifications".

Add at the end of Para 2:

The contract unit rate for approach slab shall include cost of reinforcement and providing and laying in position bitumen joint filler with joint sealing compound in the 20 mm thick gap between dirt wall and approach slab.

CLAUSE 2819

PROVIDING AND FIXING DRAINAGE SPOUT INCLUDING SEALING WITH NON-SHRINK FREE FLOW CEMENT GROUT.

For all existing bridge decks where drainage spouts are to be replaced new drainage spouts shall be provided as shown in the drawings.

The waterproofing material shall be provided, around the area of drainage spout and spout pipe, from the top of the deck.

The work shall be executed in accordance with Specifications Section 2700 clause 2705 except to the extent modified below.

The work shall be carried out after the wearing coat around the spout is removed. The existing spouts shall be removed carefully with minimum damage to surrounding concrete. The pocket formed shall be sufficiently large to ensure good flow and compaction of non-shrink cement grout around the new spout. In case the earlier spouts were provided in railing kerb, holes shall be drilled in slab without excessively damaging surrounding concrete.

CLAUSE 2820

REPAIR TO LEACHED, HONEYCOMBED, SPALLED CONCRETE

Leached, honeycombed, spelled concrete (area of damage less than 0.5 m²) shall be repaired with average 50 mm average thick PMC mortar in two or more layers with a bond coat of PMC slurry between two successive layers.

All loose concrete shall be chipped off with a chipping machine so that loose layers of concrete are removed exposing the reinforcement. All loose concrete sticking with the reinforcement shall be removed. Where reinforcement bars are already exposed, the chipping shall continue so as to expose half the diameter, prior to further treatment. The concrete surface shall be thoroughly cleaned with wire brush and oil free air blast. Where the damaged areas are large, sand blasting should be done to clean the reinforcement and the surrounding concrete. If reinforcement is seen, the same shall also be cleaned thoroughly. The reinforcement shall be coated with PMC slurry within one hour of cleaning to prevent rusting. The PMC shall be brush applied on the cleaned reinforcement ensuring that full surface area is covered in accordance with the manufacturers' recommendation.

Before applying PMC repair mortar the prepared concrete substrata shall be thoroughly soaked with clean water. Free surface water shall be removed before priming. The substrata shall be primed with PMC slurry.

The specifications for polymer modified cementitious (PMC) mortar / debonding slurry are as under:

The anti-corrosive polymer latex, which is to be used should consist of water based QA-Acrylic polymer incorporated with non-alcoholic bipolar corrosion inhibitor. The polymer to be used shall be MONOBOND-2000 or equivalent. Colour: Milky white liquid.

Solid content: The polymer solid content shall be 36 ±1 percent. The particles shall be of nearly spherical shape with a diameter of 0.35±0.05 micron. The manufacturer shall certify the above requirements about solid content & grain size. In order to

keep control over the quality, the manufacturer shall provide infrared absorption spectrum analysis for the material to be supplied by them.

Mixing proportion: Anti-corrosive polymer modified mortar

- Cement - 100 parts by weight
- Monobond-2000 - 40 parts by weight
- Silica sand - 300 parts by weight

The sand, which is to be used for constituting the PMC repair mortar, should be silica sand as the basic material, which is categorized in two groups.

- a) Coarse Silica and
- b) Fine Silica

The grading of the above groups should follow the limits provide below.

Quartz sand.

I.S. Sieve No.	Percentage passing by weight
10 mm	100
4.75 mm	100
2.36 mm	100
1.18 mm	85 - 90
600 microns	45 - 55
300 microns	15 - 20
150 microns	5 - 10
75 microns	0 - 3

In the event of using local sand, the sand to be used must satisfy the limits of deleterious materials & the requirements of soundness as given in Cl 3.2.1 & Cl 3.6 respectively of IS: 383, confirmatory test shall be conducted by the contractor and sample kept for comparison by the Engineer.

Curing

Air-corrosive polymer modified mortar curing procedure outline apply to normal weather conditions. Under hot weather, take precautions to avoid drying. PMC work should be carried out at a temperature below 40°C.

Under unusual weather conditions e.g. high humidity and / or high wind velocity or imposed constraints special curing procedure shall be followed for which approval shall be obtained from the engineer.

Anti-drying shall be considered to be taken place only during favourable uninterrupted weather condition existing throughout the existing recommend drying period. Some judgments shall be made in this respect & if conditions are deemed unfavourable for drying to occur, then drying must be prolonged for the full recommend period after weather clears.

As PMC work proceeds, precautions shall be taken to prevent rapid drying of the PMC repair mortar. This is usually accomplished by covering the filled surfaces with an impermeable sheet shortly after the work has been done.

The sheet shall be kept in place until further work is carried out over the mortar or in case where the mortar is likely to be disturbed the sheet shall be kept in place for 24 hours.

No foot traffic for further work shall be allowed over mortar until 12 hours after the time of the completion of work.

Curing compound may also be used as curing membrane. Care shall be taken to ensure complete covering particularly around the interface with the host concrete.

For the first day the repaired concrete patch shall be protected from harsh environment by laying a polythene sheet over it, lapping down the edges.

Mixing PMC

Methods of Mortar mixing

To mix PMC, it is necessary to have the following items:

- A suitable sized non-ferrous mixing container preferably plastic.
- A high-speed drill with mixing paddles.
- Promark batching containers for measuring out components to be mixed.

Pour all the liquid polymers latex into mixing container. After shaking the latex to disperse the solid uniformly throughout the liquid before use, begin mechanical mixing & while doing so, slowly add the dry components, i.e. cement & sand.

Mix for about 5 minutes until solids have been well dispersed. The resulting mix should look uniform, feel creamy & be free from lumps & grits.

Precautions shall be taken not to entrap an excessive amount of air into the mix during mixing.

Since the desired consistency depends on type & brand of cement as well as weather conditions start a trial mix with a reduced amount of cement. Once all components are mixed, add cement if necessary to achieve the desired consistency. Record the amounts of cement required & use this for subsequent mixes. Do not reduce the quantity of cement noted in the Mix Proportions.

In case the slurry sets before application of mortar, a fresh coat of slurry shall be applied. Under no circumstances, water shall be added in PMC repairs mortar mix.

Unused mortar or mortar which has partially set shall not be re-mixed & used.

Mechanical Strength of Mortar

Anti-corrosive polymer modified mortar shall have the following:

	7 day	28 days
Compressive strength	18 N/MM ²	38 N/MM ²
Flexural strength (IS 5816 –1959)	-	10 N/MM ²
Split tensile strength (IS 5816 –1959)	-	6 N/MM ²

For anti –corrosion polymer modified bonding slurry

The anti-corrosive polymer modified bonding slurry shall be QA Acrylic base MONOBOND 2000 or equivalent.

The bonding slurry should remain in tacky state prior to placing of the freshly mixed concrete or mortar.

Mixing proportions of Bonding Slurry are as follows:

Cement	-	100 parts by weight
MONOBOND 2000	-	40 parts by weight
Fine Silica sand	-	100 parts by weight

The fine silica sand, which is to be used for consistency in anti-corrosive polymer modified bonding slurry, should be with fine silica sand with following sieve sizes.

I.S. Sieve No.	Percentage passing by weight
10 mm	100
4.75 mm	100
2.36 mm	100
1.18 mm	100
600 microns	90-100
300 microns	40-60
150 microns	0-10
75 microns	0-3

Mechanical Strength of Bonding Slurry

Bond Strength –

- WET - 3-4 N/MM²
- DRY - 7-8 N/MM²

Above bonding slurry should conform to following properties.

- ASTM-C1059-86 (Latex agents for bonding fresh to old concrete)
- ASTM-C1042-86 (Bond strength of latex system with cement)
- Pot life: 1 hour for 5 kg bonding slurry mix.

CLAUSE 2821

REPAIR TO VOID IN ARCHES WITH PMC MORTAR

The voids created in the masonry arches by dislodged stones shall be filled with PMC mortar.

The surface shall be thoroughly cleaned with wire brush and oil free blast. Before applying PMC repairs, the prepared substrate shall be thoroughly soaked with clean water. Free surface water shall be removed before priming. The substrata shall be primed with PMC slurry. Repair mortar shall be applied before primer has set i.e. within 20-30 minutes. The mortar shall be applied with trowel and shall be well worked inside and compacted. The surface shall be smooth finished to match the adjacent surface. Unused mortar or mortar which has partially set shall not be used. Mortar shall be applied in layers to avoid sagging. Manufacturers' recommendation shall be followed. Specifications given in Clause 2818 shall be followed.

CLAUSE 2822

SEALING OF CRACKS IN CONCRETE IN PIER / ABUTMENT CAPS, SLABS, GIRDERS, PEDESTAL WALLS ETC. WITH EPOXY RESIN INJECTION.

The work is to seal all cracks in concrete in pier/abutment caps, slabs, girders, pedestal walls etc.

The work shall be executed in accordance with Specifications Section 2800 clauses 2803 & 2804.

The cracks shall be sealed with epoxy mortar prior to injection.

CLAUSE 2823

INSPECTION & CLEANING OF BRIDGE BEARINGS AND GREASING OF STEEL ROCKER-ROLLER / PLATE BEARINGS AND REMOVAL OF ALL DEBRIS AROUND BEARINGS.

The work shall consist of inspection of bearings to check whether the bearings are functioning properly and if any parts of the bearing or nuts and bolts are missing, to replace them. The work shall also include cleaning of bearings and oiling and greasing of metallic bearings, wherever required. Realignment/ readjustment of bearings, and replacement of missing parts of metallic bearings, requiring jacking up of superstructure is excluded from the scope of work. Replacement of existing bearings with new bearings is also excluded from the scope of the work.

The area around the bearings and their pedestals shall be cleared of all debris, vegetation, dust etc. and cleaned for proper inspection.

When grease boxes are fixed around the metallic bearings, (a) the same shall be permanently removed along with the old grease and (b) bearings shall be cleaned for proper inspection.

In case of elastomeric bearings, these shall be inspected for their proper seating, rotation, bulging, cracking, splitting etc. and a record thereof shall be provided to the Engineer for necessary instructions.

In respect of metallic bearings, fresh graphite grease as approved by the Engineer shall be applied to the surfaces, which are sliding, rotating or moving due to movement in bearings. The materials, specially, graphite grease, required for oiling and greasing of metallic bearings, wherever required, shall be as per approval of the Engineer. Grease used shall be such that it retains its properties for long life and shall not affect the bearing parts. All other surfaces of the metallic bearings shall be cleaned of all rusts, corrosion and a coat of anti-corrosive oil paint applied as per directions of the Engineer.

Missing parts of metallic bearings, nuts and bolts etc. shall be replaced by the contractor at no extra cost to the Employer.

**CLAUSE 2824 CONTROLLED JACKING UP OF SUPER STRUCTURE FOR RESETTING/ REPLACEMENT OF
ROCKER AND ROCKER CUM ROLLER BEARINGS, SEGMENTAL BEARINGS AND
ELASTOMERIC BEARINGS**

The work shall be executed before laying of new wearing coat and expansion joint. The superstructure shall be jacked up nominally at abutment end for resetting of the bearings. Jacking up of superstructure is a specialized work. Contractor shall furnish a methodology statement with his proposal for resetting/repair of bearings. Lifting shall be done through hydraulically operated jacks. The jacks shall be placed under cross diaphragm. Adequate distribution plates shall be placed at top and bottom of the jack to reduce the stress on concrete. If the soffit of the cross diaphragm is weak, the same shall be first repaired with epoxy mortar and / or epoxy injection and lifting will commence only after such repair work is fully cured. In addition to jacks, the span will also be supported on packing plates which shall be placed under the cross diaphragm between the jacks. The extent of lifting shall be decided by the Engineer.

Only proven type of jacks shall be used. These jacks shall be provided with lock nut system. The jacks shall be randomly tested for 1.5 times the capacity. In lifted condition the span will be supported on the lock nut arrangement of the jacks with no pressure on the hydraulic circuit. The contact stress on concrete shall not exceed 30 MPa. Suitable M.S. distribution plates have to be provided at top and bottom of the jack for this purpose. All jacks shall be connected to a common pump and it will be ensured that the deck is lifted equally upstream & downstream. For monitoring this, dial gauges shall be provided. Only steel packing plates shall be used. Specification for epoxy mortar / epoxy injection shall be followed for repair to soffit of cross diaphragm.

The cross diaphragms shall be closely watched during lifting and also for the entire duration when the span is supported on jacks and packing. If development of cracks is observed, the lifting will be stopped and alternate arrangement for supporting the superstructure shall be made subject to approval of Engineer.

The cost of all operations under this clause including all tools and plant, materials, jacks, pumps, labour etc. shall be incidental to cost of resetting / replacement of bearings.

CLAUSE 2825 APPLYING 1:3 CEMENT MORTAR TO EXPOSED SURFACE OF MASONRY OF EXISTING WING WALLS / RETURNS, ABUTMENT PIERS

All exposed masonry surface of existing wing walls / returns abutments, piers etc. shall be provided with 20 mm thick plaster where required. Walls / Returns and Retaining Wall at Sides of Approach Slabs with Brick Masonry shall be provided cement plaster in 1:3 cement mortar, 20 mm thick.

Existing wing walls and returns wherever deficient shall be built up and retaining walls shall be constructed at sides of the approach slabs as shown in the drawings.

The work shall be done in accordance with Specifications Section 1300. Masonry for construction of short retaining walls at sides of approach slab shall be laid over a 100 mm thick M 15 PCC levelling course.

CLAUSE 2826 BUILDING UP OF EXISTING WING WALLS/RETURNS AND RETAINING WALL AT SIDES OF APPROACH SLABS WITH BRICK MASONRY AND FINISHING WITH 1:3 CEMENT MORTAR 20mm THICK

Existing wing walls and returns wherever deficient shall be built up and retaining walls shall be constructed at sides of the approach slabs as shown in the drawings. The work shall be done in accordance with Specifications Section 1300. Masonry for construction of short retaining walls at sides of approach slab shall be laid over a 100 mm thick M 15 PCC leveling course.

CLAUSE 2827 SEALING OF WIDE GAPS AT JUNCTION OF WING WALL AND ABUTMENT WITH BRICK BATS AND FINISHING WITH 1:3 CEMENT MORTAR INCLUDING PROVIDING BITUMINOUS DEBONDING LAYER

Due to settlement of the wing wall a gap being created at the junction of the wing wall and the abutment, shall be sealed by filling with brickbats and finishing with plaster.

The abutment face of the gap shall be coated with one layer of bituminous compound. The gap shall be filled with bricks bats and rammed. The vertical exposed surface of the gap shall be plastered. Thereafter cement slurry shall be poured from the top under gravity till refusal. The top surface of the gap shall then be plastered and finally finished.

CLAUSE 2828 EARTH FILLING BELOW APPROACH SLAB

Cavities underneath the slab shall be filled.

The work shall be executed in accordance with Technical Specifications Section 300 clause 305. The cavities formed below the approach slabs shall be filled with approved back fill material. The filling shall be done in layers not exceeding 150mm. The masonry retaining wall shall also be built up in companion layers of 150mm. The compaction shall be done with the help of suitable equipment after necessary watering.

CLAUSE 2829 CASTING OF APPROACH SLAB

The grade of concrete shall be as indicated in drawings/BOQ.

Approach slabs, which are cracked / missing or otherwise damaged shall be recast.

The work shall be executed in accordance with Specifications Section 2700 clause 2704. The approach slab shall be laid over lean concrete as per drawing. The base shall be consolidated to proctor density 98%.

CLAUSE 2830 STONE PITCHING ON SLOPES GROUTED WITH 1:3 CEMENT MORTAR

Slope protection with stone pitching shall be provided at abutments as indicated in drawing. The work shall be executed in accordance with Specifications, Section 2500.

CLAUSE 2831 PROVIDING AND PLACING IN POSITION MECHANICALLY FABRICATED GABION WALL AROUND ABUTMENT AND PIERS INCLUDING EXCAVATION AND BACK FILLING

The work shall be executed in accordance with Specifications Section 2500 clause 2503. Excavation and back filling shall be done in accordance with Specifications Section 300.

Gabions shall consist of a double twisted Zinc & PVC coated wire mesh container of variable sizes, uniformly partitioned into internal cells, interconnected with other similar units, and filled with stone at the site to form flexible permeable, monolithic structures. Mechanically fabricated double twisted hexagonal mesh type gabion such as Maccaferri or equivalent conforming to ASTM/ BS specifications shall be used.

Mechanically fabricated double twisted hexagonal mesh shall be approved by the Engineer prior to procurement and use.

CLAUSE 2832 the existing clause 2813 of the Specifications shall be renumbered as 2832

CLAUSE 2833 the existing clause 2814 of the Specifications shall be renumbered as 2833.

Add the following as items (h) to (w).

h)	Dismantling of kerbs, railings, parapets, footpaths, solid slab superstructure or part of slab and approach slabs, etc. RCC and masonry items shall be measured under separate heads.	cum
i)	Steel handrail	..running metre
j)	Dismantling of existing damaged brick masonry	cum
k)	Dismantling of course rubble masonry wings walls, piers, abutments and their foundations	cum
l)	Provision of dowel bars	Nos
m)	Drainage spouts	Nos

n)	Repairs to concrete with PMC mortar with average thickness of 50 mm of mortar applied.	sqm
o)	Sealing of cracks in masonry by cement grouting (in terms of weight of cement consumption)	kg
p)	Building up of existing course rubble masonry / concrete wing walls	cum
q)	Repair of voids in arches	cum
r)	Sealing of cracks in RCC abutments, piers, slabs, girders etc. by epoxy injection (In terms of weight of epoxy actually consumed for mortar and injection)	kg
s)	Earth fill below approach slabs	cum
t)	Concrete in approach slab	cum
u)	Inspection, cleaning and greasing of bearings	Nos
v)	Stone pitching	cum
w)	Gabion Walls	cum

Existing clause 2813 of specifications shall be renumbered as 2832.

CLAUSE 2834 RATE

Add the following at the end of the Clause.

- i) The contract unit rate for dismantling of existing railing / parapets shall include the cost of all materials, labour, tools and plants, disposal of dismantled materials, safety measures and all other incidental expenses necessary for the completion of work as per specifications.
- ii) The contract unit rate for dismantling of existing wing walls shall include the cost of all materials, labour, tools and plants, disposal of dismantled materials, safety measures and all other incidental expenses necessary for completion of work as per specifications.
- iii) The contract unit rate for providing dowel bars shall include the cost of all materials, labour, tools and plant, drilling of holes, placing dowel bar in position, grouting with non-shrink free flow cement, wastage, sampling, testing and all other incidental expenses necessary for completion of work excluding steel reinforcement as per specifications.
- iv) The contract unit rate for repair to leached, honeycombed, spalled concrete by PMC or guniting shall include the cost of all materials, labour, tools and plants, safety measures and all other incidental expenses necessary for completion of work as per specifications for the respective items.
- v) The contract unit rate of earth filling below approach slab shall include the cost

of all materials, labour, tools and plants and all other incidental expenses necessary for completion of work as per specifications.

- vi) The contract unit rate for approach slabs shall include the cost of all materials, labour, tools and plants and all other incidental expenses necessary for completion of work as per specifications.
- vii) The contract unit rate for cleaning of bearing shall include the cost of all materials, labour, operations, tools and plants and all other incidental expenses necessary for completion of work as per specifications.
- viii) The contract unit rate for stone pitching shall include the cost of all materials, labour, tools and plants and all other incidental expenses necessary for completion of work as per specifications.

SECTION 3000 MAINTENANCE OF WORK

Clause 3002 RESTORATION OF RAIN CUTS

Clause 3002.1 Scope

The work shall consist of earthwork for restoration of rain cuts in the embankment and shoulders, using suitable material, and compacting the same.

Clause 3002.2 Materials

The materials used for restoration of rain cuts shall consist of soil conforming to clause 305.2.

Clause 3002.3 Construction Operation

The area affected by rain cuts shall be cleared of all loose soil and benched. The width of the benches shall be at least 300mm and they shall extend continuously for a sufficient length the height of the benches shall be in the range of 150-300mm.

Fresh material shall be deposited in layer not exceeding 250mm loose thickness and compacted so as to match with the benching at the moisture content close to the optimum. Compaction shall be carried out using suitable equipment such as plate compactors and rammers or by suitable implements handled manually.

Clause 3002.4 Measurement of Payment

The earthwork for restoration of rain cuts shall be measured in cubic meters.

Clause 3003 MAINTENANCE OF EARTHEN SHOULDER

Clause 3003.1 Scope

The work of maintenance of earth shoulder shall include making up the irregularities/loss of material on shoulder to the design 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.

Clause 3003.2 Material

The material to be added to the shoulder, if required, shall be a select soil.

Clause 3003.4 Measurement of Payment

Maintenance of earthen shoulder shall be measured in sq. meters.

Clause 3004.2 Filling Pot-holes and Patch Repairs

Clause 3004.2.1 Scope

This work shall include repair of Pot-holes and patching of all types of bituminous pavement.

The work shall include the removal of all failed material, in the pavement courses and, if necessary, below the pavement, until the root cause of the failure is removed; the trimming of the completed excavation to provide firm vertical faces; The replacement of material of at least as high a standard as that which was originally specified for the pavement layer; the painting of tack coat on to the sides and bases of excavations prior of placing of any bituminous materials and the compaction, trimming and finishing of the surfaces of all patches to form a smooth continuous surfaces, level with the surrounding road.

Clause 3004.2.5 Measurement of Pavement

Filling of Pot-holes and patch repair shall be measured in sq. m.

ADDITIONAL TECHNICAL SPECIFICATION

Appendix A-1 :: SPECIFICATION FOR PASSENGER SHELTER

1. Scope

The work consists of providing passenger shelter including seating arrangement as per drawing.

2. Description

2.1 Passenger Shelter

It will be a permanent structure supported on R.C. columns at the corners and having sloped reinforced concrete slab with protrusions on all sides. Panel walls on three sides shall be built with brick jail of 125mm thick set in cement mortar 1:4 (1 part cement : 4 parts sand). It shall have seating arrangement with 100mm thick R.C. slab with raised back with atleast 1.5% reinforcement. The mix of concrete for seating slab and back shall be nominal one with 1:2:4 (1 part cement : 2 parts sand : 4 parts stone chips) and it will be finished with neat cement punning not less than 3mm thickness. The flooring shall be with 75mm thick B.F.S. flooring (1:2:4) over 100mm thick M-10 grade concrete. All walls, ceiling and roof top shall be finished with cement mortar (1:3). The exposed surfaces of the structure shall be painted with two coats of cement based paint of make and brand approved by the Engineer.

3.0 Measurement for Payment

The passenger shelter shall be measured in number of finished constructed structure.

4.0 Rate

The Contract unit rate shall be payment in full for construction of the passenger shelter. Raised footpath, ground preparation etc. shall be considered as incidental to work.

Appendix A-2:: PAINTING OF STRUCTURES WITH SYNTHETIC ENAMEL PAINT FOR NUMBERING & SPAN DETAILS OF BRIGES / CULVERTS AND WATER PROOF CEMENT PAINT FOR PARAPET, RAILING, KERB AND CRASH BARRIER

1. Painting with Synthetic Enamel Paint

Materials

Synthetic enamel paint confirming to IS : 2932 of approved brand and manufacture and of the required colour shall be used for the top coat and an undercoat of ordinary paint of shade to match the top coat as recommended by the same manufacturer as far as top coat shall be used.

Painting on New Surface

Preparation of surface.:

The surface shall be thoroughly cleaned and dusted off. All dirt, mortar droppings and grease shall be thoroughly removed before painting is started. The prepared surface shall have received the approval of the Engineer after inspection, before painting is commenced..

Application: The number of coats including the undercoat shall be as stipulated in the item.

- (a) **Under coat:** One coat of the specified ordinary paint of shade suited to the shade of the top coat, shall be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface, free from brush marks and all loose particles dusted off.
- (b) **Top Coat:** Two top coats of synthetic enamel paint of desired shade shall be applied after the undercoat is thoroughly dry. Additional finishing coats shall be applied if found necessary to ensure properly uniform glossy surface.

Lettering and Numbering on New Surface:

The letters and numbers for bridges/culverts span and number shall be as per IRC-7-1971. The size of area for painting shall be varied depend upon the numbers and letters. The background area and letters/numbers shall be painted with one prime coat (under coat) and two coats(top coat) of synthetic enamel paint.

Measurement for payment:

The painting of culverts /Bridges numbering and span arrangement shall be measured in number of each side facing traffic.

Rate:

Rate shall include the cost of materials, labour and other operation described above to complete set of letters and numbers required in each side facing traffic.

2. Water Proof Cement Painting

Material:

The water proof cement paint shall be (conforming to IS: 5410) of approved brand and manufacture.

The water cement paint shall be brought to the site of work by the contractor in its original container in sealed condition. The material shall be brought in at a time in adequate to suffice for the whole work or at least a fortnight's work, the material be kept in the joint custody of the Contractor and the Engineer-in-Charge. The empties shall not be removed from the site of work till the relevant item of the work has been completed and permission obtained from the Engineer-in-Charge.

Preparation of Surface:

For New work, the surface shall be thoroughly cleaned of all mortar dropping, dirt, dust, algae, grease and other foreign matter by brushing and washing. Pitting in plaster shall be made good and a coat of waterproof cement paint shall be applied over patches after wetting them thoroughly.

Preparation of mix:

Cement paint shall be mixed in such quantities as can be used up within an hour of its mixing as otherwise the mixture will set and thicken, affecting flow and finish, Cement paint shall be mixed with water in two stages. The first stage shall comprise of 2 parts of cement paint and one part of water stirred thoroughly and allowed to stand for 5 minutes. Care shall be taken to add the cement paint gradually to the water and not vice versa. The second stage shall comprise of adding further one part of water to the mix and stirring thoroughly to obtain a liquid of workable and uniform consistency. In all cases the manufacturer's instructions shall be followed meticulously.

The lids of cement paint drums shall be kept tightly closed when not in use, as by exposure to atmosphere the cement paint rapidly becomes air set due to its hygroscopic qualities.

In case of cement paint brought in gunny bags, once the bag is opened, the contents should be consumed in full on the day of its opening. If the same is not likely to be consumed in full, the balance quantity should be transferred and preserved in an airtight container to avoid its exposure to atmosphere.

Application :

The solution shall be applied on the clean and wetted surface with brushes or spraying machine. The solution shall be kept well stirred during the period of application. It shall be applied on the surface which is on the shady side of the building so that the direct heat of the sun on the surface is avoided. The method of application of cement paint shall be as per manufacturer's specification. The completed surface shall be watered after the day's work.

The second coat shall be applied after the first coat has been set for at least 24 hours. Before

application of the second or subsequent coats, the surface of the previous coat shall not be wetted.

For the work, the surface shall be treated with three or more coat of waterproof cement paint as found necessary to get a uniform shade.

For old work, the treatment shall be with one or more coats as found necessary to get a uniform shade.

Precaution:

Water proof cement paint shall not be applied on surfaces already treated with white wash, colour wash, distemper dry or oil bound, varnishes, paints, etc. It shall not be applied on gypsums, wood and metal surfaces.

If water proof cement paint is required to be applied on existing surfaces previously treated with white wash, colour wash, etc., the surface shall be thoroughly cleaned by scrapping off all the white wash, colour was etc., completely. Thereafter, a coat of cement primer shall be applied followed by two or more coats of water proof cement paint.

Measurement for Payment:

The painting shall be measured in square metre of surface area treated.

Rate:

Rate shall include one prime coat and two coats of the paint over the prime coat including cost of all labour and materials involved in all operations described above.

Appendix A-3 :: SPECIFICATION FOR DISMANTLED MATERIAL REUSE IN GRANULAR SUB-BASE

1. Scope

The work consists of reusing the dismantled material in preparing granular sub-base.

2. Materials

The material used for work shall be collected from dismantled material of existing granular layer of road. The dismantled material shall be transported to batching plant to separate the materials of required grading. The finished granular material shall be mixed depending upon the required gradation. Use of materials like brick metal, kankar and crushed concrete shall be permitted in the lower sub-base. The reused material collected from dismantled material shall be free from organic or other deleterious constituents and shall conform to the grading given in Table 400-1.

3.0 Measurement for Payment

The Reused Granular Sub-Base shall be measured separately as finished in position in cubic metres.

4.0 Rate

The Contract unit rate shall be payment in full for carrying out the required operations including full compensations for:

- i.) Making arrangements for traffic to clause 112 except for initial treatment to verges, shoulders and construction of diversions.
- ii.) Supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts
- iii.) All labour tools, equipments and incidentals to complete work to the specifications.
- iv.) Carrying out the work in part widths of road where directed: and
- v.) Carrying out the required tests for quality control.

VOLUME - VI
RATE ANALYSIS

SCHEDULE OF RATE

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
1	02.01/i	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth from 300 mm to 600 mm	Each	388.42
2	02.01/ii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 600 mm to 900 mm	Each	716.32
3	02.01/iii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 900 mm to 1800 mm	Each	1,360.04
4	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm	Each	2,550.68
5	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm	Each	4,287.80
6	02.03/a/i	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by manual means) In area of light jungle	Ha	77,440.00
7	02.03/a/ii	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by manual means) In area of thorny jungle	Ha	103,818.00
8	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)	Ha	59,319.65
9	02.04/i/a	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. a) Lime concrete, cement concrete/lean mix concrete.	cum	591.45

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
10	02.04/i/b	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. b)Cement concrete M15 and M20	cum	693.57
11	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above	cum	1,739.01
12	02.04/ii/a	Dismantling Brick / Tile work a)In lime	cum	387.20
13	02.04/ii/b	Dismantling Brick / Tile work b)In cement mortar	cum	489.32
14	02.04/ii/c	Dismantling Brick / Tile work c)In mud	cum	346.35
15	02.04/ii/d	Dismantling Brick / Tile work d)Dry brick pitching or brick saling	cum	325.93
16	02.04/iii/a	Dismantling stone masonry a) Rubble stone masonry in lime	Cum	423.46
17	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	489.32
18	02.04/iii/c	Dismantling stone masonry c) Rubble stone masonry in mud	Cum	387.20
19	02.04/iii/d	Dismantling stone masonry d) Dry rubble masonry	Cum	366.78
20	02.04/iii/e	Dismantling stone masonry e) Dismantling stone pitching/dry stone spalls	Cum	423.02
21	02.04/iii/f	Dismantling stone masonry f) In wire crates including opening of crates and stacking crates materials.	Cum	387.20

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
22	02.04/v	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. steel works in all type of sections upto a height of 5m or above plinth level excluding cutting of rivet A) Including Dismembering	cum	2,027.17
23	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	264.99
24	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	358.77
25	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	614.08
26	02.04/viii/a	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m a) Top bituminous surface dressing or premix carpet	sqm	41.43
27	02.04/viii/b	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m c) Stone metal crust, 50mm to 100mm thick by road roller with scarifier along with 20mm,premix carpet/surface dressing	sqm	57.31
28	02.04/viii/d	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m d) Kankar/Gravel metal crust upto 150mm thick with pickaxes.	sqm	41.53
29	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier	sqm	33.99
30	02.04/viii/f /ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier	sqm	57.08
31	02.06	Dismantling Guard Rails by manual means and disposal of dismantled material with all lifts and up to a lead of 1000 metres, stacking serviceable materials and unserviceable materials separately.	rm	118.94
32	02.08	Removal of Telephone / Electric Poles including excavation and dismantling of foundation concrete and lines under the supervision of concerned department, disposal with all lifts and up to a lead of 1000 metres and stacking the serviceable and unserviceable material separately	each	258.70

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
33	02.4/viii/f/i	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base i)Manual Means	sqm	93.23
34	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface	sqm	315.00
35	03.01/i/a	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work. Ordinary soil a) Manual Means (Depth upto 3m) a) Manual Means (Depth upto 3m)	cum	408.50
36	03.01/i/b	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work. Ordinary soil b) Mechanical Means (Depth upto 3m) b) Mechanical Means (Depth upto 3m)	cum	105.88
37	03.01/ii/a	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work. Ordinary Rock (not requiring blasting) a) Manual Means (Depth upto 3m) a) Manual Means (Depth upto 3m)	cum	510.60
38	03.01/ii/b	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work. Ordinary Rock (not requiring blasting) b) Mechanical Means b) Mechanical Means	cum	142.33

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
39	03.01/iii/a	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work. Hard Rock (requiring blasting) a) Manual Means a) Manual Means	cum	982.17
40	03.01/iii/b	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work. Hard Rock (requiring blasting) b) Hard Rock (blasting prohibited) Mechanical Means b) Hard Rock (blasting prohibited) Mechanical Means	cum	1,900.61
41	03.01/iv/a	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work. Marshy soil a) Manual Means a) Manual Means	cum	773.37
42	03.01/iv/b	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work. Marshy soil b) Mechanical Means b) Mechanical Means	cum	269.34
43	03.02/i	Earth work in excavation of foundation trenches etc. in drains and channels etc. not exceeding 2.00 metres depth including dressing of bottom and sides of trenches, stacking the excavated soil clear from the edge of excavation including disposal of surplus soil as directed within a lead of 30.00 metres. Ordinary Soil	cum	326.80
44	03.02/ii/a	Earth work in excavation of foundation trenches etc. in drains and channels etc. not exceeding 2.00 metres depth including dressing of bottom and sides of trenches, stacking the excavated soil clear from the edge of excavation including disposal of surplus soil as directed within a lead of 30.00 metres. Blasting work a) Soft rock a) Soft rock	cum	785.74

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
45	03.02/ii/b	Earth work in excavation of foundation trenches etc. in drains and channels etc. not exceeding 2.00 metres depth including dressing of bottom and sides of trenches, stacking the excavated soil clear from the edge of excavation including disposal of surplus soil as directed within a lead of 30.00 metres. Blasting work b) Hard rock b) Hard rock	cum	1,520.49
46	03.02/iii/a	Earth work in excavation of foundation trenches etc. in drains and channels etc. not exceeding 2.00 metres depth including dressing of bottom and sides of trenches, stacking the excavated soil clear from the edge of excavation including disposal of surplus soil as directed within a lead of 30.00 metres. Chiselling/wedging out of rock (where blasting is prohibited). a) Soft rock a) Soft rock	cum	1,765.25
47	03.02/iii/b	Earth work in excavation of foundation trenches etc. in drains and channels etc. not exceeding 2.00 metres depth including dressing of bottom and sides of trenches, stacking the excavated soil clear from the edge of excavation including disposal of surplus soil as directed within a lead of 30.00 metres. Chiselling/wedging out of rock (where blasting is prohibited). b) Hard rock b) Hard rock	cum	2,647.87
48	03.03/a	Filling in foundation trenches as per drawing and Technical specification a) Sandy Soil	cum	326.10
49	03.03/b	Filling in foundation trenches as per drawing and Technical specification b) Sand Gravel	cum	692.96
50	03.04/i	Earth filling with surplus soil excavated from foundation and taken only from outside of building plinth in 15 cm layers including watering and consolidation lead 30 meters Ordinary Soil	cum	217.49
51	03.12	Construction of Embankment with Material Obtained from Borrow Pits Construction of embankment with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2	cum	226.26
52	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2	cum	160.20
53	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	246.28

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
54	03.14	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from borrow pits with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	312.34
55	03.15	Compacting original ground supporting subgrade Loosening of the ground upto a level of 500 mm below the subgrade level, watered, graded and compacted in layers to meet requirement of table 300-2 for subgrade construction.	cum	86.65
56	03.16	Compacting original ground supporting embankment Loosening, leveling and compacting original ground supporting embankment to facilitate placement of first layer of embankment, scarified to a depth of 150mm, mixed with water at OMC and then compacted dry rolling so as to achieve minimum dry density as given in Table 300-2 for embankment construction.	cum	42.00
57	03.17	Stripping and Storing Top Soil Stripping, storing of top soil by road side at 15 m internal and re-application on embankment slopes, cut slopes and other areas in localities where the available embankment material is not conducive to plant growth	cum	302.68
58	03.19	Turfing with Sods Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of sods and watering	sqm	61.87
59	03.31	Excavation in Hill Area in Soil by Mechanical Means Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with all lifts and lead upto 1000 metres	cum	211.39
60	03.32	Excavation in Hilly Area in Ordinary Rock by Mechanical Means not Requiring Blasting. Excavation in hilly area in ordinary rock not requiring ballasting by mechanical means including cutting and trimming of slopes and disposal of cut material with all lift and lead upto 1000 metres	cum	304.56
61	03.33	Excavation in Hilly Areas in Hard Rock Requiring Blasting Excavation in hilly areas in hard rock requiring blasting, by mechanical means including trimming of slopes and disposal of cut material with all lifts and lead upto 1000 metres.	cum	423.10
62	03/nsc/1	Island and Median Filling From Roadway Cutting	cum	108.52
63	04.01/i	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- II Material	Cum	2,949.87
66	04.01/ii	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading-III Material	Cum	2,893.00

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
69	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	2,997.00
72	04.02/i	Sub-base with Close Graded Material (Table:- 400-1) By Mix in Place Method Construction of granular sub-base by providing close graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401 For Grading- II Material	Cum	2,413.12
75	04.02/ii	Sub-base with Close Graded Material (Table:- 400-1) By Mix in Place Method Construction of granular sub-base by providing close graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401 For Grading-III Material	Cum	2,356.25
78	04.03/i	Granular Sub-Base with Coarse Graded Material (Table:- 400- 2) Construction of granular sub-base by providing coarse graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401 For Grading- II Material	Cum	2,285.30
80	04.03/ii	Granular Sub-Base with Coarse Graded Material (Table:- 400- 2) Construction of granular sub-base by providing coarse graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401 For Grading-III Material	Cum	2,230.59
82	04.04	Granular Sub-Base with Naturally Occuring Sand Gravel Material Providing, laying, spreading and compacting granular base/sub-base according to lines, grades and cross sections by using naturally occurred sand gravel/conforming to IRC-Grd-II of MOST specification free from organic or other deleterious constituent spreading with motor grader and compacted by rolling with power roller of 8-10 capacity in layers not exceeding 150mm (spread thickness) i/c rolling of the road surface to proper level and grades 30 cm width edging on both side etc. complete as directed by Engineer-in-charge.	Cum	782.55
84	04.06/a	Lime Stabilisation for Improving Subgrade (Laying and spreading available soil in the subgrade on a prepared surface, pulverising, mixing the spread soil in place with rotavator with 3 % slaked lime having minimum content of 70% of CaO, grading with motor grader and compacting with the road roller at OMC to the desired density to form a layer of improved sub grade) By Mechanical Means	Cum	1,652.44

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
85	04.06/b	Lime Stabilisation for Improving Subgrade (Laying and spreading available soil in the subgrade on a prepared surface, pulverising, mixing the spread soil in place with rotavator with 3 % slaked lime having minimum content of 70% of CaO, grading with motor grader and compacting with the road roller at OMC to the desired density to form a layer of improved sub grade) By Manual Means	Cum	1,662.67
86	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401	Cum	2,063.00
87	05.01/b/a	WBM/Providing, laying, spreading and compacting stone aggregate of specific sizes to water bound macadam specification including spreading in uniform thickness, hand packing, rolling with power roller 8-10 tones in stages to proper grade and camber, applying and brooming requisite type of screening & binding materials to fill up the interstices of coarse aggregates, watering and rolling making necessary earthen bund to protect edges, lighting, guarding, barricading and maintenance of diversion etc.	cum	2,216.15
90	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	2,965.34
92	05.03	Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 25 mm thick cement concrete grade M15, over laid with pre-cast concrete tiles in cement mortar including provision of all drainage arrangements but excluding kerb channel.	sqm	1,374.51
96	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	57.54
97	06.01/b	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) B) Stabilised Soil Based / Crusher run macadam 0.9 - 1.2kg /sqm	sqm	97.04
98	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	15.63
99	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	17.16
100	06.02/iii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. iii) On cement concrete pavement @ 0.300 - 0.35 kg/sqm	sqm	22.22

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
101	06.06/i	Dense Graded Bituminous Macadam (Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects.) for Grading I (40 mm nominal size) Using bitumen 60/70	cum	10,661.33
104	06.06/ii	Dense Graded Bituminous Macadam (Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects.) for GradingII(19 mm nominal size) Using bitumen 60/70	cum	10,707.15
107	06.08/i/a	Bituminous Concrete (Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects) for Grading-I (19 mm nominal size) A) Using Bitumen 60/70	cum	12,064.76
110	06.08/i/b	Bituminous Concrete (Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects) for Grading-I (19 mm nominal size) B) Using Bitumen CRMB Gr-55	cum	12,622.49

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
111	06.08/i/c	Bituminous Concrete (Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects) for Grading-I (19 mm nominal size) C) Using Bitumen PMB 70	cum	15,913.73
112	06.08/ii/a	Bituminous Concrete (Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects) for Grading-II(13 mm nominal size) A) Using Bitumen 60/70	cum	11,950.36
115	06.08/ii/b	Bituminous Concrete (Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects) for Grading-II(13 mm nominal size) B) Using Bitumen CRMB Gr-55	cum	15,599.71
116	06.08/ii/c	Bituminous Concrete (Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects) for Grading-II(13 mm nominal size) C) Using Bitumen PMB 70	cum	15,898.91
117	06.10/A	Open - Graded Premix Surfacing Providing, laying and rolling of open - graded premix surfacing of 20 mm thickness composed of 13.2 mm to 5.6 mm aggregates either using penetration grade bitumen or cut-back or emulsion to required line, grade and level to serve as wearing course on a previously prepared base, including mixing in a suitable plant, laying and rolling with a smooth wheeled roller 8-10 tonne capacity, finished to required level and grades. A) Mechanical method using Penetration grade Bitumen and HMP of appropriate capacity not less than 75 tonnes/hour .	Sqm	149.23

Item Rate Analysis has been done considering

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
119	06.10/C	Open - Graded Premix Surfacing Providing, laying and rolling of open - graded premix surfacing of 20 mm thickness composed of 13.2 mm to 5.6 mm aggregates either using penetration grade bitumen or cut-back or emulsion to required line, grade and level to serve as wearing course on a previously prepared base, including mixing in a suitable plant, laying and rolling with a smooth wheeled roller 8-10 tonne capacity, finished to required level and grades. C)Open-Graded Premix Surfacing using cationic Bitumen Emulsion	Sqm	183.17
121	06.12/I	Providing and laying seal coat sealing in the voids in a bituminous surface laid to the specific levels,grade and cross fall using Type A and B Seal Coats Type A	sqm	67.22
122	06.12/II	Providing and laying seal coat sealing in the voids in a bituminous surface laid to the specific levels,grade and cross fall using Type A and B Seal Coats Type B/Providing and Laying of premix sand seal coat with HMP of appropriate capacity not less than 75 tonnes/hour using crushed stone chipping 6.7mm size and penetration bitumen of suitable grade	sqm	53.67
123	06.16	Mastic Asphalt (Providing and laying 25 mm thick mastic asphalt wearing course with paving grade bitumen meeting the requirements given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine-grained hard stone chipping of 13.2 mm nominal size at the rate of 0.005cum per 10 sqm and at an approximate spacing of 10 cm center to center in both directions, pressed into surface when the temperature of surfaces not less than 1000C, protruding 1 mm to 4 mm over mastic surface, all complete as per clause 515.)	sqm	1,182.63
129	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	11,264.00
132	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	12,371.00
135	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	622.79

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
138	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone	each	4,556.84
142	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone	each	2,676.24
146	08.02/nsc	M15 stone of standard design fixed in Position including painting and painting letters etc. Hectometer stone (precast)	each	2,269.00
150	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	843.03
153	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	93.41
154	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade	sqm	85.06
155	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle	each	4,931.35
159	08.11/ii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm equilateral triangle	each	3,621.96
163	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular	each	4,440.80

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
167	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	5,706.23
171	08.11/v	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm x 45 cm rectangular	each	4,249.15
175	08.11/vi	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm x 60 cm square	each	5,200.94
179	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon	each	8,165.25
183	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,223.04
187	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro- reflectorised sign as per IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,831.40

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
191	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorisng Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorisng glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	1,002.14
192	08.15/a	Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) a)Cat Eye	Nos	296.53
193	08.15/b	Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) b)Median Marker	Nos	545.50
194	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) 120x120 -Road Delineator	each	1,063.19
195	08.15/f/iii	Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) f)Speed Bumps(500mm x 425mm x 75mm)	Piece	3,078.32
196	08.17/nsc	RCC Crash Barrier	m	6,947.00
200	08.18/A/a	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.2 m	Rm	2,757.81

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
201	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m	Rm	3,334.08
202	08.18/A/c	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.8 m	Rm	3,591.20
203	08.19	Cable Duct Accross the Road Single row for one utility service	m	3,039.00
204	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	383.64
205	08.21/i	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Solar light emiiting Diodes	nos	2,595.21
206	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp	nos	21,165.02
207	08/nsc/2	Convex Mirror For Blind Curve	nos	5,000.00

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
208	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.	Ton	183,662.00
209	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign	sqm	695.00
210	08/nsc/5	Reinforced Cement Concrete Crash Barrier-Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-40 grade concrete with HYSD reinforcement conforming to IRC:21 and dowel bars 25 mm dia, 450 mm long at expansion joints filled with pre-moulded asphalt filler board, keyed to the structure on which it is built and installed as per design given in the enclosure to MOST circular No. RW/NH - 33022/1/94-DO III dated 24 June 1994 as per dimensions in the approved drawing and at locations directed by the Engineer, all as specified	m	6,927.00
211	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.	sqm	1,224.98
212	09.01/nsc1	Laying Reinforced Cement Concrete Pipe NP4 / Prestressed Concrete Pipe on First Class Bedding in Single Row . B)1200 mm dia	Rm	11,638.00
215	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork. At Protection	cum	7,496.35
218	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure	Ton	72,983.59
219	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	72,983.59
220	10.11	Random rubble masonry (uncoursed) in cement sand mortar 1:3 in foundation upto a depth of 1.5m. and 1.5m. above ground/bed level.	cum	5,662.85
221	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3	sqm	223.49

Item Rate Analysis has been done considering

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
222	10.19	Dry Boulder pitching	cum	1,701.75
223	10.20/a	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting a)Good Sandy Soil free from organic material	cum	785.50
224	10.20/b	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting b)Selected Granular Material in Filling	cum	1,174.31
225	10.20/c	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting c)Filler Media behind abutment ,wing and return wall	cum	1,157.28
226	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork.	cum	7,496.35
229	10.23/a	Reinforced Cement Concrete M-30 Mixed with Stone aggregate 20 mm nominal soze mechanical mixed and vibrated for reinforced concrete work in slab excluding steel reinforcement but including centering and shuttering and laied in position. a)For Sub-Structure	cum	14,404.16
232	10.23/b	Reinforced Cement Concrete M-30 Mixed with Stone aggregate 20 mm nominal soze mechanical mixed and vibrated for reinforced concrete work in slab excluding steel reinforcement but including centering and shuttering and laied in position. b)For Super-Structure	cum	14,404.16
235	10.24/a	Laying Reinforced Cement Concrete Pipe(Hume Pipe)/Prestressed Concrete Pipe on First Class Bedding in Single ROW(Cost of NP 4 To be Paid Seperately). This includes fixing collar with cement mortar 1:2 but excluding excavation,protection works,backfilling,concrete and masonry works in heads walls and parapet a)1000 mm dia	m	711.07
236	10.24/b	Laying Reinforced Cement Concrete Pipe(Hume Pipe)/Prestressed Concrete Pipe on First Class Bedding in Single ROW(Cost of NP 4 To be Paid Seperately). This includes fixing collar with cement mortar 1:2 but excluding excavation,protection works,backfilling,concrete and masonry works in heads walls and parapet b)1200 mm dia	m	877.98
237	12/Nsc1	Geo-synthetics and Reinforced Earth With reinforcing elements of synthetic geogrids	Sqm	512.00
238	12/Nsc2	Geo-synthetics and Reinforced Earth Facing elements of RCC	Sqm	3,873.00
242	23/Nsc1	560 mm Dia cover with frame(Heavy Duty)[Ref: Delhi CPWD SOR 2007 Code 3860]	Nos	9,160.80

Item Rate Analysis has been done considering

Schedule Of Rate

SI No	SOR Ref	Item description	Unit	SOR Rate
243	23/Nsc2	Rectangular shape 600x450 mm precast R.C.C. manhole cover(CPWD; Delhi SOR 2014)	Each	958.00
244	24/i/b	Galvanised Mild steel J /L hook	kg	120.00
245	40	Gextextile material (fine net)	sqm	25.50
246	9.2/b/Nsc	Laying Reinforced Cement Concrete Pipe(Hume Pipe)/Prestressed Concrete Pipe on First Class Bedding in Single ROW(Cost of NP 4 To be Paid Separately). This includes fixing collar with cement mortar 1:2 but excluding excavation,protection works,backfilling,concrete and masonry works in heads walls and parapet b)1200 mm dia	m	11,638.00

