

**Consultancy Services for Carrying out Feasibility Study, Preparation of Detailed Project Report and providing pre-construction services in respect of 2 laning of *Maram-Peren- Dimapur section on NH 129A* (Manipur & Nagaland) on Engineering, Procurement and Construction mode in the state of Manipur & Nagaland.
(Package No. NHIDCL/DPR/SN-DMP-PC/Manipur/2016)**

FINAL DETAILED PROJECT REPORT

STAGE: IV

VOLUME – V: TECHNICAL SPECIFICATION

VOLUME VI: RATE ANALYSIS

VOLUME VII: COST ESTIMATE

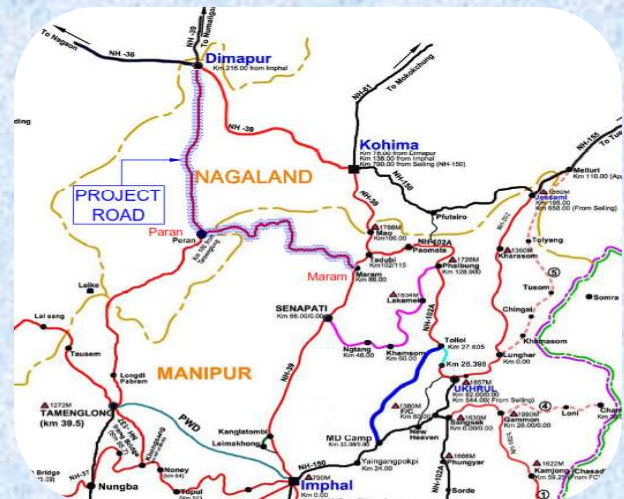
VOLUME IX: BOQ

(MARAM-PEREN SECTION IN THE STATE OF MANIPUR)

▪ PKG-IIB: KM 56+840 TO KM 75+000



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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 -I (Km 0+000 to Km 40+000) of Maram - Peren (NH-129A) road is situated in the district of Senapati, Manipur.



1.2.2 General Climatic Conditions

Senapati District is one of the 16 districts of Manipur state in northeastern India. The Senapati District is located in the northern part of the state of Manipur. It is bounded on the east by the Ukhrul District; on the west by Tamenglong District; on the north by the Phek District, state of Manipur; and on the south by the Imphal East and Imphal West Districts. The District is at an altitude varying from 1061 m to 1788 m above sea level. The hills run along the north south direction and gradually slope down towards south and meet the Imphal Valley.

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



Sr. No.	Section No.	Section Title	Clause No.
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 other Road Appurtenances	801, 802, 803, 804, 805, 807 and 811
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 confirm 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 programme 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



S. No.	Sub No.	Item, Specifications	Nos. required
	(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
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



B: For Soils and Aggregates			
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 16), and consisting of following:	1 set
	(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 needles as per IS. 1203 – 1978	1



C: For Bitumen and Bituminous Mixes			
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 Stark Method) IS – 1211 – 1978	1
xvii)		Apparatus for Determination of Loss on Heating IS – 1212-1978.	1
xviii)		Apparatus of Determination of specified Gravity IS-1202-1978	1
xix)		Core cutting machine with 100mm dia. Diamond cutting Edge	1
xx)		Apparatus for Elastic Recovery test for Modified Bitumen	1
xxi)		Apparatus for Storage Stability test for Modified Bitumen	1
xxii)		Apparatus for Separation test for modified bitumen	1

Sub-Clause 121.3.4 for Cement, Cement Concrete and Materials

D: For Cement, Cement Concrete and Materials			
i)		Water still	1



D: For Cement, Cement Concrete and Materials			
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
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)	50 m long	2 Nos.
ix)		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 / reinforced concrete including reinforcement.	cum
ii)	Dismantling pavement structures such as Sub base / Base Course, Bituminous wearing course, Concrete wearing course	cum
iii)	Dismantling pipes, guard rails, road kerbs, gutters and fencing	..running metre
iv)	Dismantling Guard Stones/KM post/Hectometre Stones	stones/Sign Nos
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 1509 RE-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	As specified by the Engineer
f) Any other item	



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:

- a) 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.
- b) 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 $\pm$ 1% of the quantity of cement in each batch.

Measurement of Water $\pm$ 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 I:



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/cm³ at 23 °C

Yield Stress : 18.0 N/mm²

Tensile Strength : 21.0 N/mm²

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 0.8Fpk 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.	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



		Ambient temperature should be in the range of 5 degree to 50 degree Celsius.		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 Joint*	Simply supported or continuous spans, Right or skew (less than 20 degree), moderately curved with maximum horizontal movement upto 50 mm	10 Years	Liable to excessive wear and tear under high traffic intensity. 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 chloprene 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 o 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 from 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 aboard.
- (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 @ 25°C	22 $\pm$ 3
Operating temperature	-	-20°C to + 80°C	
Shrinkage	-	Less than 1%	
Permanent dynamic	-	$\pm$ 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



I.S. Sieve No.	Percentage passing by weight
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 CI 3.2.1 & CI 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.

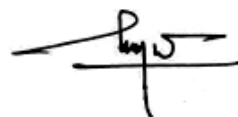
4.0 Rate

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

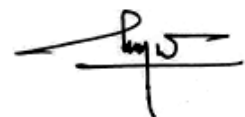
- i.) Making arrangements for traffic to clause 112 except for initial treatment to verges, shoulders and construction of diversions.
- ii.) Supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts
- iii.) All labour tools, 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

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SCHEDULE OF RATE

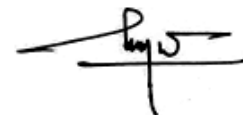
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Summary of Rate Analysis			
Code No	Descriptions	Unit	Rate
CHAPTER-2 (Road Works)			
SITE CLEARANCE AND DISMANTALING			
2.1	Cutting of Trees, including cutting of trunks , branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit.		
(i)	Girth from 300 mm to 600 mm	Each	388.41
(ii)	Girth above 600 mm to 900 mm	Each	716.32
(iii)	Girth above 900 mm to 1800 mm	Each	1360.04
(iv)	Girth above 1800 mm to 2700 mm	Each	2550.68
(v)	Girth above 2700 mm	Each	4287.80
2.3	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 upto 100m. from road boundary.		
(a)	(by manual means)		
i)	In area of light jungle	Hectare	77440.00
ii)	In area of thorny jungle	Hectare	103818.00
(b)	(by mechanical means)	Hectare	59319.65
2.4	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.		
(i)	a) Lime concrete, cement concrete M10 grade & below.	Cum	591.45
	b) Cement concrete grade M15 & M20	cum	693.57
	c) Pre-stressed/ Reinforced Cement Concrete grade M20 & above.	cum	1739.01
(ii)	Dismantling Brick / Tile work		
	a) In lime	Cum	387.20
	b) In cement mortar	Cum	489.32
	c) In mud	Cum	346.35
	d) Dry brick pitching or brick saling	Cum	325.93
(iii)	Dismantling stone masonry		
	a) Rubble stone masonry in lime	Cum	423.46
	b) Rubble stone masonry in cement mortar	Cum	489.32
	c) Rubble stone masonry in mud	Cum	387.20
	d) Dry rubble masonry	Cum	366.78
	e) Dismantling stone pitching/dry stone spalls	Cum	423.02
	f) In wire crates including opening of crates and stacking crates materials.	Cum	387.20
(vii)	Removing hume pipes class NP-3		
	a) 300mm to 600mm dia	Rm	264.99
	b) Above 600mm to 900mm dia	Rm	358.77
	c) Above 900mm dia	Rm	614.08
(viii)	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
	c) Stone metal crust, 50mm to 100mm thick by road roller with scarifier along with 20mm, premix carpet/surface dressing	sqm	57.31
	e) Kankar/Gravel metal crust upto 150mm thick with power roller with scarifier.	sqm	41.53

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Code No	Descriptions	Unit	Rate
2.6	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
2.8	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
CHAPTER-3			
EARTH WORK			
B.	ROAD CONSTRUCTION		
3.12	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
3.13	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
3.14	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
3.15	Compacting Original Ground		
	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
3.16	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
3.17	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
3.19	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
	EARTH WORK ON HILL ROAD		
3.31	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
3.32	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
3.33	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