LEAD CHART

Leads for Various Materials

Sl. No.	Name of Material	Name of Source	Distance from Source to Project Road (Km)	length of Project Road (Km)	Total Lead (Km)
1	Sand (Fine)	Tuivai River	1	17	18
2	Filling Material	Local	-	-	10
3	Stone Metal	Tuivai River	1	17	18
4	Stone Boulder	Tuivai River	1	17	18
5	Stone Chips, Aggregate	Tuivai River	1	17	18
6	Coarse Sand	Tuivai River	1	17	18
7	Cement	Imphal	189	17	206
8	Steel	Imphal	189	17	206
9	Bitumen	Imphal	189	17	206
10	Bitumen Emulsion	Imphal	189	17	206
11	Structural Steel	Imphal	189	17	206
12	RCC Pipe	Imphal	189	17	206

CARRIAGE COST

Carriage Cost of Material (Including loading & unloading)

Rubbish

Name of Quarries Local
Lead Upto Site (Km)= 10

Sl.No.	Lead (km)	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
1	10.00	Upto 5	per m ³	5	266.68	266.68
		for Every km beyond 5 km up to 10 km	per m ³	5	26.51	132.55
		Total				399.23

Stone aggregate below 40mm nominal size

Name of Quarries Tuivai River
Lead Upto Site (Km)= 17.66

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
2	17.66	Upto 5	per m ³	5	254.79	254.79
		for Every km beyond 5 km up to 10 km	per m ³	5	25.33	126.65
		for Every km beyond10 km up to 20 km	per m ³	2	20.42	40.84
		for Every km beyond 20 km	per m ³		16.51	0.00
					Total	422.28

Sand

Name of Quarries Tuivai River
Lead Upto Site (Km)= 17.66

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
3	17.66	Upto 5	per m ³	5	254.79	254.79
		for Every km beyond 5 km up to 10 km	per m ³	5	25.33	126.65
		for Every km beyond10 km up to 20 km	per m ³	2	20.42	40.84
		for Every km beyond 20 km	per m ³		16.51	0.00
					Total	422.28

Boulder

Name of Quarries Tuivai River
Lead Upto Site (Km)= 17.66

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
4	17.66	Upto 5	per m ³	5	282.63	282.63
		for Every km beyond 5 km up to 10 km	per m ³	5.00	28.10	140.50
		for Every km beyond10 km up to 20 km	per m ³	2.00	22.65	45.30
		for Every km beyond 20 km	per m ³		18.31	0.00
					Total	468.43

Cement, Steel

Name of Quarries Imphal
Lead Upto Site (Km)= 205.66

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
5	205.66	Upto 5	per Tone	5	182.77	182.77
		for Every km beyond 5 km up to 10 km	per Tone	5	18.17	90.85
		for Every km beyond10 km up to 20 km	per Tone	10	14.65	146.50
		for Every km beyond 20 km	per Tone	185.66	11.84	2198.27
					Total	2618.39

Bitumen

Name of Quarries Imphal
Lead Upto Site (Km)= 205.66

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
6	205.66	Upto 5	per Tone	5	182.77	182.77
		for Every km beyond 5 km up to 10 km	per Tone	5	18.17	90.85
		for Every km beyond10 km up to 20 km	per Tone	10	14.65	146.50
		for Every km beyond 20 km	per Tone	185.66	11.84	2198.27
					Total	2618.39

PIPE

300 mm Dia RCC Pipe from Imphal
Lead Upto Site (Km)= 205.66

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
7	86.50	upto 5	Rm	5	18.73	18.73
		for Every km beyond 5 km up to 10 km	Rm	5	1.86	9.30
		for Every km beyond10 km up to 20 km	Rm	10	1.50	15.00
		for Every km beyond 20 km	Rm	66.5	1.21	80.47
						Total

FINISHED RATE

FINISHER RATE**Road Works**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
1	02.01/i	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth from 300 mm to 600 mm	Each	388.42					0.00	392.30
2	02.01/ii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 600 mm to 900 mm	Each	716.32					0.00	723.48
3	02.01/iii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 900 mm to 1800 mm	Each	1,360.04					0.00	1,373.64
4	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm	Each	2,550.68					0.00	2,576.19

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
5	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm	Each	4,287.80					0.00	4,330.68
6	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)	Ha	59,319.65					0.00	59,912.85
7	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above	cum	1,739.01					0.00	1,756.40
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	489.32					0.00	494.21
9	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	264.99					0.00	267.64

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
10	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	358.77					0.00	362.36
11	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	614.08					0.00	620.22
12	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier	sqm	33.99					0.00	34.33
13	02.04/viii/f /ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier	sqm	57.08					0.00	57.65
14	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface	sqm	315.00					0.00	318.15

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
15	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2	cum	160.20					0.00	161.80
16	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	246.28					0.00	248.74
17	03.15	Compacting original ground supporting subgrade Loosening of the ground upto a level of 500 mm below the subgrade level, watered, graded and compacted in layers to meet requirement of table 300-2 for subgrade construction.	cum	86.65					0.00	87.52
18	03.19	Turfing with Sods Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of sods and watering	sqm	61.87					0.00	62.49
19	03.31	Excavation in Hill Area in Soil by Mechanical Means Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with all lifts and lead upto 1000 metres	cum	211.39					0.00	213.50

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

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FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
20	03.32	Excavation in Hilly Area in Ordinary Rock by Mechanical Means not Requiring Blasting. Excavation in hilly area in ordinary rock not requiring ballasting by mechanical means including cutting and trimming of slopes and disposal of cut material with all lift and lead upto 1000 metres	cum	304.56					0.00	307.61
21	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	2,997.00	Course Sand Stone Chips/Aggregate Stone Metal Cat1	0.380 0.250 0.640	cum cum cum	422.28 422.28 422.28	536.30	3,568.63
22	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401	Cum	2,063.00					0.00	2,083.63

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
23	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	2,965.34					557.41	3,557.98
					Course Sand	0.396	cum	422.28		
					Stone Metal Cat1	0.924	cum	422.28		
24	05.03	Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 25 mm thick cement concrete grade M15, over laid with pre-cast concrete tiles in cement mortar including provision of all drainage arrangements but excluding kerb channel.	sqm	1,374.51					134.88	1,524.48
					Cement	0.012	Ton	2,618.39		
					Sand	0.064	cum	422.28		
					Stone	0.112	cum	422.28		
					Chips/Aggregate					
					Stone Metal Cat1	0.069	cum	422.28		
25	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	57.54					1.83	59.96
					Bitumen Emulsion	0.001	Ton	2,618.39		

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
26	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	15.63	Bitumen Emulsion	0.000	Ton	2,618.39	0.52	16.31
27	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	17.16	Bitumen Emulsion	0.000	Ton	2,618.39	0.65	17.99
28	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	11,264.00	Aggregate Bitumen 30/40 Filler	1.440 0.104 0.040	cum Ton Ton	422.28 2,618.39 399.23	896.36	12,281.96

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
29	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	12,371.00	Aggregate Bitumen 30/40 Filler	1.456 0.130 0.030	cum Ton Ton	422.28 2,618.39 399.23	967.21	13,471.59
30	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	622.79	Cement Course Sand Stone Chips/Aggregate	0.016 0.030 0.061	Ton cum cum	2,618.39 422.28 422.28	80.32	710.14
31	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone	each	4,556.84	Cement Sand Steel	0.108 0.176 0.004	Ton cum Ton	2,618.39 422.28 2,618.39	516.65	5,124.22

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.353	cum	422.28		
32	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone	each	2,676.24	Cement	0.074	Ton	2,618.39	352.02	3,058.54
					Sand	0.121	cum	422.28		
					Steel	0.002	Ton	2,618.39		
					Stone Chips/Aggregate	0.242	cum	422.28		
33	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	843.03	Sand	0.566	cum	422.28	934.10	1,794.90
					Steel	0.080	Ton	2,618.39		
					Stone Chips/Aggregate	1.150	cum	422.28		
34	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	93.41					0.00	94.34
35	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade	sqm	85.06					0.00	85.91

**Note: Finished Rate inclusive of 1% Labour Cess

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Manipur Schedule of Rates For National Highways - Works 2018(PWD, Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
36	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle	each	4,931.35	Cement	0.033	Ton	2,618.39	409.79	5,394.55
					Sand	0.540	cum	422.28		
					Steel	0.019	Ton	2,618.39		
					Stone	0.108	cum	422.28		
					Chips/Aggregate					
37	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular	each	4,440.80	Cement	0.033	Ton	2,618.39	409.79	4,899.10
					Sand	0.540	cum	422.28		
					Steel	0.019	Ton	2,618.39		

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

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FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.108	cum	422.28		
38	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	5,706.23					409.79	6,177.18
					Cement	0.033	Ton	2,618.39		
					Sand	0.540	cum	422.28		
					Steel	0.019	Ton	2,618.39		
					Stone Chips	0.108	cum	422.28		
39	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon	each	8,165.25					409.79	8,660.79
					Cement	0.033	Ton	2,618.39		
					Sand	0.540	cum	422.28		

**Note: Finished Rate inclusive of 1% Labour Cess

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Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Steel	0.019	Ton	2,618.39		
					Stone	0.108	cum	422.28		
					Chips/Aggregate					
40	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,223.04					227.88	12,575.43
					Cement	0.037	Ton	2,618.39		
					Sand	0.060	cum	422.28		
					Steel	0.021	Ton	2,618.39		
					Stone	0.120	cum	422.28		
					Chips/Aggregate					
41	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,831.40					305.92	13,268.69

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Cement	0.044	Ton	2,618.39		
					Sand	0.072	cum	422.28		
					Steel	0.038	Ton	2,618.39		
					Stone	0.144	cum	422.28		
					Chips/Aggregate					
42	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorisng Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorisng glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	1,002.14					0.00	1,012.16
43	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) 120x120 -Road Delineator	each	1,063.19					0.00	1,073.82

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

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FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
44	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m	Rm	3,334.08					0.00	3,367.42
45	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	383.64					0.00	387.48
46	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp	nos	21,165.02					0.00	21,376.67

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

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FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
47	08/nsc/2	Convex Mirror For Blind Curve	nos	5,000.00					0.00	5,050.00
48	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.	Ton	183,662.00	Steel	1.050	Ton	2,618.39	2,749.31	188,275.42
49	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign	sqm	695.00					0.00	701.95

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
50	08/nsc/5	Reinforced Cement Concrete Crash Barrier-Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-40 grade concrete with HYSD reinforcement conforming to IRC:21 and dowel bars 25 mm dia, 450 mm long at expansion joints filled with pre-moulded asphalt filler board, keyed to the structure on which it is built and installed as per design given in the enclosure to MOST circular No. RW/NH - 33022/1/94-DO III dated 24 June 1994 as per dimensions in the approved drawing and at locations directed by the Engineer, all as specified	m	6,927.00					0.00	6,996.27
51	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.	sqm	1,224.98					0.00	1,237.23
52	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork. At Protection	cum	7,496.35					1,413.03	8,998.47
					Aggregate	0.850	cum	422.28		
					Cement	0.330	Ton	2,618.39		
					Sand	0.450	cum	422.28		

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
53	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure	Ton	72,983.59	Steel	1.050	Ton	2,618.39	2,749.31	76,490.23
54	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	72,983.59	Steel	1.050	Ton	2,618.39	2,749.31	76,490.23
55	10.16	Cement Plaster 12mm Thick in Cement Mortar 1:3	sqm	223.49					0.00	225.72
56	10.20/b	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting b)Selected Granular Material in Filling	cum	1,174.31	Stone Chips/Aggregate	1.200	cum	422.28	506.74	1,697.86
57	10.20/c	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting c)Filler Media behind abutment ,wing and return wall	cum	1,157.28	Stone Chips/Aggregate	1.200	cum	422.28	506.74	1,680.66

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
58	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork.	cum	7,496.35	Aggregate Cement Sand	0.850 0.330 0.450	cum Ton cum	422.28 2,618.39 422.28	1,413.03	8,998.47
59	24/i/b	Galvanised Mild steel J /L hook	kg	120.00					0.00	121.20
60	40	Gextextile material (fine net)	sqm	25.50					0.00	25.76

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

FINISHER RATE**Minor Bridge**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
1	10.06/Nsc	Supply, fabrication, delivery at bridge site and erection of structural steel works as per IS 2062, including two coats of primer, one at shop and the other at site and two coats of aluminium paints including all labour, material, consumables etc. Structural steel	Ton	82,834.00	Steel	1.050	Ton	2,618.39	2,749.31	86,439.14
2	10.20/a	Providing and filling in foundation tranches and at the back of abutments, return walls and below pipe bed in layers not exceeding 150 mm thick including watering and compacting a) good sandy soil free from organic material	cum	785.50					0.00	793.36
3	13.01/a/i/Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	218.93					0.00	221.12
4	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	218.93					0.00	221.12

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
5	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	209.22					0.00	211.31
6	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	1,007.86	Stone Chips/Aggregate	1.200	cum	422.28	506.74	1,529.75
7	13.03/b	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Good Sandy Soil free from organic material	cum	617.02	Sand	1.200	cum	422.28	506.74	1,135.00
8	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	1,274.65	Stone Chips/Aggregate	1.200	cum	422.28	506.74	1,799.20
9	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications	cum	11,849.87					0.00	11,968.37
10	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	6,306.36	Cement	0.170	Ton	2,618.39	1,061.66	7,441.70

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

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FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Sand	0.300	cum	422.28		
					Stone Metal Cat1	1.160	cum	422.28		
11	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	8,348.21	Aggregate	0.850	cum	422.28	1,413.03	9,858.85
					Cement	0.330	Ton	2,618.39		
					Sand	0.450	cum	422.28		
12	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	9,333.75	Aggregate	0.900	cum	422.28	1,565.07	11,007.81
					Cement	0.380	Ton	2,618.39		
					Sand	0.450	cum	422.28		
13	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	9,077.25	Aggregate	0.900	cum	422.28	1,643.62	10,828.08
					Cement	0.410	Ton	2,618.39		
					Sand	0.450	cum	422.28		
14	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	77,427.65	Steel	1.050	Ton	2,618.39	2,749.31	80,978.73

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Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
15	14/nsc2	Brick Flat Soling at Foundation	Sqm	1,077.89	Brick	1.000	Sqm	40.00	40.00	1,129.07
16	15.01	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications	cum	11,961.59					0.00	12,081.21
17	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	6,787.85	Cement Sand Stone Metal Cat1	0.170 0.300 1.160	Ton cum cum	2,618.39 422.28 422.28	1,061.66	7,928.01
18	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m	cum	9,067.33	Cement Sand Stone Chips/Aggregate	0.344 0.450 0.900	Ton cum cum	2,618.39 422.28 422.28	1,470.80	10,643.51

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
19	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	9,938.25	Cement Sand Stone Chips/Aggregate	0.403 0.450 0.900	Ton cum cum	2,618.39 422.28 422.28	1,625.29	11,679.18
20	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	77,427.65	Steel	1.050	Ton	2,618.39	2,749.31	80,978.73
21	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	445.75	Cement Sand	0.001 0.002	Ton cum	2,618.39 422.28	3.12	453.36
22	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complete as per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	10,446.36	Cement Course Sand	0.400 0.452	Ton cum	2,618.39 422.28	1,618.28	12,185.29

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.900	cum	422.28		
23	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	85,183.86	Steel	1.050	Ton	2,618.39	2,749.31	88,812.50
24	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	2,711.68	Cement	0.035	Ton	2,618.39	186.85	2,927.52
					Sand	0.039	cum	422.28		
					Steel	0.018	Ton	2,618.39		
					Stone Chips/Aggregate	0.077	cum	422.28		
25	16.09	Mild steel railing complete as per drawing and Technical Specifications	Rm	4,559.31	Steel	0.043	Ton	2,618.39	112.33	4,718.36
26	16.11	Drainage Spouts complete as per drawing and Technical specification	each	2,158.99	Structural Steel	0.004	Ton	2,618.39	10.47	2,191.15

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
27	16.17	Mastic asphalt (providing and laying 12mm thick mastic asphalt wearing courses on top of deck slab excluding prime coat with paving grade bitumen meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10sqm and at an approximate spacing of 10cm centre in both direction, pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface, all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	532.56	Bitumen Lime Stone Chips/Aggregate	0.003 0.005 0.014	Ton Ton cum	2,618.39 399.23 422.28	15.03	553.07
28	16/nsc	For Protection Work - cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade upto 5m height	cum	9,067.33	Cement Sand Stone Chips/Aggregate	0.344 0.450 0.900	Ton cum cum	2,618.39 422.28 422.28	1,470.80	10,643.51

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD, Manipur)

FINISHER RATE**Minor Bridge**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
29	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	1,655.65	Stone Bolder	1.200	cum	468.43	562.12	2,239.95
30	17/nsc1	Flexible Apron - Construction of flexible apron 750mm thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall.	cum	1,638.00	Stone Bolder	1.200	cum	468.43	562.12	2,222.12

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

FINISHER RATE**Major Bridge**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	218.93					0.00	221.12
2	13.01/a/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth 3 m to 6 m	cum	294.28					0.00	297.22
3	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	209.22					0.00	211.31
4	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	1,007.86	Stone Chips/Aggregate	1.200	cum	422.28	506.74	1,529.75
5	13.03/b	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Good Sandy Soil free from organic material	cum	617.02	Sand	1.200	cum	422.28	506.74	1,135.00

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Major Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
6	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	1,274.65	Stone Chips/Aggregate	1.200	cum	422.28	506.74	1,799.20
7	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	8,348.21	Aggregate	0.850	cum	422.28	1,413.03	9,858.85
					Cement	0.330	Ton	2,618.39		
					Sand	0.450	cum	422.28		
8	14.03/g	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M30 Grade	cum	10,966.06	Aggregate	0.860	cum	422.28	1,723.02	12,815.97
					Cement	0.450	Ton	2,618.39		
					Sand	0.430	cum	422.28		
9	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	77,427.65	Steel	1.050	Ton	2,618.39	2,749.31	80,978.73
10	14/nsc1/i	Filler joint i) Providing & fixing 2 mm thick corrugated copper plate in expansion joint complete as per drawing & Technical Specification.	m	2,060.00					0.00	2,080.60

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD, Manipur)

FINISHER RATE

Major Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
11	14/nsc1/ii	Filler joint Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification.	m	698.00					0.00	704.98
12	14/nsc1/iii	Filler joint iii)Providing and fixing in position 20 mm thick premoulded joint filler in expansion joint for fixed ends of simply supported spans not exceeding 10 m to cater for a horizontal movement upto 20 mm, covered with sealant complete as per drawing and technical specifications.	m	223.00					0.00	225.23
13	14/nsc1/iv	Filler joint iv)Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6 per cent bitumen by weight.	m	36.00					0.00	36.36
14	15.03/g/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade upto 5m height	cum	11,786.08					1,635.76	13,556.06
					Aggregate	0.900	cum	422.28		
					Cement	0.407	Ton	2,618.39		
					Sand	0.450	cum	422.28		

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Major Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
15	15.03/g/ii	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade Between 5 to 10 m height	cum	12,921.64	Aggregate	0.900	cum	422.28	1,635.76	14,702.97
					Cement	0.407	Ton	2,618.39		
					Sand	0.450	cum	422.28		
16	15.03/g/iii	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade Above 10 m	cum	14,299.92					0.00	14,442.92
17	15.03/h/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M35 Grade Pedestal	cum	11,975.71					0.00	12,095.47
18	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	77,427.65	Steel	1.050	Ton	2,618.39	2,749.31	80,978.73

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Major Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
19	15.09	Supplying, fitting and fixing in position true to line and level elastomeric bearing conforming to IRC: 83 (Part-II) section IX and clause 2005 of MoRTH specifications complete including all accessories as per drawing and Technical Specifications.	cc	3.19					0.00	3.22
20	15.10	Supplying, fitting and fixing in position true to line and level POT-PTFE bearing consisting of a metal piston supported by a disc or unreinforced elastomer confined within a metal cylinder, sealing rings, dust seals, PTFE surface sliding against stainless steel mating surface, complete assembly to be of cast steel/fabricated structural steel, metal and elastomer elements to be as per IRC: 83 part-I & II respectively and other parts conforming to BS: 5400, section 9.1 & 9.2 and clause 2006 of MoRTH Specifications complete as per drawing and approved technical specifications.	Ton	505.27					0.00	510.32
21	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	445.75					3.12	453.36
					Cement	0.001	Ton	2,618.39		
					Sand	0.002	cum	422.28		
22	16.01/b/i/c 2/ii	RCC Grade M30 For solid slab super-structure Approach Slab	cum	13,287.15					0.00	13,420.02

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Major Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
23	16.01/d/ii	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M40 For T beam and slab using batching plant, Transit Mixure and concrete pump Upto 5m	cum	14,396.84					1,837.05	16,396.23
					Aggregate	0.850	cum	422.28		
					Cement	0.500	Ton	2,618.39		
					Course Sand	0.400	cum	422.28		
24	16.01/e/ii	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M45 For T beam and slab using batching plant, Transit Mixure and concrete pump Upto 5m	cum	14,801.35					1,897.86	16,866.20
					Aggregate	0.850	cum	422.28		
					Cement	0.520	Ton	2,618.39		
					Course Sand	0.420	cum	422.28		
25	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	85,183.86					2,749.31	88,812.50
					Steel	1.050	Ton	2,618.39		

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Major Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
26	16.05	Cement concrete wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications	cum	18,782.51	Aggregate	0.860	cum	422.28	1,723.02	20,710.59
					Cement	0.450	Ton	2,618.39		
					Course Sand	0.430	cum	422.28		
27	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	2,711.68	Cement	0.035	Ton	2,618.39	186.85	2,927.52
					Sand	0.039	cum	422.28		
					Steel	0.018	Ton	2,618.39		
					Stone Chips/Aggregate	0.077	cum	422.28		
28	16.11	Drainage Spouts complete as per drawing and Technical specification	each	2,158.99	Structural Steel	0.004	Ton	2,618.39	10.47	2,191.15
29	16.12/Nsc	Reinforced cement concrete approach slab M-30 including reinforcement and formwork complete as per drawing and Technical specification	cum	15,325.00	Aggregate	0.900	cum	422.28	4,366.74	19,888.66
					Cement	0.400	Ton	2,618.39		
					Course Sand	0.450	cum	422.28		
					Steel	1.050	Ton	2,618.39		

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Major Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
30	16.13	PCC M15 ordinary Grade leveling course below approach slab complete as per drawing and Technical specification Below Approach Slab	cum	8,109.93	Cement	0.275	Ton	2,618.39	1,290.92	9,494.86
					Sand	0.450	cum	422.28		
					Stone Chips/Aggregate	0.900	cum	422.28		
31	16.16	Providing single gap(unitary) strip/seal type of expansion joint of movement capacity of 80 mm with fatigue tested structure section at the nosing and ancourage assembly complete as per approved drawing and standard specification to be installed under supervision of a specialist manufacture	Rm	41,863.77					0.00	42,282.41
32	16.17	Mastic asphalt (providing and laying 12mm thik mastic asphalt wearing coures on top of deck slab excluding prime coat with paving grade bitumem meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	532.56	Bitumen	0.003	Ton	2,618.39	15.03	553.07
					Lime	0.005	Ton	399.23		

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

FINISHER RATE

Major Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.014	cum	422.28		
33	17.01/a	laying apron complete as per drawing and Technical specification. Boulder	cum	2,280.25	Stone Bolder	1.200	cum	468.43	562.12	2,870.79
34	17.01/c	laying apron complete as per drawing and Technical specification. Cement concrete block (M-15grade) (Filter Blanket+Toe Wall)	cum	8,348.21	Aggregate	0.275	cum	422.28	2,662.70	11,121.02
					Cement	0.900	Ton	2,618.39		
					Sand	0.450	cum	422.28		
35	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	2,426.95	Aggregate	1.200	cum	422.28	506.74	2,963.03
36	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	1,655.65	Stone Bolder	1.200	cum	468.43	562.12	2,239.95

**Note: Finished Rate inclusive of 1% Labour Cess

Item Rate Analysis has been done considering

Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

NON SCHEDULE ITEM

Analysis of Non-Schedule Rate							
SUB-BASES, BASES (NON- BITUMINOUS) AND SHOULDERS							
Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs
4.1	401		Granular Sub-Base with Close Graded Material (Table:- 400-1) (Material Reuse)				
		A	Plant Mix Method				
			Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on				
			Unit = cum				
			Taking output = 225 cum (450 tonne)				
			a) Labour				
			Mate	day	0.400	550.000	220.00
			Mazdoor skilled	day	2.000	450.000	900.00
			Mazdoor Unskilled	day	8.000	400.000	3200.00
			b) Machinery				
			Wet mix plant @ 60 tonne capacity per hour	hour	6.000	5362.583	32175.50
			Electric generator 160 KVA	hour	6.000	2202.500	13215.00
			Water tanker	hour	4.500	992.333	4465.50
			Excavator Cum Loader	hour	6.000	1755.333	10532.00
			Tipper 6.5-10 tonne	tonne.	450 x L	63.897	258782.51
			Add 10 per cent of cost of carriage to cover loading and unloading				25878.25
			Motor Grader (BEML-092)	hour	6.000	5049.167	30295.00
			Vibratory roller 8-10 t	hour	6.000	1743.333	10460.00
			c) Material				
			Close graded Granular sub-base Material as per table 400-1				
			For Grading-II Material				
			26.5 mm to 9.5 mm @ 35 per cent	cum	100.800	0.00	0.00
			9.5 mm to 2.36 mm @ 25 per cent	cum	72.000	0.00	0.00
			2.36 mm below @ 40 per cent	cum	115.200	0.00	0.00
			Cost of water	KL	27.000	125.00	3375.00
4.1A		(i)	Rate per cum for grading-II Material				
			d) Overhead charges @ input on (a+b+c)				31479.90
			e) Contractor's profit @ input on (a+b+c+d)				42497.87
			Cost for 225 cum = a+b+c+d+e				464101.53
			Rate per cum = (a+b+c+d+e)/225				2062.67
						say	<u>2063.00</u>
			Labour Cess@1%				20.63
			Rate per cum =				<u>2083.63</u>

CHAPTER - 3

EARTH WORK, EROSION CONTROL AND DRAINAGE

Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs
3.12	305		Construction of Embankment with Material obtained from Borrowpits				
			Construction of embankment with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2.	cum		226.26	-----i
3.13	305		Construction of Embankment with Material Deposited from Roadway Cutting				
			Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2.	cum		160.20	-----ii
			So, Cost of Material obtained from Borrow Pit is Rs. =			66.06	----- (iii=i-ii)
3.14	305		Construction of Subgrade and Earthen Shoulders				
			Construction of sub-grade and earthen shoulders with approved material obtained from borrow pits with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum		312.34	-----iv
			So,				
			Construction of Subgrade and Earthen Shoulders				
			Construction of embankment with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2.	cum		246.28	----- (v=iv-iii)

CHAPTER-8								
TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES								
Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
8.7	802		Overhead Signs					
			Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans					
		A	Truss and Vertical Support					
			<i>Unit = tonne</i>					
			<i>Taking output = 1 tonne</i>					
			a) Labour					
			Mate	day	0.240	550.00	132.00	L-12
			Blacksmith	day	2.000	550.00	1100.00	L-02
			Mazdoor including for handling & fixing at site.	day	4.000	450.00	1800.00	L-13
			b) Material					
			Aluminium alloy/galvanised steel including 5 per cent wastage	tonne	1.050	120000.00	126000.00	M-060
			Add 1 per cent on cost of material for nuts, bolts and drilling and welding consumables				1260.00	
			Add 15 per cent on cost of material for fabrication of trusses as per approved design				19089.00	
			c) Machinery					
			Crane 3 tonne capacity	hour	3.000	1525.88	4577.65	P&M-013
			Truck	hour	0.500	1277.94	638.97	P&M-057
			d) Overhead charges @ 8% on (a+b+c)				12367.81	
			e) Contractor's profit @ 10% on (a+b+c+d)				16696.54	
			Rate per tonne = (a+b+c+d+e)				183661.97	
						say	<u>183662.00</u>	
8.7		B	Aluminium Alloy Plate for Over Head Sign					
			<i>Unit = sqm</i>					
			Taking output = 1 sqm					
			a) Labour					
			Mate	day	0.020	550.00	11.00	L-12
			Blacksmith	day	0.100	550.00	55.00	L-02
			Mazdoor	day	0.150	450.00	67.50	L-13
			b) Material					
			Aluminium alloy plate, 2 mm thick, fixed with high intensity grade sheeting vide clause 801.3	sqm	1.000	450.00	450.00	M-059
			Miscellaneous					
			Add 1 per cent of cost of labour for lifting arrangement, like ladders, pulleys, ropes etc				1.34	
			c) Overhead charges @ 8% on (a+b)				46.79	
			d) Contractor's profit @ 10% on (a+b+c)				63.16	
			Rate per sqm = (a+b+c+d)				694.78	
						say	<u>695.00</u>	
		Note	1. The cost of excavation and foundation concrete for fixing of vertical support system to be worked out separately as per the approved drawing/design and to be included in the estimate.					
			2. Lettering and arrow marks on sign board to be provided separately as per actual requirement. Rates for these items have been included separately in this chapter.					

CHAPTER-8								
TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES								
Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.

Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
8.22	809	Reinforced Cement Concrete Crash Barrier					
		Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-40 grade concrete with HYSD reinforcement conforming to IRC:21 and dowel bars 25 mm dia, 450 mm long at expansion joints filled with pre-moulded asphalt filler board, keyed to the structure on which it is built and installed as per design given in the enclosure to MOST circular No. RW/NH - 33022/1/94-DO III dated 24 June 1994 as per dimensions in the approved drawing and at locations directed by the Engineer, all as specified					
		Unit = Linear metre					
		Taking output = 10 m					
		(i) a) M 40 grade concrete					
		M 40 grade concrete	cum	3.000	11992.30	35976.90	0.00
		b) Labour					
		Mate	day	0.040	550.00	22.00	0.00
		Mazdoor	day	1.000	450.00	450.00	0.00
		c) Material					
		HYSD steel reinforcement including dowel bars	tonne	0.280	77427.65	21679.74	0.00
		Pre-moulded asphalt filler board	sqm	0.320	1084.84	347.15	0.00
		d) Overhead charges @ on (b+c)				4678.06	
		e) Contractor's profit @ on (b+c+d)				6315.39	
		Cost for 10 metre = a+b+c+d+e				69469.24	
		Rate per metre = (a+b+c+d+e)/10				6946.92	
					say	6947.00	

[illegible]

Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
14.18		(iv)	Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6 per cent bitumen by weight					
			<i>Unit = Running meter</i>					
			<i>Taking output = 12 m</i>					
			12m long x 100 mm wide x 10mm deep recess					
			a) Labour					
			Mate	day	0.02	550.00	11.00	L-12
			Mazdoor	day	0.50	400.00	200.00	L-13
			Mazdoor (Skilled)	day	0.10	450.00	45.00	L-15
			b) Material					
			Sand	cum	0.012	1612.00	19.34	M-005
			Volume $12 \times 0.1 \times 0.01 = 0.012$ cum					
			Weight $0.012 \times 1400 = 16.8$ kg					
			Bitumen	cum	0.001	42361.44	42.36	Schedule M-4 (xix)
			$16.8 \times 0.06 = 1$ kg					
			c) Overhead charges @ 0.25 on (a+b)				79.43	
			d) Contractor's profit @ 0.1 on (a+b+c)				39.71	
			Cost for 12 m = (a+b+c+d)				436.84	
			Rate per m = (a+b+c+d)/12				36.40	
						say	36.40	
							36.00	
		Note	For arriving at the final rate of filler joints per m					
			length and per cm depth of joint filling compound,					
			the rates at Sl. No. i), ii), iii) & iv) shall be added					

Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs
Rate Analysis performed on basis of sample analysis published in "Guidebook for Fabrication & Erection of Steel Structures" by Alok Baishya, BE(Civil), MBA and published by Institute for Steel Development & Growth (INSDAG)		Supply, fabrication, delivery at bridge site and erection of structural steel works as per IS 2062, including two coats of primer, one at shop and the other at site and two coats of aluminium paints including all labour, material, consumables etc.				
		Unit =1MT				
		Taking output = 1MT				
		a) Material				
		Structural Steel	tonne	1.05	61092.77	64147.41
		Permanent Bolts of tested quality	kg	7.00	105.00	735.00
		Electrode (@10 kg of weld metal (approx 275 nos. of 4mm electrode / ton of fabrication)	nos.	275.00	9.35	2570.70
		Electrode (@2 kg of weld metal (approx 275 nos. of 4mm electrode / ton of erection)	nos.	50.00	9.35	467.40
		DA Gas for fabrication	cum	2.00	734.40	1468.80
		DA Gas for erection	cum	0.50	734.40	367.20
		Oxygen for fabrication	cum	6.00	126.84	761.04
		Oxygen for erection	cum	1.50	126.84	190.26
		Red Lead Primer for fabrication	l	1.50	160.27	240.41
		Red Lead Primer for erection	l	1.00	160.27	160.27
		Paint	l	2.00	191.44	382.88
		Service bolts for erection	kg	7.00	105.00	735.00
		b) Labour				
		Marker for fabrication	day	0.60	450.00	270.00
		Fitter-I for fabrication	day	0.90	550.00	495.00
		Gas Cutter for fabrication	day	0.90	450.00	405.00
		Hammer man	day	0.30	400.00	120.00
		Welder-I for fabrication	day	1.50	450.00	675.00
		Foreman for fabrication	day	0.90	450.00	405.00
		Grinder for fabrication	day	0.90	450.00	405.00
		Work Supervisor for fabrication	day	0.30	550.00	165.00
		Unskilled for fabrication	day	6.00	400.00	2400.00
		Painter for fabrication	day	1.52	550.00	836.00
		Painter for erection	day	5.05	550.00	2777.50
		Sarang for erection	day	1.00	450.00	450.00
		Riggers for erection	day	8.00	400.00	3200.00
		Welder for erection	day	1.00	450.00	450.00
		Gas Cutter for erection	day	1.00	450.00	450.00
		Fitter for erection	day	1.00	550.00	550.00
		Semi skilled for erection	day	3.00	350.00	1050.00
		c) Machinery				
		Welding machine, grinding machine for fabrication	LS		890.40	890.40
		Tools, Zigs and fixtures for fabrication	LS		254.40	254.40
		Crane, inch, Welding generator, rectifier, transformer, etc. for erection	LS		890.40	890.40
		Tools, tackles, safety appliances, etc for erection	LS		254.40	254.40
		d)Overheads @ 22.5% on (a+b+c)				20164.38
		e)Contractor's profit @ 10% on (a+b+c+d)				10978.39
		Rate for per MT (a+b+c+d+e)				120762.24
					say	120762.00

Flexible Apron

Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
15.11	2507.2	Flexible Apron :Construction of flexible apron 1 m thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall					
		<i>Unit = cum</i>					
		<i>Taking Output = 1 cum</i>					
		a) Material					
		Stone	cum	1.00	575.00	575.00	M-003
		Stone Spalls	cum	0.20	66.00	13.20	M-008
		b) Labour					
		Mate	day	0.05	450.00	22.50	L-12
		Mason	day	0.25	500.00	125.00	L-11
		Mazdoor	day	1.00	400.00	400.00	L-13
		Add 1 per cent of cost of (a+b) for trimming and preparation of bed.				11.36	
		c) Overhead charges @ 8% on (a+b)				91.76	
		d) Contractor's profit @ 10% on (a+b+c)				123.88	
		Rate per cum = (a+b+c+d)				1362.70	
					<i>say</i>	1363.00	

Approach Slab

Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks / Input ref.
14.11	1500,1600,1700 & 2704	Reinforced cement concrete approach slab including reinforcement and formwork complete as per drawing and Technical specification <i>Unit = 1 cum</i> <i>Taking output = 1 cum</i>					
		a) Material					
		Cement concrete M30 Grade Refer relevant item of concrete in item 12.8(G) by using batching plant, excluding formwork i.e. per cum basic cost (a+b+c) (Excluding OH & CP)	cum	1.00	8235.60	8235.60	Item 12.8 (G)
		(Refer relevant item of concrete in item No. 13.8 (G) except that form work may be added at the rate of 2 per cent of cost against 3.5 per cent provided in the foundation concrete.				164.71	
		HYSD bar reinforcement Rate as per item No 14.2(Excluding OH & CP)	tonne	0.05	59458.22	2972.91	Item 14.2 A
		b) Overhead charges @ 22.5%on (a)				2558.97	
		c) Contractor's profit @ 10% on(a+b)				1393.22	
		Rate per cum (a+b+c)				15325.42	
					say	15325.00	
						15325.00	

BASES AND SURFACE COURSES (BITUMINOUS VG-40)

Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
5.6	507	Dense Graded Bituminous Macadam					
		Providing and laying dense graded bituminous macadam with 100-120 TPH batch type HMP producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.0 to 4.5 per cent by weight of total mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in					
		Unit = cum					
		Taking output = 195 cum (450 tonnes)					
		a) Labour					
		Mate	day	0.840	550.00	462.00	L-12
		Mazdoor working with HMP, mechanical broom, paver, roller, asphalt cutter and assistance for setting out lines, levels and layout of construction	day	16.000	400.00	6400.00	L-13
		Skilled mazdoor for checking line & levels	day	5.000	450.00	2250.00	L-15
		b) Machinery					
		Batch mix HMP @ 75 tonne per hour	hour	6.000	49595.33	297572.00	P&M-022
		Paver finisher hydrostatic with sensor control @ 75 cum per hour	hour	6.000	6852.67	41116.00	P&M-034
		Generator 250 KVA	hour	6.000	3441.41	20648.44	P&M-081
		Front end loader 1 cum bucket capacity	hour	6.000	1755.33	10532.00	P&M-017
		Tipper 10 tonne capacity	tonne.km	450 x L	547.69	246459.54	Lead =1 km & P&M-058
		Add 10 per cent of cost of carriage to cover cost of loading and unloading				24645.95	
		smooth wheeled roller 8-10 tonnes for initial break down rolling.	hour	6.00x0.65*	1072.88	4184.25	P&M-044
		Vibratory roller 8 tonnes for intermediate rolling.	hour	6.00x0.65*	1743.33	6799.00	P&M-059
		Finish rolling with 6-8 tonnes smooth wheeled tandem roller.	hour	6.00x0.65*	1191.66	4647.47	P&M-045

		c) Materials					
		Bitumen @ 4.25 per cent of weight of mix	tonne	19.130	42361.44	810374.35	M-074
		Aggregate					
		Total weight of mix = 450 tonnes					
		Weight of bitumen = 19.13 tonnes					
		Weight of aggregate = 450 - 19.13 = 430.87 tonnes					
		Taking density of aggregate = 1.5 ton/cum					
		Volume of aggregate = 287.25 cum					
		Grading - I (40 mm Nominal Size)					
		37.5 - 25 mm 22 per cent	cum	63.190	1214.45	76741.10	M-049
		25 - 10 mm 13 per cent	cum	37.340	1351.50	50464.92	M-046
		10 - 4.75 mm 19 per cent	cum	54.580	1224.55	66835.94	M-040
		4.75 mm and below 44 per cent	cum	126.390	1174.20	148407.14	M-030
		Filler @ 2 per cent of weight of aggregates.	tonne	8.620	2653.22	22870.79	M-188
		or					
		Grading - II (19 mm Nominal Size)					
		25 - 10 mm 30 per cent	cum	86.160	1351.50	116445.02	M-046
		10 - 5 mm 28 per cent	cum	80.430	1224.55	98490.56	M-040
		5 mm and below 40 per cent	cum	114.900	1174.20	134915.58	M-030
		Filler @ 2 per cent of weight of aggregates.	tonne	8.620	2653.22	22870.79	M-188
		* Any one of the alternative may be adopted as per approved design					
		(i) For Grading I (40 mm nominal size)					
		d) Overhead charges @ 0.08 on (a+b+c)				147312.87	
		e) Contractor's profit @ 0.1 on (a+b+c+d)				198872.37	
		Cost for 205 cum = a+b+c+d+e				2187596.12	
		Rate per cum = (a+b+c+d+e)/195 (For Grading I)				11218.44	
					say	11218.00	
		(ii) For Grading II (19 mm nominal size)					
		d) Overhead charges @ 0.08 on (a+b+c)				147905.04	
		e) Contractor's profit @ 0.1 on (a+b+c+d)				199671.80	
		Cost for 205 cum = a+b+c+d+e				2196389.78	
		Rate per cum = (a+b+c+d+e)/195 (For Grading-II)				11263.54	
					say	11264.00	

		Note	*1. Although the roller are required only for 3 hours as per norms of output, but the same have to be available at site for six hours as the hot mix plant and paver will take six hours for mixing and paving the output of 450 tonnes considered in this analysis. To cater for the idle period of these rollers, their usage rates have been multiplied by a factor of 0.65.					
			2.Quantity of Bitumen has been taken for analysis purpose. The actual quantity will depend upon job mix formula.					
			3. Labour for traffic control, watch and ward and other miscellaneous duties at site including sundries have been included in administrative overheads of the contractor.					
			4. In case DBM is laid over freshly laid tack coat, provision of mechanical broom and 2 mazdoors shall be deleted as the same has been included in the cost of tack coat.					
			5. The individual density for each size of aggregates to be used for construction i.e. 37.5-25 mm, 25-10 mm etc. should be found in the laboratory and accordingly the quantities should be ammended for use in field. The average density of 1.5 tonne/cum is only a reference density in this Data Book.					
			6. The individual percentage of aggregates should be calculated from the total weight of dry aggregates i.e.. excluding the weight of bitumen. The weight of filler will also be 2 per cent by weight of dry aggregates.					

5.8	509	Bituminous Concrete					
		Providing and laying bituminous concrete with 100-120 TPH batch type hot mix plant producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.4 to 5.6 per cent of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all					
		Unit = cum					
		Taking output = 191 cum (450 tonnes)					
		a) Labour					
		Mate	day	0.840	550.00	462.00	L-12
		Mazdoor working with HMP, mechanical broom, paver, roller, asphalt cutter and assistance for setting out lines, levels and layout of construction	day	16.000	400.00	6400.00	L-13
		Skilled mazdoor for checking line & levels	day	5.000	450.00	2250.00	L-15
		b) Machinery					
		Batch mix HMP @ 75 tonne per hour	hour	6.000	49595.33	297572.00	P&M-022
		Paver finisher hydrostatic with sensor control @ 75 cum per hour	hour	6.000	6852.67	41116.00	P&M-034
		Generator 250 KVA	hour	6.000	3441.41	20648.44	P&M-081
		Front end loader 1 cum bucket capacity	hour	6.000	1755.33	10532.00	P&M-017
		Tipper 10 tonne capacity	tonne.km	450 x L	547.69	246459.54	Lead =1 km & P&M-058
		Add 10 per cent of cost of carriage to cover cost of loading and unloading				24645.95	
		Smooth wheeled roller 8-10 tonnes for initial break down rolling.	hour	6.00x0.65*	1072.88	4184.25	P&M-044
		Vibratory roller 8 tonnes for intermediate rolling.	hour	6.00x0.65*	1743.33	6799.00	P&M-059
		Finish rolling with 6-8 tonnes smooth wheeled tandem roller.	hour	6.00x0.65*	1191.66	4647.47	P&M-045
		c) Material					
		i) Bitumen@ 5 per cent of weight of mix	tonne	22.500	42361.44	953132.40	M-074
		ii) Aggregate					
		Total weight of mix = 450 tonnes					
		Weight of bitumen = 22.5 tonnes					
		Weight of aggregate = 450 -22.50 = 427.50 tonnes					
		Taking density of aggregate = 1.5 ton/cum					
		Volume of aggregate = 285 cum					
		Grading - I (19 mm Nominal Size)					
		20 - 10 mm 35 per cent	cum	99.750	1399.51	139601.46	M-045
		10 - 5 mm 23 per cent	cum	65.550	1224.55	80269.25	M-040
		5 mm and below 40 per cent	cum	114.000	1174.20	133858.80	M-030
		Filler @ 2 per cent of weight of aggregates.	tonne	8.620	2653.22	22870.79	M-188
		or					
		Grading - II (13 mm Nominal Size)					
		13.2 - 10 mm 30 per cent	cum	85.500	1358.50	116151.75	M-044
		10 - 5 mm 25 per cent	cum	71.250	1224.55	87249.19	M-040
		5 mm and below 43 per cent	cum	122.550	1174.20	143898.21	M-030
		Filler @ 2 per cent of weight of aggregates.	tonne	8.620	2653.22	22870.79	M-188
		*Any one of the alternative may be adopted as per approved design					

		(i)	for Grading-I (19 mm nominal size)					
			d) Overhead charges @ 0.08 on (a+b+c)				159635.95	
			e) Contractor's profit @ 0.1 on (a+b+c+d)				215508.53	
			Cost for 205 cum = a+b+c+d+e				2370593.82	
			Rate per cum = (a+b+c+d+e)/191				12411.49	
						say	12411.00	
5.8		(ii)	for Grading-II(13 mm nominal size)					
			d) Overhead charges @ 0.08 on (a+b+c)				159121.52	
			e) Contractor's profit @ 0.1 on (a+b+c+d)				214814.05	
			Cost for 205 cum = a+b+c+d+e				2362954.55	
			Rate per cum = (a+b+c+d+e)/191 (For Grading-II)				12371.49	
						say	12371.00	
		Note	*1. Although the rollers are required only for 3 hours as per norms of output, but the same have to be available at site for six hours as the hot mix plant and paver will take six hours for mixing and paving the output of 450 tonnes considered in this analysis. To cater for the idle period of these rollers, their usage rates have been multiplied by a factor of 0.65.					
			2.Quantity of Bitumen has been taken for analysis purpose. The actual quantity will depend upon job mix formula.					
			3. Labour for traffic control, watch and ward and other miscellaneous duties at site including sundries have been included in administrative overheads of the contractor.					
			4. In case BC is laid over freshly laid tack coat, provision of mechanical broom and 2 mazdoors shall be deleted as the same has been included in the cost of tack coat.					
			5. The individual density for each size of aggregates to be used for construction i.e. 37.5-25 mm, 25-10 mm etc. should be found in the laboratory and accordingly the quantities should be ammended for use in field. The average density of 1.5 tonne/cum is only a reference density in this Data Book					
			6. The individual percentage of aggregates should be calculated from the total weight of dry aggregates i.e.. excluding the weight of bitumen. The weight of filler will also be 2 per cent by weight of dry aggregates					

CHAPTER-9

PIPE CULVERTS

Sr No	to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs
9.2	2900	Laying Reinforced Cement Concrete Pipe NP4 / Prestressed Concrete Pipe on First Class Bedding in Single Row .				
		Laying Reinforced cement concrete pipe NP4/prestressed concrete pipe for culverts on first class bedding of granular material in single row including fixing collar with cement mortar 1:2 but excluding excavation, protection works, backfilling, concrete and masonry works in head walls and parapets .				
		Unit = metre				
		Taking output = 12.5 metres (5 pipes of 2.5 m length each)				
9.2	B	1200 mm dia				
		a) Labour				
		Mate	day	0.280	550.00	154.00
		Mason	day	1.000	400.00	400.00
		Mazdoor	day	6.000	450.00	2700.00
		b) Material				
		Sand at site	cum	0.090	1612.00	145.08
		Cement at site	tonne	0.070	9830.60	688.14
		RCC pipe NP-4/prestressed concrete pipe including collar	metre	12.500	8970.00	112125.00
		Granular material passing 5-6 mm sieve for class bedding	cum	5.000	1174.20	5871.00
		c) Overhead charges @ on (a+b)				9766.66
		d) Contractor's profit @ on (a+b+c)				13184.99
		Cost for 12.5 metres = a+b+c+d				145034.87
		Rate per metre= (a+b+c+d)/12.5				11602.79
					say	11603.00
		Note				
		1. In case of cement craddle bedding, quantity of PCC M15 is to be calculated as per design and priced separately and added .				
		2. The rate analysis does not include excavation, cement /masonry works in head walls, backfilling, protection works and parapet walls. The same are to be calculated as per approved design and drawings and priced separately on rates available under respective sections				

CHAPTER - 4						
SUB-BASES, BASES (NON- BITUMINOUS) AND SHOULDERS						
Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs
4.1	401	Granular Sub-Base with Close Graded Material (Table:- 400-1)				
	A	Plant Mix Method				
		Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401				
		Unit = cum				
		Taking output = 225 cum (450 tonne)				
		a) Labour				
		Mate	day	0.400	550.00	220.00
		Mazdoor skilled	day	2.000	450.00	900.00
		Mazdoor	day	8.000	400.00	3200.00
		b) Machinery				
		Wet mix plant @ 75 tonne capacity per hour	hour	6.000	5362.58	32175.50
		Electric generator 125 KVA	hour	6.000	2202.50	13215.00
		Water tanker 6 KL capacity 5 km lead with one trip per hour	hour	4.500	992.33	4465.50
		Front end loader 1 cum bucket capacity	hour	6.000	1755.33	10532.00
		Tipper 10 tonne (taking Lead, L= 2km)	tonne.km	450 x L	63.90	57507.23
		Add 10 per cent of cost of carriage to cover loading and unloading				5750.72
		Motor Grader 110 HP	hour	6.000	5049.17	30295.00
		Vibratory roller 8-10 t	hour	6.000	1743.33	10460.00
		c) Material				
		Close graded Granular sub-base Material as per table 400-1				
		For Grading-V Material				
		53 mm to 9.5 mm @ 50 per cent	cum	144.000	1325.49	190870.27
		9.5 mm to 2.36 mm @ 20 per cent	cum	57.000	1224.55	69799.35
		2.36 mm below @ 30 per cent	cum	86.400	1560.72	134846.21
		Cost of water	KL	27.000	125.00	3375.00
4.1A	(i)	Rate per cum for grading-V Material				
		d) Overhead charges @ on (a+b+c)				45408.94
		e) Contractor's profit @ on (a+b+c+d)				61302.07
		Cost for 225 cum = a+b+c+d+e				674322.79
		Rate per cum = (a+b+c+d+e)/225				2996.99
					say	<u>2997.00</u>
	Note	Any one of the grading for material may be adopted as per design				

8.38	Sug ges tive	Rumble Strips				
		Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.				
		Unit = sqm				
		Taking output = 1 sqm (including gaps)				
		The rate per sqm of premix carpet and road marking may be adopted				
6.1	511	Open - Graded Premix Surfacing By Manual Method				222.54
8.14		Road Marking With Hot Applied Thermo Plastic Compound				1002.44
		Rate per sqm =				1224.98

VOLUME VII
COST ESTIMATE

ABSTRACT OF COST

Road name- Churachandpur -Tuivai road section on NH-102B in the State of Manipur on EPC Mode
(PKG - IV-B)
(130+000 km to 141+029 km)

GENERAL ABSTRACT OF COST

Length of Road (KM)

:

11.029

DESCRIPTION OF WORKS				
A.	ROAD WORKS	TOTAL COST (IN LAKHS.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	% of Cost of Civil Works (% of C)
1	Site Clearance and Dismantling	0.41	0.04	0.35%
2	Earth work ,Subgrade and Erosion control	21.13	1.92	18.09%
3	Sub-Base & Base	20.53	1.86	17.57%
4	Bituminous Courses	11.82	1.07	10.12%
5	Junction Improvement (Major & Minor)	0.00	0.00	0.00%
6	Traffic signs, Road marking & other road appurtenances	3.20	0.29	2.74%
7	Passenger Shelter	0.00	0.00	0.00%
8	Busbay	0.00	0.00	
	Drainage and Protective Works			
9	Longitudinal Drains	3.73	0.34	3.19%
10	Retaining wall	20.40	1.85	17.46%
11	Breast wall	9.30	0.84	7.96%
12	Toe Wall	0.65	0.06	0.56%
B.	BRIDGES & CULVERTS			
13	Culvert	11.84	1.07	10.14%
14	Major Bridges	13.81	1.25	11.82%
15	Repairing & Rehabilitation of Minor Bridges	0.00	0.00	0.00%
C.	COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)	116.82	10.59	
D.	Maintenance for 5 years, i.e 2.5% on civil cost (C)	2.92		
E.	GST @ 12% of (C)	14.02		
F.	Contingencies @ 2.8% over Civil Cost (C)	3.27		
G.	Supervision Charges @ 3% of (C)	3.50		
H.	Agency Charges @3% of (C)	3.50		
I.	Escalation Cost @ 10% during Construction Period	11.68		
J.	TOTAL CONSTRUCTION COST * (C+D+E+F+G+H+I)=J	155.71	14.12	
K.	DEPARTMENTAL COST			
a.	LA Cost	9.20		
b.	R&R Cost	0.00		
c.	Utility Shifting(Electrical+PHE)	1.17		
d.	Environmental Budget +FC Clearance	11.68		
L.	Sub Total (K)	22.05		
M.	TOTAL CAPITAL COST (K+L)=M	177.76	16.12	

BILL
(ROAD PART)

Summary of Bill of Quantity

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	02.01/ii	Cutting of Girth 600-900mm	Each	6.00	723.48	4,341
2	02.01/iii	Cutting of Girth 900-1800mm	Each	25.00	1,373.64	34,341
3	02.01/iv	Cutting of Girth 1800-2700mm	Each	5.00	2,576.19	12,881
4	02.01/v	Cutting of Girth 2700mm more	Each	4.00	4,330.68	17,323
5	02.03/b	Clearing & grubbing of road by Mechanical means in	Ha	6.62	59,912.85	396,623
		Light Jungle				
6	02.04/i/c	Dismantling Structure RCC	cum	21.00	1,756.40	36,884
7	02.04/iii/b	Dismantling Structure Rubble Stone Masonry Cement	Cum	852.00	494.21	421,067
		Morter				
8	02.04/vii/a	Dismantle HP (300-600)	rm	3.00	267.64	803
9	02.04/vii/b	Dismantle HP (upto 600 - 900 mm dia)	rm	14.00	362.36	5,073
10	02.04/vii/c	Dismantle HP (above 900 mm dia)	rm	42.00	620.22	26,049
11	02.04/viii/e	Dismantle Flexible Pavement Granular	sqm	34,921.00	34.33	1,198,838
12	02.04/viii/f/ii	Dismantle Flexible Pavement Bituminous(Roller &	sqm	34,456.00	57.65	1,986,388
		Scarifier)				
Total of Bill						4,140,611

Bill No : 02. Earth work,Subgrade and Erosion control

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	02/nsc/1	Hydro Seeding On Cutting Surface	sqm	24,969.00	318.15	7,943,887
2	03.13	Embankment fill from Roadway Cutting	cum	79,402.00	161.80	12,847,244
3	03.14/Nsc	Subgrade and Earthen Shoulder Fill From Roadway	cum	46,552.40	248.74	11,579,445
		Cutting				
4	03.15	Compacting original ground supporting sub-grade	cum	14,427.86	87.52	1,262,726
5	03.19	Turfing	sqm	27,006.00	62.49	1,687,605
6	03.31	Excavation in Hill in Soil For Roadway	cum	606,069.60	213.50	129,395,860
7	03.32	Excavation for Roadway Ordinary Rock Mechanical	cum	151,517.40	307.61	46,608,267
		(Without Blasting)				
Total of Bill						211,325,034

Bill No : 03. Sub-Base & Base Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	04.01/Nsc1	GSB Close Graded GR V	Cum	33,835.55	3,568.63	120,746,559
2	04/nsc1	GSB Reuse	Cum	4,690.06	2,083.63	9,772,346
3	05.02	WMM	Cum	21,024.44	3,557.98	74,804,530
Total of Bill						205,323,434

Summary of Bill of Quantity

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	06.01/a	Prime Coat	sqm	80,071.00	59.96	4,801,057
2	06.02/i	Tack Coat(Bituminous Layer)	sqm	4,905.00	16.31	80,001
3	06.02/ii	Tack Coat(Granular Layer)	sqm	75,166.00	17.99	1,352,236
4	06/Nsc1	DBM GR II	cum	5,604.97	12,281.96	68,840,017
5	06/Nsc2	BC GR II	cum	3,202.84	13,471.59	43,147,347
Total of Bill						118,220,659

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	08.02/a	5 th km Stone	each	2.00	5,124.22	10,248
2	08.02/b	Ordinary km Stone	each	9.00	3,058.54	27,527
3	08.04	Boundary Stone	each	113.00	1,794.90	202,824
4	08.06	Paint on Steel Surface	sqm	36.00	85.91	3,093
5	08.11/i	90 cm equilateral triangle	each	69.00	5,394.55	372,224
6	08.11/iii	60 cm circular	each	44.00	4,899.10	215,560
7	08.11/iv	80 cm x 60 cm rectangular	each	6.00	6,177.18	37,063
8	08.11/vii	90 cm high octagon	each	3.00	8,660.79	25,982
9	08.12	Direction Sign(<.0.9 sqm)	sqm	257.00	12,575.43	3,231,886
10	08.13	Direction Sign(>.0.9 sqm)	sqm	4.00	13,268.69	53,075
11	08.14	Paint on Bituminous Surface	sqm	3,583.93	1,012.16	3,627,514
12	08.15/c/v	Road Delineators(100 cm long above Road)	each	950.00	1,073.82	1,020,129
13	08.18/A/b	Type-A, "W" Metal Beam Crash Barrier	Rm	6,139.00	3,367.42	20,672,591
14	08.20/ii	Road Stud/Road Markers	nos	4,758.00	387.48	1,843,630
15	08.22	Lighting on Bridges	nos	10.00	21,376.67	213,767
16	08/nsc/2	Convex Mirror for Blind Curve	nos	5.00	5,050.00	25,250

Summary of Bill of Quantity

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
17	08/nsc/4/a	Overhead Signs-Truss and Vertical Support	Ton	1.04	188,275.42	196,560
18	08/nsc/4/b	Overhead Signs-Aluminium Alloy Plate for Over Head	sqm	36.00	701.95	25,270
19	08/nsc/6	Sign Rumble Strip	sqm	21.00	1,237.23	25,982
20	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	26.24	221.12	5,803
21	14.03/a	Foundation PCC M15	cum	0.97	9,858.85	9,543
22	14.03/e/II	Foundation RCC M25	cum	5.70	10,828.08	61,763
23	14.08	Foundation Steel (HYSD)	MT	0.86	80,978.73	69,318
24	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	2.00	11,679.18	23,358
25	15.05	Sub Structure Steel (HYSD)	MT	0.30	80,978.73	24,294
Total of Bill						32,024,254

Bill No : 09. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	10,227.42	221.12	2,261,487
2	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed) Cement Morter(1:3)	cum	4,210.72	7,441.70	31,334,930
3	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	467.54	7,928.01	3,706,654
4	15.12	Sub Structure Weepholes per Meter	Rm	1.00	453.36	453
Total of Bill						37,303,524

Bill No : 10. Retaining wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	10,556.88	221.12	2,334,338
2	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	2,347.06	211.31	495,957
3	13.04	Sub Structure Filter Media	cum	10,131.14	1,799.20	18,227,943
4	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed) Cement Morter(1:3)	cum	6,258.18	7,441.70	46,571,498
5	14.03/a	Foundation PCC M15	cum	3,040.38	9,858.85	29,974,621
6	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	12,367.71	7,928.01	98,051,336
7	15.12	Sub Structure Weepholes per Meter	Rm	18,174.00	453.36	8,239,365
Total of Bill						203,895,059

Summary of Bill of Quantity

Bill No : 11. Breast wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	9,073.37	221.12	2,006,304
2	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	2,268.34	211.31	479,324
3	13.03/a	Sub Structure Backfill Granular Material	cum	983.12	1,529.75	1,503,920
4	13.03/b	Sub Structure Backfill Sandy Material	cum	421.34	1,135.00	478,215
5	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed) Cement Morter(1:3)	cum	4,274.02	7,441.70	31,805,990
6	14.03/a	Foundation PCC M15	cum	2,059.86	9,858.85	20,307,851
7	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	4,447.43	7,928.01	35,259,230
8	15.12	Sub Structure Weepholes per Meter	Rm	2,496.80	453.36	1,131,949
Total of Bill						92,972,782

Bill No : 12. Toe Wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	460.18	221.12	101,755
2	14.03/a	Foundation PCC M15	cum	65.74	9,858.85	648,121
3	14.03/b	Foundation PCC M20	cum	269.88	11,007.81	2,970,788
4	15.03/b/i	Sub Structure PCC M20	cum	259.50	10,643.51	2,761,991
Total of Bill						6,482,654

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02.01/ii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 600 mm to 900 mm	Each	6.00	723.48	4,340.88
2	02.01/iii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 900 mm to 1800 mm	Each	25.00	1373.64	34,341.00
3	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm	Each	5.00	2576.19	12,880.95
4	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm	Each	4.00	4330.68	17,322.72
5	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)	Ha	6.62	59912.85	396,623.07
6	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above				

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	21.00	1756.40	36,884.40
7	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	852.00	494.21	421,066.92
8	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	3.00	267.64	802.92
9	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	14.00	362.36	5,073.04
10	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	42.00	620.22	26,049.24
11	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier	sqm	34,921.00	34.33	1,198,837.93
12	02.04/viii/f/ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier	sqm	34,456.00	57.65	1,986,388.40
Total of Bill 01. Site Clearance and Dismantling						4,140,611.47

Item Rate Analysis has been done considering

Bill No : 02. Earth work,Subgrade and Erosion control

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface	sqm	24,969.00	318.15	7,943,887.35
2	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2	cum	79,402.00	161.80	12,847,243.60
3	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	46,552.40	248.74	11,579,444.97
4	03.15	Compacting original ground supporting subgrade Loosening of the ground upto a level of 500 mm below the subgrade level, watered, graded and compacted in layers to meet requirement of table 300-2 for subgrade construction.	cum	14,427.86	87.52	1,262,725.96
5	03.19	Turfing with Sods Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of sods and watering	sqm	27,006.00	62.49	1,687,604.94
6	03.31	Excavation in Hill Area in Soil by Mechanical Means Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with all lifts and lead upto 1000 metres	cum	606,069.60	213.50	129,395,859.60

Bill No : 02. Earth work,Subgrade and Erosion control

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	03.32	Excavation in Hilly Area in Ordinary Rock by Mechanical Means not Requiring Blasting. Excavation in hilly area in ordinary rock not requiring ballasting by mechanical means including cutting and trimming of slopes and disposal of cut material with all lift and lead upto 1000 metres	cum	151,517.40	307.61	46,608,267.41
Total of Bill 02. Earth work,Subgrade and Erosion control						211,325,033.83

Bill No : 03. Sub-Base & Base Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	33,835.55	3568.63	120,746,558.80
2	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401	Cum	4,690.06	2083.63	9,772,345.55
3	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	21,024.44	3557.98	74,804,529.92
		Total of Bill 03. Sub-Base & Base Courses				205,323,434.26

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	80,071.00	59.96	4,801,057.16
2	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	4,905.00	16.31	80,000.55
3	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	75,166.00	17.99	1,352,236.34
4	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	5,604.97	12281.96	68,840,017.34

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	3,202.84	13471.59	43,147,347.32
Total of Bill 04. Bituminous Courses						118,220,658.71

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone	each	2.00	5124.22	10,248.44
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone	each	9.00	3058.54	27,526.86
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	113.00	1794.90	202,823.70
4	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade	sqm	36.00	85.91	3,092.76
5	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle	each	69.00	5394.55	372,223.95

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
6	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular	each	44.00	4899.10	215,560.40
7	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	6.00	6177.18	37,063.08
8	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon	each	3.00	8660.79	25,982.37

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign asper IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	257.00	12575.43	3,231,885.51
10	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign asper IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	4.00	13268.69	53,074.76
11	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	3,583.93	1012.16	3,627,513.63

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
12	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming to IRC-79 and the drawings.) 120x120 -Road Delineator	each	950.00	1073.82	1,020,129.00
13	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fittings to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m	Rm	6,139.00	3367.42	20,672,591.38
14	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	4,758.00	387.48	1,843,629.84
15	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp	nos	10.00	21376.67	213,766.70

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
16	08/nsc/2	Convex Mirror For Blind Curve	nos	5.00	5050.00	25,250.00
17	08/nsc/4 /a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.	Ton	1.04	188275.42	196,559.54
18	08/nsc/4 /b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign	sqm	36.00	701.95	25,270.20
19	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.	sqm	21.00	1237.23	25,981.83

Item Rate Analysis has been done considering

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
20	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	26.24	221.12	5,803.07
21	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	0.97	9858.85	9,543.37
22	14.03/e/l	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.70	10828.08	61,763.37
23	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.86	80978.73	69,317.79
24	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	2.00	11679.18	23,358.36
25	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	0.30	80978.73	24,293.62
		Total of Bill 06. Traffic signs, Road marking & other road appurtenances				32,024,253.52

Bill No : 09. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	10,227.42	221.12	2,261,487.11
2	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,210.72	7441.70	31,334,929.91
3	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	467.54	7928.01	3,706,653.87
4	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	1.00	453.36	453.36
Total of Bill 09. Longitudinal Drains						37,303,524.25

Bill No : 10. Retaining wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	10,556.88	221.12	2,334,337.97
2	13.01/b/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	2,347.06	211.31	495,957.25
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	10,131.14	1799.20	18,227,943.49
4	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	6,258.18	7441.70	46,571,498.11
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	3,040.38	9858.85	29,974,620.79
6	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	12,367.71	7928.01	98,051,336.49
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	18,174.00	453.36	8,239,364.64
		Total of Bill 10. Retaining wall				203,895,058.72

Bill No : 11. Breast wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	9,073.37	221.12	2,006,303.80
2	13.01/b/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	2,268.34	211.31	479,323.56
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	983.12	1529.75	1,503,920.17
4	13.03/b	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Good Sandy Soil free from organic material	cum	421.34	1135.00	478,215.23
5	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,274.02	7441.70	31,805,989.52
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	2,059.86	9858.85	20,307,850.76
7	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,447.43	7928.01	35,259,229.87
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	2,496.80	453.36	1,131,949.25
		Total of Bill 11. Breast wall				92,972,782.15

Bill No : 12. Toe Wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	460.18	221.12	101,755.00
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	65.74	9858.85	648,120.80
3	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	269.88	11007.81	2,970,787.76
4	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m	cum	259.50	10643.51	2,761,990.85
Total of Bill 12. Toe Wall						6,482,654.41

BILL
(STRUCTURE PART)

Summary of Bill of Quantity

Bill No : 13. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
Foundation						
1	10.20	Foundation Culvert PCC M15	cum	538.41	8,998.47	4,844,884
2	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	7,896.69	221.12	1,746,115
End of Sub Total Foundation						6,590,999
Sub Structure						
3	10.06/a	Steel culvert for Sub-Structure	Ton	205.85	76,490.23	15,745,667
4	10.20/b	Culvert Backfilling culvert by Gravelly materials	cum	855.79	1,697.86	1,453,012
5	10.20/c	Filter Media culvert behind abutment, wing and return wall	cum	2,430.17	1,680.66	4,084,290
6	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	2,940.74	11,679.18	34,345,455
7	15.12	Sub Structure Weepholes per Meter	Rm	1,650.20	453.36	748,135
End of Sub Total Sub Structure						56,376,558
Super Structure						
8	06.02/i	Tack Coat(Bituminous Layer)	sqm	1,991.00	16.31	32,473
9	06/Nsc2	BC GR II	cum	129.42	13,471.59	1,743,426
10	10.06/b	Steel culvert for Super-Structure	Ton	73.39	76,490.23	5,613,541
11	16.01/a/i	Super Structure RCC M25 - Solid Slab Super Structure(Upto 5m)	cum	938.52	12,185.29	11,436,175
12	16.08	Protection Work RCC Railing M30 (Precast 12mm Aggregate)	Rm	362.00	2,927.52	1,059,762
13	16.11	Super Structure Drainage Spout	each	138.00	2,191.15	302,379
14	16.17	Super Structure Mastic Asphalt	sqm	1,991.00	553.07	1,101,162
End of Sub Total Super Structure						21,288,919
Protection Work						
15	10.02/Nsc	Protection Work Culvert M15	cum	1,706.88	8,998.47	15,359,344
16	13.01/a/i/Nsc	Excavation For Protection work	cum	6,934.05	221.12	1,533,258
17	16/nsc	Protection Work Curtain Wall- PCC (M-15)	cum	1,386.35	10,643.51	14,755,588
18	17.03/a	Protection Work Pitching on slopes laid over prepared filter media(Stone)	cum	1,052.79	2,239.95	2,358,195
End of Sub Total Protection Work						34,006,385
Miscellaneous Work						
19	08.05	Paint on Concrete Surface(2 Coat)	sqm	926.00	94.34	87,358
End of Sub Total Miscellaneous Work						87,358
Total						118,350,219

Item Rate Analysis has been done considering

Summary of Bill of Quantity

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	08.12	Direction Sign(<0.9 sqm)	sqm	2.00	12,575.43	25,151
2	17.01/c	Protection Work PCC M15 Cement Concrete	cum	8.16	11,121.02	90,748
3	17.02	Block at Protection Protection Work Filter material underneath	cum	34.63	2,963.03	102,610
4	17.03/a	pitching in slopes Protection Work Pitching on slopes laid over	cum	69.23	2,239.95	155,072
		prepared filter media(Stone)				
End of Sub Total						373,580
		Foundation				
5	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	1,301.04	221.12	287,686
6	13.01/a/ii	Foundation Earthwork Ordinary Soil (3m-6m)	cum	570.90	297.22	169,683
7	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	1,900.28	211.31	401,548
8	14.03/a	Foundation PCC M15	cum	631.36	9,858.85	6,224,484
9	14.03/g	Foundation RCC M30	cum	1,108.63	12,815.97	14,208,169
10	14.08	Foundation Steel (HYSD)	MT	155.21	80,978.73	12,568,709
End of Sub Total Foundation						33,860,278
		Sub Structure				
11	13.03/a	Sub Structure Backfill Granular Material	cum	164.77	1,529.75	252,057
12	13.03/b	Sub Structure Backfill Sandy Material	cum	500.31	1,135.00	567,852
13	13.04	Sub Structure Filter Media	cum	154.49	1,799.20	277,958
14	15.03/g/i	Sub Structure RCC M30 (Upto 5m)	cum	452.40	13,556.06	6,132,762
15	15.03/g/ii	Sub Structure RCC M30 (5m-10m)	cum	208.18	14,702.97	3,060,864
16	15.03/h/i	Sub Structure RCC M35 (Upto 5m)	cum	6.04	12,095.47	73,057
17	15.05	Sub Structure Steel (HYSD)	MT	99.99	80,978.73	8,097,063
18	15.09	Sub Structure Elastometric Bearing	cc	62,635.00	3.22	201,685
19	15.10	Sub Structure POT Cum PTFE Bearing	Ton	2,400.00	510.32	1,224,768
20	15.12	Sub Structure Weepholes per Meter	Rm	132.60	453.36	60,116
End of Sub Total Sub Structure						19,948,181
		Super Structure				
21	06.02/i	Tack Coat(Bituminous Layer)	sqm	1,241.13	16.31	20,243
22	06/Nsc2	BC GR II	cum	49.65	13,471.59	668,864
23	10.06/Nsc	Super Structure Steel(Structural Steel)	Ton	700.00	86,439.14	60,507,398
24	14/nsc1/i	Super Structure Filler (Copper Plate)	m	32.00	2,080.60	66,579
25	14/nsc1/ii	Super Structure Filler (Fibre Board)	m	32.00	704.98	22,559
26	14/nsc1/iii	Super Structure Filler (Premoulder Joint)	m	32.00	225.23	7,207
27	14/nsc1/iv	Super Structure Filler (Sealing Compound)	m	32.00	36.36	1,164

Summary of Bill of Quantity

Bill No : 14. Major Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
28	16.01/b/i/c2/i	Super Structure RCC M30 (T Beam & Slab)	cum	515.53	13,420.02	6,918,423
29	16.03	(Upto 5m) Super Structure Steel(HYSD)	MT	92.80	88,812.50	8,241,800
30	16.05	Cement concrete wearing coat M30	cum	23.39	20,710.59	484,421
31	16.08	Protection Work RCC Railing M30 (In situ	Rm	45.58	2,927.52	133,436
32	16.09	20mm Aggregate) Protection Work Steel Railing	Rm	180.08	4,718.36	849,682
33	16.11	Super Structure Drainage Spout	each	35.00	2,191.15	76,690
34	16.12/Nsc	Super Structure Approach Slab (M30)	cum	37.70	19,888.66	749,802
35	16.13	Super Structure PCC M15 Levelling Course	cum	15.92	9,494.86	151,158
36	16.16	Below Approach Slab Super Structure Strip Seal Expansion Joint	Rm	64.00	42,282.41	2,706,074
37	16.17	Super Structure Mastic Asphalt	sqm	1,241.13	553.07	686,432
End of Sub Total Super Structure						82,291,934
		Protection Work				
38	08/nsc/5	Crash Barrier RCC M40	m	225.66	6,996.27	1,578,778
End of Sub Total Protection Work						1,578,778
		Miscellaneous Work				
39	08.05	Paint on Concrete Surface(2 Coat)	sqm	907.90	94.34	85,651
End of Sub Total Miscellaneous Work						85,651
Total						138,138,402

Item Rate Analysis has been done considering

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
Foundation						
1	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork.	cum	538.41	8998.47	4,844,884.23
2	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	7,896.69	221.12	1,746,114.99
Sub Total of Foundation						6,590,999.22
Sub Structure						
3	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure	Ton	205.85	76490.23	15,745,666.83
4	10.20/b	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting b)Selected Granular Material in Filling	cum	855.79	1697.86	1,453,011.61
5	10.20/c	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting c)Filler Media behind abutment ,wing and return wall	cum	2,430.17	1680.66	4,084,289.51
6	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	2,940.74	11679.18	34,345,455.15

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	1,650.20	453.36	748,134.67
Sub Total of Sub Structure						56,376,557.77
Super Structure						
8	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	1,991.00	16.31	32,473.21
9	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	129.42	13471.59	1,743,425.82
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	73.39	76490.23	5,613,541.49
11	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	938.52	12185.29	11,436,174.93

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
12	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	362.00	2927.52	1,059,762.24
13	16.11	Drainage Spouts complete as per drawing and Technical specification	each	138.00	2191.15	302,378.70
14	16.17	Mastic asphalt (providing and laying 12mm thik mastic asphalt wearing coures on top of deck slab excluding prime coat with paving grade bitumem meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	1,991.00	553.07	1,101,162.37
Sub Total of Super Structure						21,288,918.76
		Protection Work				
15	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formvork. At Protection	cum	1,706.88	8998.47	15,359,344.47
16	13.01/a/i/Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	6,934.05	221.12	1,533,257.80
17	16/nsc	For Protection Work - cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade upto 5m height				

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	1,386.35	10643.51	14,755,587.51
18	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	1,052.79	2239.95	2,358,194.72
Sub Total of Protection Work						34,006,384.50
		Miscellaneous Work				
19	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	926.00	94.34	87,358.46
Sub Total of Miscellaneous Work						87,358.46
		Total of Bill 13. Culvert				118,350,218.71

Item Rate Analysis has been done considering

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	2.00	12575.43	25,150.86
2	17.01/c	laying apron complete as per drawing and Technical specification. Cement concrete block (M-15grade) (Filter Blanket+Toe Wall)	cum	8.16	11121.02	90,747.52
3	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	34.63	2963.03	102,609.73
4	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	69.23	2239.95	155,071.74
Sub Total of						373,579.85
Foundation						
5	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	1,301.04	221.12	287,685.96
6	13.01/a/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth 3 m to 6 m	cum	570.90	297.22	169,682.90

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	1,900.28	211.31	401,548.17
8	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	631.36	9858.85	6,224,483.54
9	14.03/g	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M30 Grade	cum	1,108.63	12815.97	14,208,168.82
10	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	155.21	80978.73	12,568,708.68
Sub Total of Foundation						33,860,278.07
Sub Structure						
11	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	164.77	1529.75	252,056.91
12	13.03/b	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Good Sandy Soil free from organic material	cum	500.31	1135.00	567,851.85
13	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	154.49	1799.20	277,958.41
14	15.03/g/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade upto 5m height	cum	452.40	13556.06	6,132,761.54

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
15	15.03/g/ii	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade Between 5 to 10 m height	cum	208.18	14702.97	3,060,864.29
16	15.03/h/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M35 Grade Pedestal	cum	6.04	12095.47	73,056.64
17	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	99.99	80978.73	8,097,063.21
18	15.09	Supplying, fitting and fixing in position true to line and level elastomeric bearing conforming to IRC: 83 (Part-II) section IX and clause 2005 of MoRTH specifications complete including all accessories as per drawing and Technical Specifications.	cc	62,635.00	3.22	201,684.70
19	15.10	Supplying, fitting and fixing in position true to line and level POT-PTFE bearing consisting of a metal piston supported by a disc or unreinforced elastomer confined within a metal cylinder, sealing rings, dust seals, PTFE surface sliding against stainless steel mating surface, complete assembly to be of cast steel/fabricated structural steel, metal and elastomer elements to be as per IRC: 83 part-I & II respectively and other parts conforming to BS: 5400, section 9.1 & 9.2 and clause 2006 of MoRTH Specifications complete as per drawing and approved technical specifications.	Ton	2,400.00	510.32	1,224,768.00
20	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications				

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			Rm	132.60	453.36	60,115.54
Sub Total of Sub Structure						19,948,181.09
		Super Structure				
21	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	1,241.13	16.31	20,242.83
22	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	49.65	13471.59	668,864.44
23	10.06/Nsc	Supply, fabrication, delivery at bridge site and erection of structural steel works as per IS 2062, including two coats of primer, one at shop and the other at site and two coats of aluminium paints including all labour, material, consumables etc. Structural steel	Ton	700.00	86439.14	60,507,398.00
24	14/nsc1/i	Filler joint i)Providing & fixing 2 mm thick corrugated copper plate in expansion joint complete as per drawing & Technical Specification.	m	32.00	2080.60	66,579.20
25	14/nsc1/ii	Filler joint Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification.	m	32.00	704.98	22,559.36

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
26	14/nsc1 /iii	Filler joint iii)Providing and fixing in position 20 mm thick premoulded joint filler in expansion joint for fixed ends of simply supported spans not exceeding 10 m to cater for a horizontal movement upto 20 mm, covered with sealant complete as per drawing and technical specifications.	m	32.00	225.23	7,207.36
27	14/nsc1 /iv	Filler joint iv)Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6 per cent bitumen by weight.	m	32.00	36.36	1,163.52
28	16.01/b/ i/c2/ii	RCC Grade M30 For solid slab super-structure Approach Slab	cum	515.53	13420.02	6,918,422.91
29	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	92.80	88812.50	8,241,800.00
30	16.05	Cement concrete wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications	cum	23.39	20710.59	484,420.70
31	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	45.58	2927.52	133,436.36
32	16.09	Mild steel railing complete as per drawing and Technical Specifications	Rm	180.08	4718.36	849,682.27
33	16.11	Drainage Spouts complete as per drawing and Technical specification	each	35.00	2191.15	76,690.25
34	16.12/N sc	Reinforced cement concrete approach slab M-30 including reinforcement and formwork complete as per drawing and Technical specification	cum	37.70	19888.66	749,802.48

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
35	16.13	PCC M15 ordinary Grade leveling course below approach slab complete as per drawing and Technical specification Below Approach Slab	cum	15.92	9494.86	151,158.17
36	16.16	Providing single gap(unitary) strip/seal type of expansion joint of movement capacity of 80 mm with fatigue tested structure section at the nosing and ancourage assembly complete as per approved drawing and standard specification to be installed under supervision of a specialist manufacture	Rm	64.00	42282.41	2,706,074.24
37	16.17	Mastic asphalt (providing and laying 12mm thik mastic asphalt wearing coures on top of deck slab excluding prime coat with paving grade bitumem meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	1,241.13	553.07	686,431.77
Sub Total of			Super Structure			82,291,933.87
		Protection Work				

Item Rate Analysis has been done considering

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
38	08/nsc/5	Reinforced Cement Concrete Crash Barrier-Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-40 grade concrete with HYSD reinforcement conforming to IRC:21 and dowel bars 25 mm dia, 450 mm long at expansion joints filled with pre-moulded asphalt filler board, keyed to the structure on which it is built and installed as per design given in the enclosure to MOST circular No. RW/NH - 33022/1/94-DO III dated 24 June 1994 as per dimensions in the approved drawing and at locations directed by the Engineer, all as specified	m	225.66	6996.27	1,578,778.29
Sub Total of Protection Work						1,578,778.29
		Miscellaneous Work				
39	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	907.90	94.34	85,651.29
Sub Total of Miscellaneous Work						85,651.29
Total of Bill 14. Major Bridge						138,138,402.45

Item Rate Analysis has been done considering

CIRCULAR

TA
Circulate amongst all
concerned, incl. Consultants.
17/3/19



No RW-NH-33044/10/2019-S&R(P&B)
Government of India
Ministry of Road Transport & Highways
S&R(P&B) Zone

Transport Bhawan, 01 Parliament Street, New Delhi-110 001

S.E., NH P & D Circle
Receipt No./Date: 417/08/19
File No. G-264
Recd. through Rail
Recd. By: H.S. D. S.

Dated: 7th March, 2019

To,

1. The Chief Secretaries of all the State Governments/ UTs
2. The Principal Secretaries/ Secretaries of all States/ UTs Public Works Department dealing with National Highways, other centrally sponsored schemes.
3. All Engineers-in-Chief and Chief Engineers of Public Works Department of States/ UTs dealing with National Highways, other centrally sponsored schemes.
4. The Director General (Border Roads), Seema Sadak Bhawan, Ring Road, New Delhi-110 010.
5. The Chairman, National Highways Authority of India, G-5 & 6, Sector-10, Dwarka, New Delhi-110 075.
6. The Managing Director, NHIDCL, PTI Building, New Delhi-110001
7. All CE-ROs, ROs and ELOs of the Ministry

Subject: Cost of construction for work on EPC mode reg.

While arriving at the total cost of construction for work under EPC mode, the agency charges etc. are to be provided as follows:

- a) Civil cost
 - b) GST - 12% of (a)
 - c) Contingencies - 2.8% of (a)
 - d) Supervision charges - 3% of (a)
 - e) Agency charges - 3% of (a)
2. For EPC contracts, no separate quality control and road safety charges are to be provided in the estimate as these are considered to be included in the civil cost.
 3. Similarly, avenue plantation is not to be provided in the estimate separately. However, the cost of forestation against the tree cutting in the ROW, need to be provided separately as per the demand of Forest/Other Concerned Authority.
 4. All the executive agency should strictly adhere to this circular.

Yours faithfully,

(Md Shadab Imam)

Assistant Executive Engineer-S&R (P&B)RS
For Director General (Road Development) & SS

No.RW/NH-37010/4/2010-EAP(Printing) Vol.-IV
Government of India
Ministry of Road Transport & Highways
(EAP Section)
Transport Bhawan, 1, Parliament Street, New Delhi - 110001

Dated: 05.03.2019

To,

1. The Principal Secretaries/Secretaries of all States/UTs Public Works Department dealing with National Highways, other Centrally Sponsored Schemes & State Schemes.
2. The Engineers-in-Chief and Chief Engineers of all States/UTs Public Works Department dealing with National Highways, other Centrally Sponsored Schemes & State Schemes.
3. The Chairman, National Highways Authority of India (NHAI), G-5&6, Sector-It), Dwarka, New Delhi-110 075.
4. The Managing Director, National Highway Infrastructure Development Corporation Ltd., 3rd floor, PTI Building, Parliament Street, New Delhi- 110 001

Sub: Standard EPC Agreement for National Highways and Centrally Sponsored road works proposed to be implemented on Engineering Procurement and Construction (EPC) mode of Contract.

Ref: Ministry's letter no. RW/NH-37010/4/2010/PIC-EAP (Printing) dated 28.11.2018.

Sir,

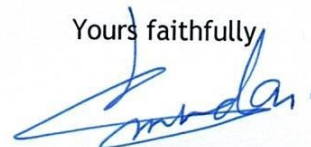
This is in supersession to Ministry's circular referred above. Standard EPC Agreement document incorporating the various amendments made from time to time is enclosed herewith.

2. This Standard EPC Agreement shall be used for all the National Highways and centrally sponsored road works proposed to be implemented on EPC Mode of Contract for which the bids will be invited in future from the date of issue of this circular.
3. This document is available on Ministry's Web Portal(www.morth.nic.in).
4. Contents of this circular may be brought to the notice of all the concerned for immediate compliance.



5. This issues with approval of Competent Authority

Yours faithfully



(Khushal Chand)
Chief Engineer (EAP)

Encl: As above

Copy to:

1. All Technical Officers at the Headquarters
2. Secretary General, Indian Roads Congress
3. Director, IAHE, NOIDA
4. All CE-ROs/SE-ROs of MoRT&H.

Copy for information to:

1. PPS to Secretary (RT&H), PPS to DG(RD) & SS, PPS to AS&FA, PPS to AS, PPS to JS(H), PS to ADG I/II.
2. NIC- with the request to upload on the Ministry's portal

Article 14

Maintenance

14.1 Maintenance obligations of the Contractor

- (i) The Contractor shall maintain the Project Highway for a period of [5 (five) / 10 (ten)] years, corresponding to the Defects Liability Period, commencing from the date of the Completion Certificate (the “**Maintenance Period**”). For the performance of its Maintenance obligations, the Contractor shall be paid:
 - (a) For flexible pavement with 5 years Maintenance Period including structures: no maintenance charges shall be paid for the first year; 0.50% of the Contract Price each for the second, third and fourth year; and 1% of the Contract Price for the fifth year
 - (b) For rigid pavement with 10 years Maintenance Period including structures: 0.25% of the Contract Price each for the first, second and third year, 0.5% of the Contract Price each for fourth, fifth, sixth and seventh year, and 0.75% of the Contract Price each for eighth, ninth and tenth year.
 - (c) For flexible perpetual pavement with 10 years maintenance period including structures: no maintenance charges shall be paid for the first year; 0.5% of the Contract Price each for the second, third and fourth year; 0.75% of the Contract Price each for the subsequent years till laying of the renewal layer or end of maintenance period, whichever is earlier. The requirement for the renewal layer shall be worked out based on the survey and investigation of the existing pavement and the cost of such renewal works shall be made separately to the Contractor based on the principles defined under clause 13.2(iii). After laying of the renewal layer, the Contractor shall be paid @ 0.5% of the original Contract Price each for the remaining years till the end of maintenance period.
 - (d) For stand-alone Bridge/ Tunnel works: the contractor shall be paid @ 0.25% of the Contract Price each for the first five years and @ 0.50% of the Contract Price each for the remaining period of five years.

Above amount for the performance of Contractors' Maintenance obligations shall be, inclusive of all taxes. The amount payable for maintenance shall be adjusted to reflect any increase or decrease arising out of variation in WPI to be determined in accordance with the provisions of Clause 19.12. It is further agreed that the Contract Price hereunder shall be reckoned with reference to the amount specified in Clause 19.1 (i), which shall be adjusted to the extent of Change of Scope and the works withdrawn under the provisions of Clause 8.3 (iii), but shall not include any price adjustments in pursuance of Clause 19.10.

VOLUME VIII
BILL OF QUANTITY

VARIABLE NOTATION
&
CHAINAGE DETAILS
(ROAD PART)

TCS TYPE	DESCRIPTION
TCS 1	2 Lane carriageway with hard shoulder in built up area with both side footpath cum RCC covered drain (existing pavement)
TCS 5	2 Lane carriageway with hard shoulder and one side toe wall & one side trapizoidal drain (existing pavement)
TCS 6	2 Lane carriageway with hard shoulder and both side trapizoidal drain (existing pavement)
TCS 6A	2 Lane carriageway with hard shoulder and both side trapizoidal drain (realignment strech)
TCS 7	2 Lane carriageway with hard shoulder and one side trapizoidal drain (existing pavement)
TCS 7A	2 Lane carriageway with hard shoulder and one side trapizoidal drain (realignment strech)
TCS 8	2 Lane carriageway with hard shoulder and one side breast wall (existing pavement)
TCS 8A	2 Lane carriageway with hard shoulder and one side breast wall (realignment strech)
TCS 9	2 Lane carriageway with hard shoulder and one side breast wall & one side drain (existing pavement)
TCS 9A	2 Lane carriageway with hard shoulder and one side breast wall & one side drain (realignment strech)
TCS 10	2 Lane carriageway with hard shoulder and one side ret wall (existing pavement)
TCS 11	2 Lane carriageway with hard shoulder and one side ret wall & one side drain (existing pavement)
TCS 11A	2 Lane carriageway with hard shoulder and one side ret wall & one side drain (realignment strech)
TCS 12	2 Lane carriageway with hard shoulder and one side ret wall & one breast wall (existing pavement)
TCS 12A	2 Lane carriageway with hard shoulder and one side ret wall & one breast wall (realignment strech)
TCS 13	2 Lane carriageway with hard shoulder and both side ret wall (existing pavement)
TCS 14	2 Lane carriageway with hard shoulder and one side toe wall & one side breast wall (existing pavement)
TCS 15A	2 Lane carriageway with hard shoulder and both side breast wall (realignment strech)

Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
136870	136970	2.7	97.3	TCS-7
136970	137620	13.1	636.9	TCS-11
137620	137920	2.6	297.4	TCS-7
137920	137970		50	TCS-5
137970	138470	2.7	497.3	TCS-8
138470	138570	2.6	97.4	TCS-7
138570	138670	2.6	97.4	TCS-8
138670	138720	2.6	47.4	TCS-7
138720	138770		50	TCS-11
138770	138820		50	TCS-7
138820	138870	2.6	47.4	TCS-11
138870	138970		100	TCS-7
138970	139170		200	TCS-9
139170	139470	5.2	294.8	TCS-7
139470	139720	8	242	TCS-11
139720	139820	2.7	97.3	TCS-12
139820	140020	2.6	197.4	TCS-8
140020	140170	2.6	147.4	TCS-5
140170	140220		50	TCS-8
140220	140620	5.2	394.8	TCS-11
140620	141029	110	299	TCS-7
Total Length		291	10738	

Summary of TCS Length

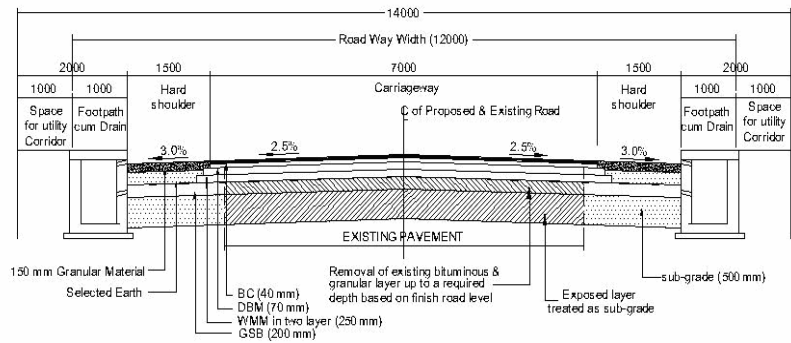
TCS No.	Length (m)	CD Length	Total Length
TCS-5	592		
TCS-7	2068		
TCS-8	2132		
TCS-9	500		
TCS-11	4957		
TCS-12	389		
TCS-14	100		
Total=	10738.00	291	11029

Variable Declaration

TCS-01

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	8.500	

Variable Declaration



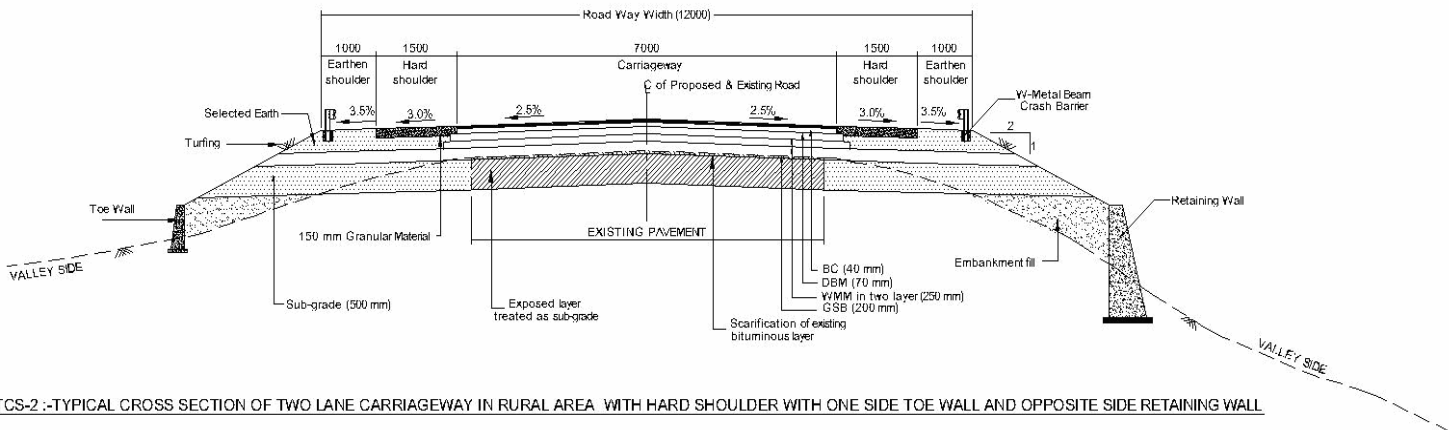
TCS-1 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN BUILT UP AREA WITH BOTH SIDE FOOTPATH CUM RCC RECTENGULAR DRAIN
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-02

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



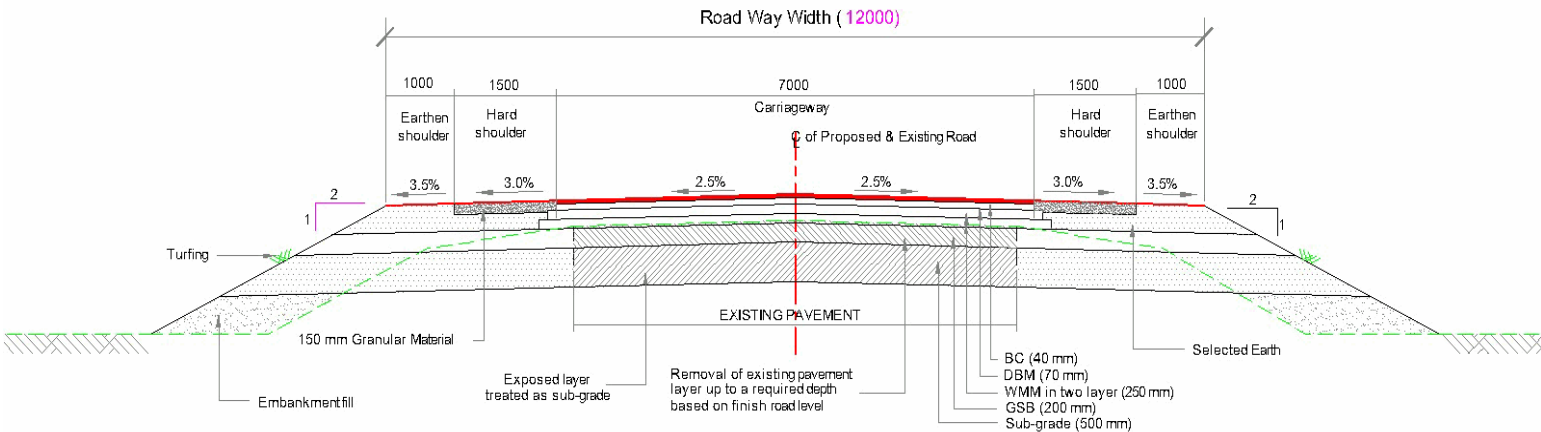
TCS-2 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY IN RURAL AREA WITH HARD SHOULDER WITH ONE SIDE TOE WALL AND OPPOSITE SIDE RETAINING WALL
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-03

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



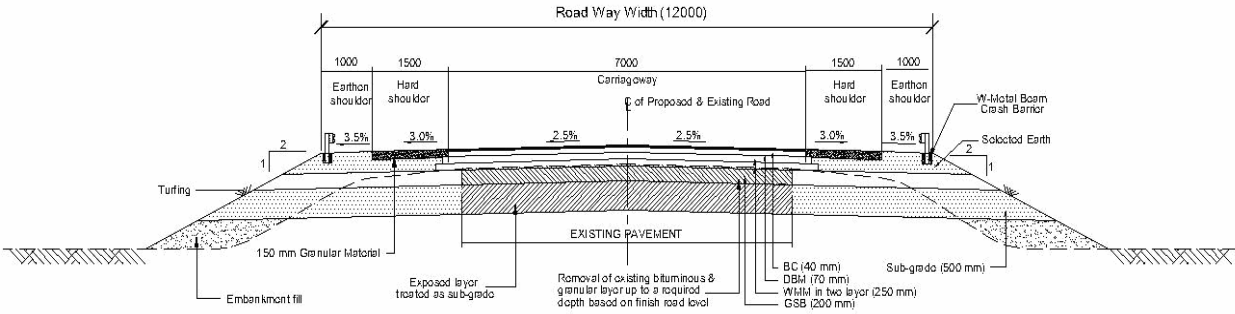
TCS- 3 :-Typical Cross Section of Two Lane Carriageway in Rural Area (Reconstruction of Existing Pavement)