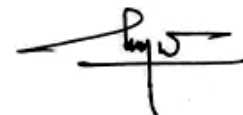



Code No	Descriptions	Unit	Rate
C.	EXCAVATION FOR STRUCTURE		
3.1	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work.		
(i)	Ordinary soil		
	a) Manual Means (Depth upto 3m)	Cum	408.50
	b) Mechanical Means (Depth upto 3m)	Cum	105.88
(ii)	Ordinary Rock (not requiring blasting)		
	a) Manual Means (Depth upto 3m)	Cum	510.60
	b) Mechanical Means	Cum	142.33
(iii)	Hard Rock (requiring blasting)		
	a) Manual Means	Cum	982.17
	b) Hard Rock (blasting prohibited) Mechanical Means	Cum	1900.61
(iv)	Marshy soil		
	a) Manual Means	Cum	773.37
	b) Mechanical Means	Cum	269.34
3.2	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.		
(i)	Ordinary Soil (Manual means)	Cum	326.80
	Mechanical Means	Cum	84.70
(ii)	Blasting work		
	a) Soft rock	Cum	785.74
	b) Hard rock	Cum	1520.49
(iii)	Chiselling/wedging out of rock (where blasting is prohibited).		
	a) Soft rock	Cum	1765.25
	b) Hard rock	Cum	2647.87
3.3	Filling in foundation trenches as per drawing and Technical specification		
	a) Sandy Soil	Cum	326.10
	b) Sand Gravel	Cum	692.96
3.4	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		
(i)	Ordinary Soil	cum	217.49

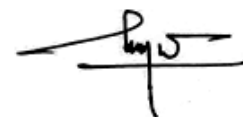
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Code No	Descriptions	Unit	Rate
CHAPTER-4			
SUB-BASES			
4.1	Sub-base with Close Graded Material (Table:- 400-1)		
	Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage 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	2949.87
	For Grading-III Material	Cum	2893.00
4.2	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	2413.12
	For Grading-III Material	Cum	2356.25
4.3	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	2285.30
	For Grading-III Material	Cum	2230.59
4.4	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
4.6	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)		
A	By Mechanical Means	cum	1652.44
B	By Manual Means	cum	1662.67




Code No	Descriptions	Unit	Rate
CHAPTER-5			
BASES			
5.2	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water to OMC in mechanical mix plant (Pug mill), carriage of mixed Material by tipper/dumper to site, laying in uniform layers in base courses on well prepared under base and compacting with vibratory roller to achieve the desired density i/c lighting, guarding, barricading, and maintenance of diversion, etc)	cum	2965.34
5.3	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.	cum	1374.51
CHAPTER-6			
BITUMINOUS CONSTRUCTION			
6.1	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
	B) Stabilised Soil Based / Crusher run macadam 0.9 - 1.2kg /sqm	sqm	97.04
6.2	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
	iii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	17.16
	iv) On cement concrete pavement @ 0.300 - 0.35 kg/sqm	sqm	22.22



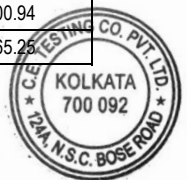

Code No	Descriptions	Unit	Rate
6.6	Dense Graded Bituminous Macadam (Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total 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.)		
(i)	for Grading I (40 mm nominal size)		
	Using bitumen 60/70	cum	10661.33
(ii)	for GradingII(19 mm nominal size)		
	Using bitumen 60/70	cum	10707.15
6.8	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)		
(i)	for Grading-I (19 mm nominal size)		
	A) Using Bitumen 60/70	cum	12064.76
	B) Using Bitumen CRMB Gr-55	cum	12622.49
	C) Using Bitumen PMB 70	cum	15913.73
(ii)	for Grading-II(13 mm nominal size)		
	A) Using Bitumen 60/70	cum	11950.36
	B) Using Bitumen CRMB Gr-55	cum	15599.71
	C) Using Bitumen PMB 70	cum	15898.91
6.15	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	1182.63

CHAPTER-8

TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES

8.1	Precast Cement concrete M20 Kerb including fixing at site	Rm	622.79
8.2	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc.		
	a) 5th KM stone	each	4556.84
	b) Ordinary kilometer stone	each	2676.24
8.6	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
8.11	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)		
(i)	90 cm equilateral triangle	each	4931.35
(ii)	60 cm equilateral triangle	each	3621.96
(iii)	60 cm circular	each	4440.80
(iv)	80 mm x 60 mm rectangular	each	5706.23
(v)	60 cm x 45 cm rectangular	each	4249.15
(vi)	60 cm x 60 cm square	each	5200.94
(vii)	90 cm high octagon	each	8165.25

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Code No	Descriptions	Unit	Rate
8.12	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	12223.04
8.13	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 single 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	12831.40
8.14	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	1002.14
8.15	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 conforming to IRC-79 and the drawings.)		
c)(v)	120x120 -Road Delineator	Piece	1063.19
8.17	RCC Crash Barrier (Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridges structures and medians, constructed with M20 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 the locations directed by the Engineer, all as specified.	Linear Metre	5277.53
8.18	Metal Beam Crash Barrier		
A	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)		
(a)	For post Height of 1.2 m	Rm	2757.81
(b)	For post Height of 1.5 m	Rm	3334.08
(c)	For post Height of 1.8 m	Rm	3591.20
8.20	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		
(i)	Solar light emitting Diodes	Nos.	2595.21
(ii)	Light Reflecting Lense Type	Nos.	383.64
8.21	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.	21165.02
CHAPTER-10			
CULVERTS			
10.6	Steel reinforcement for RCC works including bending, binding and placing in position		
	HYSD bars	MT	72983.59
CD Works			