Variable Declaration

TCS-04

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



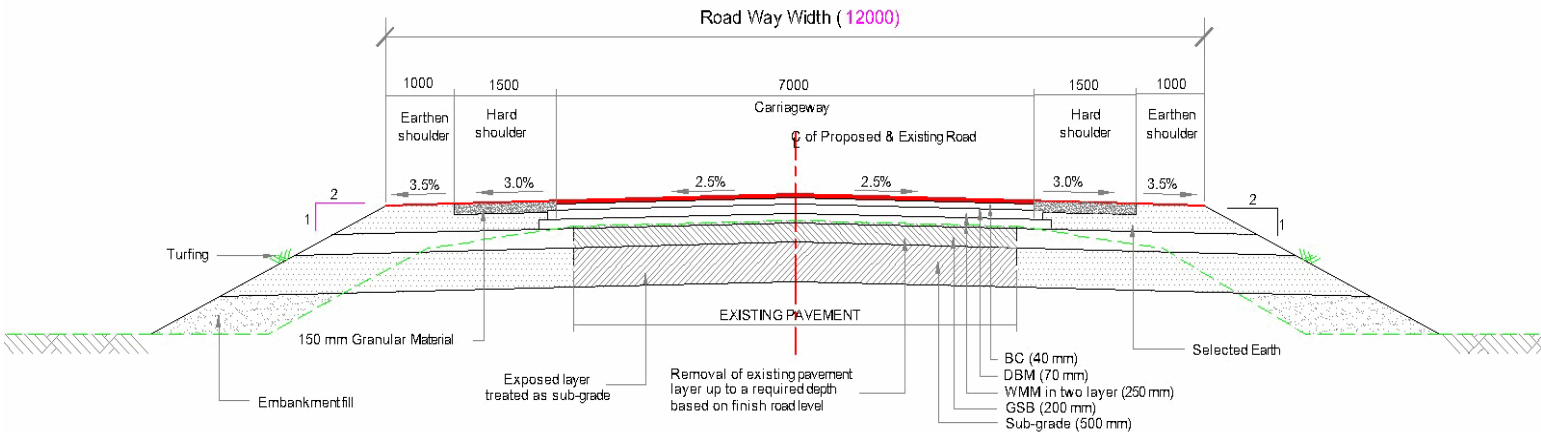
TCS- 4 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA

Variable Declaration

TCS-04A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



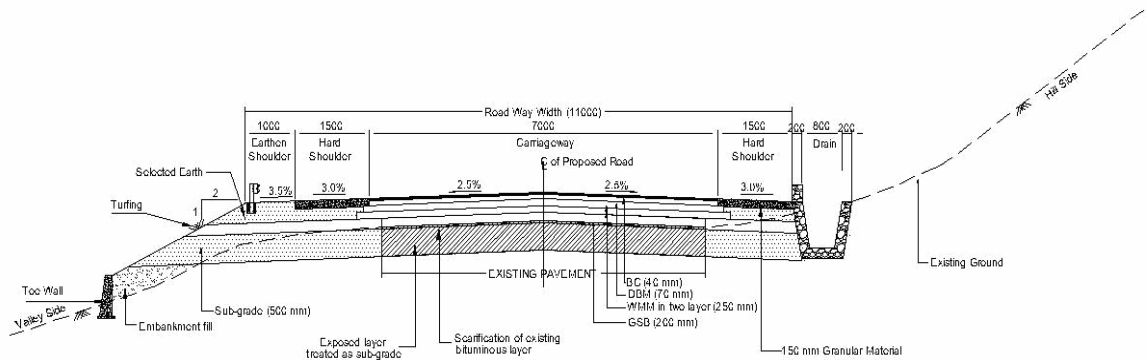
TCS- 3 :-Typical Cross Section of Two Lane Carriageway in Rural Area (Reconstruction of Existing Pavement)

Variable Declaration

TCS-05

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	592.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



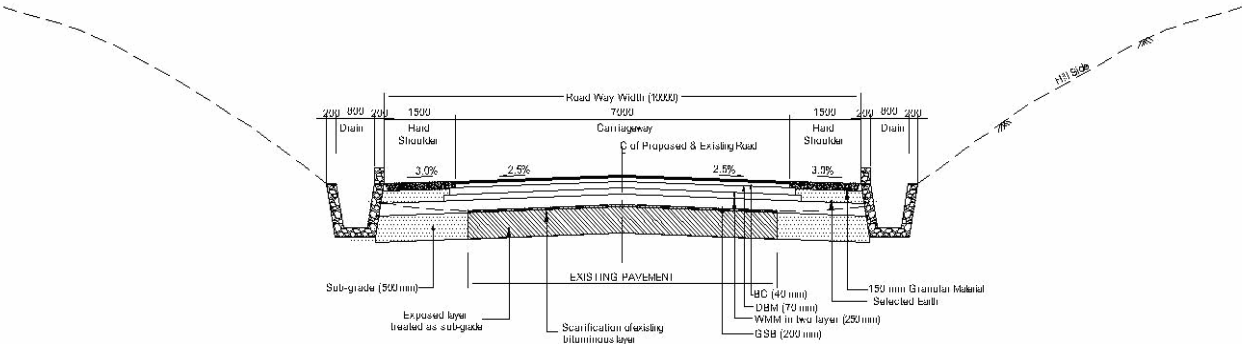
TCS-5 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH TOE WALL ON VALLEY SIDE & OPEN TRAPEZOIDAL DRAIN ON HILL SIDE
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-06

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	8.500	

Variable Declaration



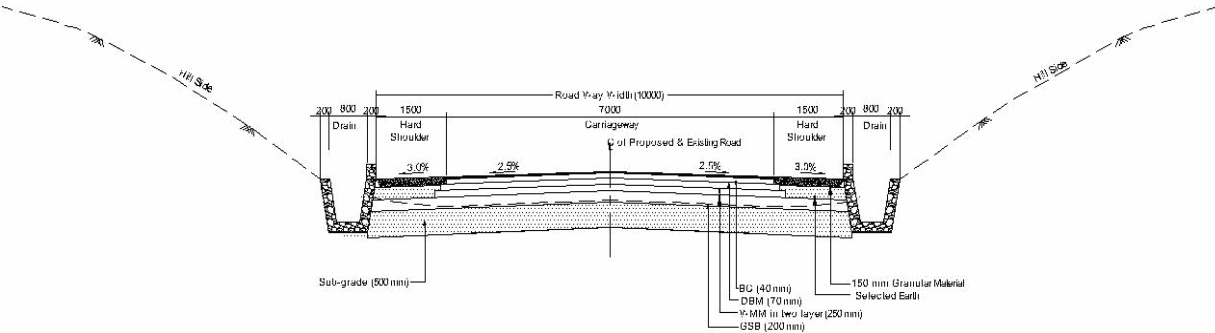
TCS-6 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH BOTH SIDE OPEN TRAPEZOIDAL DRAIN ON HILL SECTION
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-06A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	8.500	

Variable Declaration



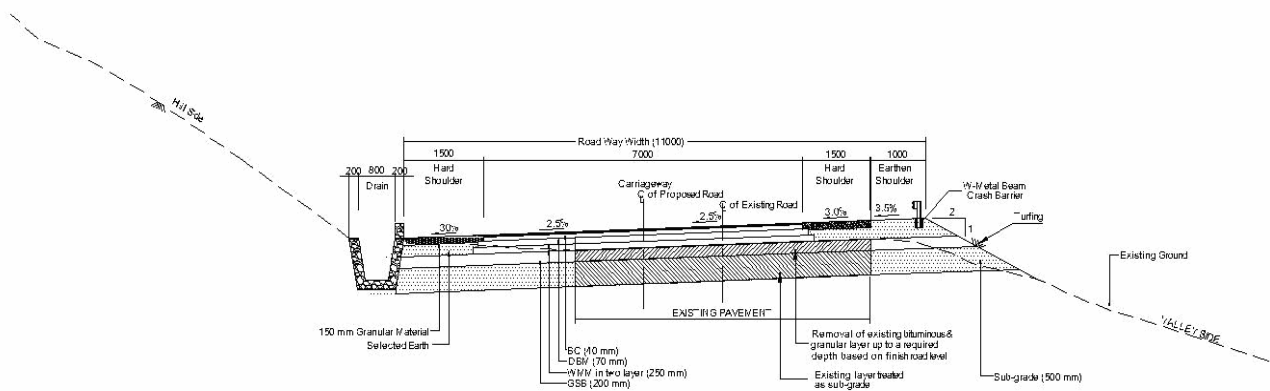
TCS-6A :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH BOTH SIDE OPEN TRAPEZOIDAL DRAIN ON HILL SECTION
(REALIGNMENT STRETCH)

Variable Declaration

TCS-07

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	2068.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



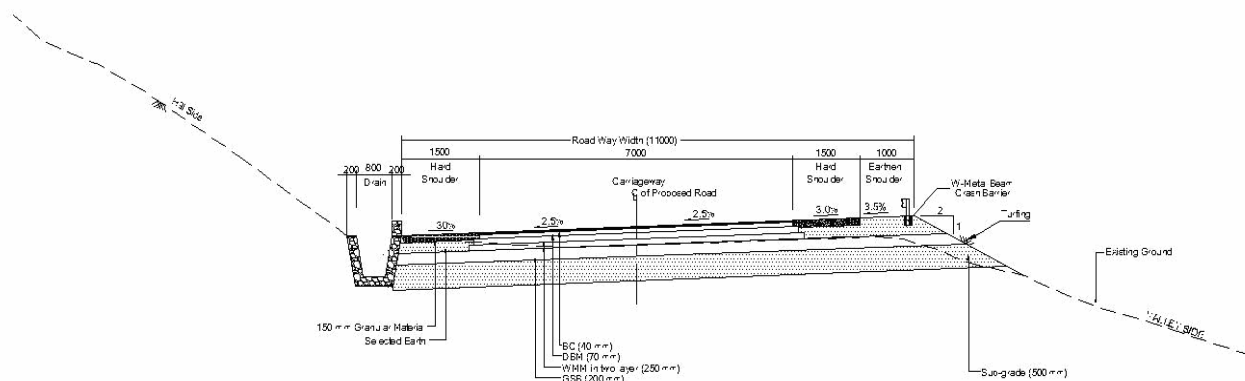
TCS-7 : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH OPEN TRAPEZOIDAL DRAIN ON HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-07A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



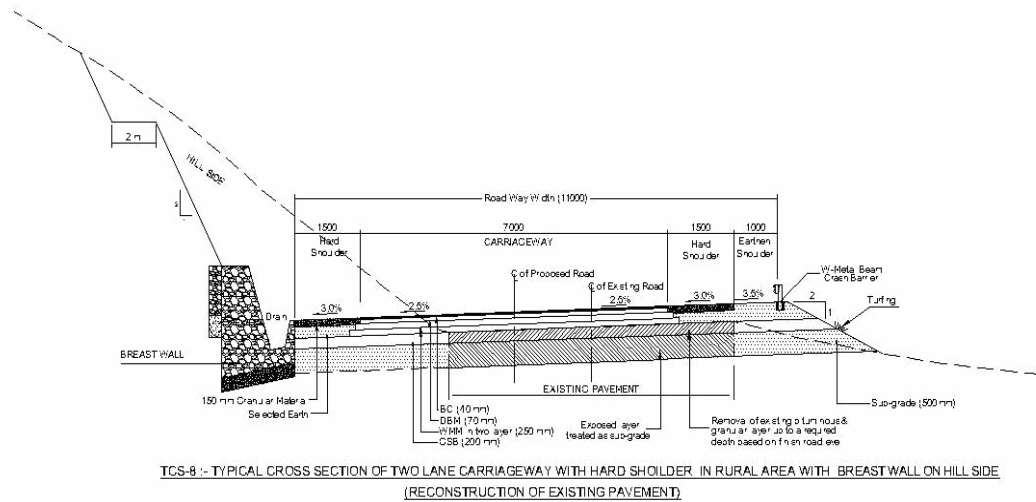
TCS-7A: TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH OPEN TRAPEZOIDAL DRAIN ON HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE
(NEW CONSTRUCTION)

Variable Declaration

TCS-08

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	2132.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration

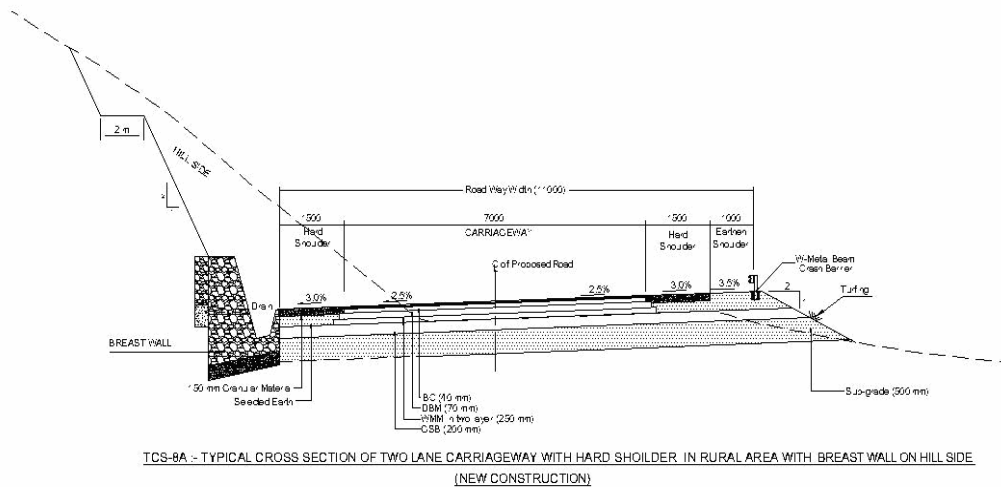


Variable Declaration

TCS-08A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration

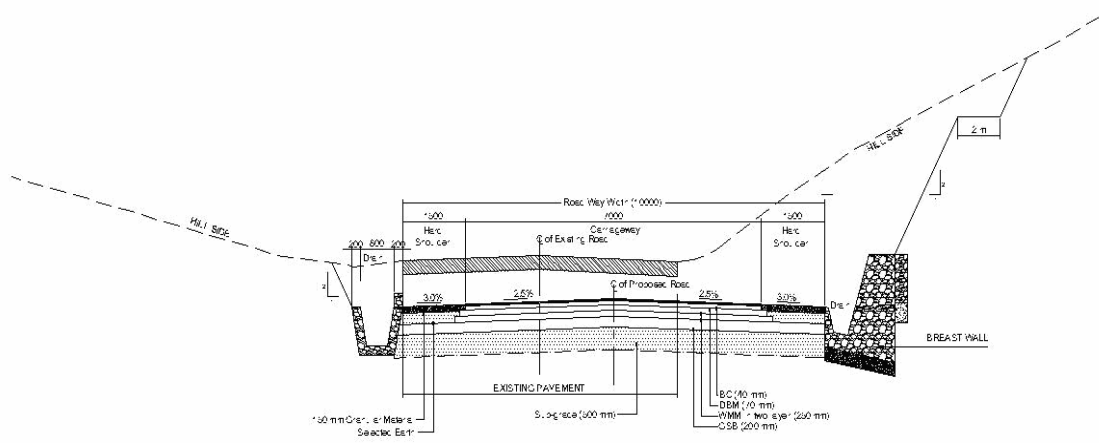


Variable Declaration

TCS-09

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	500.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	8.500	

Variable Declaration



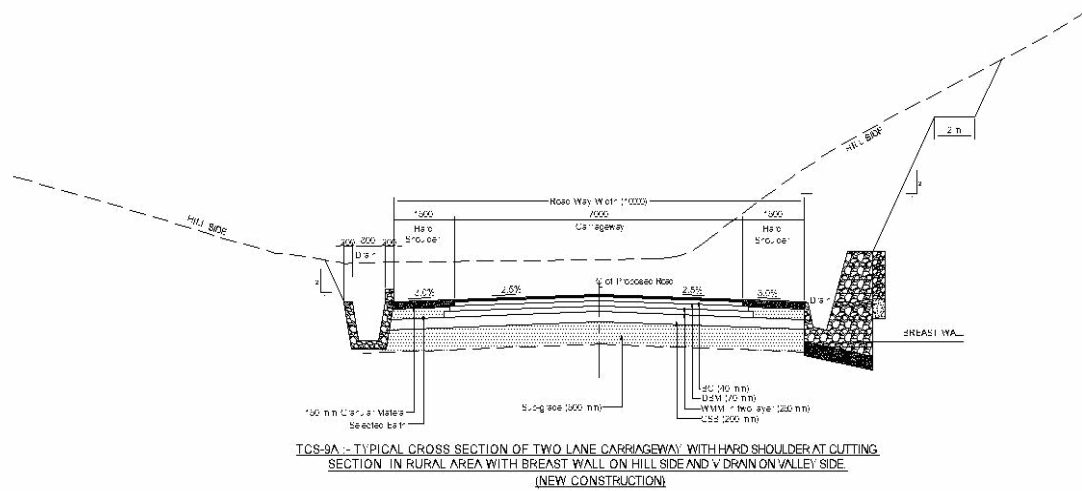
TCS-9 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER AT CUTTING SECTION IN RURAL AREA WITH BREAST WALL ON HILL SIDE AND 'V' DRAIN ON VALLEY SIDE. (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-09A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	8.500	

Variable Declaration

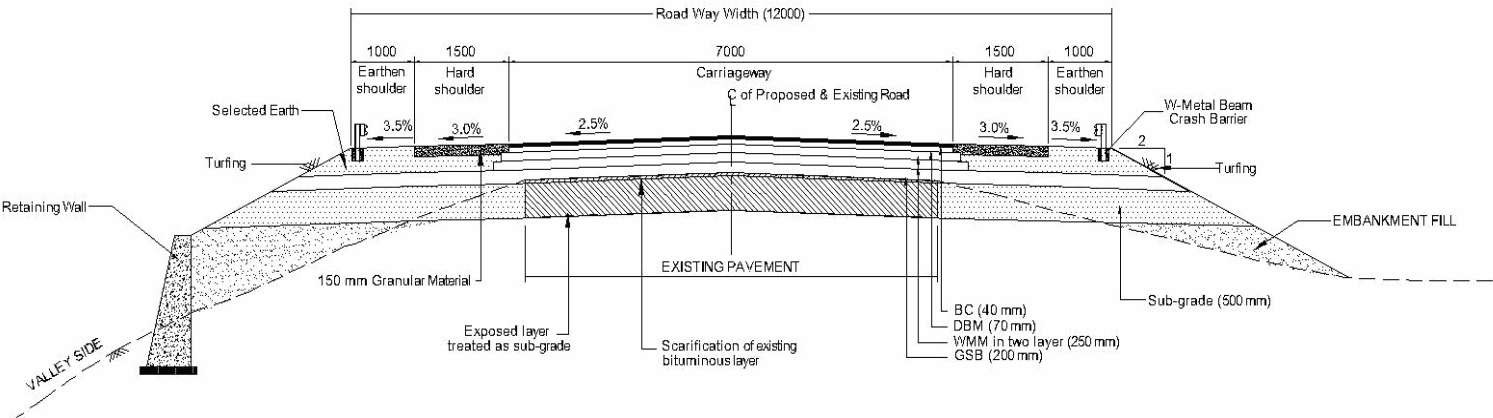


Variable Declaration

TCS-10

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



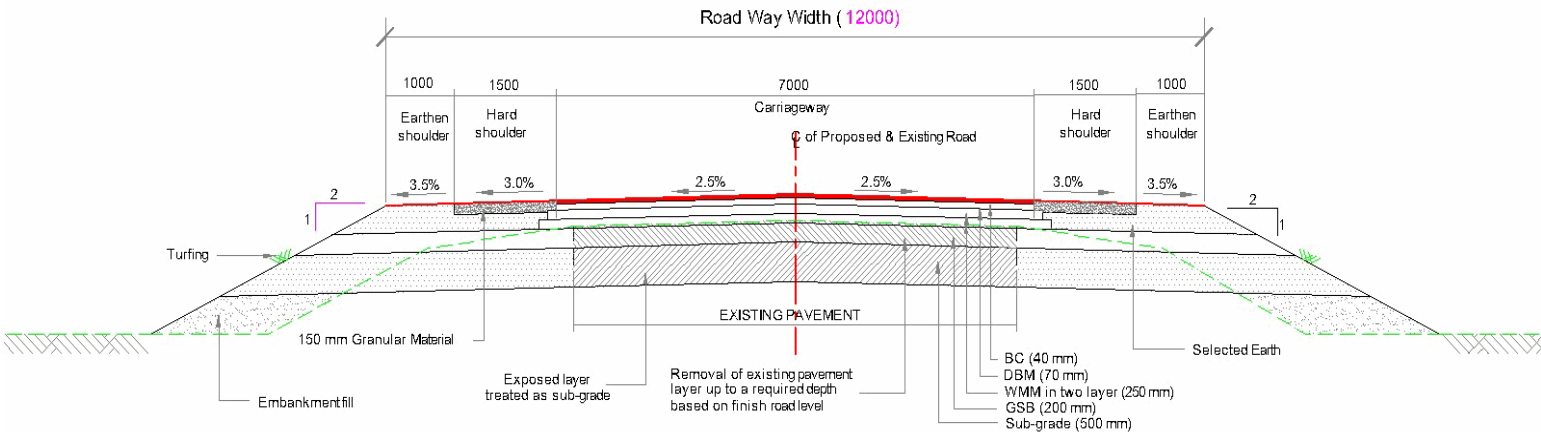
TCS-10 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-10A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



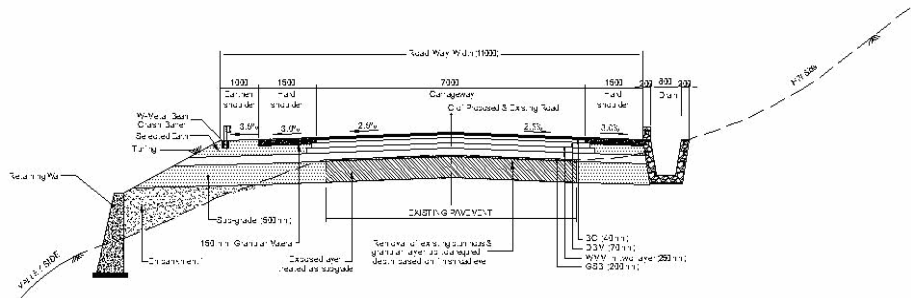
TCS- 3 :-Typical Cross Section of Two Lane Carriageway in Rural Area (Reconstruction of Existing Pavement)

Variable Declaration

TCS-11

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	4957.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



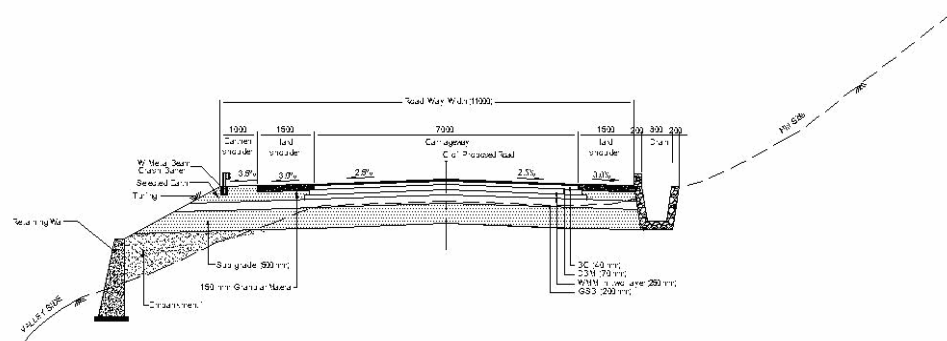
TCS-11 : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE AND OPEN TRAPEZOIDAL DRAIN ON HILL SIDE
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-11A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



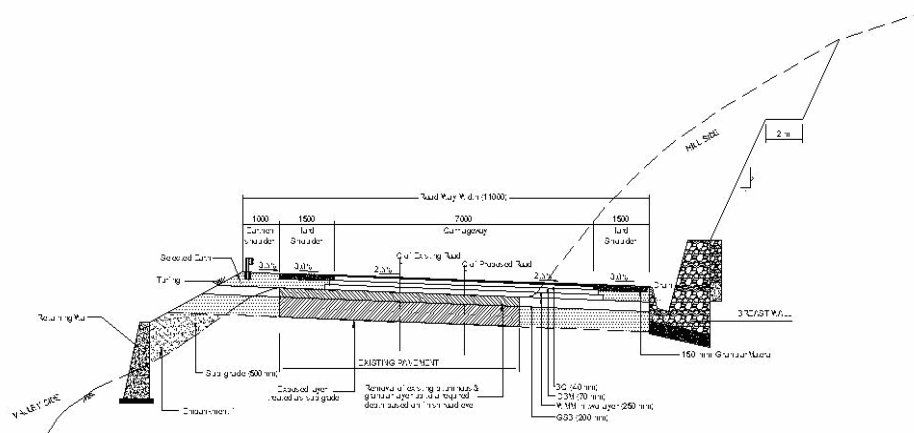
TCS-11A - TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE AND OPEN TRAPEZOIDAL DRAIN ON HILL SIDE
(NEW CONSTRUCTION)

Variable Declaration

TCS-12

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	389.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



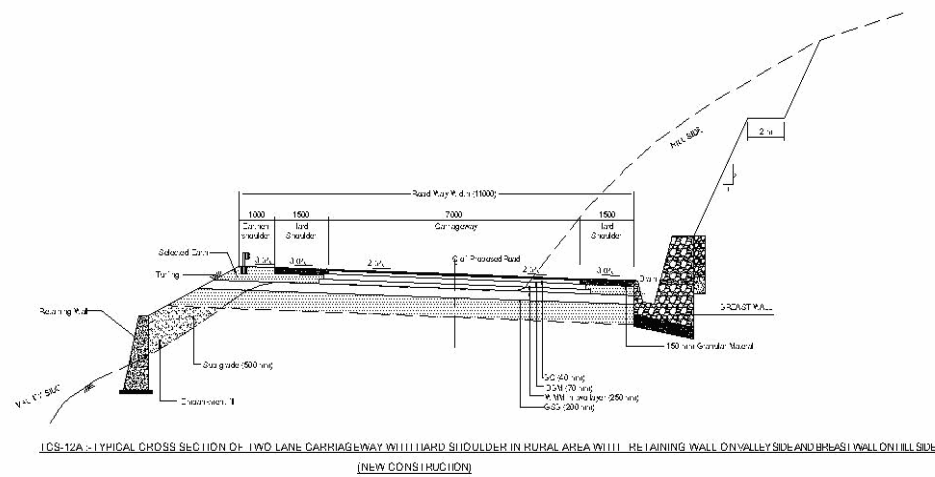
TCS-12 : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE AND BREAST WALL ON HILL SIDE (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-12A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration

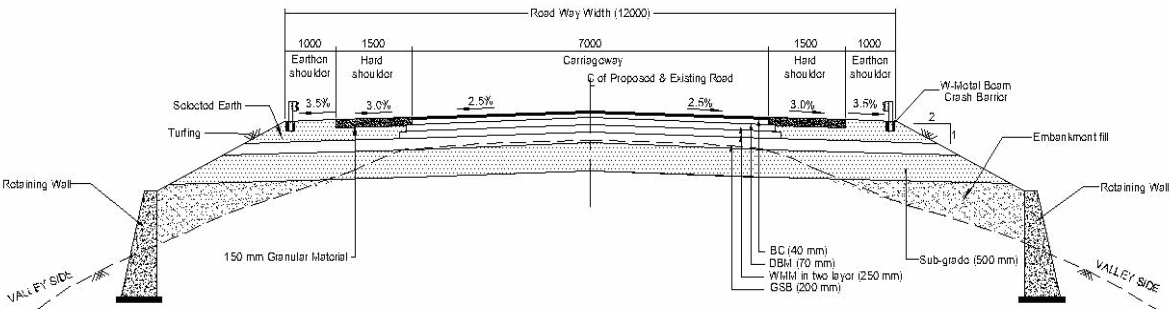


Variable Declaration

TCS-13

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration



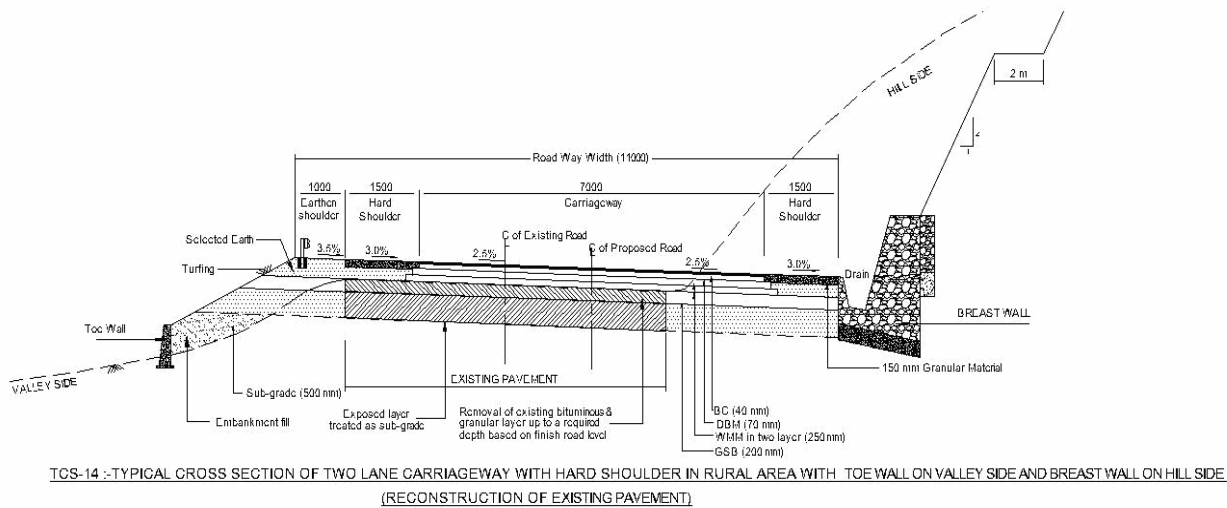
TCS-13 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH BOTH SIDE RETAINING WALL ON VALLEY SIDE
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-14

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	100.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	8.500	

Variable Declaration

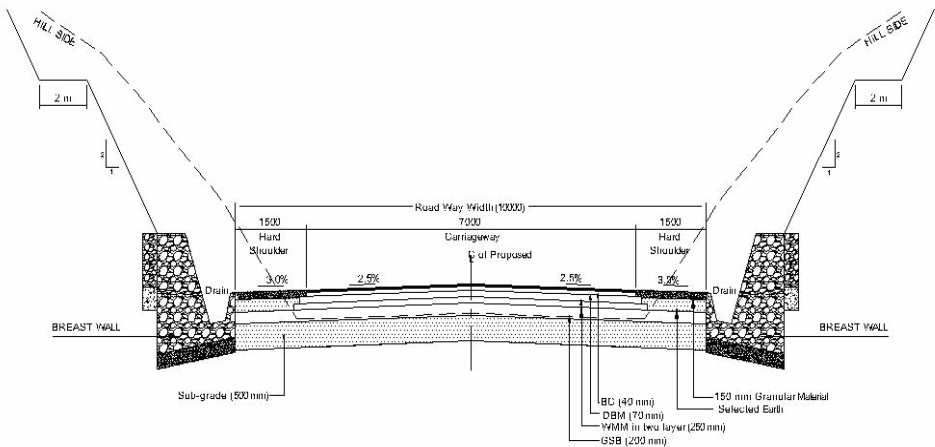


Variable Declaration

TCS-15A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	8.500	

Variable Declaration



TCS-15A :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH BOTH SIDE BREAST WALL
(NEW CONSTRUCTION)

Site Clearance and Dismantling

A.Tree Cutting

SI No	Girth Details		
1	Girth from 600 mm to 900 mm	6	Each
2	Girth from 900 mm to 1800 mm	25	Each
3	Girth from 1800 mm to 2700 mm	5	Each
4	Above 2700 mm	4	Each

..... Bill No- 01, Sl. No- 1
 Bill No- 01, Sl. No- 2
 Bill No- 01, Sl. No- 3
 Bill No- 01, Sl. No- 4

B.Clearing and grubbing

Clearing and Grubbing Area 6.62 Ha

..... Bill No- 01, Sl. No- 5

C. Dismantling

SI No A.Rubble stone masonry in cement mortar

1	Culvert	=	852	Cum
		Total=	852	cum

..... Bill No- 01, Sl. No- 7

SI No B.Total Dismantling of Reinforced cement concrete

1	Culvert	=	21	Cum
		Total=	21	cum

..... Bill No- 01, Sl. No- 6

SI No C.Total Dismantling Hume Pipe Culvert

1	up to 600 mm dia=	3	m
2	600-900 mm dia=	14	m
3	above 900 mm dia=	42	m

..... Bill No- 01, Sl. No- 8
 Bill No- 01, Sl. No- 9
 Bill No- 01, Sl. No- 10

SI No D.Total Dismantling of Bituminous layer

1	Road	=	34456	sqm
		Total=	34456	sqm

..... Bill No- 01, Sl. No- 12

SI No E.Total Dismantling of Granular Layer

1	Road	=	34921	sqm
	Refer backup calculation sheet			
		Total=	34921	sqm

..... Bill No- 01, Sl. No- 11

Site Clearance and Dismantling
(Calculation of Quantities for Dismantling)

Sl. No.	Brief Description	Unit	Survey ch.	No.	L	B / H	T	Quantity	Total Quantity
A) Stone Masonry	Head wall for existing pipe culvert H=h, Length=L, and thickness=t	Cum							
			135.860	2	5.6	2.6	0.8	23.30	
			136.375	2	5.6	2.6	0.8	23.30	
			136.530	2	6.6	2.6	0.8	27.46	
			137.640	2	5.5	2.5	0.8	22.00	
			137.755	2	5.6	2.6	0.8	23.30	
			139.035	2	5.5	2.5	0.8	22.00	
			139.290	2	5.5	2.5	0.8	22.00	
			140.434	2	5.8	2.8	0.8	25.98	
			140.490	2	5.6	2.6	0.8	23.30	
			148.698	2	5.5	2.5	0.8	22.00	
			148.815	2	5.5	2.5	0.8	22.00	
			148.900	2	5.6	2.6	0.8	23.30	
			149.079	2	5.8	2.8	0.8	25.98	
			149.372	2	5.5	2.5	0.8	22.00	
			149.410	2	5.5	2.5	0.8	22.00	
			149.600	2	5.6	2.6	0.8	23.30	
			149.907	2	5.6	2.6	0.8	23.30	
			150.233	2	5.8	2.8	0.8	25.98	
			150.725	2	5.6	2.6	0.8	23.30	
			151.014	2	5.6	2.6	0.8	23.30	
			151.047	2	5.5	2.5	0.8	22.00	
			151.165	2	5.5	2.5	0.8	22.00	
			151.306	2	5.2	2.2	0.8	18.30	
			151.837	2	5.5	2.5	0.8	22.00	
			153.700	2	5.5	2.5	0.8	22.00	
			155.650	2	5.6	2.6	0.8	23.30	
			155.839	2	5.8	2.8	0.8	25.98	
			156.120	2	5.8	2.8	0.8	25.98	
			156.556	2	5.8	2.8	0.8	25.98	
			157.800	2	5.8	2.8	0.8	25.98	
			160.235	2	5.5	2.5	0.8	22.00	
			A) Stone Masonry	Abutments for existing slab culvert H=h, Length=L, and thickness=t.	cum	134.748	2	3.5	3.00
135.231	2	3.2				3.00	0.50	9.60	
136.236	2	3.2				3.00	0.50	9.60	
136.940	2	3.5				3.00	0.50	10.50	
139.948	2	3.5				3.00	0.50	10.50	
140.790	2	3.0				3.00	0.50	9.00	
150.659	2	3.5				3.00	0.50	10.50	
151.557	2	3.0				3.00	0.50	9.00	
156.990	2	3.5				3.00	0.50	10.50	
157.075	2	3.2				3.00	0.50	9.60	
157.150	2	3.0				3.00	0.50	9.00	
157.832	2	2.8				3.00	0.50	8.40	
160.749	2	3.5				3.00	0.50	10.50	
Total =								851.81	

B) RCC	For Slab culvert	Cum	134.748	1	3.5	1.40	0.3	1.47	
			135.231	1	3.2	3.00	0.4	3.84	
			136.236	1	3.2	1.8	0.3	1.73	
			136.940	1	3.5	2.5	0.3	2.63	
			139.948	1	3.5	1.0	0.35	1.23	
			140.790	1	3.0	2.0	0.3	1.80	
			150.659	1	3.5	1.5	0.2	1.05	
			151.557	1	3.0	1.2	0.3	1.08	
			156.990	1	3.5	1.40	0.3	1.47	
			157.075	1	3.2	1.40	0.3	1.34	
			157.150	1	3.0	1.40	0.3	1.26	
			157.832	1	2.8	1.40	0.3	1.18	
			160.749	1	3.5	1.20	0.25	1.05	
								Total=	21.12
	Hume Pipe								
C) Hume Pipe	Dia upto 600 mm =	m		1	3.00				3.00
	Dia from 600-900 mm =	m		4	3.40				13.60
	Dia above 900mm=	m		13	3.20				41.60

Quantity Summary of Dismantling of Existing Culvert::

Total Dismantling of Rubble stone masonry in cement mortar=	851.81 cum		Bill No- 01, Sl. No- 7
Total Dismantling of Reinforced cement concrete=	21.118 cum		Bill No- 01, Sl. No- 6
Total Dismantling of up to 600 mm dia Hume Pipe=	3 m		Bill No- 01, Sl. No- 8
Total Dismantling of above 600 mm to 900 mm dia Hume Pipe=	14 m		Bill No- 01, Sl. No- 9
Total Dismantling of above 900 mm dia Hume Pipe=	42 m		Bill No- 01, Sl. No- 10

Site Clearance and Dismantling
(Quantity calculation for dismantling of Flexible Pavement)

TCS	Net Length (m)	Avg. Width (m)	Thickness of Bituminous Layer (m)	Thickness of Base Layer/Sub Base Layer (m)	Quantity of Bituminous Layer (Cum)	Quantity of Base Layer (Sqm)	Quantity of Base Layer for reuse (cum)
TCS-1	0	5.4	0.0650	0.110	0	0	0
TCS-5	592.1	5	0.0900	0.100	266	2961	296
TCS-6	0	5.2	0.0600	0.11	0	0	0
TCS-7	2067.5	5	0.0500	0.100	517	10338	1034
TCS-8	2131.7	5	0.0300	0.100	320	10659	1066
TCS-9	500	4.35	0.0350	0.100	76	2175	218
TCS-10	0	4.8	0.0400	0.100	0	0	0
TCS-11	4957.3	4.75	0.0550	0.100	1295	23547	2355
TCS-12	389.4	4.7	0.0500	0.120	92	1830	220
TCS-13	0	4.7	0.0300	0.150	0	0	0
TCS-14	100	4.6	0.0400	0.110	18	460	51
Total =					2584	51969	5238

Total quantity for dismantling (Bituminous layer)= 2584 cum

Quantity of Dismantelled Bituminous Material(sqm) (Assume avg thickness 75mm)	34456	sqm	

Bill No- 01, Sl. No- 12

Total quantity for dismantling (Granular Layer)= 5238 Sqm

Quantity of Granular Material(sqm) (Assume avg thickness 150mm)	34921	sqm	

Bill No- 01, Sl. No- 11

Quantity of stone material for reuse (@ 60%) = 3143 cum

Site Clearance and Dismantling (Tree Cutting List)

SI No	CHAINAGE(KM)	EASTING(M)	NORTHING(M)	GIRTH (M)	SIDE
19		130133	529842.026	2663054.658	1.1
20	130392	529853.272	2662857.048	1.5	LHS
21	130983	529463.939	2662765.035	1.5	RHS
22	131102	529504.703	2662652.834	0.8	RHS
23	131718	529195.116	2662389.904	1.3	LHS
24	131971	529153.434	2662180.487	1.5	LHS
25	132058	529068.112	2662154.818	1.9	RHS
26	132104	529026.245	2662133.362	1.5	RHS
27	132494	528903.515	2661863.325	1.5	RHS
28	132558	528847.007	2661832.871	0.9	RHS
29	132634	528778.639	2661810.116	0.9	RHS
30	132784	528705.070	2661699.912	1.1	RHS
31	135129	527573.889	2660211.632	1.3	RHS
32	135174	527557.633	2660180.289	0.9	RHS
33	135255	527492.311	2660132.017	2.9	RHS
34	135297	527457.639	2660108.190	3.1	RHS
35	135722	527106.761	2659943.694	1.1	LHS
36	136447	526800.002	2659461.419	0.8	LHS
37	136459	526803.828	2659445.105	1.3	RHS
38	136501	526839.882	2659422.874	0.9	RHS
39	136598	526863.986	2659340.983	0.8	RHS
40	136625	526853.640	2659317.549	1.2	RHS
41	136665	526827.849	2659287.399	1.5	RHS
42	136697	526813.310	2659258.740	2	RHS
43	136792	526737.560	2659213.084	3.2	LHS
44	137171	526573.244	2658957.633	2.1	RHS
45	137179	526565.807	2658950.526	1.3	RHS
46	137212	526570.370	2658915.728	2	RHS
47	137232	526587.140	2658896.911	4	LHS
48	137251	526571.365	2658876.701	1.2	RHS
49	137732	526262.071	2658901.529	1.3	RHS

50	138125	526136.493	2658684.515	0.9	RHS
51	138193	526069.767	2658675.948	0.8	LHS
52	138251	526047.731	2658628.484	0.8	LHS
53	138449	525940.766	2658455.747	1.5	RHS
54	138878	525925.124	2658257.491	1.8	RHS
55	139887	525974.444	2657555.646	1.2	RHS
56	139908	525988.191	2657539.753	1.3	RHS
57	140173	526080.952	2657343.596	1.2	RHS
58	141029	525653.851	2656810.442	0.7	LHS

Summary Girth

Girth from 300 mm to 600 mm	0	Nos		
Girth from 600 mm to 900 mm	6	Nos		Bill No- 01,
Girth from 900 mm to 1800 mm	25	Nos		Bill No- 01,
Girth from 1800 mm to 2700 mm	5	Nos		Bill No- 01,
Above2700 mm	4	Nos		Bill No- 01,

Site Clearance and Dismantling
(Clearing and Grubbing Road Land :)

TCS Type	Net Length(m)	Existing Road Width (m)	Width of TCS (m)	Width to be cleared and grubbed (m)	Area to be cleared and grubbed (Ha)
TCS-1	0.00	5.4	14	8.6	0.0
TCS-5	592.10	5	12	7	0.4
TCS-6	0.00	5.2	10	4.8	0.0
TCS-6A	0.00		12	12	0.0
TCS-7	2067.50	5	11	6	1.2
TCS-7A	0.00		11	11	0.0
TCS-8	2131.70	5	11	6	1.3
TCS-8A	0.00		11	11	0.0
TCS-9	500.00	4.35	10	5.65	0.3
TCS-9A	0.00		10	10	0.0
TCS-10	0.00	4.8	12	7.2	0.0
TCS-11	4957.30	4.75	11	6.25	3.1
TCS-11A	0.00		11	11	0.0
TCS-12	389.40	4.7	11	6.3	0.2
TCS-12A	0.00		11	11	0.0
TCS-13	0.00	4.7	11	6.3	0.0
TCS-14	100.00	4.6	11	6.4	0.1
TCS-15A	0.00		10	10	0.0

Total= 6.6

Total area of clearing & grubbing= 6.6 Ha **Bill No- 01, Sl. No- 5**

QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
130000	221.94	1.16	5496.75	50.00
130025	216.61	0	5481.88	14.50
130050	261.24	0	5973.13	0.00
130075	249.65	0.02	6386.13	0.25
130100	342.30	2.06	7399.38	26.00
130125	60.07	2.16	5029.63	52.75
130150	44.44	6.55	1306.38	108.88
130175	105.97	0	1880.13	0.00
130200	51.70	2.27	0.00	28.38
130225	104.88	4.72	1957.25	87.38
130250	252.95	0.08	4472.88	60.00
130275	48.10	0	3763.13	1.00
130300	5.48	32.01	669.75	400.13
130325	0.00	54.77	68.50	1084.75
130350	8.13	44.73	101.63	1243.75
130375	41.63	0.94	622.00	570.88
130400	98.01	1.07	1745.50	25.13
130425	155.01	0	3162.75	13.38
130450	145.11	0	3751.50	0.00
130475	160.83	0	3824.25	0.00
130500	295.31	8.36	5701.75	104.50
130525	136.50	0	5397.63	104.50
130550	61.19	19.9	2471.13	248.75
130575	241.90	0	3788.63	248.75
130600	189.65	0.01	5394.38	0.13
130625	206.88	0	4956.63	0.13
130650	187.11	1.76	4924.88	22.00
130675	175.82	0	4536.63	22.00
130700	227.59	0	5042.63	0.00
130725	238.55	0	5826.75	0.00
130750	204.41	0	5537.00	0.00
130775	59.37	0	3297.25	0.00
130800	72.65	2.03	1650.25	25.38
130825	131.10	0	2546.88	25.38

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
130850	193.25	0.44	4054.38	5.50
130875	166.93	0	4502.25	5.50
130900	45.80	18.11	2659.13	226.38
130925	42.69	31.75	1106.13	623.25
130950	272.08	0.07	3934.63	397.75
130975	293.37	0	7068.13	0.88
131000	30.58	10.73	4049.38	134.13
131025	31.73	0	778.88	134.13
131050	238.12	0	3373.13	0.00
131075	233.42	0	0.00	0.00
131100	84.74	0.97	3977.00	12.13
131125	0.00	93.75	1059.25	1184.00
131150	73.03	9.68	912.88	1292.88
131175	56.97	1.26	1625.00	136.75
131200	17.73	8.53	933.75	122.38
131225	0.00	53.74	221.63	778.38
131250	3.66	29.05	45.75	1034.88
131275	22.63	0	328.63	363.13
131300	102.43	0	1563.25	0.00
131325	97.07	0.19	2493.75	2.38
131350	42.91	0.89	1749.75	13.50
131375	20.90	15.23	797.63	201.50
131400	33.17	4.8	675.88	250.38
131425	14.46	6.55	595.38	141.88
131450	10.91	3.48	317.13	125.38
131475	19.17	0.45	376.00	49.13
131500	46.01	0	814.75	5.63
131525	38.83	0	1060.50	0.00
131550	43.89	3.95	1034.00	49.38
131575	36.09	0.28	999.75	52.88
131600	33.66	1.59	871.88	23.38
131625	46.04	8.97	996.25	132.00
131650	8.83	3.28	685.88	153.13
131675	178.81	0	2345.50	41.00
131700	72.36	0.32	3139.63	4.00
131725	6.18	12.45	981.75	159.63
131750	86.63	0	1160.13	155.63
131775	25.92	1.88	1406.88	23.50
131800	10.31	12.96	452.88	185.50
131825	31.40	1.92	521.38	186.00

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
131850	10.31	2.6	521.38	56.50
131875	11.37	3.65	271.00	78.13
131900	16.41	2.05	347.25	71.25
131925	10.28	4.35	333.63	80.00
131950	17.63	1.38	348.88	71.63
131975	22.26	10.3	498.63	146.00
132000	103.93	0.07	1577.38	129.63
132025	157.36	0	3266.13	0.88
132050	124.31	4.74	3520.88	59.25
132075	87.82	0	2651.63	59.25
132100	155.55	0	3042.13	0.00
132125	216.22	0	4647.13	0.00
132150	86.57	0	3784.88	0.00
132175	42.48	0.69	1613.13	8.63
132200	69.82	1.39	1403.75	26.00
132225	105.25	0	2188.38	17.38
132250	95.70	0.29	2511.88	3.63
132275	60.55	0.46	1953.13	9.38
132300	20.15	15.49	1008.75	199.38
132325	6.88	9.9	337.88	317.38
132350	35.08	1.27	524.50	139.63
132375	79.61	0	1433.63	15.88
132400	32.55	16.95	1402.00	211.88
132425	3.31	68.01	448.25	1062.00
132450	18.47	2.02	272.25	875.38
132475	17.83	1.87	453.75	48.63
132500	16.43	2.63	428.25	56.25
132525	21.14	0	469.63	32.88
132550	19.20	39.09	504.25	488.63
132575	0.00	72.76	240.00	1398.13
132600	123.32	0	1541.50	909.50
132625	238.04	0	4517.00	0.00
132650	267.35	0.27	6317.38	3.38
132675	125.54	0	4911.13	3.38
132700	79.29	0	2560.38	0.00
132725	56.57	0	1698.25	0.00
132750	16.55	1.41	914.00	17.63
132775	6.33	4.25	286.00	70.75
132800	4.80	21.03	139.13	316.00
132825	23.93	0	359.13	262.88

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
132850	9.81	9.04	421.75	113.00
132875	2.34	17.42	151.88	330.75
132900	14.56	0	211.25	217.75
132925	58.50	0	913.25	0.00
132950	45.49	0.33	1299.88	4.13
132975	12.60	16.28	726.13	207.63
133000	4.24	36.28	210.50	657.00
133025	6.46	1.08	133.75	467.00
133050	42.48	0	611.75	13.50
133075	51.39	0	1173.38	0.00
133100	42.15	0	1169.25	0.00
133125	67.51	0	1370.75	0.00
133150	0.52	32.7	850.38	408.75
133175	0.25	57.33	9.63	1125.38
133200	14.64	3.77	186.13	763.75
133225	17.99	6.36	407.88	126.63
133250	51.08	0	863.38	79.50
133275	73.05	0	1551.63	0.00
133300	67.57	0.04	1757.75	0.50
133325	5.59	52.78	914.50	660.25
133350	0.07	40.03	70.75	1160.13
133375	30.55	0.22	382.75	503.13
133400	51.80	0	1029.38	2.75
133425	49.56	0	1267.00	0.00
133450	25.64	0	940.00	0.00
133475	6.12	14.1	397.00	176.25
133500	1.45	22.27	94.63	454.63
133525	7.22	3.69	108.38	324.50
133550	48.60	0	697.75	46.13
133575	95.56	0	1802.00	0.00
133600	74.18	0.03	2121.75	0.38
133625	34.45	0.32	1357.88	4.38
133650	39.00	1.43	918.13	21.88
133675	7.19	45.39	577.38	585.25
133700	9.91	23.68	213.75	863.38
133725	45.98	0.77	698.63	305.63
133750	13.67	4.67	745.63	68.00
133775	11.32	20.25	312.38	311.50
133800	14.44	12.43	322.00	408.50
133825	47.62	0	775.75	155.38

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
133850	65.02	0.01	1408.00	0.13
133875	49.39	0	1430.13	0.13
133900	8.21	14.71	720.00	183.88
133925	3.04	9.18	140.63	298.63
133950	88.04	0.16	1138.50	116.75
133975	35.06	0	1538.75	2.00
134000	69.51	0	1307.13	0.00
134025	46.82	0	1454.13	0.00
134050	79.18	0.14	1575.00	1.75
134075	37.10	3.09	1453.50	40.38
134100	80.45	0.73	1469.38	47.75
134125	50.87	0.46	1641.50	14.88
134150	26.02	14.19	961.13	183.13
134175	22.24	0.01	603.25	177.50
134200	26.73	0.4	612.13	5.13
134225	19.37	4.71	576.25	63.88
134250	25.12	0.08	556.13	59.88
134275	8.21	16.08	416.63	202.00
134300	17.10	13.48	316.38	369.50
134325	53.28	0.77	879.75	178.13
134350	41.78	0	1188.25	9.63
134375	53.21	0	1187.38	0.00
134400	16.77	1.13	874.75	14.13
134425	28.95	2.78	571.50	48.88
134450	24.34	0.14	666.13	36.50
134475	0.00	77.41	304.25	969.38
134500	0.36	1.17	4.50	982.25
134525	197.18	0	2469.25	14.63
134550	102.86	0	3750.50	0.00
134575	92.35	0	2440.13	0.00
134600	33.28	2.33	1570.38	29.13
134625	26.47	1.28	746.88	45.13
134650	3.17	6.18	370.50	93.25
134675	14.02	2.44	214.88	107.75
134700	38.61	1.02	657.88	43.25
134725	27.71	1.11	829.00	26.63
134750	87.85	0	1444.50	13.88
134775	71.61	0	1993.25	0.00
134800	14.16	14.42	1072.13	180.25
134825	192.03	0	2577.38	180.25

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
134850	123.89	0	3949.00	0.00
134875	49.73	4.53	2170.25	56.63
134900	18.91	50.56	858.00	688.63
134925	14.49	41.1	417.50	1145.75
134950	22.78	25.72	465.88	835.25
134975	59.18	0	1024.50	321.50
135000	64.36	0	1544.25	0.00
135025	22.41	2.48	1084.63	31.00
135050	17.77	2.2	502.25	58.50
135075	18.85	2.96	457.75	64.50
135100	20.20	4.37	488.13	91.63
135125	23.43	3.97	545.38	104.25
135150	43.30	0	834.13	49.63
135175	21.71	0.53	812.63	6.63
135200	3.30	28.45	312.63	362.25
135225	38.34	0	520.50	355.63
135250	53.62	0	1149.50	0.00
135275	250.67	0	3803.63	0.00
135300	273.07	0.01	6546.75	0.13
135325	1.07	4.7	3426.75	58.88
135350	0.00	91.27	13.38	1199.63
135375	32.08	0.9	401.00	1152.13
135400	235.50	0.03	3344.75	11.63
135425	425.85	0	8266.88	0.38
135450	363.78	0	9870.38	0.00
135475	416.01	0	9747.38	0.00
135500	116.48	0	6656.13	0.00
135525	34.98	17.18	1893.25	214.75
135550	15.13	62.02	626.38	990.00
135575	37.44	14.84	657.13	960.75
135600	24.24	8.53	771.00	292.13
135625	49.77	0	925.13	106.63
135650	23.71	0	918.50	0.00
135675	42.61	0	829.00	0.00
135700	107.96	0.12	1882.13	1.50
135725	39.68	8.92	1845.50	113.00
135750	29.58	6.19	865.75	188.88
135775	87.44	0	1462.75	77.38
135800	11.63	6.34	1238.38	79.25
135825	6.35	5.15	224.75	143.63

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
135850	2.30	3.59	108.13	109.25
135875	43.02	0.18	566.50	47.13
135900	73.95	0	1462.13	2.25
135925	0.56	15.04	931.38	188.00
135950	24.89	0.37	318.13	192.63
135975	86.74	3.18	1395.38	44.38
136000	132.30	0.16	2738.00	41.75
136025	114.55	0	3085.63	2.00
136050	25.45	0.91	1750.00	11.38
136075	38.62	0.95	800.88	23.25
136100	11.90	5.28	631.50	77.88
136125	91.02	0	1286.50	66.00
136150	62.11	1.28	1914.13	16.00
136175	80.66	13.29	1784.63	182.13
136200	50.32	12.19	1637.25	318.50
136225	6.90	18.36	715.25	381.88
136250	47.74	4.57	683.00	286.63
136275	12.33	6.17	750.88	134.25
136300	55.52	1.11	848.13	91.00
136325	43.10	0	1232.75	13.88
136350	113.30	0.1	1955.00	1.25
136375	136.92	0	3127.75	1.25
136400	118.85	0	3197.13	0.00
136425	16.87	0.29	1696.50	3.63
136450	23.52	0	504.88	3.63
136475	50.71	0.17	927.88	2.13
136500	0.47	21.3	639.75	268.38
136525	47.65	2.56	601.50	298.25
136550	18.24	3.09	823.63	70.63
136575	0.00	58.51	228.00	770.00
136600	0.44	7.44	5.50	824.38
136625	6.82	2.3	90.75	121.75
136650	19.98	8.91	335.00	140.13
136675	1.03	23.2	262.63	401.38
136700	150.21	0.75	1890.50	299.38
136725	277.34	11.71	5344.38	155.75
136750	44.04	14.36	4017.25	325.88
136775	32.38	5.22	955.25	244.75
136800	138.29	0.01	2133.38	65.38
136825	80.65	0	2736.75	0.13

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
136850	25.73	9.38	1329.75	117.25
136875	40.21	0	824.25	117.25
136900	79.61	0	1497.75	0.00
136925	1.62	8.26	1015.38	103.25
136950	1.12	6.78	34.25	188.00
136975	25.14	0.18	328.25	87.00
137000	31.68	0.08	710.25	3.25
137025	32.74	5.08	805.25	64.50
137050	43.27	0.27	950.13	66.88
137075	55.20	0	1230.88	3.38
137100	36.04	0.34	1140.50	4.25
137125	16.26	5.42	653.75	72.00
137150	33.46	1.76	621.50	89.75
137175	27.98	1.54	768.00	41.25
137200	215.02	1.57	3037.50	38.88
137225	97.18	0.71	3902.50	28.50
137250	37.73	3.52	1686.38	52.88
137275	33.05	31.73	884.75	440.63
137300	0.86	18.55	423.88	628.50
137325	26.53	0	342.38	231.88
137350	1.54	20.64	350.88	258.00
137375	9.76	12.58	141.25	415.25
137400	57.31	0.49	838.38	163.38
137425	14.62	17.42	899.13	223.88
137450	21.62	0.19	453.00	220.13
137475	72.08	0	1171.25	2.38
137500	67.26	0	1741.75	0.00
137525	49.53	3.01	1459.88	37.63
137550	29.87	7.92	992.50	136.63
137575	57.65	0.12	1094.00	100.50
137600	38.33	9.42	1199.75	119.25
137625	77.88	0	1452.63	117.75
137650	201.67	0.21	3494.38	2.63
137675	91.75	0.43	3667.75	8.00
137700	63.30	0	1938.13	5.38
137725	17.17	1.28	1005.88	16.00
137750	141.25	0	1980.25	16.00
137775	116.53	0	3222.25	0.00
137800	33.14	3.56	1870.88	44.50
137825	110.10	0	1790.50	44.50

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
137850	126.47	0	2957.13	0.00
137875	210.59	0	4213.25	0.00
137900	214.32	0	5311.38	0.00
137925	32.11	0.66	3080.38	8.25
137950	29.11	1.02	765.25	21.00
137975	0.11	30.45	365.25	393.38
138000	24.88	2.21	312.38	408.25
138025	267.90	0	3659.75	27.63
138050	181.39	0	5616.13	0.00
138075	112.86	0	3678.13	0.00
138100	159.32	0	3402.25	0.00
138125	254.20	0	5169.00	0.00
138150	267.79	0	6524.88	0.00
138175	179.62	0	5592.63	0.00
138200	104.29	0.04	3548.88	0.50
138225	75.75	0	2250.50	0.50
138250	119.44	2.67	2439.88	33.38
138275	163.75	0	3539.88	33.38
138300	208.84	0.03	4657.38	0.38
138325	220.08	0	5361.50	0.38
138350	102.01	0	4026.13	0.00
138375	41.82	0	1797.88	0.00
138400	54.02	0	1198.00	0.00
138425	70.01	0	1550.38	0.00
138450	104.33	11.77	2179.25	147.13
138475	33.01	0.26	1716.75	150.38
138500	24.19	0	715.00	3.25
138525	101.12	0	1566.38	0.00
138550	159.85	0.03	3262.13	0.38
138575	88.91	1.64	3109.50	20.88
138600	125.00	0	2673.88	20.50
138625	5.84	0.22	1635.50	2.75
138650	36.81	1.29	533.13	18.88
138675	61.14	2.33	1224.38	45.25
138700	30.71	0.15	1148.13	31.00
138725	11.82	0	531.63	1.88
138750	2.17	10.34	174.88	129.25
138775	105.61	0	1347.25	129.25
138800	129.96	0.07	2944.63	0.88
138825	32.63	4.92	2032.38	62.38

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
138850	0.94	20.43	419.63	316.88
138875	5.31	2.59	78.13	287.75
138900	45.50	0	635.13	32.38
138925	26.01	3.2	893.88	40.00
138950	45.99	0	900.00	40.00
138975	34.72	0	1008.88	0.00
139000	137.89	0	2157.63	0.00
139025	89.29	0	2839.75	0.00
139050	219.23	0.01	3856.50	0.13
139075	350.49	0	7121.50	0.13
139100	180.56	0	6638.13	0.00
139125	190.92	0	4643.50	0.00
139150	154.39	0	4316.38	0.00
139175	135.01	0	3617.50	0.00
139200	171.02	0.29	3825.38	3.63
139225	64.49	0	2943.88	3.63
139250	43.69	0.03	1352.25	0.38
139275	71.88	0	1444.63	0.38
139300	66.71	0.01	1732.38	0.13
139325	71.75	0	1730.75	0.13
139350	30.98	0.03	1284.13	0.38
139375	64.62	0	1195.00	0.38
139400	0.00	6.04	807.75	75.50
139425	7.11	0	88.88	75.50
139450	54.55	0	770.75	0.00
139475	8.16	8.87	783.88	110.88
139500	0.00	48.81	102.00	721.00
139525	28.67	9.5	358.38	728.88
139550	30.88	12.79	744.38	278.63
139575	18.21	18.75	613.63	394.25
139600	2.35	47.15	257.00	823.75
139625	1.77	51.15	51.50	1228.75
139650	9.80	46.1	144.63	1215.63
139675	0.00	79.52	122.50	1570.25
139700	0.87	31.68	10.88	1390.00
139725	26.50	5.52	342.13	465.00
139750	9.28	40.36	447.25	573.50
139775	206.26	29.68	2694.25	875.50
139800	189.91	10.57	4952.13	503.13
139825	74.54	0.81	3305.63	142.25

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
139850	45.98	3.67	1506.50	56.00
139875	250.31	0	3703.63	45.88
139900	179.01	0	5366.50	0.00
139925	138.29	0	3966.25	0.00
139950	304.89	0	5539.75	0.00
139975	54.62	0	4493.88	0.00
140000	35.79	3.32	1130.13	41.50
140025	105.69	0	1768.50	41.50
140050	78.99	0.02	2308.50	0.25
140075	15.82	16.14	1185.13	202.00
140100	19.87	0.02	446.13	202.00
140125	7.81	20.9	346.00	261.50
140150	16.00	1.89	297.63	284.88
140175	19.71	0.14	446.38	25.38
140200	44.88	0	807.38	1.75
140225	17.31	0	777.38	0.00
140250	21.01	6.33	479.00	79.13
140275	14.90	19.12	448.88	318.13
140300	0.00	31.74	186.25	635.75
140325	0.25	31.62	3.13	792.00
140350	0.41	37.04	8.25	858.25
140375	14.77	19.69	189.75	709.13
140400	13.21	20.19	349.75	498.50
140425	26.73	17.59	499.25	472.25
140450	17.01	18.17	546.75	447.00
140475	11.91	24.85	361.50	537.75
140500	9.91	23.08	272.75	599.13
140525	3.26	23.58	164.63	583.25
140550	4.72	27.44	99.75	637.75
140575	26.21	7.26	386.63	433.75
140600	30.41	0.6	707.75	98.25
140625	20.94	1.1	641.88	21.25
140650	40.63	0	769.63	13.75
140675	66.46	0	1338.63	0.00
140700	94.22	0.01	2008.50	0.13
140725	136.97	0	2889.88	0.13
140750	140.99	0.61	3474.50	7.63
140775	121.06	0	3275.63	7.63

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
140800	81.08	0.04	2526.75	0.50
140825	0.41	0.91	Major Bridge	
140850	0.32	143.67		
140875	0.00	305.18		
140900	0.00	270.58		
140925	0.00	112.25		
140950	0.01	44.77		
140975	0.00	16.31	0.13	763.50
141000	12.89	2.89	161.13	240.00
141025	3.78	0.44	208.38	41.63
141029	22.66	10.13	52.88	21.14
Total =			757587	79402

Total Earthwork in cutting =

757587 cum

Assume 20% total cutting Volume for

Ordinary Rock Cutting=

151517 cum

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Bill No- 02, Sl. No- 7

Total earthwork in soil=

606070 cum

.....

Bill No- 02, Sl. No- 6

Total Earthwork in filling =

79402 cum

.....

Bill No- 02, Sl. No- 2

Using 60% of cutting material for filling earthworks in embankment

Earthwork used from Roadway Cutting Material= 363641.94 cum

So no Earthwork required for embankment const from borrowpit ::

Variable Declaration

Earthwork

SI No	Variable Description	Variable	Dimension	Unit
1	Total Earthwork In Cutting	tot_cut	757587.000	cum
2	Total Earthwork In Filling (Consider Only Embankment)	tot_fill	79402.000	cum
3	Percentage of Rock	per_rock	20.000	percent

Calculation of Extra Widening						
For 0.6m EXTRA WIDENING						
HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	132371.853	132386.853	15	7.5	
1156	Arc	132386.853	132403.683	16.83	16.83	125.00
	Transition	132403.683	132418.683	15	7.5	
	Transition	133060.995	133075.995	15	7.5	
1161	Arc	133075.995	133085.083	9.088	9.088	150.00
	Transition	133085.083	133100.083	15	7.5	
	Transition	137005.405	137020.405	15	7.5	
1187	Arc	137020.405	137022.948	2.543	2.543	150.00
	Transition	137022.948	137037.948	15	7.5	
	Transition	137120.121	137135.121	15	7.5	
1188	Arc	137135.121	137162.595	27.474	27.474	150.00
	Transition	137162.595	137177.595	15	7.5	
	Straight	140398.961	140563.023	0	0	
1217	Arc	140563.023	140597.227	34.204	34.204	170
	Straight	140597.227	140615.735	0	0	
	Straight	140597.227	140615.735	0	0	
1218	Arc	140615.735	140637.232	21.497	21.497	170
	Straight	140637.232	140756.147	0	0	
Total Length of 0.6m Extra Widening=					172	m

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
For 0.9m EXTRA WIDENING						
	Transition	130444.114	130464.114	20	10	
1141	Arc	130464.114	130513.828	49.714	49.714	100
	Transition	130513.828	130533.828	20	10	
	Transition	130717.254	130737.254	20	10	
1143	Arc	130737.254	130857.008	119.754	119.754	100
	Transition	130857.008	130877.008	20	10	
	Transition	130914.802	130934.802	20	10	
1144	Arc	130934.802	130938.507	3.705	3.705	100
	Transition	130938.507	130958.507	20	10	
	Transition	132841.853	132861.853	20	10	
1160	Arc	132861.853	132872.114	10.261	10.261	80
	Transition	132872.114	132892.114	20	10	
	Transition	133172.895	133192.895	20	10	
1162	Arc	133192.895	133311.927	119.032	119.032	100
	Transition	133311.927	133331.927	20	10	
	Transition	134112.273	134132.273	20	10	
1167	Arc	134132.273	134158.495	26.222	26.222	100
	Transition	134158.495	134178.495	20	10	
	Transition	134415.791	134440.791	25	12.5	
1170	Arc	134440.791	134490.484	49.692	49.692	80
	Transition	134490.484	134515.484	25	12.5	
	Transition	138225.667	138250.667	25	12.5	
1196	Arc	138250.667	138258.651	7.984	7.984	80
	Transition	138258.651	138283.651	25	12.5	
	Transition	139279.651	139299.651	20	10	
1206	Arc	139299.651	139317.412	17.761	17.761	100
	Transition	139317.412	139337.412	20	10	
	Transition	139429.729	139444.729	15	7.5	
1208	Arc	139444.729	139449.38	4.651	4.651	80
	Transition	139449.38	139464.38	15	7.5	
	Transition	140346.548	140371.548	25	12.5	
1216	Arc	140371.548	140373.961	2.413	2.413	80
	Transition	140373.961	140398.961	25	12.5	
Total Length of 0.9m Extra Widening=					641 m	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
For 1.2m EXTRA WIDENING						
	Transition	130084.044	130099.044	15	7.5	
1136	Arc	130099.044	130112.247	13.203	13.203	50
	Transition	130112.247	130127.247	15	7.5	
	Transition	130231.387	130246.387	15	7.5	
1138	Arc	130246.387	130247.825	1.438	1.438	60
	Transition	130247.825	130262.825	15	7.5	
	Transition	131174.762	131199.762	25	12.5	
1146	Arc	131199.762	131208.26	8.498	8.498	60
	Transition	131208.26	131233.26	25	12.5	
	Transition	131379.242	131394.242	15	7.5	
1148	Arc	131394.242	131403.275	9.033	9.033	60
	Transition	131403.275	131418.275	15	7.5	
	Transition	131452.227	131467.227	15	7.5	
1149	Arc	131467.227	131472.069	4.842	4.842	50
	Transition	131472.069	131487.069	15	7.5	
	Transition	131868.421	131893.421	25	12.5	
1152	Arc	131893.421	131934.634	41.213	41.213	50
	Transition	131934.634	131959.634	25	12.5	
	Transition	132535.287	132550.287	15	7.5	
1157	Arc	132550.287	132559.911	9.624	9.624	60
	Transition	132559.911	132574.911	15	7.5	
	Transition	132695.968	132710.968	15	7.5	
1159	Arc	132710.968	132723.809	12.842	12.842	60
	Transition	132723.809	132738.809	15	7.5	
	Transition	133393.584	133418.584	25	12.5	
1163	Arc	133418.584	133477.929	59.345	59.345	50
	Transition	133477.929	133502.929	25	12.5	
	Transition	133674.265	133699.265	25	12.5	
1164	Arc	133699.265	133776.06	76.795	76.795	60
	Transition	133776.06	133801.06	25	12.5	
	Transition	133863.25	133878.25	15	7.5	
1165	Arc	133878.25	133892.809	14.559	14.559	60
	Transition	133892.809	133907.809	15	7.5	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	134249.447	134274.447	25	12.5	
1168	Arc	134274.447	134285.313	10.866	10.866	50
	Transition	134285.313	134310.313	25	12.5	
	Transition	134342.836	134367.836	25	12.5	
1169	Arc	134367.836	134380.043	12.206	12.206	50
	Transition	134380.043	134405.043	25	12.5	
	Transition	134548.623	134563.623	15	7.5	
1171	Arc	134563.623	134595.701	32.078	32.078	60
	Transition	134595.701	134610.701	15	7.5	
	Transition	134622.477	134637.477	15	7.5	
1172	Arc	134637.477	134653.047	15.57	15.57	60
	Transition	134653.047	134668.047	15	7.5	
	Transition	134683.757	134698.757	15	7.5	
1173	Arc	134698.757	134757.127	58.37	58.37	60
	Transition	134757.127	134772.127	15	7.5	
	Transition	135549.161	135564.161	15	7.5	
1176	Arc	135564.161	135607.379	43.218	43.218	50
	Transition	135607.379	135622.379	15	7.5	
	Transition	135647.036	135662.036	15	7.5	
1177	Arc	135662.036	135740.302	78.266	78.266	60
	Transition	135740.302	135755.302	15	7.5	
	Transition	136544.945	136569.945	25	12.5	
1184	Arc	136569.945	136577.633	7.688	7.688	60
	Transition	136577.633	136602.633	25	12.5	
	Transition	136667.268	136692.268	25	12.5	
1185	Arc	136692.268	136719.485	27.217	27.217	50
	Transition	136719.485	136744.485	25	12.5	
	Transition	136801.192	136836.192	35	17.5	
1186	Arc	136836.192	136898.147	61.955	61.955	60
	Transition	136898.147	136933.147	35	17.5	
	Transition	137427.516	137452.516	25	12.5	
1190	Arc	137452.516	137475.907	23.39	23.39	50
	Transition	137475.907	137500.907	25	12.5	
	Transition	138112.062	138137.062	25	12.5	
1195	Arc	138137.062	138182.63	45.569	45.569	50
	Transition	138182.63	138207.63	25	12.5	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	138711.199	138736.199	25	12.5	
1201	Arc	138736.199	138740.964	4.765	4.765	50
	Transition	138740.964	138765.964	25	12.5	
	Transition	138785.973	138810.973	25	12.5	
1202	Arc	138810.973	138820.375	9.402	9.402	50
	Transition	138820.375	138845.375	25	12.5	
	Transition	138993.479	139018.479	25	12.5	
1204	Arc	139018.479	139025.043	6.565	6.565	50
	Transition	139025.043	139050.043	25	12.5	
	Transition	139132.371	139157.371	25	12.5	
1205	Arc	139157.371	139177.964	20.593	20.593	50
	Transition	139177.964	139202.964	25	12.5	
	Transition	139510.27	139550.27	40	20	
1209	Arc	139550.27	139586.116	35.846	35.846	50
	Transition	139586.116	139626.116	40	20	
	Transition	139793.983	139808.983	15	7.5	
1210	Arc	139808.983	139821.676	12.693	12.693	50
	Transition	139821.676	139836.676	15	7.5	
	Transition	140238.54	140263.54	25	12.5	
1215	Arc	140263.54	140268.703	5.162	5.162	50
	Transition	140268.703	140293.703	25	12.5	
	Transition	140928.786	140943.786	15	7.5	
1220	Arc	140943.786	140999.201	55.415	55.415	50
	Transition	140999.201	141014.201	15	7.5	
Total Length of 1.2m Extra Widening=					1478	m

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
For 1.5m EXTRA WIDENING						
	Transition	130164.387	130179.387	15	7.5	
1137	Arc	130179.387	130200.053	20.665	20.665	20
	Transition	130200.053	130215.053	15	7.5	
	Transition	130279.367	130294.367	15	7.5	
1139	Arc	130294.367	130317.362	22.995	22.995	20
	Transition	130317.362	130332.362	15	7.5	
	Transition	130336.011	130356.011	20	10	
1140	Arc	130356.011	130365.457	9.446	9.446	40
	Transition	130365.457	130385.457	20	10	
	Transition	130578.442	130593.442	15	7.5	
1142	Arc	130593.442	130616.129	22.688	22.688	30
	Transition	130616.129	130631.129	15	7.5	
	Transition	131071.17	131086.17	15	7.5	
1145	Arc	131086.17	131131.103	44.933	44.933	30
	Transition	131131.103	131146.103	15	7.5	
	Transition	131258.411	131278.411	20	10	
1147	Arc	131278.411	131324.154	45.743	45.743	40
	Transition	131324.154	131344.154	20	10	
	Transition	131551.655	131566.655	15	7.5	
1150	Arc	131566.655	131591.01	24.355	24.355	20
	Transition	131591.01	131606.01	15	7.5	
	Transition	131685.747	131700.747	15	7.5	
1151	Arc	131700.747	131741.113	40.365	40.365	30
	Transition	131741.113	131756.113	15	7.5	
	Transition	132106.025	132121.025	15	7.5	
1153	Arc	132121.025	132145.82	24.796	24.796	20
	Transition	132145.82	132160.82	15	7.5	
	Transition	132190.268	132210.268	20	10	
1154	Arc	132210.268	132221.76	11.492	11.492	40
	Transition	132221.76	132241.76	20	10	
	Transition	132284.343	132304.343	20	10	
1155	Arc	132304.343	132319.676	15.334	15.334	40
	Transition	132319.676	132339.676	20	10	
	Transition	132599.22	132624.22	25	12.5	
1158	Arc	132624.22	132660.48	36.26	36.26	40
	Transition	132660.48	132685.48	25	12.5	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	133968.685	133983.685	15	7.5	
1166	Arc	133983.685	134016.054	32.368	32.368	20
	Transition	134016.054	134031.054	15	7.5	
	Transition	134943.53	134958.53	15	7.5	
1174	Arc	134958.53	134981.016	22.486	22.486	20
	Transition	134981.016	134996.016	15	7.5	
	Transition	135068.734	135088.734	20	10	
1175	Arc	135088.734	135117.34	28.606	28.606	40
	Transition	135117.34	135137.34	20	10	
	Transition	135854.678	135869.678	15	7.5	
1178	Arc	135869.678	135879.178	9.5	9.5	30
	Transition	135879.178	135894.178	15	7.5	
	Transition	135895.534	135910.534	15	7.5	
1179	Arc	135910.534	135925.511	14.977	14.977	30
	Transition	135925.511	135940.511	15	7.5	
	Transition	135982.861	135997.861	15	7.5	
1180	Arc	135997.861	136025.21	27.35	27.35	30
	Transition	136025.21	136040.21	15	7.5	
	Transition	136056.381	136071.381	15	7.5	
1181	Arc	136071.381	136113.908	42.527	42.527	30
	Transition	136113.908	136128.908	15	7.5	
	Transition	136280.942	136305.942	25	12.5	
1182	Arc	136305.942	136369.505	63.563	63.563	40
	Transition	136369.505	136394.505	25	12.5	
	Transition	136457.036	136482.036	25	12.5	
1183	Arc	136482.036	136499.648	17.611	17.611	40
	Transition	136499.648	136524.648	25	12.5	
	Transition	137241.956	137266.956	25	12.5	
1189	Arc	137266.956	137309.168	42.213	42.213	25
	Transition	137309.168	137334.168	25	12.5	
	Transition	137629.25	137644.25	15	7.5	
1191	Arc	137644.25	137671.649	27.399	27.399	20
	Transition	137671.649	137686.649	15	7.5	
	Transition	137699.937	137714.937	15	7.5	
1192	Arc	137714.937	137750.269	35.331	35.331	30
	Transition	137750.269	137765.269	15	7.5	
	Transition	137808.52	137823.52	15	7.5	
1193	Arc	137823.52	137861.861	38.341	38.341	30
	Transition	137861.861	137876.861	15	7.5	
	Transition	137932.482	137947.482	15	7.5	
1194	Arc	137947.482	137999.827	52.345	52.345	30
	Transition	137999.827	138014.827	15	7.5	
	Transition	138369.96	138384.96	15	7.5	
1197	Arc	138384.96	138432.955	47.995	47.995	30
	Transition	138432.955	138447.955	15	7.5	
	Transition	138468.524	138483.524	15	7.5	
1198	Arc	138483.524	138499.015	15.491	15.491	20
	Transition	138499.015	138514.015	15	7.5	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	138540.441	138555.441	15	7.5	
1199	Arc	138555.441	138568.746	13.305	13.305	20
	Transition	138568.746	138583.746	15	7.5	
	Transition	138602.339	138617.339	15	7.5	
1200	Arc	138617.339	138646.698	29.359	29.359	20
	Transition	138646.698	138661.698	15	7.5	
	Transition	138867.877	138882.877	15	7.5	
1203	Arc	138882.877	138906.684	23.806	23.806	20
	Transition	138906.684	138921.684	15	7.5	
	Transition	139375.198	139390.198	15	7.5	
1207	Arc	139390.198	139404.024	13.826	13.826	30
	Transition	139404.024	139419.024	15	7.5	
	Transition	139874.615	139899.615	25	12.5	
1211	Arc	139899.615	139902.421	2.806	2.806	40
	Transition	139902.421	139927.421	25	12.5	
	Transition	139942.168	139972.168	30	15	
1212	Arc	139972.168	139987.085	14.917	14.917	30
	Transition	139987.085	140017.085	30	15	
	Transition	140125.193	140140.193	15	7.5	
1213	Arc	140140.193	140147.054	6.861	6.861	30
	Transition	140147.054	140162.054	15	7.5	
	Transition	140180.265	140195.265	15	7.5	
1214	Arc	140195.265	140204.455	9.19	9.19	30
	Transition	140204.455	140219.455	15	7.5	
	Transition	140756.147	140771.147	15	7.5	
1219	Arc	140771.147	140809.066	37.919	37.919	30
	Transition	140809.066	140824.066	15	7.5	
Total Length of 1.5m Extra Widening=					1634	m

Total Length of 0.6m Extra Widening= 172 m
 Total Length of 0.9m Extra Widening= 641 m
 Total Length of 1.2m Extra Widening= 1478 m
 Total Length of 1.5m Extra Widening= 1634 m
Total Area of Extra Widening= 4905 Sqm

Variable Declaration**Extra Widening on Flexible Pavement**

SI No	Variable Description	Variable	Dimension	Unit
1	Total Area of Extra Widening	ew_area	4905.000	Sqm
2	BC	bc	0.040	m
3	DBM	dbm	0.070	m
4	WMM-I	wmm1	0.125	m
5	WMM-II	wmm2	0.125	m
6	GSB	gsb	0.200	m
7	GSB percentage Re-use	gsb_per	8.500	percentage

RCC Cover Drain

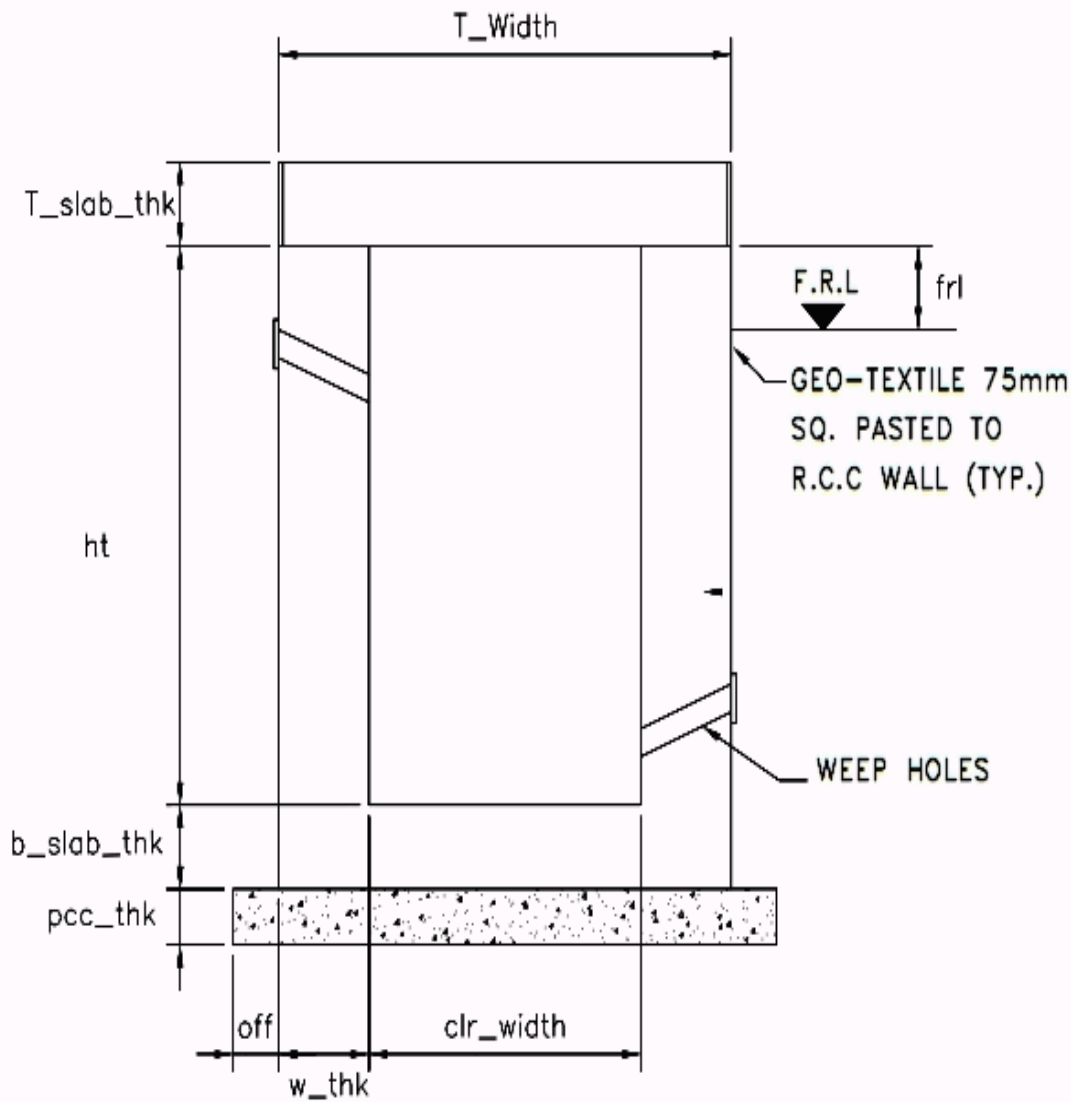
RCC Cover Drain			
TCS Type	Length(m)	Side	Net Length (m)
TCS-1	0.00	Both side	0
		Total Length=	0

Variable Declaration

RCC Cover Drain

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width	t_width	1.000	m
2	Top Slab Thickness	t_slab_thk	0.125	m
3	Height of Drain	ht	0.900	m
4	Bottom Slab Thickness	b_slab_thk	0.125	m
5	Side Wall Thickness	w_thk	0.150	m
6	Foundation PCC thickness	pcc_thk	0.100	m
7	Foundation PCC Offset	off	0.100	m
8	Length	l	0.000	m
9	Reinforcement Per Cum RCC	s	0.050	MT/Cum RCC
10	Finished Road Level	frl	0.300	m

Variable Declaration



RR Masonary Trapezoidal Drain

RR Masonary Trapezoidal Drain :-

TCS Type	Length(km)	Side	Net Length (m)
TCS-5	592.1	Single side	592
TCS-6	0	Both side	0
TCS-6A	0	Both side	0
TCS-7	2067.5	Single side	2068
TCS-7A	0	Single side	0
TCS-9	500	Single side	500
TCS-9A	0	Single side	0
TCS-11	4957.3	Single side	4957
TCS-11A	0	Single side	0

Total length = 8117

Length of Side Drain 8117 m

Length of catch water Drain= 0 m

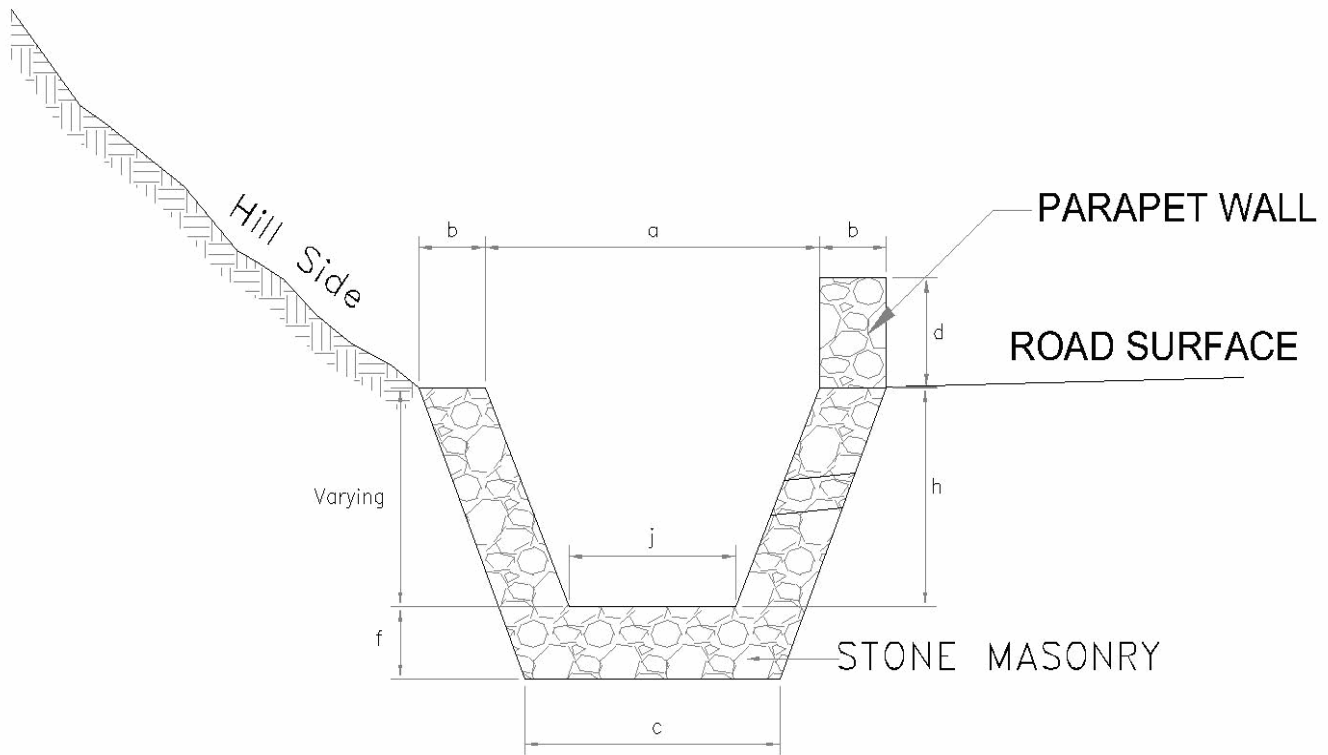
Length of Outlet= 8117 m

Total Length of Drain= 8117 m

Variable Declaration

RR Masonry Trapezoidal Drain

SI No	Variable Description	Variable	Dimension	Unit
1	Ref Drawing	a	0.800	m
2	Ref Drawing	b	0.200	m
3	Ref Drawing	d	0.300	m
4	Ref Drawing	h	0.850	m
5	Ref Drawing	c	0.835	m
6	Ref Drawing	j	0.500	m
7	Ref Drawing	f	0.200	m
8	Length	l	8117.000	m

Variable Declaration

SECTION OF STONE MASONRY TRAPEZOIDAL DRAIN

Breast Wall

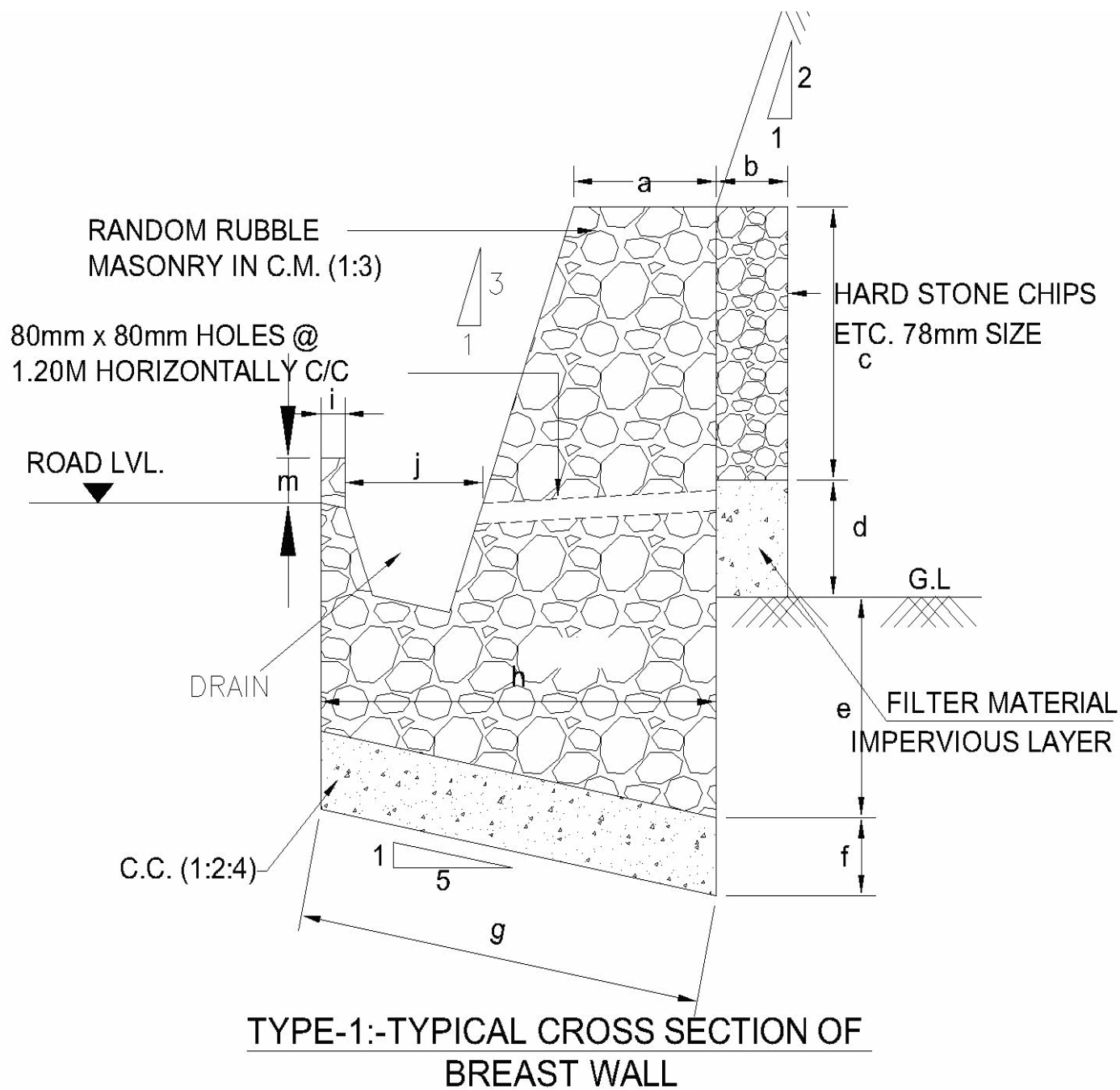
TCS Type	Length	Side	Net Length
TCS-8	2131.70	Single	2132
TCS-8A	0.00	Single	0
TCS-9	500.00	Single	500
TCS-9A	0.00	Single	0
TCS-12	389.40	Single	389
TCS-12A	0.00	Single	0
TCS-14	100.00	Single	100
TCS-15A	0.00	Both	0
Total=			3121

Variable Declaration

Breast Wall

SI No	Variable Description	Variable	Dimension	Unit
1	From Diagram	a	0.600	m
2	From Diagram	b	0.300	m
3	From Diagram	c	1.050	m
4	From Diagram	d	0.450	m
5	From Diagram	e	0.850	m
6	From Diagram	f	0.300	m
7	PCC Width $g = \sqrt{h^2 + (h/5)^5}$	g	2.200	m
8	From Diagram	h	2.160	m
9	From Diagram	i	0.200	m
10	From Diagram	j	1.000	m
11	length	l	3121.000	m
12	Percentage of Earthwork in Ordinary Rock(20%)	p	0.200	
13	From Diagram	m	0.300	m

Variable Declaration



RETAINING WALL

Chainage		Side	Avg. Height	CD Length	Length	Net Length	TCS
From	To						
130000	130220	single	2.50	2.6	220	217.4	TCS-11
130970	131620	single	2.00	7.9	650	642.1	TCS-11
131770	131970	single	1.50	2.6	200	197.4	TCS-11
132220	132570	single	2.50	8	350	342	TCS-11
132720	133020	single	4.00	5.2	300	294.8	TCS-11
133320	133520	single	2.00	2.7	200	197.3	TCS-11
133620	133920	single	2.50	7.8	300	292.2	TCS-11
134420	134470	single	2.00	2.6	50	47.4	TCS-11
134570	135220	single	3.00	15.6	650	634.4	TCS-11
135770	135870	single	2.00	2.6	100	97.4	TCS-11
136020	136320	single	2.00	7.9	300	292.1	TCS-12
136520	136770	single	2.00	7.9	250	242.1	TCS-11
136820	136870	single	2.00		50	50	TCS-11
136970	137620	single	2.00	13.1	650	636.9	TCS-11
138720	138770	single	2.50		50	50	TCS-11
138820	138870	single	2.50	2.6	50	47.4	TCS-11
139470	139720	single	4.00	8	250	242	TCS-11
139720	139820	single	4.00	2.7	100	97.3	TCS-12
130270	130370	single	6.00	7.8	100	92.2	TCS-11
130870	130920	single	6.00	2.6	50	47.4	TCS-11
133120	133170	single	6.00	2.6	50	47.4	TCS-11
135320	135370	single	6.00	2.6	50	47.4	TCS-11
135470	135570	single	6.00	2.7	100	97.3	TCS-11
140220	140620	single	5.00	5.2	400	394.8	TCS-11