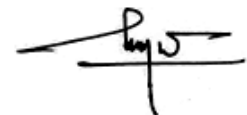


Code No	Descriptions	Unit	Rate
CHAPTER-13			
EARTHWORK			
13.1	Earth work in excavation of foundation for structures as per drawing and technical specification		
(a)	Ordinary soil		
(i)	Depth upto 3 m	cum	218.93
(ii)	Depth 3 m to 6 m	cum	294.27
(iii)	Above 6 m depth	cum	409.42
(b)	Ordinary rock		
(i)	if blasting is resorted to	cum	312.75
(ii)	if blasting is not resorted to	cum	209.22
(c)	Hard rock (requiring blasting)	cum	765.10
(d)	Hard rock (blasting prohibited)	cum	670.52
(e)	Marshy soil (upto 3 m depth)	cum	947.09
13.2	Filling in Foundation Trenches as per drawing & technical specification using		
(i)	Coarse sand	cum	2528.78
(ii)	Sandy soil with PI value less than 6	cum	362.40
13.3	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification		
(a)	Gravelly materials	cum	1007.86
(b)	Good Sandy Soil free from organic material	cum	617.02
13.4	Filter medium behind abutment,wing wall and return wall complete as per drawing and technical specification .	cum	1274.65
CHAPTER-14			
FOUNDATION			
14.1	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications	cum	11849.87
14.2	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification		
(a)	Coursed rubble masonry(first sort)	cum	6418.90
(b)	Random Rubble Masonry (coursed/uncoursed)	cum	6306.36
14.3	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications		
A	PCC M15 Grade	cum	8348.21
B	PCC M20 Grade	cum	9333.75
C	RCC M20 Grade		
Case I	Using Concrete Mixture	cum	9458.76
Case II	With batching plant, transit mixture & concrete pump	cum	8327.62
D	PCC M25 Grade		
Case I	Using Concrete Mixture	cum	10071.78
Case II	With batching plant, transit mixture & concrete pump	cum	8949.09
E	RCC M25Grade		
Case I	Using Concrete Mixture	cum	10230.25
Case II	With batching plant, transit mixture & concrete pump	cum	9077.25
F	PCC M30 Grade		
Case I	Using Concrete Mixture	cum	11992.49
Case II	With batching plant, transit mixture & concrete pump	cum	10864.5
G	RCC M30 Grade		
Case I	Using Concrete Mixture	cum	12089.498
Case II	With batching plant, transit mixture & concrete pump	cum	10966.06
H	RCC M35 Grade		
Case II	With batching plant, transit mixture & concrete pump	cum	11122.3

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Code No	Descriptions	Unit	Rate
I	RCC M40 Grade		
Case II	With batching plant, transit mixture & concrete pump	cum	12859.89
14.4	Providing and laying cutting edge of mild steel for well foundation complete as per drawing and technical specification	MT	114794.69
14.8	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	77427.65
14.10	Providing and laying steel liner for cubs and steining for wells including fabrication and setting out as per detailed drawing	MT	112802.59
14.11	Boring, Providing and installing bored cast-in-situ reinforcement cement concrete pile of specified dia and length below the pile cape in cement concrete of M20 grade subject to a min cement content of 400 kg per cubic metre of concrete , mix water cement ratio of 0.5 , slum range from 150 mm to 200 mm (max) , to carry a safe working load not les than specified i/c the cost of boring with casing and /or bentonite solution and length of pile to be embeded in the pile cap (length of pile for payment shall be measured upto bottom of pile cap),but excluding the cost of steel reinforcement which shall be paid separately (pile test as per relevent ISI/IRC codes shall be carried out for the same where required shall be made separately		
(a)	1200 mm dia (M30 grade)	Rm	19896.77
	1000 mm dia (M30 grade)	Rm	15508.44
	750 mm dia (M30 grade)	Rm	9441.59
Note :	For load testing assume		
(a)	Initial & Routine test L.S. cost	tonne	503.12
(b)	For lateral testing test L.S. cost	tonne	15901.68
14.12	Boring, Providing and installing bored cast-in-situ reinforcement cement concrete pile of specified dia and length below the pile cape in cement concrete of M35 grade subject to a min cement content of 475 kg per cubic metre of concrete , mix water cement ratio of 0.5 , slum range from 150 mm to 200 mm (max) , to carry a safe working load not les than specified i/c the cost of boring with casing and /or bentonite solution and length of pile to be embeded in the pile cap (length of pile for payment shall be measured upto bottom of pile cap),but excluding the cost of steel reinforcement which shall be paid separately (pile test as per relevent ISI/IRC codes shall be carried out for the same where required shall be made separately		
(a)	1200 mm dia (M35 grade)	Rm	20126.29
(b)	1000 mm dia (M35 grade)	Rm	15667.89
(c)	750 mm dia (M35 grade)	Rm	9531.23
Note :	For load testing assume		
(a)	Initial & Routine test L.S. cost	tonne	503.12
(b)	For lateral testing test L.S. cost	tonne	15901.68
14.14	Cement concrete for Reinforced concrete in pile cap i/c form work complete as per drawing and technical specification		
(a)	M-35 Grade		
Case I	Using Concrete Mixture	cum	14349.42
Case II	With batching plant, transit mixture & concrete pump	cum	11182.62
(b)	M-30 Grade		
Case I	Using Concrete Mixture	cum	14140.28
Case II	With batching plant, transit mixture & concrete pump	cum	10973.48
(c)	M-25 Grade		
Case I	Using Concrete Mixture	cum	12187.1
Case II	With batching plant, transit mixture & concrete pump	cum	9020.31