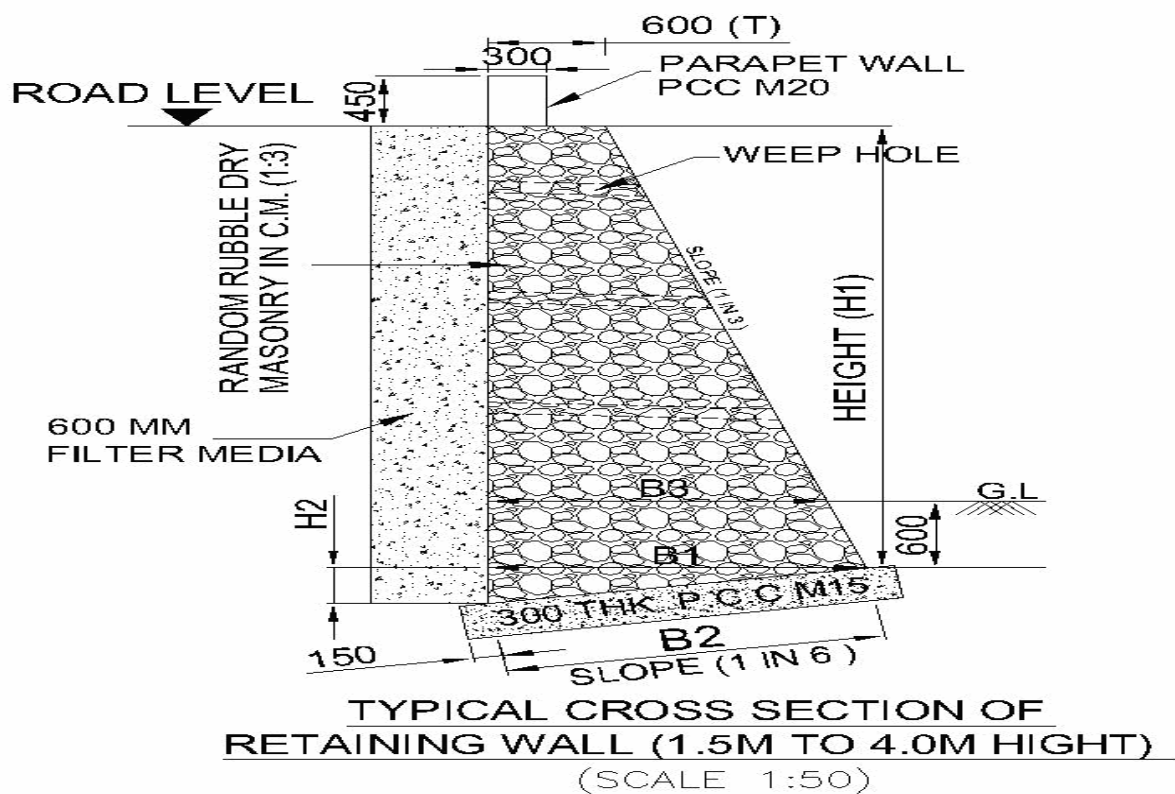
Length of 1.5m Retaining Wall=	197 m
Length of 2.0m Retaining Wall=	2205 m
Length of 2.5m Retaining Wall=	949 m
Length of 3.0m Retaining Wall=	634 m
Length of 4.0m Retaining Wall=	634 m
Length of 5.0m Retaining Wall=	395 m
Length of 6.0m Retaining Wall=	332 m

Variable Declaration

Retaining Wall 1.5m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height	H1	1.500	m
3	Slope at Base(1 In 6)	Z	9.462	degree
4	$B1 = (T+H1/3)$	B1	1.100	m
5	$B2 = B1/\cos Z$	B2	1.115	m
6	$H2 = B1.\tan Z$	H2	0.183	m
7	EGL to PCC top Height	d	0.600	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	$B3 = T + (H1-d)\tan Y$	e	0.900	m
10	Thickness PCC	pcc_thk	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	197.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \cos Y) / 1$	n	2.000	nos
15	Avg Length of Weephole $q = (B3 + T) / 2$	weep_len	0.750	m
16	percentage of Rock cutting	p_c	0.200	
17	Width of parapet wall	para_w	0.300	m
18	Height of parapet wall	para_ht	0.450	m
19	Taking gap every 10m length	gap	0.300	m

Variable Declaration

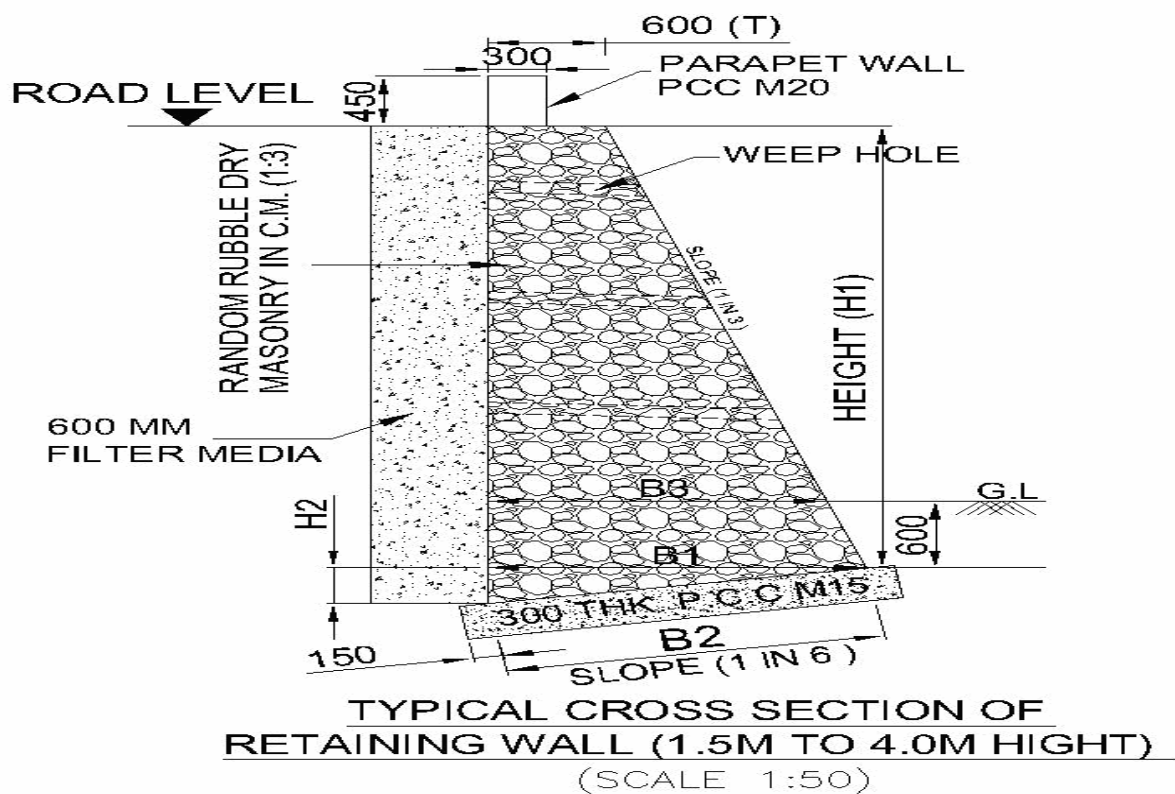


Variable Declaration

Retaining Wall 2.0m

SI No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height	H1	2.000	m
3	Slope at Base(1 In 6)	Z	9.462	degree
4	$B1 = (T+H1/3)$	B1	1.270	m
5	$B2 = B1/\cos Z$	B2	1.284	m
6	$H2 = B1.\tan Z$	H2	0.211	m
7	EGL to PCC top Height	d	0.600	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	$B3 = T + (H1-d)\tan Y$	e	1.067	m
10	Thickness PCC	pcc_thk	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	2205.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \cos Y) / 1$	n	2.000	nos
15	Avg Length of Weephole $q = (B3 + T) / 2$	weep_len	0.834	m
16	percentage of rock cutting	p_c	0.200	
17	Taking gap every 10m length	gap	0.300	m
18	Height of parapet wall	para_ht	0.450	m
19	width of parapet wall	para_w	0.300	m

Variable Declaration

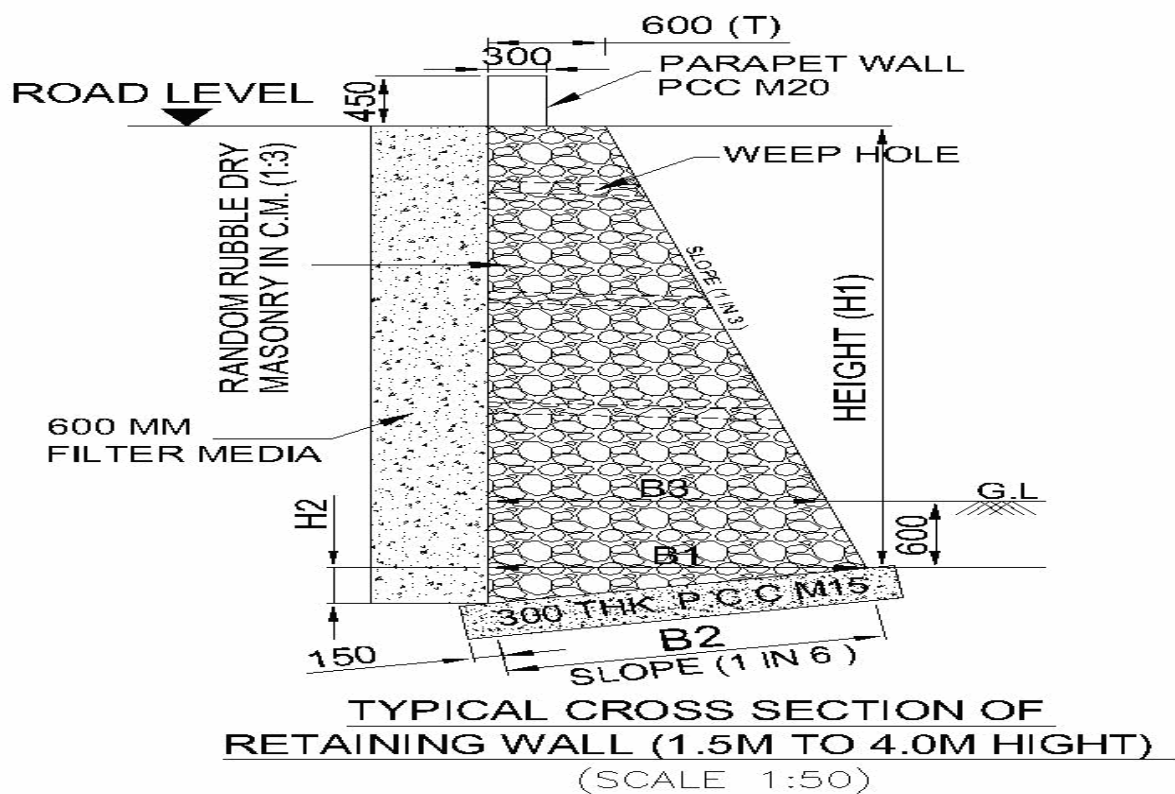


Variable Declaration

Retaining Wall 2.5m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height (H1)	H1	2.500	m
3	Slope at Base(1 in 6)	Z	9.462	degree
4	$B1 = (T+H1/3)$	B1	1.430	m
5	$B2 = B1/\cos Z$	B2	1.453	m
6	$H2 = B1.\tan Z$	H2	0.239	m
7	EGL to PCC top Height	d	0.600	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	$B3 = T + (H1-d)\tan Y$	B3	1.230	m
10	Thickness PCC	pcc_th1k	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	949.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \cos Y) / 1$	n	3.000	nos
15	Avg Length of Weephole $q = (B3 + T) / 2$	weep_len	0.915	m
16	percentage of rock cutting	p_c	0.200	
17	width of parapet wall	para_w	0.300	m
18	Height of parapet wall	para_ht	0.450	m
19	Taking gap every 10m length	gap	0.300	m

Variable Declaration

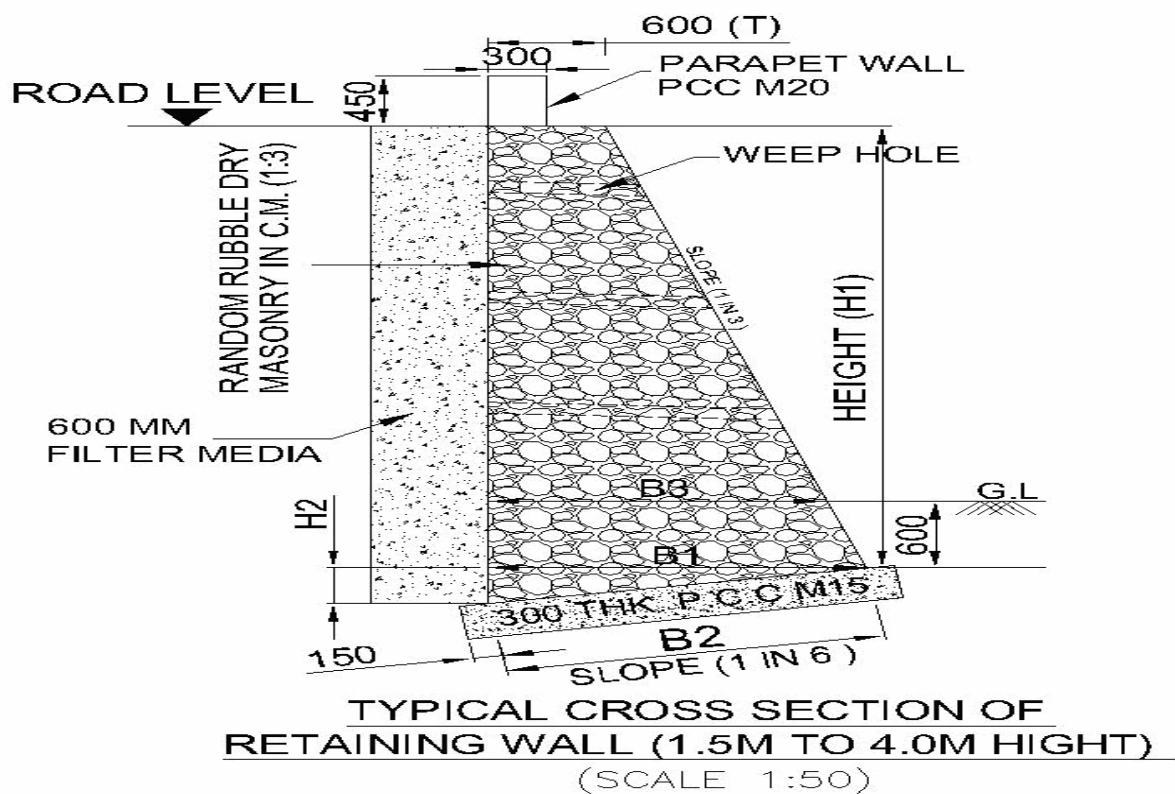


Variable Declaration

Retaining Wall 3.0m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height (H1)	H1	3.000	m
3	Slope at Base(1 in 6)	Z	9.462	degree
4	$B1 = (T+H1/3)$	B1	1.600	m
5	$B2 = B1/\cos Z$	B2	1.622	m
6	$H2 = B1.\tan Z$	H2	0.267	m
7	EGL to PCC top Height	d	0.600	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	$B3 = T + (H1-d)\tan Y$	B3	1.400	m
10	Thickness PCC	pcc_th1k	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	634.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \cos Y) / 1$	n	3.000	nos
15	Avg Length of Weephole $q = (B3 + T) / 2$	weep_len	1.000	m
16	percentage of rock cutting	p_c	0.200	
17	width of parapet wall	para_w	0.300	m
18	height of parapet wall	para_ht	0.450	m
19	Taking gap every 10m length	gap	0.300	m

Variable Declaration

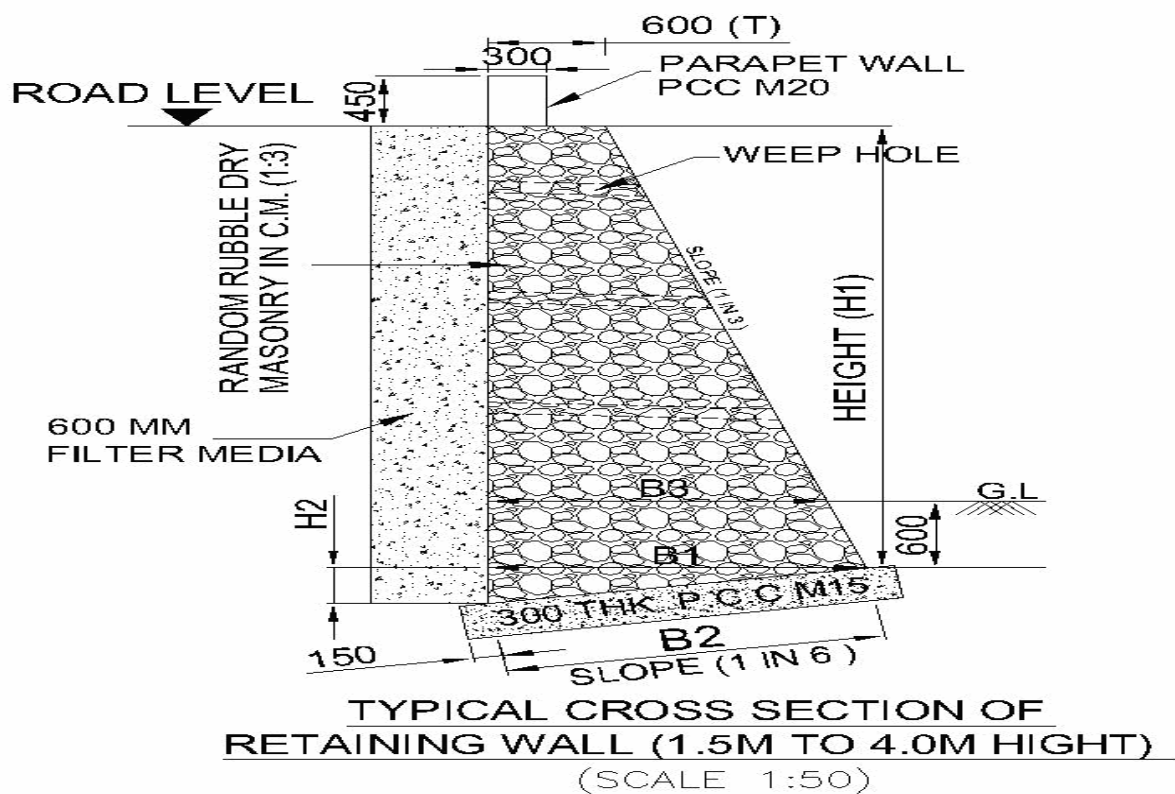


Variable Declaration

Retaining Wall 4.0m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height (H1)	H1	4.000	m
3	Slope at Base(1 in 6)	Z	9.462	degree
4	$B1 = (T+H1/3)$	B1	1.933	m
5	$B2 = B1/\cos Z$	B2	1.960	m
6	$H2 = B1 \cdot \tan Z$	H2	0.322	m
7	EGL to PCC top Height	d	0.600	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	$B3 = T + (H1-d)\tan Y$	B3	1.733	m
10	Thickness PCC	pcc_thk	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	634.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \cos Y) / 1$	n	4.000	nos
15	Avg Length of Weephole $q = (B3 + T) / 2$	weep_len	1.667	m
16	percentage of rock cutting	p_c	0.200	
17	Taking gap every 10m length	gap	0.300	m
18	Height of parapet wall	para_ht	0.450	m
19	width of parapet wall	para_w	0.300	m

Variable Declaration

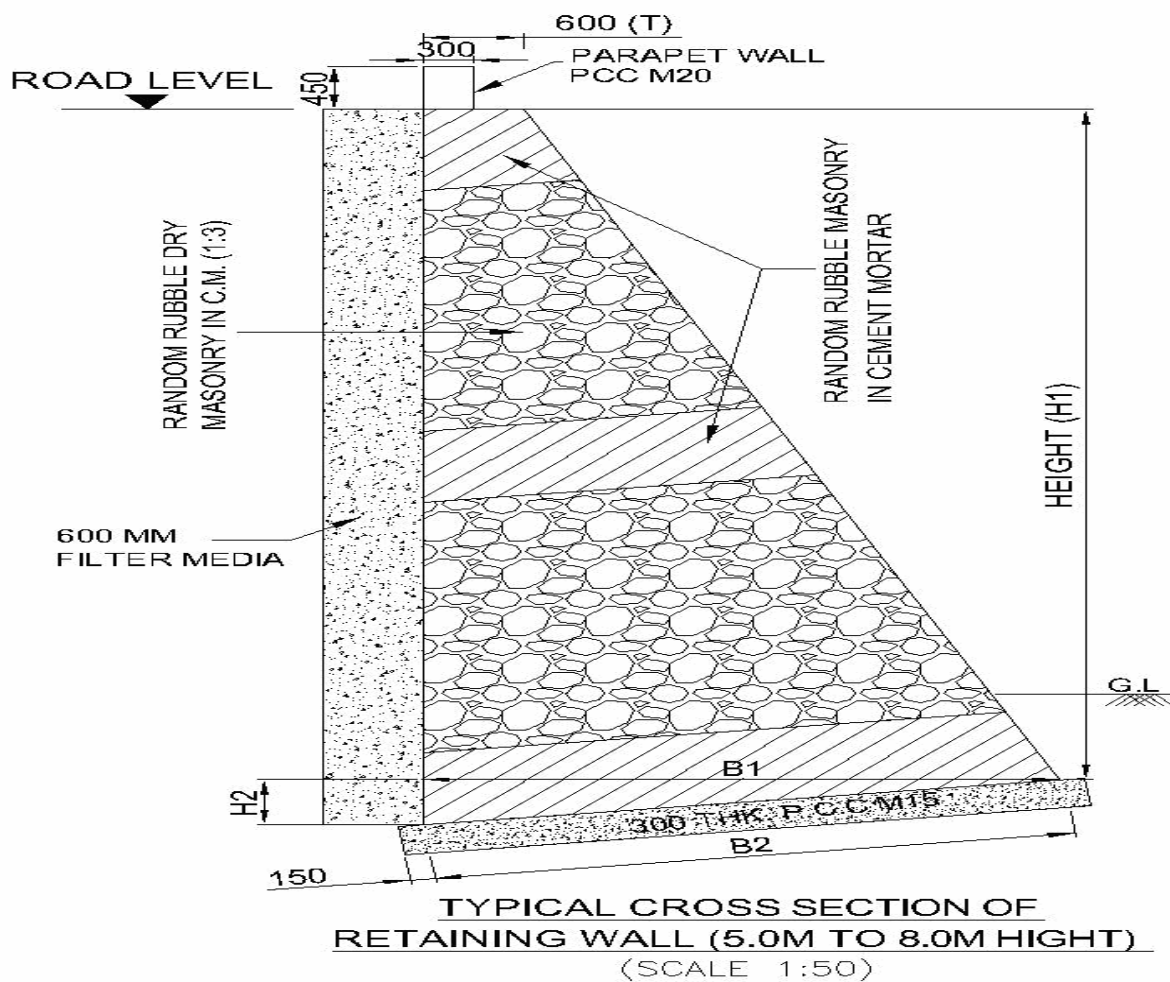


Variable Declaration

Retaining Wall 5.0m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height (H1)	H1	5.000	m
3	Slope at Base(1 in 6)	Z	9.462	degree
4	$B1 = (T+H1/3)$	B1	2.300	m
5	$B2 = B1/\cos Z$	B2	2.330	m
6	$H2 = B1.\tan Z$	H2	0.383	m
7	EGL to PCC top Height	d	0.900	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	$B3 = T + (H1-d)\tan Y$	B3	1.280	m
10	Thickness PCC	pcc_th1k	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	395.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \cos Y) / 1$	n	7.000	nos
15	Avg Length of Weephole $q = (B3 + T) / 2$	weep_len	0.940	m
16	percentage of rock cutting	p_c	0.200	
17	height of parapet wall	para_ht	0.450	m
18	width of parapet wall	para_w	0.300	m
19	Taking gap every 10m length	gap	0.300	m

Variable Declaration

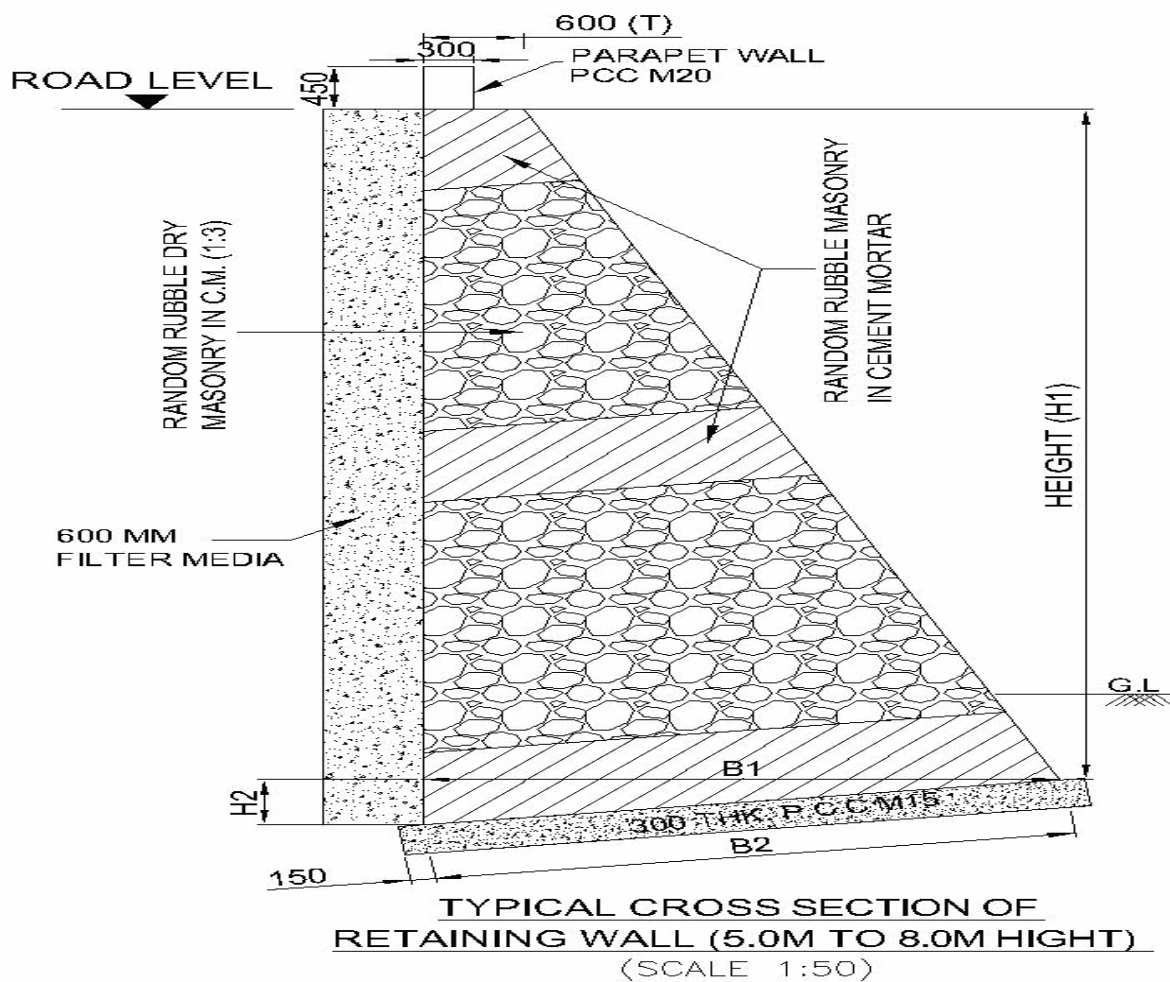


Variable Declaration

Retaining Wall 6.0m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height (H1)	H1	6.000	m
3	Slope at Base(1 in 6)	Z	9.462	degree
4	$B1 = (T+H1/3)$	B1	2.700	m
5	$B2 = B1/\cos Z$	B2	2.740	m
6	$H2 = B1.\tan Z$	H2	0.450	m
7	EGL to PCC top Height	d	0.900	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	$B3 = T + (H1-d)\tan Y$	B3	2.298	m
10	Thickness PCC	pcc_th1k	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	332.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \cos Y) / 1$	n	10.000	nos
15	Avg Length of Weephole $q = (B3 + T) / 2$	weep_len	1.025	m
16	percentage of rock cutting	p_c	0.200	
17	Taking gap every 10m length	gap	0.300	m
18	Height of parapet wall	para_ht	0.450	m
19	width of parapet wall	para_w	0.300	m

Variable Declaration



Toe Wall

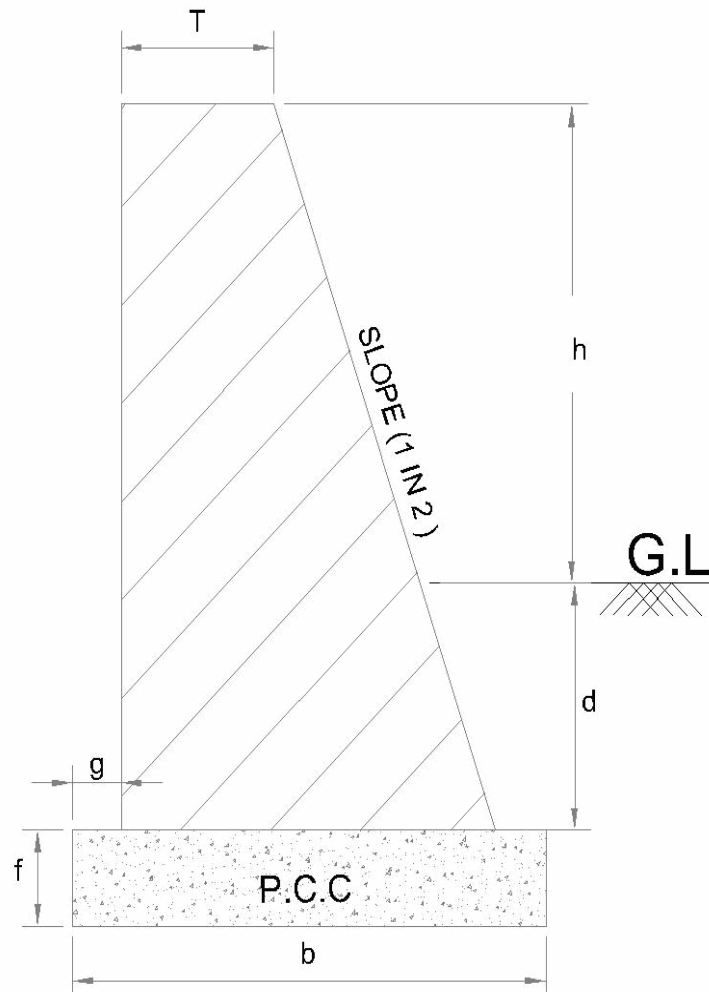
TCS Type	Length (m)	Side	Net Length (m)
TCS-5	592.1	Single	592.1
TCS-14	100	Single	100

Total Length= 692

Variable Declaration**Toe Wall 1m**

SI No	Variable Description	Variable	Dimension	Unit
1	Top Width	T	0.200	m
2	Bottom Width	b	0.750	m
3	Offset	g	0.100	m
4	Height above Ground	h	1.000	m
5	Height Below Ground	d	0.600	m
6	Foundation Thickness	f	0.100	m
7	Length	l	692.000	m
8	Width At GL ($c = b - 2.g - h/2$)	c	0.550	m

Variable Declaration



**TYPICAL CROSS SECTION OF
TOE WALL**

Variable Declaration

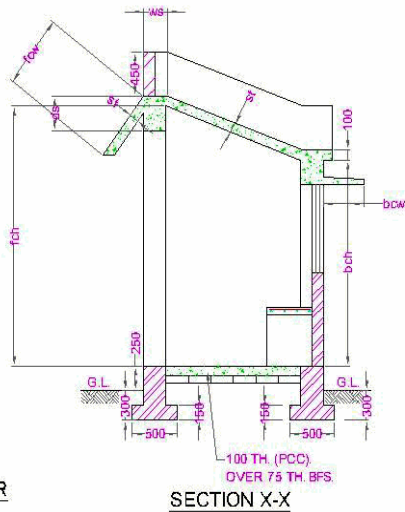
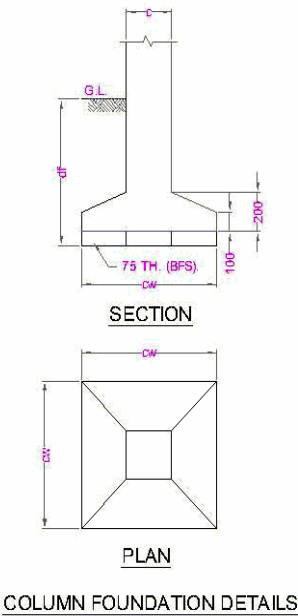
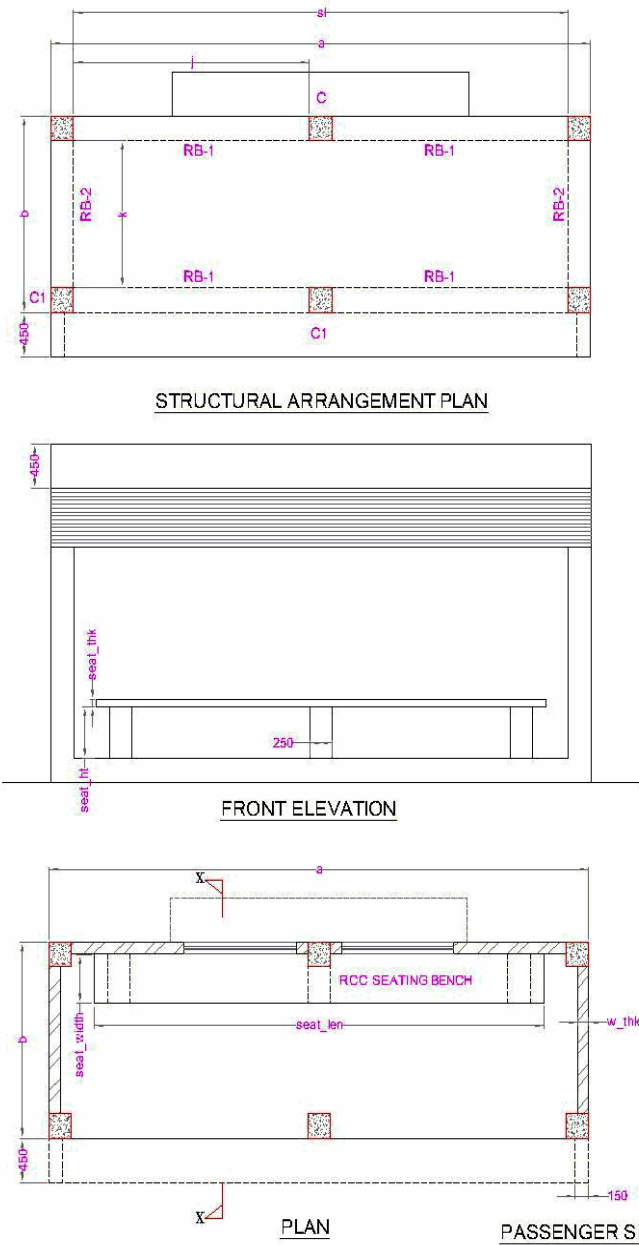
Passenger Shelter

SI No	Variable Description	Variable	Dimension	Unit
1	No of Passenger Shelter	n	0.000	nos
2	Foundation Length for column	a	0.750	m
3	Foundation Width for column	b	0.750	m
4	Foundation Depth for column	df	0.750	m
5	Nos of column	col_n	6.000	Nos
6	Foundation length for Brick work	l	13.500	m
7	Foundation width for Brick work	w	0.500	m
8	Foundation depth for Brick work	db	0.300	m
9	Each column length	col_l	0.250	m
10	Each column width	col_w	0.250	m
11	Thickness of foundation at bottom	btm_thk	0.100	m
12	Thickness of foundation at top	top_thk	0.100	m
13	Foundation reinforcement	rf	120.000	kg/cum
14	Width of brick wall	w_wall	0.125	m
15	Thickness of pcc	pcc_thk	0.100	m
16	Length of Passenger shelter	l_pass	6.000	m
17	Width of Passenger shelter	w_pass	2.000	m
18	Foundation brick wall top thickness	wtop_thk	0.150	m
19	Foundation brick wall btm thickness	wbtm_thk	0.150	m
20	Side wall & back wall lower portion height	wall_h	0.550	m
21	Side wall upper portion length	sw_l	1.500	m
22	Side wall upper portion height	sw_h	2.130	m
23	Back wall upper portion Length	bw_l	2.650	m
24	Back wall upper portion height	bw_h	0.950	m
25	Seating bench length	bch_l	5.000	m
26	Seating bench width	bch_w	0.500	m
27	Seating bench thickness	bch_thk	0.075	m
28	Nos of window	win_n	2.000	nos
29	Length of window	win_l	1.250	m
30	Height of window	win_h	0.900	m
31	Front column height	fcol_h	2.650	m
32	Back column height	bcol_h	2.100	m
33	Side beam length (RB2)	sb_l	1.530	m
34	Side beam width	sb_w	0.250	m
35	Side beam thickness	sb_thk	0.350	m
36	Side beam length (RB1)	sb_a	3.000	m
37	Thickness of Roof slab	roof_thk	0.110	m

Variable Declaration

38	Width of front Chajja	fchj_w	0.680	m
39	Width of back Chajja	bchj_w	0.450	m
40	Length of railing	rail_l	9.500	m
41	Height of railing	rail_h	0.450	m
42	Width of roof slab	roof_w	1.530	m
43	Superstructure reinforcement	srf	100.000	kg/cum
44	Side wall inner side length	sw_in	1.875	m
45	Back wall inner side length	bw_in	5.800	m
46	Side wall height (plastering &painting)	sw_ht	3.830	m
47	Back wall height (plastering &painting)	bw_ht	2.350	m
48	top width of wall in foundation	fw_wall	0.250	m

Variable Declaration



OVERHEAD SIGN

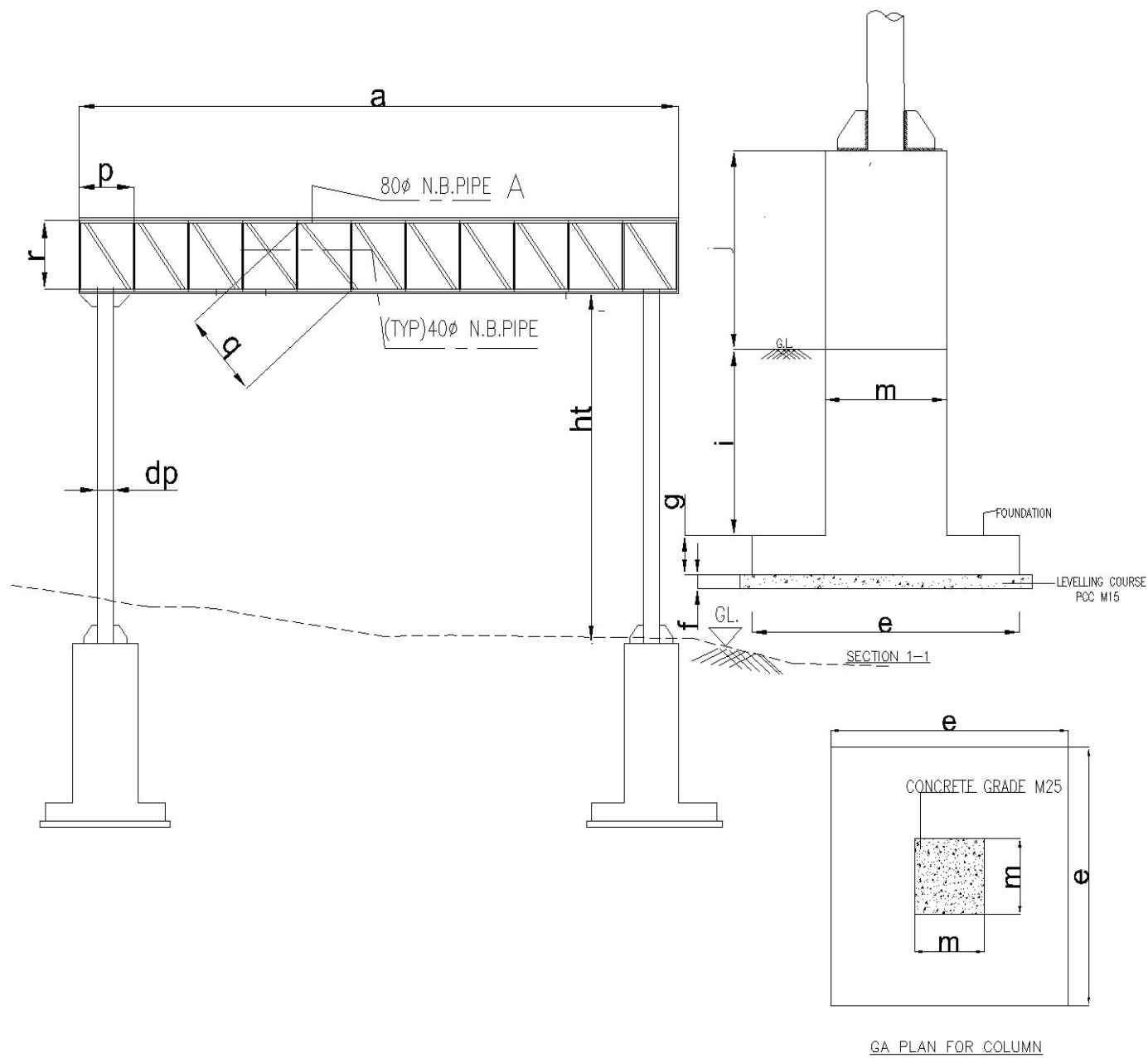
Chainage Details:		
Location	Ch. Km	Nos
Start & End Road	141+029 km	1
	Total	1

Variable Declaration

Overhead Signs

Sl No	Variable Description	Variable	Dimension	Unit
1	Nos of Signs	n	1.000	Nos
2	End to end Grantry Distance	a	15.000	m
3	From Fig	p	1.000	m
4	From Fig	q	1.560	m
5	From Fig	r	1.200	m
6	80 NB per meter Weight(IS 1239 -Part-1)	wt	0.010	ton/m
7	40 NB per meter Weight(IS 1239 -Part-1)	ws	0.004	ton/m
8	Height	ht	5.500	m
9	300 NB per meter Weight	wp	0.049	ton/m
10	Foundation PCC width	e	2.200	m
11	Foundation PCC thickness	f	0.100	m
12	From Fig	g	0.300	m
13	From Fig	i	1.400	m
14	From Fig	m	1.000	m
15	From Fig	j	1.000	m
16	Steel At Foundation per cum of RCC	sf	150.000	kg/cum
17	Steel At Sub Structure per cum of RCC	ss	150.000	kg/cum
18	Dia of Vertical Support	dp	0.300	m

Variable Declaration



Crash Barrier

TCS Type	Length (m)	Side	Net Length (m)
TCS-5	592.10	Single	592.1
TCS-10	0.00	Single	0
TCS-11	4957.30	Single	4957.3
TCS-11A	0.00	Single	0
TCS-12	389.40	Single	389.4
TCS-12A	0.00	Single	0
TCS-13	0.00	Both	0
TCS-14	100.00	Single	100

Total= 6039

For Bridge Approaches = 100.00 m
(Taking 50 m each Approach)

Total length of crash barrier = 6139 m

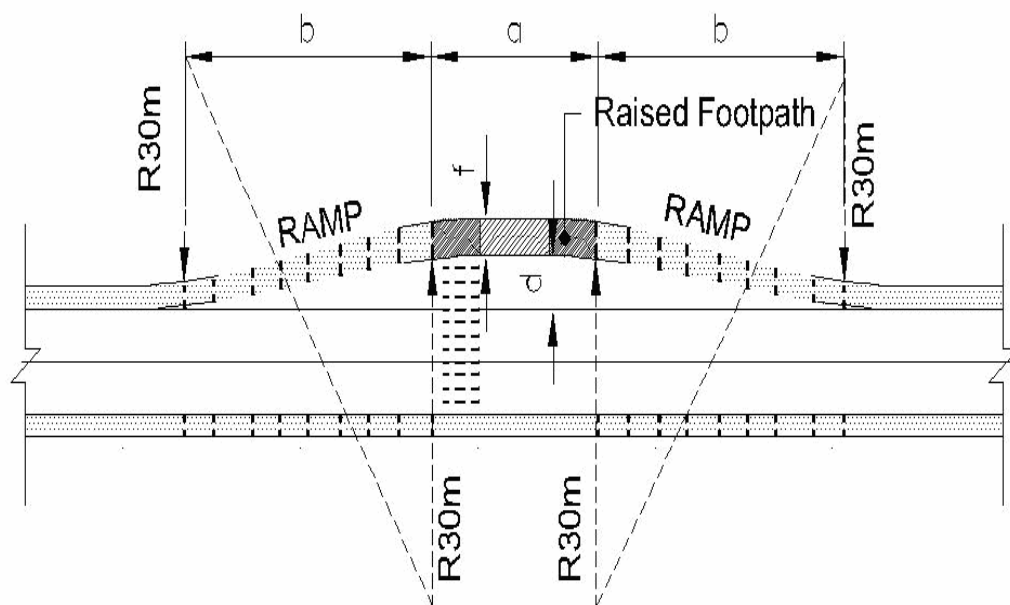
Variable Declaration**Crash Barrier**

Sl No	Variable Description	Variable	Dimension	Unit
1	No of Location of Crash Barrier	n	17.000	nos
2	Each side of Crash Barrier Length	cl	25.000	m
3	Total Length of Crash Barrier	tot_len	6139.000	m

Variable Declaration

Busbay (2 Lane) at Hill

SI No	Variable Description	Variable	Dimension	Unit
1	BC Thickness	bc	0.040	m
2	DBM Thickness	dbm	0.070	m
3	WMM-I Thickness	wmm1	0.125	m
4	WMM-II Thickness	wmm2	0.125	m
5	GSB Thickness	gsb	0.200	m
6	SG Thickness	sg	0.500	m
7	Nos of Bus Bay	n	0.000	nos
8	Width Footpath	f	2.500	m
9	Ref Drawing	a	15.000	m
10	Ref Drawing	b	22.000	m
11	Ref Drawing	d	3.500	m
12	GSB percentage Re-use	gsb_per	8.500	percentage
13	Eech Pedestrian Marking Area for Each Busbay(1.5m x 20m)	ped_mar	30.000	sqm

Variable Declaration

TYPICAL LAYOUT OF PICK-UP BUS STOP ON HILLY AREA

Traffic Signs and Other Appurtenance

Summary Of Traffic Signs				
Total No of Street Light=	10	Nos	Bill No- 06,	Sl. No- 15
Kilometer stones=	9	Nos	Bill No- 06,	Sl. No- 2
5th Kilometer stones=	2	Nos	Bill No- 06,	Sl. No- 1
Boundary Stones=	113	Nos	Bill No- 06,	Sl. No- 3
Delineators (100 cm long and circular shaped)+H	950	Nos	Bill No- 06,	Sl. No- 12
Road Stud=	4758	Nos	Bill No- 06,	Sl. No- 14
900 mm Octagonal	3	Nos	Bill No- 06,	Sl. No- 8
600 mm circular	44	Nos	Bill No- 06,	Sl. No- 6
900 mm Tringular	69	Nos	Bill No- 06,	Sl. No- 5
800 mm x 600 mm rectangular	6	Nos	Bill No- 06,	Sl. No- 7
Direction Sign < 0.9 sqm	257	sqm	Bill No- 06,	Sl. No- 9
Direction Sign > 0.9 sqm	4	sqm	Bill No- 06,	Sl. No- 10
Convex Mirror for Blind Curve	5	Nos	Bill No- 06,	Sl. No- 16
Rumble Strip=	21	sqm	Bill No- 06,	Sl. No- 19

Traffic Signs and Other Appurtenance

Traffic sign Calculation

Sl No	Type	IRC-67 2012 Specification	Dimension	Chainage / Location		No	Remarks
1	Right Hand Side Curve	fig 15.02	900 mm Triangular		131.914,132.395,132.555,132.717,132.867,135.103,137.974,138.255,138.739,138.816,139.022,140.580,140.790	26	@ 2per location
2	Left Hand Side Curve	fig 15.01	900 mm Triangular		132.642, 134.97, 137.464, 138.16, 138.895, 139.168, 140.373, 140.626, 140.971,	20	@ 2per location
3	Zig-Zag Curve	fig 15.07	900 mm Triangular		130.08, 130.64, 130.71, 131.5, 133.67, 134.78, 135.85, 136.15, 136.27, 137.34, 138.36, 138.67, 139.27, 139.64, 139.79, 140.03, 140.12, 140.3	18	@ 1per location
4	Reverse Curve	fig 15.06 & 15.05	900 mm Triangular		131.54, 131.76, 132.1, 132.42, 133.05, 133.51, 135.54, 135.76, 137.62, 137.89	20	@ 1per location
5	Built-up area	fig 15.35	900 mm Triangular			2	@ 2per location
6	Side road	fig 15.09 & 15.10	900 mm Triangular			2	@ 2per location
7	Pedestain Crossing		900 mm Triangular	side road, bus bay		2	@ 2per location
8	Bus Stop	fig 17.35	800x600 rectangular			2	@ 2per location
9	Direction Sign		<0.9 sqm	Side road & cross road		2	@ 2per location
10	Direction Sign		>0.9 sqm	bridge	140.88	2	@ 2per location
11	Hazard Marker	fig 15.76 & fig 15.77	900x300 mm rectangular	Culvert, Bridge Location	Bridge = 140.880 Culvert=130.093, 130.282, 130.308, 130.36, 130.778, 130.905, 131.112, 131.212, 131.503, 131.639, 131.779, 132.002, 132.248, 132.42, 132.562, 132.786, 132.984, 133.167, 133.335, 133.625, 133.681, 133.788, 134.081, 134.414, 134.461, 134.652, 134.751, 134.883, 134.932, 135.072, 135.19, 135.233, 135.333, 135.56, 135.59, 135.805, 135.927, 136.084, 136.14, 136.216, 136.42, 136.432, 136.483, 136.498, 136.572, 136.662, 136.724, 136.924, 137.158, 137.25, 137.282, 137.325, 137.378, 137.91, 137.975, 138.485, 138.662, 138.711, 138.854, 139.392, 139.421, 139.486, 139.63, 139.673, 139.747, 139.977, 140.12, 140.3, 140.502,	284	@ 4 per structure
12	Stop Sign	fig 14.01	900 mm Octagonal	Side road & cross road	125.400, 128.800, 129.325	3	@ 1 per location
13	Speed limit	fig 14.37	600mm Circular		119.47, 119.1, 119.76, 119.864, 121.25, 121.56, 121.62, 121.87, 122.43, 122.5, 122.727, 122.9, 122.96, 123.1, 123.14, 123.49, 123.52, 123.56, 123.71, 123.89, 124.26, 124.33, 124.53, 125, 125.17, 125.4, 126.02, 126.36, 126.83, 126.935, 127.07, 127.24, 127.3, 127.53, 128.089, 128.56, 129.19, 129.39, 129.52, 129.74, 129.95, 130.08, 130.64, 130.71, 131.5, 131.54, 131.76, 132.1, 132.42, 133.05, 133.51, 133.67, 134.78, 135.54, 135.76, 135.85, 136.15, 136.27, 137.288, 137.34, 137.62, 137.89, 138.36, 138.67, 139.27, 139.64, 139.79, 140.03, 140.12, 140.3,	40	Every on Zigzag sign, Reverse Curve & Hair pin bend
14	Rumble strip	fig 15.50	900 Triangular			3	@ 2per location in Built Up Area & @ 1per location in Side
15	Hair pin Bend	fig 15.03 & 15.04	900 mm Triangular		137.288	2	@ 2per location
16	Convex Mirror for Blind Curve				134, 134.97, 137.288, 138.895,	5	@ 1per location

Junction Part

SUMMARY			
90 cm equilateral triangle		69	nos
Stop Sign (90 cm high octagon)		3	nos
60 cm circular		44	nos
80 cm x 60 cm rectangular		6	nos
Direction Sign	<.0.9 sqm	1.8	sqm
Direction Sign	>.0.9 sqm	4	sqm
Hazard Marker	<.0.9 sqm	256	sqm
Convex Mirror for Blind Curve		5	nos
Rumble Strip		21	nos

Calculation of km Stone, Hectometer Stone and Boundary Stone

Item	Remarks	Nos
Kilometer stones	Total KM Stone- No. of 5th KM stone	9
	(km stone 5th, 10th , 15th, 20th etc)	2
Boundary stones	(Total Lengthx5x2) + 2x1	113

Traffic Signs and Other Appurtenance

CALCULATION FOR DELINEATOR

In horizontal Curves (radius > 1000m)

HIP / CURVE NO.	ELEMENT	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	HAND OF ARC	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve
					as per IRC:79- 1981										
1136	Arc	130099.044	130112.247	50	8	Right	13.203	2	1	1	1	1	0	1	0
1137	Arc	130179.387	130200.053	20	6	Left	20.666	4	2	1	1	1	0	1	0
1138	Arc	130246.387	130247.825	60	8	Right	1.438	1	1	1	1	1	0	1	0
1139	Arc	130294.367	130317.362	20	6	Right	22.995	4	2	1	1	1	0	1	0
1140	Arc	130356.011	130365.457	40	6	Right	9.446	2	1	1	1	1	1	1	0
1141	Arc	130464.114	130513.828	100	12	Right	49.714	5	3	1	1	1	0	1	0
1142	Arc	130593.442	130616.129	30	6	Left	22.687	4	2	1	1	1	1	1	0
1143	Arc	130737.254	130857.008	100	12	Left	119.754	10	5	1	1	1	0	1	0
1144	Arc	130934.802	130938.507	100	12	Left	3.705	1	1	1	1	1	1	1	0
1145	Arc	131086.170	131131.103	30	6	Right	44.933	8	4	1	1	1	1	1	0
1146	Arc	131199.762	131208.260	60	8	Right	8.498	2	1	1	1	1	0	1	0
1147	Arc	131278.411	131324.154	40	6	Left	45.743	8	4	1	1	1	1	1	0
1148	Arc	131394.242	131403.275	60	8	Left	9.033	2	1	1	1	1	0	1	0
1149	Arc	131467.227	131472.069	50	8	Left	4.842	1	1	1	1	1	1	1	0
1150	Arc	131566.655	131591.010	20	6	Right	24.355	5	3	1	1	1	1	1	0
1151	Arc	131700.747	131741.113	30	6	Left	40.366	7	4	1	1	1	1	1	1
1152	Arc	131893.421	131934.634	50	8	Right	41.213	6	3	1	1	1	1	1	1
1153	Arc	132121.025	132145.820	20	6	Left	24.795	5	3	1	1	1	1	1	0
1154	Arc	132210.268	132221.760	40	6	Right	11.492	2	1	1	1	1	1	1	0
1155	Arc	132304.343	132319.676	40	6	Right	15.333	3	2	1	1	1	1	1	0
1156	Arc	132386.853	132403.683	125	12	Right	16.830	2	1	1	1	1	1	1	0
1157	Arc	132550.287	132559.911	60	8	Right	9.624	2	1	1	1	1	0	1	0
1158	Arc	132624.220	132660.480	40	6	Left	36.260	7	4	1	1	1	0	1	0
1159	Arc	132710.968	132723.809	60	8	Right	12.841	2	1	1	1	1	1	1	0
1160	Arc	132861.853	132872.114	80	8	Right	10.261	2	1	1	1	1	1	1	1

HIP / CURVE NO.	ELEMENT	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	HAND OF ARC	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve
					as per IRC:79- 1981										
1161	Arc	133075.995	133085.083	150	12	Right	9.088	1	1	1	1	1	0	1	0
1162	Arc	133192.895	133311.927	100	12	Left	119.032	10	5	1	1	1	0	1	0
1163	Arc	133418.584	133477.929	50	8	Right	59.345	8	4	1	1	1	1	1	1
1164	Arc	133699.265	133776.060	60	8	Left	76.795	10	5	1	1	1	1	1	0
1165	Arc	133878.250	133892.809	60	8	Left	14.559	2	1	1	1	1	1	1	0
1166	Arc	133983.685	134016.054	20	6	Right	32.369	6	3	1	1	1	1	1	0
1167	Arc	134132.273	134158.495	100	12	Left	26.222	3	2	1	1	1	1	1	0
1168	Arc	134274.447	134285.313	50	8	Left	10.866	2	1	1	1	1	1	1	0
1169	Arc	134367.836	134380.043	50	8	Right	12.207	2	1	1	1	1	0	1	0
1170	Arc	134440.791	134490.484	80	8	Left	49.693	7	4	1	1	1	0	1	0
1171	Arc	134563.623	134595.701	60	8	Right	32.078	5	3	1	1	1	0	1	0
1172	Arc	134637.477	134653.047	60	8	Left	15.570	2	1	1	1	1	0	1	0
1173	Arc	134698.757	134757.127	60	8	Right	58.370	8	4	1	1	1	1	1	1
1174	Arc	134958.530	134981.016	20	6	Left	22.486	4	2	1	1	1	1	1	0
1175	Arc	135088.734	135117.340	40	6	Right	28.606	5	3	1	1	1	1	1	1
1176	Arc	135564.161	135607.379	50	8	Right	43.218	6	3	1	1	1	0	1	0
1177	Arc	135662.036	135740.302	60	8	Left	78.266	10	5	1	1	1	1	1	0
1178	Arc	135869.678	135879.178	30	6	Left	9.500	2	1	1	1	1	0	1	0
1179	Arc	135910.534	135925.511	30	6	Right	14.977	3	2	1	1	1	1	1	0
1180	Arc	135997.861	136025.210	30	6	Left	27.349	5	3	1	1	1	0	1	0
1181	Arc	136071.381	136113.908	30	6	Right	42.527	8	4	1	1	1	1	1	1
1182	Arc	136305.942	136369.505	40	6	Left	63.563	11	6	1	1	1	1	1	0
1183	Arc	136482.036	136499.648	40	6	Right	17.612	3	2	1	1	1	1	1	0
1184	Arc	136569.945	136577.633	60	8	Right	7.688	1	1	1	1	1	1	1	0
1185	Arc	136692.268	136719.485	50	8	Right	27.217	4	2	1	1	1	1	1	0
1186	Arc	136836.192	136898.147	60	8	Left	61.955	8	4	1	1	1	1	1	0
1187	Arc	137020.405	137022.948	150	12	Right	2.543	1	1	1	1	1	0	1	0
1188	Arc	137135.121	137162.595	150	12	Left	27.474	3	2	1	1	1	0	1	0
1189	Arc	137266.956	137309.168	25	8	Right	42.212	6	3	1	1	1	1	1	0
1190	Arc	137452.516	137475.907	50	8	Left	23.391	3	2	1	1	1	1	1	0
1191	Arc	137644.250	137671.649	20	6	Left	27.399	5	3	1	1	1	0	1	0
1192	Arc	137714.937	137750.269	30	6	Right	35.332	6	3	1	1	1	1	1	0
1193	Arc	137823.520	137861.861	30	6	Left	38.341	7	4	1	1	1	1	1	0

HIP / CURVE NO.	ELEMENT	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	HAND OF ARC	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve	
					as per IRC:79- 1981											
1194	Arc	137947.482	137999.827	30	6	Right	52.345	9	5	1	1	1	1	1	1	
1195	Arc	138137.062	138182.630	50	8	Left	45.568	6	3	1	1	1	0	1	0	
1196	Arc	138250.667	138258.651	80	8	Right	7.984	1	1	1	1	1	1	1	0	
1197	Arc	138384.960	138432.955	30	6	Left	47.995	8	4	1	1	1	0	1	0	
1198	Arc	138483.524	138499.015	20	6	Right	15.491	3	2	1	1	1	0	1	0	
1199	Arc	138555.441	138568.746	20	6	Left	13.305	3	2	1	1	1	0	1	0	
1200	Arc	138617.339	138646.698	20	6	Right	29.359	5	3	1	1	1	1	1	0	
1201	Arc	138736.199	138740.964	50	8	Right	4.765	1	1	1	1	1	0	1	0	
1202	Arc	138810.973	138820.375	50	8	Right	9.402	2	1	1	1	1	0	1	0	
1203	Arc	138882.877	138906.684	20	6	Left	23.807	4	2	1	1	1	1	1	0	
1204	Arc	139018.479	139025.043	50	8	Right	6.564	1	1	1	1	1	1	1	0	
1205	Arc	139157.371	139177.964	50	8	Left	20.593	3	2	1	1	1	1	1	0	
1206	Arc	139299.651	139317.412	100	12	Left	17.761	2	1	1	1	1	0	1	0	
1207	Arc	139390.198	139404.024	30	6	Right	13.826	3	2	1	1	1	0	1	0	
1208	Arc	139444.729	139449.380	80	8	Left	4.651	1	1	1	1	1	1	1	0	
1209	Arc	139550.270	139586.116	50	8	Left	35.846	5	3	1	1	1	1	1	1	
1210	Arc	139808.983	139821.676	50	8	Right	12.693	2	1	1	1	1	1	1	0	
1211	Arc	139899.615	139902.421	40	6	Left	2.806	1	1	1	1	1	1	1	0	
1212	Arc	139972.168	139987.085	30	6	Right	14.917	3	2	1	1	1	1	1	1	
1213	Arc	140140.193	140147.054	30	6	Right	6.861	2	1	1	1	1	0	1	0	
1214	Arc	140195.265	140204.455	30	6	Left	9.190	2	1	1	1	1	1	1	0	
1215	Arc	140263.540	140268.703	50	8	Right	5.163	1	1	1	1	1	1	1	0	
1216	Arc	140371.548	140373.961	80	8	Left	2.413	1	1	1	1	1	1	1	1	
1217	Arc	140563.023	140597.227	170	12	Right	34.204	3	2	1	0	1	0	1	0	
1218	Arc	140615.735	140637.232	170	12	Left	21.497	2	1	0	1	1	1	1	0	
1219	Arc	140771.147	140809.066	30	6	Right	37.919	7	4	1	1	1	1	1	1	
1220	Arc	140943.786	140999.201	50	8	Left	55.415	7	4	1	0	1	0	1	0	
TOTAL								=	352	197	84	83	85	52	85	12

Total No of Road Delineators =

950 nos.

Traffic Signs and Other Appurtenance

Quantity Calculation for Road Stud

SL. No.	Description of section	START	END	Transition length	START CH.	END CH.	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
		CHAINAGE	CHAINAGE		Road Stud	Road stud					
1	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	130099.044	130112.247	15	130064.044	130147.247	83.20	50	6	14	28
		130179.387	130200.053	15	130144.387	130235.053	90.67	35	6	16	32
		130246.387	130247.825	15	130211.387	130282.825	71.44	30	6	12	24
		130294.367	130317.362	15	130259.367	130352.362	92.99	25	6	16	32
		130356.011	130365.457	20	130316.011	130405.457	89.45	60	6	15	30
		130464.114	130513.828	20	130424.114	130553.828	129.71	60	6	22	44
		130593.442	130616.129	15	130558.442	130651.129	92.69	80	6	16	32
		130737.254	130857.008	20	130697.254	130897.008	199.75	125	6	34	68
		130934.802	130938.507	20	130894.802	130978.507	83.71	60	6	14	28
		131086.170	131131.103	15	131051.170	131166.103	114.93	40	6	20	40
		131199.762	131208.260	25	131154.762	131253.260	98.50	25	6	17	34
		131278.411	131324.154	20	131238.411	131364.154	125.74	200	6	21	42
		131394.242	131403.275	15	131359.242	131438.275	79.03	50	6	14	28
		131467.227	131472.069	15	131432.227	131507.069	74.84	35	6	13	26
		131566.655	131591.010	15	131531.655	131626.010	94.36	100	6	16	32
		131700.747	131741.113	15	131665.747	131776.113	110.37	25	6	19	38
		131893.421	131934.634	25	131848.421	131979.634	131.21	125	6	22	44
		132121.025	132145.820	15	132086.025	132180.820	94.80	80	6	16	32
		132210.268	132221.760	20	132170.268	132261.760	91.49	125	6	16	32
		132304.343	132319.676	20	132264.343	132359.676	95.33	80	6	16	32
		132386.853	132403.683	15	132351.853	132438.683	86.83	70	6	15	30
		132550.287	132559.911	15	132515.287	132594.911	79.62	100	6	14	28
		132624.220	132660.480	25	132579.220	132705.480	126.26	20	6	22	44
		132710.968	132723.809	15	132675.968	132758.809	82.84	70	6	14	28
		132861.853	132872.114	20	132821.853	132912.114	90.26	20	6	16	32
		133075.995	133085.083	15	133040.995	133120.083	79.09	20	6	14	28
		133192.895	133311.927	20	133152.895	133351.927	199.03	45	6	34	68

SL. No.	Description of section	START	END	Transition length	START CH.	END CH.	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
		CHAINAGE	CHAINAGE		Road Stud	Road stud					
	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	133418.584	133477.929	25	133373.584	133522.929	149.35	35	6	25	50
		133699.265	133776.060	25	133654.265	133821.060	166.79	50	6	28	56
		133878.250	133892.809	15	133843.250	133927.809	84.56	25	6	15	30
		133983.685	134016.054	15	133948.685	134051.054	102.37	125	6	18	36
		134132.273	134158.495	20	134092.273	134198.495	106.22	125	6	18	36
		134274.447	134285.313	25	134229.447	134330.313	100.87	66	6	17	34
		134367.836	134380.043	25	134322.836	134425.043	102.21	70	6	18	36
		134440.791	134490.484	25	134395.791	134535.484	139.69	50	6	24	48
		134563.623	134595.701	15	134528.623	134630.701	102.08	80	6	18	36
		134637.477	134653.047	15	134602.477	134688.047	85.57	20	6	15	30
		134698.757	134757.127	15	134663.757	134792.127	128.37	100	6	22	44
		134958.530	134981.016	15	134923.530	135016.016	92.49	60	6	16	32
		135088.734	135117.340	20	135048.734	135157.340	108.61	80	6	19	38
		135564.161	135607.379	15	135529.161	135642.379	113.22	30	6	19	38
		135662.036	135740.302	15	135627.036	135775.302	148.27	60	6	25	50
		135869.678	135879.178	15	135834.678	135914.178	79.50	80	6	14	28
		135910.534	135925.511	15	135875.534	135960.511	84.98	80	6	15	30
		135997.861	136025.210	15	135962.861	136060.210	97.35	50	6	17	34
		136071.381	136113.908	15	136036.381	136148.908	112.53	80	6	19	38
		136305.942	136369.505	25	136260.942	136414.505	153.56	20	6	26	52
		136482.036	136499.648	25	136437.036	136544.648	107.61	30	6	18	36
		136569.945	136577.633	25	136524.945	136622.633	97.69	125	6	17	34
		136692.268	136719.485	25	136647.268	136764.485	117.22	40	6	20	40
		136836.192	136898.147	35	136781.192	136953.147	171.95	20	6	29	58
		137020.405	137022.948	15	136985.405	137057.948	72.54	20	6	13	26
		137135.121	137162.595	15	137100.121	137197.595	97.47	20	6	17	34
		137266.956	137309.168	25	137221.956	137354.168	132.21	80	6	23	46
		137452.516	137475.907	25	137407.516	137520.907	113.39	60	6	19	38
		137644.250	137671.649	15	137609.250	137706.649	97.40	50	6	17	34
		137714.937	137750.269	15	137679.937	137785.269	105.33	35	6	18	36
		137823.520	137861.861	15	137788.520	137896.861	108.34	60	6	19	38
		137947.482	137999.827	15	137912.482	138034.827	122.35	35	6	21	42
		138137.062	138182.630	25	138092.062	138227.630	135.57	35	6	23	46

SL. No.	Description of section	START	END	Transition length	START CH.	END CH.	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
		CHAINAGE	CHAINAGE		Road Stud	Road stud					
	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	138250.667	138258.651	25	138205.667	138303.651	97.98	125	6	17	34
		138384.960	138432.955	15	138349.960	138467.955	117.99	60	6	20	40
		138483.524	138499.015	15	138448.524	138534.015	85.49	40	6	15	30
		138555.441	138568.746	15	138520.441	138603.746	83.31	40	6	14	28
		138617.339	138646.698	15	138582.339	138681.698	99.36	125	6	17	34
		138736.199	138740.964	25	138691.199	138785.964	94.77	20	6	16	32
		138810.973	138820.375	25	138765.973	138865.375	99.40	30	6	17	34
		138882.877	138906.684	15	138847.877	138941.684	93.81	125	6	16	32
		139018.479	139025.043	25	138973.479	139070.043	96.56	60	6	17	34
		139157.371	139177.964	25	139112.371	139222.964	110.59	20	6	19	38
		139299.651	139317.412	20	139259.651	139357.412	97.76	60	6	17	34
		139390.198	139404.024	15	139355.198	139439.024	83.83	25	6	14	28
		139444.729	139449.380	15	139409.729	139484.380	74.65	30	6	13	26
		139550.270	139586.116	40	139490.270	139646.116	155.85	60	6	26	52
		139808.983	139821.676	15	139773.983	139856.676	82.69	30	6	14	28
		139899.615	139902.421	25	139854.615	139947.421	92.81	50	6	16	32
		139972.168	139987.085	30	139922.168	140037.085	114.92	80	6	20	40
		140140.193	140147.054	15	140105.193	140182.054	76.86	80	6	13	26
		140195.265	140204.455	15	140160.265	140239.455	79.19	60	6	14	28
		140263.540	140268.703	25	140218.540	140313.703	95.16	60	6	16	32
		140371.548	140373.961	25	140326.548	140418.961	92.41	50	6	16	32
		140563.023	140597.227		140543.023	140617.227	74.20	70	6	13	26
		140615.735	140637.232		140595.735	140657.232	61.50	60	6	11	22
		140771.147	140809.066	15	140736.147	140844.066	107.92	80	6	18	36
		140943.786	140999.201	15	140908.786	141034.201	125.42	70	6	21	42
2	Major Bridge	Structure					500.00		9	56	112
3	Builtup sections						0		18	0	0
										1586	3172

Total no. of Road stud = 4758 no.

CALCULATION FOR STREET LIGHTING

Refer to BOQ Item Sl.No.- 6.11

Street light in Built Up Location:

TCS Type	Length	Length (m)
TCS-1	0	0.00
Total =		0

Total length = 0 m

Assuming , street lights @= 50m interval

for 0 m 0 nos

At Busbay location=
(@ 5 nos per Busbay) 0 nos

At Bridge Portion =
(@ 6 nos per Bridge) 6 nos

At Bridge Approach=
(@ 4 nos per Approach) 4 nos

Total nos of street light= 10 nos

Errosion Control

Quantity Calculation (Turfig with Sods) ::

Length of Turfig for TCS-5(Single side)=	592.10 m
Length of Turfig for TCS-10(single side)=	0.00 m
Length of Turfig for TCS-11(Single side)=	4957.30 m
Length of Turfig for TCS-11A(Single side)=	0.00 m
Length of Turfig for TCS-12(Single side)=	389.40 m
Length of Turfig for TCS-12A(Single side)=	0.00 m
Length of Turfig for TCS-13(Both side)=	0.00 m
Length of Turfig for TCS-14(Single side)=	100.00 m

Assume ht. of embankment = 2.0 m
Width of Turfig = 4.47 m

Total = 27006 sqm

Quantity of Turfig = 27006 sqm

Bill No- 02, Sl. No- 5

Quantity Calculation (Hydroseeding) ::

TCS Type	Length (m)	side	Length
TCS-8	2131.7	Single	2131.7
TCS-8A	0	Single	0
TCS-9	500	Single	500
TCS-9A	0	Single	0
TCS-12	389.4	Single	389.4
TCS-12A	0	Single	0
TCS-14	100	Single	100
TCS-15A	0	Both	0
Total =			3121.1

Avg Width of Hydro Seeding = 8.00 m

Total Area of Hydro Seeding= 24969 sqm

Bill No- 02, Sl. No- 1

Reusable Sub-base Base Calculation

	Required GSB Qty	Reusable GSB Quantity	
TCS-05	1995.188	169.591	Cum
TCS-07	6969.677	592.423	Cum
TCS-08	7185.373	610.757	Cum
TCS-09	1493.125	126.916	Cum
TCS-11	16706.33	1420.038	Cum
TCS-12	1311.027	111.437	Cum
TCS-14	337.025	28.647	Cum
Extra Widening on Flexible Pavement	981	83.385	Cum
Total=	36979	3143	

Reuseable GSB Quantity=

8.50%

Total Dismantle Granular Quantity(cum)=

5238

Refer backup calculation sheet

use 60% of Total Dismantle Granular Quantity for GSB (cum)=

3143

≈

Total Required GSB Qty (Cum)=

36979

8.5 % of this required quantity will be bought from dismantle material i.e

3143

Re Useable Quantity of GSB Material(cum)=

3143

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Remaining Quantity of GSB(cum) =

33836

BILL OF QUANTITY
(ROAD PART)

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02.01/ii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 600 mm to 900 mm	Each	6.00		
2	02.01/iii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 900 mm to 1800 mm	Each	25.00		
3	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm	Each	5.00		
4	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm	Each	4.00		
5	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)	Ha	6.62		
6	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above				

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	21.00		
7	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	852.00		
8	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	3.00		
9	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	14.00		
10	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	42.00		
11	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier	sqm	34,921.00		
12	02.04/viii/f/ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier	sqm	34,456.00		
		Total of Bill 01. Site Clearance and Dismantling				

Quantity Backup Calculation For Bill : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	02.01/ii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 600 mm to 900 mm			
		Refer: Site Clearance and Dismantling Formula: 6	6	6.00	Each
			Total :	6.00	Each
2	02.01/iii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 900 mm to 1800 mm			
		Refer: Site Clearance and Dismantling Formula: 25	25	25.00	Each
			Total :	25.00	Each
3	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm			
		Refer: Site Clearance and Dismantling Formula: 5	5	5.00	Each
			Total :	5.00	Each
4	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm			
		Refer: Site Clearance and Dismantling Formula: 4	4	4.00	Each
			Total :	4.00	Each

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)			
		Refer: Site Clearance and Dismantling Formula: 6.62	6.62	6.62	Ha
			Total :	6.62	Ha
6	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above			
		Refer: Site Clearance and Dismantling Formula: 21	21	21.00	cum
			Total :	21.00	cum
7	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar			
		Refer: Site Clearance and Dismantling Formula: 852	852	852.00	Cum
			Total :	852.00	Cum
8	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia			
		Refer: Site Clearance and Dismantling Formula: 3	3	3.00	rm
			Total :	3.00	rm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
9	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia			
		Refer: Site Clearance and Dismantling Formula: 14	14	14.00	rm
			Total :	14.00	rm
10	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia			
		Refer: Site Clearance and Dismantling Formula: 42	42	42.00	rm
			Total :	42.00	rm
11	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier			
		Refer: Site Clearance and Dismantling Formula: 34921	34921	34,921.00	sqm
			Total :	34,921.00	sqm
12	02.04/viii/f/i	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier			
		Refer: Site Clearance and Dismantling Formula: 34456	34456	34,456.00	sqm
			Total :	34,456.00	sqm

Bill No : 02. Earth work,Subgrade and Erosion control

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface	sqm	24,969.00		
2	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2	cum	79,402.00		
3	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	46,552.40		
4	03.15	Compacting original ground supporting subgrade Loosening of the ground upto a level of 500 mm below the subgrade level, watered, graded and compacted in layers to meet requirement of table 300-2 for subgrade construction.	cum	14,427.86		
5	03.19	Turfing with Sods Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of sods and watering	sqm	27,006.00		
6	03.31	Excavation in Hill Area in Soil by Mechanical Means Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with all lifts and lead upto 1000 metres	cum	606,069.60		

Bill No : 02. Earth work,Subgrade and Erosion control

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	03.32	Excavation in Hilly Area in Ordinary Rock by Mechanical Means not Requiring Blasting. Excavation in hilly area in ordinary rock not requiring ballasting by mechanical means including cutting and trimming of slopes and disposal of cut material with all lift and lead upto 1000 metres	cum	151,517.40		
		Total of Bill 02. Earth work,Subgrade and Erosion control				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface			
		Refer: Errosion Control Formula: 24969	24969	24,969.00	sqm
			Total :	24,969.00	sqm
2	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2			
		Refer: Earthwork Formula: tot_fill	79402.000	79,402.00	cum
			Total :	79,402.00	cum
3	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2			
		Refer: TCS-05 Formula: (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*1* + (cw+2*hs+1*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*1) *sg*	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *1*592.000+ (7.000+2*1.500+1*1.000-0.000+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*1)*0.500*592.000	4,025.36	cum
		Refer: TCS-07 Formula: (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*1* + (cw+2*hs+1*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*1) *sg*	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *1*2068.000+ (7.000+2*1.500+1*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*1)*0.500*2068.000	8,581.37	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 Formula: $(0.5 * (es + es + (bc + dbm + wmm1 + wmm2) * 2) * (bc + dbm + wmm1 + wmm2)) * 1 * l + (cw + 2 * hs + 1 * es - ext\_pav + 2 * (bc + dbm + wmm1 + wmm2 + gsb + 0.5 * sg) * 1) * sg * l$	$(0.5 * (1.000 + 1.000 + (0.040 + 0.070 + 0.125 + 0.125) * 2) * (0.040 + 0.070 + 0.125 + 0.125)) * 1 * 2132.000 + (7.000 + 2 * 1.500 + 1 * 1.000 - 5.300 + 2 * (0.040 + 0.070 + 0.125 + 0.125 + 0.200 + 0.5 * 0.500) * 1) * 0.500 * 2132.000$	8,846.95	cum
		Refer: TCS-09 Formula: $(cw + 2 * hs - ext\_pav) * sg * l$	$(7.000 + 2 * 1.500 - 0.000) * 0.500 * 500.000$	2,500.00	cum
		Refer: TCS-11 Formula: $(0.5 * (es + es + (bc + dbm + wmm1 + wmm2) * 2) * (bc + dbm + wmm1 + wmm2)) * 1 * l + (cw + 2 * hs + 1 * es - ext\_pav + 2 * (bc + dbm + wmm1 + wmm2 + gsb + 0.5 * sg) * 1) * sg * l$	$(0.5 * (1.000 + 1.000 + (0.040 + 0.070 + 0.125 + 0.125) * 2) * (0.040 + 0.070 + 0.125 + 0.125)) * 1 * 4957.000 + (7.000 + 2 * 1.500 + 1 * 1.000 - 5.300 + 2 * (0.040 + 0.070 + 0.125 + 0.125 + 0.200 + 0.5 * 0.500) * 1) * 0.500 * 4957.000$	20,569.57	cum
		Refer: TCS-12 Formula: $(0.5 * (es + es + (bc + dbm + wmm1 + wmm2) * 2) * (bc + dbm + wmm1 + wmm2)) * 1 * l + (cw + 2 * hs + 1 * es - ext\_pav + 2 * (bc + dbm + wmm1 + wmm2 + gsb + 0.5 * sg) * 1) * sg * l$	$(0.5 * (1.000 + 1.000 + (0.040 + 0.070 + 0.125 + 0.125) * 2) * (0.040 + 0.070 + 0.125 + 0.125)) * 1 * 389.000 + (7.000 + 2 * 1.500 + 1 * 1.000 - 5.300 + 2 * (0.040 + 0.070 + 0.125 + 0.125 + 0.200 + 0.5 * 0.500) * 1) * 0.500 * 389.000$	1,614.19	cum
		Refer: TCS-14 Formula: $(0.5 * (es + es + (bc + dbm + wmm1 + wmm2) * 2) * (bc + dbm + wmm1 + wmm2)) * 1 * l + (cw + 2 * hs + 1 * es - ext\_pav + 2 * (bc + dbm + wmm1 + wmm2 + gsb + 0.5 * sg) * 1) * sg * l$	$(0.5 * (1.000 + 1.000 + (0.040 + 0.070 + 0.125 + 0.125) * 2) * (0.040 + 0.070 + 0.125 + 0.125)) * 1 * 100.000 + (7.000 + 2 * 1.500 + 1 * 1.000 - 5.300 + 2 * (0.040 + 0.070 + 0.125 + 0.125 + 0.200 + 0.5 * 0.500) * 1) * 0.500 * 100.000$	414.96	cum
			Total :	46,552.40	cum
4	03.15	Compacting original ground supporting subgrade Loosening of the ground upto a level of 500 mm below the subgrade level, watered, graded and compacted in layers to meet requirement of table 300-2 for subgrade construction.			
		Refer: TCS-02 Formula: $((cw - ext\_pav + 2 * hs + 2 * es + ((bc + dbm + wmm1 + wmm2 + gsb + (sg/2)) * 2 * 2) * sg * l) + (es * (bc + dbm + wmm1 + wmm2 + gsb) * 2) + ((0.5 * (bc + dbm + wmm1 + wmm2 + gsb) * ((bc + dbm + wmm1 + wmm2 + gsb) * 2) * 2) * l))$	$((7.000 - 5.300 + 2 * 1.500 + 2 * 1.000 + ((0.040 + 0.070 + 0.125 + 0.125 + 0.200 + (0.500/2)) * 2 * 2) * 0.500 * 0.000) + (1.000 * (0.040 + 0.070 + 0.125 + 0.125 + 0.200) * 2) + ((0.5 * (0.040 + 0.070 + 0.125 + 0.125 + 0.200) * ((0.040 + 0.070 + 0.125 + 0.125 + 0.200) * 2) * 0.000))$	7.82	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-03 Formula: $((cw-ext\_pav+2*hs+2*es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb)*2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2)*I))$	$((7.000-5.300+2*1.500+2*1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2*2)*0.500*0.000)+(1.000*(0.040+0.070+0.125+0.125+0.200)*2)+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2)*0.000)$	7.82	cum
		Refer: TCS-04 Formula: $((cw-ext\_pav+2*hs+2*es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb)*2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2)*I))$	$((7.000-5.300+2*1.500+2*1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2*2)*0.500*0.000)+(1.000*(0.040+0.070+0.125+0.125+0.200)*2)+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2)*0.000)$	7.82	cum
		Refer: TCS-04A Formula: $((cw-ext\_pav+2*hs+2*es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb)*2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2)*I))$	$((7.000-0.000+2*1.500+2*1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2*2)*0.500*0.000)+(1.000*(0.040+0.070+0.125+0.125+0.200)*2)+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2)*0.000)$	13.12	cum
		Refer: TCS-05 Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2)*I))$	$((7.000-0.000+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2)*0.500*592.000)+(1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*592.000)$	676.73	cum
		Refer: TCS-07 Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2)*I))$	$((7.000-5.300+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2)*0.500*2068.000)+(1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*2068.000)$	2,329.87	cum
		Refer: TCS-07A Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2)*I))$	$((7.000-0.000+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2)*0.500*0.000)+(1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*0.000)$	11.56	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I)$	$((7.000-5.300+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2)*0.500*2132.000))+1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*2132.000)$	2,401.78	cum
		Refer: TCS-08A Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I)$	$((7.000-0.000+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2)*0.500*0.000))+1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*0.000)$	11.56	cum
		Refer: TCS-09 Formula: $((cw-ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2)-ext\_pav)*sg*I$	$((7.000-0.000+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2)-0.000)*0.500*500.000$	2,770.00	cum
		Refer: TCS-10 Formula: $((cw-ext\_pav+2*hs+2*es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb)*2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2)*2)*I)$	$((7.000-5.300+2*1.500+2*1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2*2)*0.500*0.000))+1.000*(0.040+0.070+0.125+0.125+0.200)*2+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2)*2)*0.000)$	7.82	cum
		Refer: TCS-10A Formula: $((cw-ext\_pav+2*hs+2*es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb)*2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2)*2)*I)$	$((7.000-0.000+2*1.500+2*1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2*2)*0.500*0.000))+1.000*(0.040+0.070+0.125+0.125+0.200)*2+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2)*2)*0.000)$	13.12	cum
		Refer: TCS-11 Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I)$	$((7.000-5.300+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2)*0.500*4957.000))+1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*4957.000)$	5,575.95	cum
		Refer: TCS-11A Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I)$	$((7.000-0.000+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2)*0.500*0.000))+1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*0.000)$	11.56	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-12 Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))^2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I))$	$((7.000-5.300+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))^2)*0.500*389.000)+(1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*389.000)$	443.34	cum
		Refer: TCS-12A Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))^2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I))$	$((7.000-0.000+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))^2)*0.500*0.000)+(1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*0.000)$	11.56	cum
		Refer: TCS-13 Formula: $((cw-ext\_pav+2*hs+2*es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))^2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb)*2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I))$	$((7.000-5.300+2*1.500+2*1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))^2)*0.500*0.000)+(1.000*(0.040+0.070+0.125+0.125+0.200)*2)+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*0.000)$	7.82	cum
		Refer: TCS-14 Formula: $((cw-ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))^2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I))$	$((7.000-5.300+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))^2)*0.500*100.000)+(1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*100.000)$	118.62	cum
			Total :	14,427.86	cum
5	03.19	Turfing with Sods Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of sods and watering			
		Refer: Errosion Control Formula: 27006	27006	27,006.00	sqm
			Total :	27,006.00	sqm
6	03.31	Excavation in Hill Area in Soil by Mechanical Means Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with all lifts and lead upto 1000 metres			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Earthwork Formula: $\text{tot\_cut} * (1 - \text{per\_rock} / 100)$	$757587.000 * (1 - 20.000 / 100)$	606,069.60	cum
			Total :	606,069.60	cum
7	03.32	Excavation in Hilly Area in Ordinary Rock by Mechanical Means not Requiring Blasting. Excavation in hilly area in ordinary rock not requiring ballasting by mechanical means including cutting and trimming of slopes and disposal of cut material with all lift and lead upto 1000 metres			
		Refer: Earthwork Formula: $\text{tot\_cut} * (\text{per\_rock} / 100)$	$757587.000 * (20.000 / 100)$	151,517.40	cum
			Total :	151,517.40	cum

Bill No : 03. Sub-Base & Base Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	33,835.55		
2	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401	Cum	4,690.06		
3	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	21,024.44		
		Total of Bill 03. Sub-Base & Base Courses				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	04.01/Nsc1	Sub-base with Close Graded Material (Table: - 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material			
		Refer: Extra Widening on Flexible Formula: Pavement (ew_area*gsb)*(1-gsb_per/100)	$(4905.000*0.200)*(1-8.500/100)$	897.62	Cum
		Refer: TCS-05 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*592.000*2+$ $(7.000+2*1.500+1*1.000+2*$ $(0.040+0.070+0.125+0.125+0.5*0.200)$ $*1)*0.200*592.000)*(1-8.500/100)$	1,825.60	Cum
		Refer: TCS-07 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*2068.000*2+$ $(7.000+2*1.500+1*1.000+2*$ $(0.040+0.070+0.125+0.125+0.5*0.200)$ $*1)*0.200*2068.000)*(1-8.500/100)$	6,377.25	Cum
		Refer: TCS-08 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*2132.000*2+$ $(7.000+2*1.500+1*1.000+2*$ $(0.040+0.070+0.125+0.125+0.5*0.200)$ $*1)*0.200*2132.000)*(1-8.500/100)$	6,574.62	Cum
		Refer: TCS-09 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*500.000*2+(7.000+2*1.500)$ $*0.200*500.000)*(1-8.500/100)$	1,366.21	Cum
		Refer: TCS-11 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*4957.000*2+$ $(7.000+2*1.500+1*1.000+2*$ $(0.040+0.070+0.125+0.125+0.5*0.200)$ $*1)*0.200*4957.000)*(1-8.500/100)$	15,286.29	Cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-12 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs+1*es+2*(bc+dbm+wmm1+wmm2+0.5*gsb)*1)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*389.000*2+(7.000+2*1.500+1*1.000+2*(0.040+0.070+0.125+0.125+0.5*0.200)*1)*0.200*389.000)*(1-8.500/100)$	1,199.59	Cum
		Refer: TCS-14 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs+1*es+2*(bc+dbm+wmm1+wmm2+0.5*gsb)*1)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*100.000*2+(7.000+2*1.500+1*1.000+2*(0.040+0.070+0.125+0.125+0.5*0.200)*1)*0.200*100.000)*(1-8.500/100)$	308.38	Cum
			Total :	33,835.55	Cum
2	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401			
		Refer: Extra Widening on Flexible Formula: Pavement $(ew\_area*gsb)*(gsb\_per/100)$	$(4905.000*0.200)*(8.500/100)$	83.39	Cum
		Refer: TCS-05 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs+1*es+2*(bc+dbm+wmm1+wmm2+0.5*gsb)*1)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*592.000*2+(7.000+2*1.500+1*1.000+2*(0.040+0.070+0.125+0.125+0.5*0.200)*1)*0.200*592.000)*(8.500/100)$	169.59	Cum
		Refer: TCS-07 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs+1*es+2*(bc+dbm+wmm1+wmm2+0.5*gsb)*gsb*I)*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*2068.000*2+(7.000+2*1.500+1*1.000+2*(0.040+0.070+0.125+0.125+0.5*0.200)*0.200*1)*2068.000)*(8.500/100)$	2,139.29	Cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*l*2+(cw+2*hs+1*es+2*(bc+dbm+wmm1+wmm2+0.5*gsb)*1)*gsb*l)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*2132.000*2+(7.000+2*1.500+1*1.000+2*(0.040+0.070+0.125+0.125+0.5*0.200))*1*0.200*2132.000)*(8.500/100)$	610.76	Cum
		Refer: TCS-09 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*l*2+(cw+2*hs)*gsb*l)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*500.000*2+(7.000+2*1.500)*0.200*500.000)*(8.500/100)$	126.92	Cum
		Refer: TCS-11 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*l*2+(cw+2*hs+1*es+2*(bc+dbm+wmm1+wmm2+0.5*gsb)*1)*gsb*l)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*4957.000*2+(7.000+2*1.500+1*1.000+2*(0.040+0.070+0.125+0.125+0.5*0.200))*1*0.200*4957.000)*(8.500/100)$	1,420.04	Cum
		Refer: TCS-12 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*l*2+(cw+2*hs+1*es+2*(bc+dbm+wmm1+wmm2+0.5*gsb)*1)*gsb*l)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*389.000*2+(7.000+2*1.500+1*1.000+2*(0.040+0.070+0.125+0.125+0.5*0.200))*1*0.200*389.000)*(8.500/100)$	111.44	Cum
		Refer: TCS-14 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*l*2+(cw+2*hs+1*es+2*(bc+dbm+wmm1+wmm2+0.5*gsb)*1)*gsb*l)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*100.000*2+(7.000+2*1.500+1*1.000+2*(0.040+0.070+0.125+0.125+0.5*0.200))*1*0.200*100.000)*(8.500/100)$	28.65	Cum
			Total :	4,690.06	Cum
3	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)			
		Refer: Extra Widening on Flexible Formula: Pavement $ew\_area*(wmm1+wmm2)$	$4905.000*(0.125+0.125)$	1,226.25	Cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-05 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*592.000)$	1,091.50	Cum
		Refer: TCS-07 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*2068.000)$	3,812.88	Cum
		Refer: TCS-08 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*2132.000)$	3,930.88	Cum
		Refer: TCS-09 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*500.000)$	921.88	Cum
		Refer: TCS-11 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*4957.000)$	9,139.47	Cum
		Refer: TCS-12 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*389.000)$	717.22	Cum
		Refer: TCS-14 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*100.000)$	184.38	Cum
			Total :	21,024.44	Cum

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	80,071.00		
2	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	4,905.00		
3	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	75,166.00		
4	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	5,604.97		

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	3,202.84		
		Total of Bill 04. Bituminous Courses				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm			
		Refer: Extra Widening on Flexible Formula: Pavement ew_area	4905.000	4,905.00	sqm
		Refer: TCS-05 Formula: cw*I	7.000*592.000	4,144.00	sqm
		Refer: TCS-07 Formula: cw*I	7.000*2068.000	14,476.00	sqm
		Refer: TCS-08 Formula: cw*I	7.000*2132.000	14,924.00	sqm
		Refer: TCS-09 Formula: cw*I	7.000*500.000	3,500.00	sqm
		Refer: TCS-11 Formula: cw*I	7.000*4957.000	34,699.00	sqm
		Refer: TCS-12 Formula: cw*I	7.000*389.000	2,723.00	sqm
		Refer: TCS-14 Formula: cw*I	7.000*100.000	700.00	sqm
			Total :	80,071.00	sqm
2	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm			
		Refer: Extra Widening on Flexible Formula: Pavement ew_area	4905.000	4,905.00	sqm
			Total :	4,905.00	sqm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
3	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm			
		Refer: TCS-05 Formula: $cw * l$	7.000*592.000	4,144.00	sqm
		Refer: TCS-07 Formula: $cw * l$	7.000*2068.000	14,476.00	sqm
		Refer: TCS-08 Formula: $cw * l$	7.000*2132.000	14,924.00	sqm
		Refer: TCS-09 Formula: $cw * l$	7.000*500.000	3,500.00	sqm
		Refer: TCS-11 Formula: $cw * l$	7.000*4957.000	34,699.00	sqm
		Refer: TCS-12 Formula: $cw * l$	7.000*389.000	2,723.00	sqm
		Refer: TCS-14 Formula: $cw * l$	7.000*100.000	700.00	sqm
			Total :	75,166.00	sqm
4	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Extra Widening on Flexible Formula: Pavement $ew\_area * dbm$	$4905.000 * 0.070$	343.35	cum
		Refer: TCS-05 Formula: $cw * dbm * l$	$7.000 * 0.070 * 592.000$	290.08	cum
		Refer: TCS-07 Formula: $cw * dbm * l$	$7.000 * 0.070 * 2068.000$	1,013.32	cum
		Refer: TCS-08 Formula: $cw * dbm * l$	$7.000 * 0.070 * 2132.000$	1,044.68	cum
		Refer: TCS-09 Formula: $cw * dbm * l$	$7.000 * 0.070 * 500.000$	245.00	cum
		Refer: TCS-11 Formula: $cw * dbm * l$	$7.000 * 0.070 * 4957.000$	2,428.93	cum
		Refer: TCS-12 Formula: $cw * dbm * l$	$7.000 * 0.070 * 389.000$	190.61	cum
		Refer: TCS-14 Formula: $cw * dbm * l$	$7.000 * 0.070 * 100.000$	49.00	cum
			Total :	5,604.97	cum
5	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii) Using bitumen 30/40			
		Refer: Extra Widening on Flexible Formula: Pavement $ew\_area * bc$	$4905.000 * 0.040$	196.20	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-05 Formula: $cw*bc*I$	$7.000*0.040*592.000$	165.76	cum
		Refer: TCS-07 Formula: $cw*bc*I$	$7.000*0.040*2068.000$	579.04	cum
		Refer: TCS-08 Formula: $cw*bc*I$	$7.000*0.040*2132.000$	596.96	cum
		Refer: TCS-09 Formula: $cw*bc*I$	$7.000*0.040*500.000$	140.00	cum
		Refer: TCS-11 Formula: $cw*bc*I$	$7.000*0.040*4957.000$	1,387.96	cum
		Refer: TCS-12 Formula: $cw*bc*I$	$7.000*0.040*389.000$	108.92	cum
		Refer: TCS-14 Formula: $cw*bc*I$	$7.000*0.040*100.000$	28.00	cum
			Total :	3,202.84	cum

Bill No : 05. Junction Improvement (Major & Minor)

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2	cum	132.88		
2	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	270.29		
		Total of Bill 05. Junction Improvement (Major & Minor)				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2			
		Refer: Major Junction Formula: (area_is-(peri_kerb*width_kerb))*ht_med	$(286.620-(270.290*0.150))*0.540$	132.88	cum
			Total :	132.88	cum
2	08.01	Precast Cement concrete M20 Kerb including fixing at site			
		Refer: Major Junction Formula: peri_kerb	270.290	270.29	rm
			Total :	270.29	rm

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone	each	2.00		
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone	each	9.00		
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	113.00		
4	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade	sqm	36.00		
5	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle	each	69.00		
6	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular				

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			each	44.00		
7	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	6.00		
8	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon	each	3.00		
9	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	257.00		

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	08.13	Direction and Place Identification signs with size more than 0.9sqm size board. (Providing and erecting direction and place identification retro- reflectorised sign as per IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	4.00		
11	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorisng Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorisng glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	3,583.93		
12	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming to IRC-79 and the drawings.) 120x120 -Road Delineator	each	950.00		

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
13	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m	Rm	6,139.00		
14	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	4,758.00		
15	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp	nos	10.00		
16	08/nsc/2	Convex Mirror For Blind Curve	nos	5.00		

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
17	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.	Ton	1.04		
18	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign	sqm	36.00		
19	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.	sqm	21.00		
20	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	26.24		
21	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade				

Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	0.97		
22	14.03/e/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.70		
23	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.86		
24	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	2.00		
25	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	0.30		
		Total of Bill 06. Traffic signs, Road marking & other road appurtenances				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone			
		Refer: Traffic Signs Formula: 2	2	2.00	each
			Total :	2.00	each
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone			
		Refer: Traffic Signs Formula: 9	9	9.00	each
			Total :	9.00	each
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting			
		Refer: Traffic Signs Formula: 113	113	113.00	each
			Total :	113.00	each
4	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade			
		Refer: Overhead Signs Formula: $a*r*2*n$	$15.000*1.200*2*1.000$	36.00	sqm
			Total :	36.00	sqm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle			
		Refer: Traffic Signs Formula: 69	69	69.00	each
			Total :	69.00	each
6	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular			
		Refer: Traffic Signs Formula: 44	44	44.00	each
			Total :	44.00	each

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
7	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular			
		Refer: Traffic Signs Formula: 6	6	6.00	each
			Total :	6.00	each
8	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon			
		Refer: Traffic Signs Formula: 3	3	3.00	each
			Total :	3.00	each

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
9	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)			
		Refer: Traffic Signs Formula: 257	257	257.00	sqm
			Total :	257.00	sqm
10	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)			
		Refer: Traffic Signs Formula: 4	4	4.00	sqm
			Total :	4.00	sqm
11	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-01 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-02 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-03 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-04 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-04A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-05 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((592.000+6)/9)*3.000*0.100)+$ $(2.000*592.000*0.150)$	197.53	sqm
		Refer: TCS-06 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-06A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-07 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((2068.000+6)/9)*3.000*0.100)+$ $(2.000*2068.000*0.150)$	689.53	sqm
		Refer: TCS-07A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-08 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((2132.000+6)/9)*3.000*0.100)+$ $(2.000*2132.000*0.150)$	710.87	sqm
		Refer: TCS-08A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-09 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((500.000+6)/9)*3.000*0.100)+$ $(2.000*500.000*0.150)$	166.87	sqm
		Refer: TCS-09A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-10 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-10A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-11 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((4957.000+6)/9)*3.000*0.100)+$ $(2.000*4957.000*0.150)$	1,652.53	sqm
		Refer: TCS-11A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-12 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((389.000+6)/9)*3.000*0.100)+$ $(2.000*389.000*0.150)$	129.87	sqm
		Refer: TCS-12A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-13 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
		Refer: TCS-14 Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((100.000+6)/9)*3.000*0.100)+$ $(2.000*100.000*0.150)$	33.53	sqm
		Refer: TCS-15A Formula: $((l+6)/9)*lc*wc+(nc*l*wid\_mar)$	$((0.000+6)/9)*3.000*0.100)+$ $(2.000*0.000*0.150)$	0.20	sqm
			Total :	3,583.93	sqm
12	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming to IRC-79 and the drawings.) 120x120 -Road Delineator			
		Refer: Traffic Signs Formula: 950	950	950.00	each
			Total :	950.00	each

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
13	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m			
		Refer: Crash Barrier Formula: tot_len	6139.000	6,139.00	Rm
			Total :	6,139.00	Rm
14	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type			
		Refer: Traffic Signs Formula: 4758	4758	4,758.00	nos
			Total :	4,758.00	nos
15	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp			
		Refer: Traffic Signs Formula: 10	10	10.00	nos
			Total :	10.00	nos

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
16	08/nsc/2	Convex Mirror For Blind Curve			
		Refer: Traffic Signs Formula: 5	5	5.00	nos
			Total :	5.00	nos
17	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.			
		Refer: Overhead Signs Formula: $(p \cdot (a/p^2 + r^2) \cdot wt + q \cdot ((a/p) + (a/p-1)) \cdot ws + ht \cdot wp^2) \cdot n$	$(1.000 \cdot (15.000/1.000^2 + 1.200^2) \cdot 0.010 + 1.560 \cdot ((15.000/1.000) + (15.000/1.000-1)) \cdot 0.004 + 5.500 \cdot 0.049^2) \cdot 1.000$	1.04	Ton
			Total :	1.04	Ton
18	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign			
		Refer: Overhead Signs Formula: $a \cdot r^2 \cdot n$	$15.000 \cdot 1.200^2 \cdot 1.000$	36.00	sqm
			Total :	36.00	sqm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
19	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.			
		Refer: Traffic Signs Formula: 21	21	21.00	sqm
			Total :	21.00	sqm
20	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Overhead Signs Formula: $(i+g+f)*(e+.5)*(e+.5)*2*n$	$(1.400+0.300+0.100)*(2.200+.5)* (2.200+.5)*2*1.000$	26.24	cum
			Total :	26.24	cum
21	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Overhead Signs Formula: $e*e*f*2*n$	$2.200*2.200*0.100*2*1.000$	0.97	cum
			Total :	0.97	cum
22	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade			
		Refer: Overhead Signs Formula: $(e*e*g+m*m*i)*2*n$	$(2.200*2.200*0.300+1.000*1.000*1.400)*2*1.000$	5.70	cum
			Total :	5.70	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
23	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification			
		Refer: Overhead Signs Formula: $(e*e*g+m*m*i)*2*n*sf/1000$	$(2.200*2.200*0.300+1.000*1.000*1.400)*2*1.000*150.000/1000$	0.86	MT
			Total :	0.86	MT
24	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height			
		Refer: Overhead Signs Formula: $m*m*j*2*n$	$1.000*1.000*1.000*2*1.000$	2.00	cum
			Total :	2.00	cum
25	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification			
		Refer: Overhead Signs Formula: $m*m*j*2*n*ss/1000$	$1.000*1.000*1.000*2*1.000*150.000/1000$	0.30	MT
			Total :	0.30	MT

Bill No : 09. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	10,227.42		
2	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,210.72		
3	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	467.54		
4	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	1.00		
		Total of Bill 09. Longitudinal Drains				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: RR Masonry Trapezoidal Drain Formula: $(a+2*b)*(h+f)*l$	$(0.800+2*0.200)*(0.850+0.200)*8117.000$	10,227.42	cum
			Total :	10,227.42	cum
2	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification R a n d o m R u b b l e M a s o n r y (coursed/uncoursed)			
		Refer: RR Masonry Trapezoidal Drain Formula: $((0.5*(c+j+2*b)*f)+(((a-j)/2)^2+h^2)^{(1/2})*b*2)*l$	$((0.5*(0.835+0.500+2*0.200)*0.200)+(((0.800-0.500)/2)^2+0.850^2)^{(1/2})*0.200*2)*8117.000$	4,210.72	cum
			Total :	4,210.72	cum
3	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification R a n d o m R u b b l e M a s o n r y (coursed/uncoursed)			
		Refer: RR Masonry Trapezoidal Drain Formula: $(l-(l/5*0.2))*b*d$	$(8117.000-(8117.000/5*0.2))*0.200*0.300$	467.54	cum
			Total :	467.54	cum
4	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			
		Refer: RCC Cover Drain Formula: $(l/2+1)$	$(0.000/2+1)$	1.00	Rm
			Total :	1.00	Rm

Bill No : 10. Retaining wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	10,556.88		
2	13.01/b/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	2,347.06		
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	10,131.14		
4	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	6,258.18		
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	3,040.38		
6	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	12,367.71		
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	18,174.00		
		Total of Bill 10. Retaining wall				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Retaining Wall 1.5m Formula: $(((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.183+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o)))*I)*(1-p\_c)$	$(((0.5*((0.300+0.183+0.600)+(0.300+0.600))*(1.100+2*0.150)))+(0.183+0.600)*(0.600-0.150)))*197.000*(1-0.200)$	274.30	cum
		Refer: Retaining Wall 2.0m Formula: $(((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.211+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o)))*I)*(1-p\_c)$	$(((0.5*((0.300+0.211+0.600)+(0.300+0.600))*(1.270+2*0.150)))+(0.211+0.600)*(0.600-0.150)))*2205.000*(1-0.200)$	3,428.48	cum
		Refer: Retaining Wall 2.5m Formula: $(((0.5*((pcc\_tH1k+H2+d)+(pcc\_tH1k+d))*((0.239+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o)))*I)*(1-p\_c)$	$(((0.5*((0.300+0.239+0.600)+(0.300+0.600))*(1.430+2*0.150)))+(0.239+0.600)*(0.600-0.150)))*949.000*(1-0.200)$	1,625.66	cum
		Refer: Retaining Wall 3.0m Formula: $(((0.5*((pcc\_tH1k+H2+d)+(pcc\_tH1k+d))*((0.267+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o)))*I)*(1-p\_c)$	$(((0.5*((0.300+0.267+0.600)+(0.300+0.600))*(1.600+2*0.150)))+(0.267+0.600)*(0.600-0.150)))*634.000*(1-0.200)$	1,193.85	cum
		Refer: Retaining Wall 4.0m Formula: $(((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.322+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o)))*I)*(1-p\_c)$	$(((0.5*((0.300+0.322+0.600)+(0.300+0.600))*(1.933+2*0.150)))+(0.322+0.600)*(0.600-0.150)))*634.000*(1-0.200)$	1,412.10	cum
		Refer: Retaining Wall 5.0m Formula: $(((0.5*((pcc\_tH1k+H2+d)+(pcc\_tH1k+d))*((0.383+0.900)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o)))*I)*(1-p\_c)$	$(((0.5*((0.300+0.383+0.900)+(0.300+0.900))*(2.300+2*0.150)))+(0.383+0.900)*(0.600-0.150)))*395.000*(1-0.200)$	1,325.70	cum
		Refer: Retaining Wall 6.0m Formula: $(((0.5*((pcc\_tH1k+H2+d)+(pcc\_tH1k+d))*((0.450+0.900)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o)))*I)*(1-p\_c)$	$(((0.5*((0.300+0.450+0.900)+(0.300+0.900))*(2.700+2*0.150)))+(0.450+0.900)*(0.600-0.150)))*332.000*(1-0.200)$	1,296.79	cum
			Total :	10,556.88	cum
2	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Retaining Wall 1.5m Formula: $((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.183+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o))*I)*p\_c$	$((0.5*((0.300+0.183+0.600)+(0.300+0.600))*((1.100+2*0.150)))+(0.183+0.600)*(0.600-0.150))*197.000*0.200$	68.57	cum
		Refer: Retaining Wall 2.0m Formula: $((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.211+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o))*I)*p\_c$	$((0.5*((0.300+0.211+0.600)+(0.300+0.600))*((1.270+2*0.150)))+(0.211+0.600)*(0.600-0.150))*2205.000*0.200$	857.12	cum
		Refer: Retaining Wall 2.5m Formula: $((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.239+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o))*I)*p\_c$	$((0.5*((0.300+0.239+0.600)+(0.300+0.600))*((1.430+2*0.150)))+(0.239+0.600)*(0.600-0.150))*949.000*0.200$	307.91	cum
		Refer: Retaining Wall 3.0m Formula: $((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.267+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o))*I)*p\_c$	$((0.5*((0.300+0.267+0.600)+(0.300+0.600))*((1.600+2*0.150)))+(0.267+0.600)*(0.600-0.150))*634.000*0.200$	226.19	cum
		Refer: Retaining Wall 4.0m Formula: $((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.322+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o))*I)*p\_c$	$((0.5*((0.300+0.322+0.600)+(0.300+0.600))*((1.933+2*0.150)))+(0.322+0.600)*(0.600-0.150))*634.000*0.200$	353.03	cum
		Refer: Retaining Wall 5.0m Formula: $((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.383+0.900)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o))*I)*p\_c$	$((0.5*((0.300+0.383+0.900)+(0.300+0.900))*((2.300+2*0.150)))+(0.383+0.900)*(0.600-0.150))*395.000*0.200$	269.81	cum
		Refer: Retaining Wall 6.0m Formula: $((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.450+0.900)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o))*I)*p\_c$	$((0.5*((0.300+0.450+0.900)+(0.300+0.900))*((2.700+2*0.150)))+(0.450+0.900)*(0.600-0.150))*332.000*0.200$	264.44	cum
			Total :	2,347.06	cum
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .			
		Refer: Retaining Wall 1.5m Formula: $mw*(H2+H1)*I$	$0.600*(0.183+1.500)*197.000$	198.93	cum
		Refer: Retaining Wall 2.0m Formula: $mw*(H2+H1)*I$	$0.600*(0.211+2.000)*2205.000$	2,925.15	cum
		Refer: Retaining Wall 2.5m Formula: $mw*(H2+H1)*I$	$0.600*(0.239+2.500)*949.000$	1,559.59	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Retaining Wall 3.0m Formula: $mw*(H2+H1)*I$	$0.600*(0.267+3.000)*634.000$	1,242.77	cum
		Refer: Retaining Wall 4.0m Formula: $mw*(H2+H1)*I$	$0.600*(0.322+4.000)*634.000$	1,644.09	cum
		Refer: Retaining Wall 5.0m Formula: $mw*(H2+H1)*I$	$0.600*(0.383+5.000)*395.000$	1,275.77	cum
		Refer: Retaining Wall 6.0m Formula: $mw*(H2+H1)*I$	$0.600*(0.450+6.000)*332.000$	1,284.84	cum
			Total :	10,131.14	cum
4	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification R a n d o m R u b b l e M a s o n r y (coursed/uncoursed)			
		Refer: Retaining Wall 1.5m Formula: $((0.5*(B1+e)*d)+(0.5*B1*H2))*I$	$((0.5*(1.100+0.900)*0.600)+(0.5*1.100*0.183))*197.000$	138.03	cum
		Refer: Retaining Wall 2.0m Formula: $((0.5*(B1+e)*d)+(0.5*B1*H2))*I$	$((0.5*(1.270+1.067)*0.600)+(0.5*1.270*0.211))*2205.000$	1,841.36	cum
		Refer: Retaining Wall 2.5m Formula: $((0.5*(B1+B3)*d)+(0.5*B1*H2))*I$	$((0.5*(1.430+1.230)*0.600)+(0.5*1.430*0.239))*949.000$	919.47	cum
		Refer: Retaining Wall 3.0m Formula: $((0.5*(B1+B3)*d)+(0.5*B1*H2))*I$	$((0.5*(1.600+1.400)*0.600)+(0.5*1.600*0.267))*634.000$	706.02	cum
		Refer: Retaining Wall 4.0m Formula: $((0.5*(B1+B3)*d)+(0.5*B1*H2))*I$	$((0.5*(1.933+1.733)*0.600)+(0.5*1.933*0.322))*634.000$	894.58	cum
		Refer: Retaining Wall 5.0m Formula: $((0.5*(B1+B3)*d)+(0.5*B1*H2))*I$	$((0.5*(2.300+1.280)*0.900)+(0.5*2.300*0.383))*395.000$	810.32	cum
		Refer: Retaining Wall 6.0m Formula: $((0.5*(B1+B3)*d)+(0.5*B1*H2))*I$	$((0.5*(2.700+2.298)*0.900)+(0.5*2.700*0.450))*332.000$	948.39	cum
			Total :	6,258.18	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Retaining Wall 1.5m Formula: (B2+2*o)*pcc_thk*I	(1.115+2*0.150)*0.300*197.000	83.63	cum
		Refer: Retaining Wall 2.0m Formula: (B2+2*o)*pcc_thk*I	(1.284+2*0.150)*0.300*2205.000	1,047.82	cum
		Refer: Retaining Wall 2.5m Formula: (B2+2*o)*pcc_thk*I	(1.453+2*0.150)*0.300*949.000	499.08	cum
		Refer: Retaining Wall 3.0m Formula: (B2+2*o)*pcc_thk*I	(1.622+2*0.150)*0.300*634.000	365.56	cum
		Refer: Retaining Wall 4.0m Formula: (B2+2*o)*pcc_thk*I	(1.960+2*0.150)*0.300*634.000	429.85	cum
		Refer: Retaining Wall 5.0m Formula: (B2+2*o)*pcc_thk*I	(2.330+2*0.150)*0.300*395.000	311.66	cum
		Refer: Retaining Wall 6.0m Formula: (B2+2*o)*pcc_thk*I	(2.740+2*0.150)*0.300*332.000	302.78	cum
			Total :	3,040.38	cum
6	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification R a n d o m R u b b l e M a s o n r y (coursed/uncoursed)			
		Refer: Retaining Wall 1.5m Formula: (0.5*(T+e)*(H1-d))*I	(0.5*(0.600+0.900)*(1.500-0.600))*197.000	132.98	cum
		Refer: Retaining Wall 2.0m Formula: (0.5*(T+e)*(H1-d))*I	(0.5*(0.600+1.067)*(2.000-0.600))*2205.000	2,573.02	cum
		Refer: Retaining Wall 2.5m Formula: (0.5*(T+B3)*(H1-d))*I	(0.5*(0.600+1.230)*(2.500-0.600))*949.000	1,649.84	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Retaining Wall 3.0m Formula: $(0.5 \times (T+B3) \times (H1-d)) \times I$	$(0.5 \times (0.600+1.400) \times (3.000-0.600))$ *634.000	1,521.60	cum
		Refer: Retaining Wall 4.0m Formula: $(0.5 \times (T+B3) \times (H1-d)) \times I$	$(0.5 \times (0.600+1.733) \times (4.000-0.600))$ *634.000	2,514.51	cum
		Refer: Retaining Wall 5.0m Formula: $(0.5 \times (T+B3) \times (H1-d)) \times I$	$(0.5 \times (0.600+1.280) \times (5.000-0.900))$ *395.000	1,522.33	cum
		Refer: Retaining Wall 6.0m Formula: $(0.5 \times (T+B3) \times (H1-d)) \times I$	$(0.5 \times (0.600+2.298) \times (6.000-0.900))$ *332.000	2,453.45	cum
			Total :	12,367.71	cum
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			
		Refer: Retaining Wall 1.5m Formula: $n \times I$	2.000*197.000	394.00	Rm
		Refer: Retaining Wall 2.0m Formula: $n \times I$	2.000*2205.000	4,410.00	Rm
		Refer: Retaining Wall 2.5m Formula: $n \times I$	3.000*949.000	2,847.00	Rm
		Refer: Retaining Wall 3.0m Formula: $n \times I$	3.000*634.000	1,902.00	Rm
		Refer: Retaining Wall 4.0m Formula: $n \times I$	4.000*634.000	2,536.00	Rm
		Refer: Retaining Wall 5.0m Formula: $n \times I$	7.000*395.000	2,765.00	Rm
		Refer: Retaining Wall 6.0m Formula: $n \times I$	10.000*332.000	3,320.00	Rm
			Total :	18,174.00	Rm

Bill No : 11. Breast wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	9,073.37		
2	13.01/b/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	2,268.34		
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	983.12		
4	13.03/b	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Good Sandy Soil free from organic material	cum	421.34		
5	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,274.02		
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	2,059.86		
7	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,447.43		
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	2,496.80		
		Total of Bill 11. Breast wall				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Breast Wall Formula: $(h+2*0.5)*(e+f)*(1-p)*l$	$(2.160+2*0.5)*(0.850+0.300)*(1-0.200)*3121.000$	9,073.37	cum
			Total :	9,073.37	cum
2	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to			
		Refer: Breast Wall Formula: $(h+2*0.5)*(e+f)*p*l$	$(2.160+2*0.5)*(0.850+0.300)*0.200*3121.000$	2,268.34	cum
			Total :	2,268.34	cum
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials			
		Refer: Breast Wall Formula: $c*b*l$	$1.050*0.300*3121.000$	983.12	cum
			Total :	983.12	cum
4	13.03/b	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Good Sandy Soil free from organic material			
		Refer: Breast Wall Formula: $d*b*l$	$0.450*0.300*3121.000$	421.34	cum
			Total :	421.34	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification R a n d o m R u b b l e M a s o n r y (coursed/uncoursed)			
		Refer: Breast Wall Formula: $0.5*(e+(e-(h/5)))*h*I$	$0.5*(0.850+(0.850-(2.160/5)))*2.160*3121.000$	4,274.02	cum
			Total :	4,274.02	cum
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Breast Wall Formula: $g*f*I$	$2.200*0.300*3121.000$	2,059.86	cum
			Total :	2,059.86	cum
7	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification R a n d o m R u b b l e M a s o n r y (coursed/uncoursed)			
		Refer: Breast Wall Formula: $(0.5*((a+(c+d)/3)+a)*(d+c)+i*d+i*m)*I$	$(0.5*((0.600+(1.050+0.450)/3)+0.600)*(0.450+1.050)+0.200*0.450+0.200*0.300)*3121.000$	4,447.43	cum
			Total :	4,447.43	cum
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			
		Refer: Breast Wall Formula: $(l/1.2)*(h-j-i)$	$(3121.000/1.2)*(2.160-1.000-0.200)$	2,496.80	Rm
			Total :	2,496.80	Rm

Bill No : 12. Toe Wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	460.18		
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	65.74		
3	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	269.88		
4	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m	cum	259.50		
		Total of Bill 12. Toe Wall				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Toe Wall 1m Formula: $(b+2*g)*(d+f)*l$	$(0.750+2*0.100)*(0.600+0.100)*692.000$	460.18	cum
			Total :	460.18	cum
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Toe Wall 1m Formula: $(b+2*g)*f*l$	$(0.750+2*0.100)*0.100*692.000$	65.74	cum
			Total :	65.74	cum
3	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade			
		Refer: Toe Wall 1m Formula: $(0.5*(c+b)*d)*l$	$(0.5*(0.550+0.750)*0.600)*692.000$	269.88	cum
			Total :	269.88	cum
4	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m			
		Refer: Toe Wall 1m Formula: $(0.5*(T+c)*h)*l$	$(0.5*(0.200+0.550)*1.000)*692.000$	259.50	cum
			Total :	259.50	cum

**BILL OF QUANTITY
(STRUCTURE PART)**

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
Foundation						
1	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork.	cum	538.41		
2	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	7,896.69		
Sub Total of Foundation						
Sub Structure						
3	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure	Ton	205.85		
4	10.20/b	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting b)Selected Granular Material in Filling	cum	855.79		
5	10.20/c	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting c)Filler Media behind abutment ,wing and return wall	cum	2,430.17		
6	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	2,940.74		
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications				

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			Rm	1,650.20		
Sub Total of			Sub Structure			
		Super Structure				
8	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	1,991.00		
9	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	129.42		
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	73.39		
11	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	938.52		
12	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	362.00		
13	16.11	Drainage Spouts complete as per drawing and Technical specification				

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			each	138.00		
14	16.17	Mastic asphalt (providing and laying 12mm thick mastic asphalt wearing courses on top of deck slab excluding prime coat with paving grade bitumen meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an approximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	1,991.00		
Sub Total of			Super Structure			
		Protection Work				
15	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork. At Protection	cum	1,706.88		
16	13.01/a/i /Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	6,934.05		
17	16/nsc	For Protection Work - cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade upto 5m height	cum	1,386.35		
18	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	1,052.79		
Sub Total of			Protection Work			
		Miscellaneous Work				

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
19	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	926.00		
Sub Total of Miscellaneous Work						
		Total of Bill 13. Culvert				

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	2.00		
2	17.01/c	laying apron complete as per drawing and Technical specification. Cement concrete block (M-15grade) (Filter Blanket+Toe Wall)	cum	8.16		
3	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	34.63		
4	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	69.23		
Sub Total of						
		Foundation				
5	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	1,301.04		
6	13.01/a/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth 3 m to 6 m	cum	570.90		

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	1,900.28		
8	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	631.36		
9	14.03/g	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M30 Grade	cum	1,108.63		
10	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	155.21		
Sub Total of				Foundation		
		Sub Structure				
11	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	164.77		
12	13.03/b	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Good Sandy Soil free from organic material	cum	500.31		
13	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	154.49		
14	15.03/g/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade upto 5m height	cum	452.40		

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
15	15.03/g/ii	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade Between 5 to 10 m height	cum	208.18		
16	15.03/h/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M35 Grade Pedestal	cum	6.04		
17	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	99.99		
18	15.09	Supplying, fitting and fixing in position true to line and level elastomeric bearing conforming to IRC: 83 (Part-II) section IX and clause 2005 of MoRTH specifications complete including all accessories as per drawing and Technical Specifications.	cc	62,635.00		
19	15.10	Supplying, fitting and fixing in position true to line and level POT-PTFE bearing consisting of a metal piston supported by a disc or unreinforced elastomer confined within a metal cylinder, sealing rings, dust seals, PTFE surface sliding against stainless steel mating surface, complete assembly to be of cast steel/fabricated structural steel, metal and elastomer elements to be as per IRC: 83 part-I & II respectively and other parts conforming to BS: 5400, section 9.1 & 9.2 and clause 2006 of MoRTH Specifications complete as per drawing and approved technical specifications.	Ton	2,400.00		
20	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	132.60		

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
Sub Total of			Sub Structure			
		Super Structure				
21	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	1,241.13		
22	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	49.65		
23	10.06/Nsc	Supply, fabrication, delivery at bridge site and erection of structural steel works as per IS 2062, including two coats of primer, one at shop and the other at site and two coats of aluminium paints including all labour, material, consumables etc. Structural steel	Ton	700.00		
24	14/nsc1/i	Filler joint i)Providing & fixing 2 mm thick corrugated copper plate in expansion joint complete as per drawing & Technical Specification.	m	32.00		
25	14/nsc1/i	Filler joint Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification.	m	32.00		

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
26	14/nsc1/i	Filler joint iii)Providing and fixing in position 20 mm thick premoulded joint filler in expansion joint for fixed ends of simply supported spans not exceeding 10 m to cater for a horizontal movement upto 20 mm, covered with sealant complete as per drawing and technical specifications.	m	32.00		
27	14/nsc1/i	Filler joint iv)Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6 per cent bitumen by weight.	m	32.00		
28	16.01/b/i /c2/ii	RCC Grade M30 For solid slab super-structure Approach Slab	cum	515.53		
29	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	92.80		
30	16.05	Cement concrete wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications	cum	23.39		
31	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	45.58		
32	16.09	Mild steel railing complete as per drawing and Technical Specifications	Rm	180.08		
33	16.11	Drainage Spouts complete as per drawing and Technical specification	each	35.00		
34	16.12/Ns	Reinforced cement concrete approach slab M-30 including reinforcement and formwork complete as per drawing and Technical specification	cum	37.70		
35	16.13	PCC M15 ordinary Grade leveling course below approach slab complete as per drawing and Technical specification Below Approach Slab				

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	15.92		
36	16.16	Providing single gap(unitary) strip/seal type of expansion joint of movement capacity of 80 mm with fatigue tested structure section at the nosing and ancourage assembly complete as per approved drawing and standard specification to be installed under supervision of a specialist manufacture	Rm	64.00		
37	16.17	Mastic asphalt (providing and laying 12mm thik mastic asphalt wearing coures on top of deck slab excluding prime coat with paving grade bitumem meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	1,241.13		
Sub Total of			Super Structure			
		Protection Work				
38	08/nsc/5	Reinforced Cement Concrete Crash Barrier-Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-40 grade concrete with HYSD reinforcement conforming to IRC:21 and dowel bars 25 mm dia, 450 mm long at expansion joints filled with pre-moulded asphalt filler board, keyed to the structure on which it is built and installed as per design given in the enclosure to MOST circular No. RW/NH - 33022/1/94-DO III dated 24 June 1994 as per dimensions in the approved drawing and at locations directed by the Engineer, all as specified	m	225.66		
Sub Total of			Protection Work			

Bill No : 14. Major Bridge

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
		Miscellaneous Work				
39	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	907.90		
Sub Total of			Miscellaneous Work			
		Total of Bill 14. Major Bridge				

Summary sheet of Small Culvert (Quantities)

		Span (m) x Height (m) =	Type-1_2.0 X 2.0 M_1 CELL_BOX C_STEPPED Ap_NC_TW-12.0M	Type-2_2.0 X 3.0 M_1 CELL_BOX C_STEPPED Ap_NC_TW-12.0M	Total Quantity
	No. of Culverts =		53	16	69
ITEM NO.	Description	Unit			
	A. Foundation				
Item no 1(a)	Excavation (upto 3 m depth)	cum	105.03	145.62	7896.685
Item no 3	P.C.C (M-15)	cum	7.05	10.30	538.412
	B. SubStructure				
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	36.69	62.27	2940.742
Item no 3	Steel (Substructure)	ton	2.57	4.36	205.852
Item no 4	Weep Holes	metre	22.20	29.60	1650.200
Item no 5	Backfilling - Granular Material	cum	11.75	14.57	855.790
Item no 7	Filter Media	cum	30.18	51.91	2430.170
	C. Super Structure				
Item no 1(b)	R.C.C M30 (Superstructure) upto 5m	cum	13.34	14.49	938.523
Item no 2	Steel (Superstructure)	ton	1.00	1.09	70.389
Item no 3(a)	Bituminous Concrete Wearing Coat(40mm)	cum	1.86	1.93	129.415
Item no 3(b)	Mastic Asphalt (12mm)	sqm	28.60	29.70	1991.000
Item no 3(c)	Tack Coat	sqm	28.60	29.70	1991.000
Item no 5	Crash Barrier	metre	5.20	5.40	362.000
Item no 6	Drainage Spout	each	2.00	2.00	138.000
	D. Protection Work				
Item no 1	Earth work for excavation	cum	100.49	100.49	6934.053
Item no 2	Catch Pit PCC M15 slab	cum	12.73	12.73	878.510
Item no 3	Catch Pit Stone Masonry	cum	1.94	1.94	134.136
Item no 4	300 mm thick Rubble stone flooring laid over 100mm thick cement concrete bedding	cum	13.10	13.10	903.613
Item no 6	Curtain Wall & Guide Wall- PCC (M-20)	cum	20.09	20.09	1386.346
Item no 7	PCC M15	cum	11.65	11.65	803.990
	E. Miscellaneous				
Item no 1	Painting	sqm	13.30	13.81	925.996

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x2m
2.0x2.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	4.60	13.00	1.530	91.49
	Shear Key	cum	2	4.80	1.720	0.820	13.54
	Total						105.03

2	PCC-M15						
	Box culvert	cum	1	3.60	9.76	0.15	5.27
	Shear Key	cum	2	3.80	1.560	0.15	1.78
	Total						7.05

SUBSTRUCTURE

3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall $= 11.4/2 + 1 =$					7	
	No of weep holes in vertical direction per side wall $= 2/1 + 1 =$					3	
	No of weep holes in horizontal direction per return wall $l = 0.5/2 + 1 =$					2	
	No of weep holes in vertical direction per return wall $l = 2.4/1 + 1 =$					4	
	Total no of Weep holes per side wall = 7×3					21	
	Total no of Weep holes per return wall $l = 2 \times 4$					8	
	Total length of weep holes = $21 \times 2 + 8 \times 4$						22.20

4	RCC-M30						
	Bottom Slab	cum	1	3.60	12.00	0.38	16.42
	Box Side Wall	cum	2	12.00	0.30	2.00	14.40
	Return wall I	cum	4	0.500	0.30	2.35	1.41
	Shear key	cum	2	3.600		0.582	4.19
	Haunch	cum	2	12.000		0.011	0.27
	Total=						36.69

5	Steel						
	@70 Kg per cum of concrete	ton					2.568
	Total						2.568

6	Filter media						
	Behind Side Wall	cum	2	11.400	0.60	2.000	27.36
	Behind Return Wall I	cum	4	0.500	0.60	2.350	2.82
	Total						30.18

7	Backfilling by granular material						
	Box culvert	cum	1	16.60		0.53	8.80
	Shear Key	cum	2	1.80		0.82	2.95
	Total						11.75

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x2m
2.0x2.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	2.600	12.000	0.419	13.065
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	13.335

9	Steel						
	@ 75 Kg per cum of concrete	ton					1.000
						Total	1.000

10	Crash Barrier	m	2	2.60			5.20
						Total	5.20

11	Drainage Spout	nos.	2				2.00

12	Bituminas Concrete Wearing Coat						
		cum	1	2.60	11.00	0.065	1.86
						Total	1.86

13	Tack Coat						
		sqm	1	2.60	11.00		28.60
						Total	28.60

14	Mastic Asphalt						
		sqm	1	2.60	11.00		28.60
						Total	28.60

PROTECTION WORK

Upstream side

15	Eatrh work for excavation						
		cum	1	3.40	2.00	1.00	6.80
						Total	6.80

16	Catch Pit PCC M15 slab						
		cum	1	2.40	1.50	0.30	1.08
						Total	1.08

17	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	2.40	0.36		0.86
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	1.94

18	300 mm thick Boulder Pitching						
		cum	1	2.00	1.30	0.30	0.78
		cum	1	4.89	5.00	0.30	7.33
						Total=	8.11

19	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

Box Size:- 1 cell of 2m x2m
2.0x2.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
20	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	7.912	1.85	0.15	2.20
	For PCC wall						
		cum	1	3.184	0.35	1.00	1.11
		cum	1	4.569	0.35	1.60	2.56
		cum	1	5.955	0.35	1.60	3.33
	Below PCC Wall						
		cum	1	3.38	0.55	0.10	0.19
		cum	1	4.77	0.55	0.10	0.26
		cum	1	6.15	0.55	0.10	0.34
	On trades						
		cum	1	2.491	0.85	0.10	0.21
		cum	1	3.876	0.85	0.10	0.33
		cum	1	5.262	0.85	0.10	0.45
		cum	1	6.734	1.00	0.10	0.67
						Total	11.65
21	Eathr work for excavation						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
		cum	1	3.23		1.100	3.55
	stone Pitching	cum	1	4.89		1.700	8.32
		cum	1	6.56		1.700	11.15
		cum	1	6.73		0.500	3.37
						Total	93.69
22	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	7.912	1.898		15.012
	Guide wall	cum	2	4.22		0.300	2.533
						Total	17.546
23	300 MM thk stone pitching						
	Below trades						
		cum	1	2.491	0.85	0.30	0.64
		cum	1	3.876	0.85	0.30	0.99
		cum	1	5.262	0.85	0.30	1.34
		cum	1	6.734	1.00	0.30	2.02
						Total	4.99
Miscellaneous							
24	Painting						
	Crash Barrier	sqm	2	2.60	2.558		13.30
						Total	13.30

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	6.30	13.00	1.570	128.58
	Shear Key	cum	2	6.50	1.680	0.780	17.04
	Total						145.62

2	PCC-M15						
	Box culvert	cum	1	5.30	9.84	0.15	7.82
	Shear Key	cum	2	5.50	1.503	0.15	2.48
	Total						10.30

SUBSTRUCTURE

3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall = $11.5/2+1 =$						7
	No of weep holes in vertical direction per side wall = $3/1+1 =$						4
	No of weep holes in horizontal direction per return wall I = $1.3/2+1 =$						2
	No of weep holes in vertical direction per return wall I = $3.4/1+1 =$						5
	Total no of Weep holes per side wall = 7×4						28
	Total no of Weep holes per return wall I = 2×5						10
	Total length of weep holes = $28 \times 2 + 10 \times 4$						29.60

4	RCC-M30						
	Bottom Slab	cum	1	5.30	12.00	0.42	26.71
	Box Side Wall	cum	2	12.00	0.35	3.00	25.20
	Return wall I	cum	4	1.300	0.25	3.37	4.38
	Shear key	cum	2	5.300	0.538		5.70
	Haunch	cum	2	12.000	0.011		0.27
	Total=						62.27

5	Steel						
	@70 Kg per cum of concrete	ton					4.359
	Total						4.359

6	Filter media						
	Behind Side Wall	cum	2	11.500	0.60	3.000	41.40
	Behind Return Wall I	cum	4	1.300	0.60	3.370	10.51
	Total						51.91

7	Backfilling by granular material						
	Box culvert	cum	1	18.30		0.57	10.43
	Shear Key	cum	2	2.65		0.78	4.13
	Total						14.57

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	2.700	12.000	0.439	14.216
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	14.486

9	Steel						
	@ 75 Kg per cum of concrete	ton					1.086
						Total	1.086

10	Crash Barrier	m	2	2.70			5.40
						Total	5.40

11	Drainage Spout	nos.	2				2.00

12	Bituminas Concrete Wearing Coat						
		cum	1	2.70	11.00	0.065	1.93
						Total	1.93

13	Tack Coat						
		sqm	1	2.70	11.00		29.70
						Total	29.70

14	Mastic Asphalt						
		sqm	1	2.70	11.00		29.70
						Total	29.70

PROTECTION WORK

Upstream side

15	Eatrh work for excavation						
		cum	1	3.40	2.00	1.00	6.80
						Total	6.80

16	Catch Pit PCC M15 slab						
		cum	1	2.40	1.50	0.30	1.08
						Total	1.08

17	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	2.40	0.36		0.86
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	1.94

18	300 mm thick Boulder Pitching						
		cum	1	2.00	1.30	0.30	0.78
		cum	1	4.89	5.00	0.30	7.33
						Total=	8.11

19	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
20	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	7.912	1.85	0.15	2.20
	For PCC wall						
		cum	1	3.184	0.35	1.00	1.11
		cum	1	4.569	0.35	1.60	2.56
		cum	1	5.955	0.35	1.60	3.33
	Below PCC Wall						
		cum	1	3.38	0.55	0.10	0.19
		cum	1	4.77	0.55	0.10	0.26
		cum	1	6.15	0.55	0.10	0.34
	On trades						
		cum	1	2.491	0.85	0.10	0.21
		cum	1	3.876	0.85	0.10	0.33
		cum	1	5.262	0.85	0.10	0.45
		cum	1	6.734	1.00	0.10	0.67
						Total	11.65
21	Eathr work for excavation						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
		cum	1	3.23		1.100	3.55
	stone Pitching	cum	1	4.89		1.700	8.32
		cum	1	6.56		1.700	11.15
		cum	1	6.73		0.500	3.37
						Total	93.69
22	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	7.912	1.898		15.012
	Guide wall	cum	2	4.22		0.300	2.533
						Total	17.546
23	300 MM thk stone pitching						
	Below trades						
		cum	1	2.491	0.85	0.30	0.64
		cum	1	3.876	0.85	0.30	0.99
		cum	1	5.262	0.85	0.30	1.34
		cum	1	6.734	1.00	0.30	2.02
						Total	4.99
Miscellaneous							
24	Painting						
	Crash Barrier	sqm	2	2.70	2.558		13.81
						Total	13.81

Summary sheet of Major Bridges (Quantities)

		CHAINAGE	140.880	Total Quantity
		Span(m) x Height(m)=	1X10+1X90+1X10 TRUSS+RCC SLAB	
ITEM NO.	Description	Unit		
	A. Foundation			
Item no 1(a)	Excavation (upto 3 m depth)	cum	1301.040	1301.040
Item no 1(b)	Excavation (3 m to 6 m depth)	cum	570.900	570.900
Item no 1(c)	Excavation (above 6 m depth in rock)	cum	1900.280	1900.280
Item no 2	R.C.C M30 (Foundation)	cum	1108.630	1108.630
Item no 3	P.C.C (M-15)	cum	631.360	631.360
Item no 7	Steel (Foundation)	ton	155.210	155.210
	B. SubStructure			
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	452.400	452.400
Item no 1(b)	R.C.C M30 (Substructure) from 5m to 10m	cum	208.180	208.180
Item no 1(c)	R.C.C M30 (Substructure) above 10m	cum		0.000
Item no 2	R.C.C. M35 for Pedestals	cum	6.040	6.040
Item no 3	Steel (Substructure)	ton	99.990	99.990
Item no 4	Weep Holes	Rm	132.600	132.600
Item no 5	Backfilling - Granular Material	cum	164.770	164.770
Item no 6	Backfilling - Sandy Material	cum	500.310	500.310
Item no 7	Filter Media	cum	154.490	154.490
Item no 8	Pot cum PTFE Bearing	Ton	2400.000	2400.000
	Elastomeric Bearing	Cucm	62635.000	62635.000
	C. Super Structure			
Item no 1(a)	R.C.C M30 (Superstructure)	cum	515.530	515.530
Item no 2	Steel (Superstructure)	ton	92.800	92.800
Item no 3(a)	Bituminous Concrete Wearing Coat(65mm)	cum	49.650	49.650
Item no 3(b)	Mastic Asphalt (12mm)	sqm	1241.130	1241.130
Item no 3(c)	Tack Coat	sqm	1241.130	1241.130
Item no 3(d)	Cement Concrete Wearing Course	cum	25.390	25.390
Item no 4	RCC railing	metre	45.580	45.580
Item no 5	Crash Barrier	metre	225.660	225.660
Item no 6	Drainage Spout	each	35.000	35.000
Item no 8	PCC below approach slab	cum	15.920	15.920
Item no 9	R.C.C. Approach Slab with steel (M30)	cum	37.700	37.700
Item no 10	Strip Seal Expansion Joint	metre	64.000	64.000
Item no 11	Filler Joint			
	(i) copper plate	metre	32.000	32.000
	(ii) fibar board	metre	32.000	32.000
	(iii) 20mm thick premoulded joint filler	metre	32.000	32.000
	(iv) joint sealing compound	metre	32.000	32.000
	Steel Railing	m	180.080	180.080
	Supply, fabrication, delivery at bridge site and erection of STRUCTURAL STEEL works	ton	700.000	700.000
Item no 1a	Boulder Pitching	cum	69.230	69.230
Item no 1b	Filter Blanket	cum	34.630	34.630
Item no 2	Falling Apron on River Bed	cum		0.000
Item no 3	Toe Wall	cum	8.160	8.160
	E. Miscellaneous			
Item no 1a	Painting	sqm	907.900	907.900
Item no 2	Citizen information board	no.	2	2.000

ESTIMATE OF QUANTITY OF TRUSS + T-Beam BRIDGE (10m+90m+10m SPAN)

Chainage:- 140.88 Km

BOQ SI No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1(i)	Excavation upto 3.0m depth in soil						
	Abutment-1	cum	1	17.30	6.600	3.000	342.54
	Pier-2	cum	1	17.40	11.800	3.000	615.96
	Abutment-2	cum	1	17.30	6.600	3.000	342.54
	Total						1301.04

1(ii)	Excavation 3.0m to 6.0m depth in soil						
	Abutment-1	cum	1	17.30	6.600	3.000	342.54
	Abutment-2	cum	1	17.30	6.600	2.000	228.36
	Total						570.90

2	Excavation in Rock						
	Abutment-1	cum	1	17.30	6.60	1.588	181.32
	Pier-1	cum	1	17.40	11.80	5.420	1112.83
	Pier-2	cum	1	17.40	11.80	2.520	517.41
	Abutment-2	cum	1	17.30	6.60	0.777	88.72
	Total						1900.28

3	Foundation M30						
	Abutment 1 & 2 (Rectangular part)	cum	2	16.30	5.60	0.80	146.05
	Abutment 1 & 2 (Trapezoidal part)	cum	2	16.30	3.40	0.40	44.34
	Pier-1 & 2 (Rectangular part)	cum	2	16.40	10.800	2.000	708.48
	Pier-1 & 2 (Trapezoidal Part)	cum	2	15.20	6.900	1.000	209.76
	Total=						1108.63

4	Levelling Course for Foundation M15						
	Below Abutment foundation-1 & 2	cum	2	16.60	5.900	0.150	29.38
	Below Pier foundation-1 & 2	cum	2	16.70	11.100	0.150	55.61
	Above Abutment foundation-1 & 2	cum	2	16.30	2.000	0.591	38.53
	Above Pier foundation-1 & 2	cum	4	16.40	3.900	1.985	507.84
	Total=						631.36

5	Steel Reinforcement						
	@140 Kg per cum of concrete	t					155.21
	Total=						155.21

SUBSTRUCTURE

6	RCC M30 upto 5 m						
	Abutment-1	cum	1	16.00	1.000	5.000	80.00
	Pier-1 (straight part)	cum	1	11.00	3.000	5.000	109.80
	Pier-1 (Circular part)	cum	1	7.07		5.000	35.35
	Pier-2 (straight part)	cum	1	11.00	2.30	5.000	126.50
	Pier-2 (Circular part)	cum	1	4.15		5.000	20.75
	Abutment-2	cum	1	16.00	1.000	5.000	80.00
	Total=						452.40

ESTIMATE OF QUANTITY OF TRUSS + T-Beam BRIDGE (10m+90m+10m SPAN)

Chainage:- 140.88 Km

BOQ SI No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
7	RCC M30 5 m to 10 m						
	Abutment-1	cum	1	16.00	0.900	0.300	4.32
	Pier-1 (straight part)	cum	1	11.00	3.000	0.500	10.98
	Pier-2 (straight part)	cum	1	11.00	2.300	0.500	2.30
	Pier-2 (Circular part)	cum	1	4.15		0.500	2.12
	Abutment-2	cum	1	16.00	0.900	0.300	4.32
	Abutment Cap 1 & 2	cum	2	16.00	0.800	0.800	20.48
	Pier cap-1 (Rectangular part)	cum	1	2.60	19.00	0.70	34.58
	Pier cap-1 (Trapezoidal part)	cum	1	2.10	16.50	0.90	31.19
	Pier cap-2 (Rectangular part)	cum	1	2.60	19.00	0.70	34.58
	Pier cap-2 (Trapezoidal part)	cum	1	2.10	16.50	0.90	31.19
	Dirt Wall	cum	2	16.00	0.300	0.891	8.55
	Bracket	cum	2	16.00	0.180		5.76
	Fin Wall	cum	4	4.20	0.400	2.650	17.81
						Total=	208.18
8	RCC M35 upto 5 m for pedestal & reaction block						
	RB-1	cum	4	0.500	1.220		2.44
	RB-3	cum	4	0.485	1.000	1.410	2.74
	Pier-1 pedestal	cum	2	1.200	1.200	0.150	0.43
	Pier-2 pedestal	cum	2	1.200	1.200	0.150	0.43
						Total=	6.04
9	Steel Reinforcement						
	@150 Kg per cum of concrete	t					99.99
						Total=	99.99
10	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment = $16/2+1 =$					9	
	No of weep holes in vertical direction per abutment = $5.3+1 =$					7	
	No of weep holes in horizontal direction per Fin Wall = $4.2/2+1 =$					3	
	No of weep holes in vertical direction per Fin Wall = $2.65/1+1 =$					4	
	Total no of Weep holes per abutment = 9×7					63	
	Total no of Weep holes per Fin Wall = 3×4					12	
	Total length of weep holes in metre = $63 \times 2 \times 0.9 + 12 \times 4 \times 0.4$						
						Total	132.60
11	Backfilling - Granular Material						
	Abutment Foundation	cum	2	22.90		0.950	43.510
	Pier Foundation	cum	2	28.20		2.150	121.260
						Total	164.77
12	Backfilling - Sandy Material						
	Behind Abutment 1	cum	1	16.00	2.90	7.056	327.40
	Behind Abutment 2	cum	1	16.00	2.90	7.056	327.40
	Deduct for filter media	cum					-154.49
						Total	500.31
13	Filter media						
	Behind Abutment	cum	2	16.000	0.60	7.056	135.48
	Behind Fin Wall	cum	4	3.600	0.60	2.200	19.01
						Total	154.49
14	Elastomeric Bearing						
	Bearing B2	cc	4	35.00	7.30	42.50	43435.00
	Bearing B3	cc	4	25.00	6.40	30.00	19200.00
						Total	62635.00

Chainage:- 140.88 Km

15	Pot Cum PTFE						
	pot cum ptfе (for TRUSS)	per tonne	4	600.00			2400.00
						Total	2400.00

SUPERSTRUCTURE

16	RCC Superstructure M30						
	10m RCC Slab	cum	2	10.400	11.660		242.53
	Deck slab in Truss bridge	cum	1	90.040	11.00	0.25	247.61
	Kerb	cum	2	112.830	0.50	0.225	25.39
						Total	515.53

17	Steel Reinforcement						
	@ 180 kg/cum of concrete	t		92.795		Total	92.80

18	Structural Steel for 90m Truss						
		t	1	700.000		Total	700.00

19	Bituminous Wearing Coat						
		cum	1	112.83	11.00	0.040	49.65
						Total=	49.65

20	Cement Concrete wearing coarse(75mm)						
		cum	2	112.830	1.500	0.075	25.387
						Total=	25.387

21	Drainage Spout	nos.	35			Total	35.000

22	Tack Coat						
		sqm	1	112.83	11.00		1241.13
						Total=	1241.13

23	Mastic Asphalt						
		sqm	1	112.83	11.00		1241.13
						Total=	1241.13

24	Crash Barrier	m	2	112.83			225.66
						Total	225.66

25	Steel Railing	m	2	90.04			180.08
						Total	180.08

26	R.C.C Railing	m	2	22.79			45.58
						Total	45.58

27	PCC below Approach Slab						
		cum	2	15.16	3.50	0.15	15.92
						Total	15.92

28	Approach Slab						
		cum	2	15.16	3.37	0.369	37.70
						Total	37.70

29	Strip Seal Expansion Joint						
		m	4	16.000			64.00
						Total	64.00

ESTIMATE OF QUANTITY OF TRUSS + T-Beam BRIDGE (10m+90m+10m SPAN)

Chainage:- 140.88 Km

BOQ SI No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
30	Filler Joint						
	(i) copper plate	m	2	16.000			32.000
	(ii) fibar board	m	2	16.000			32.000
	(iii) 20mm thick premoulded joint filler	m	2	16.000			32.000
	(iv) joint sealing compound	m	2	16.000			32.000

PROTECTION WORK

31	Boulder Pitching on River Bed						
	A1 side	cum	2	20.065		0.30	12.04
	A2side	cum	2	77.823		0.30	46.69
	Bank protection A1 side	cum	1	7.000	2.500	0.30	5.25
	Bank protection A2 side	cum	1	7.000	2.500	0.30	5.25
	Total						69.23

32	Filter Blanket						
	A1 side	cum	2	20.07		0.15	6.02
	A2 side	cum	2	77.82		0.15	23.35
	Bank protection A1 side	cum	1	7.00	2.50	0.15	2.63
	Bank protection A2 side	cum	1	7.00	2.50	0.15	2.63
	Total						34.63

33	Toe Wall						
	A1 side	cum	1	11.12	0.33		3.67
	A2side	cum	1	13.61	0.33		4.49
	Total						8.16

MISCELLANNEOUS

34	Painting						
	Crash Barrier	sqm	2.00	2.207		112.83	498.03
	Railing(Post) for 10m slab	sqm	32.00	1.050		1.10	36.96
	Railing(Beam) for 10m slab	sqm	6.00	0.69		22.79	94.35
	Railing(Post) for 90 m truss	sqm	82.00	0.700		0.90	51.66
	Railing(Beam) for 90 m truss	sqm	4.00	0.63		90.04	226.90
	Total						907.90

35	Citizen information board	no.	2				2.000