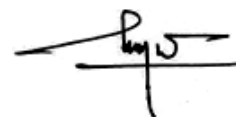



Code No	Descriptions	Unit	Rate
CHAPTER-15			
SUB-STRUCTURE			
15.1	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications	cum	11961.59
15.2	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification		
(a)	Coursed rubble masonry(first sort)	cum	6382.65
(b)	Random Rubble Masonry (coursed/uncoursed)	cum	6787.85
15.3	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		
(a)	PCC M15 Grade		
(i)	upto 5m height	cum	8705.63
(ii)	Between 5 to 10 m height	cum	8943.91
(iii)	Above 10 m	cum	9241.76
(b)	PCC M20 Grade		
(i)	upto 5m height	cum	9067.33
(ii)	Between 5 to 10 m height	cum	9999.78
(iii)	Above 10 m	cum	10332.79
(c)	PCC M25 Grade		
(i)	upto 5m height	cum	9801.62
(ii)	Between 5 to 10 m height	cum	10810.22
(iii)	Above 10 m	cum	11170.43
(d)	PCC M30 Grade		
(i)	upto 5m height	cum	11691.53
(ii)	Between 5 to 10 m height	cum	12895.37
(iii)	Above 10 m	cum	13325.31
(e)	RCC M20 Grade		
(i)	upto 5m height	cum	9188.78
(ii)	Between 5 to 10 m height	cum	9529.56
(iii)	Above 10 m	cum	10133.71
(f)	RCC M25 Grade		
(i)	upto 5m height	cum	9938.25
(ii)	Between 5 to 10 m height	cum	10945.65
(iii)	Above 10 m	cum	11325.25
(g)	RCC M30 Grade		
(i)	upto 5m height	cum	11786.08
(ii)	Between 5 to 10 m height	cum	12921.64
(iii)	Above 10 m	cum	14299.92
(h)	RCC M35 Grade		
(i)	upto 5m height	cum	11975.71
(ii)	Between 5 to 10 m height	cum	13069.28
(iii)	Above 10 m	cum	13386.77
(i)	RCC M40 Grade		
(i)	upto 5m height	cum	11992.30
(ii)	Between 5 to 10 m height	cum	13068.11

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Code No	Descriptions	Unit	Rate
(iii)	Above 10 m	cum	13380.45
15.5	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	77427.65
15.6	Supplying, fitting and fixing in position true to line and level cast steel rocker bearing conforming to IRC: 83(Pt.-1) section IX and clause 2003 of MoRTH specifications complete including all accessories as per drawing and Technical Specifications.	tonne capacity	3.18
15.7	Supplying, fitting and fixing in position true to line and level forged steel roller bearing conforming to IRC: 83(Pt.-1) section IX and clause 2003 of MoRTH specifications complete including all accessories as per drawing and Technical Specifications.	tonne capacity	3.18
15.8	Supplying, fitting and fixing in position true to line and level sliding plate bearing with PTFE surface sliding on stainless steel complete including all accessories as per drawing and Technical Specifications and BS: 5400, section 9.1 & 9.2 (for PTFE) and clause 2004 of MoRTH Specifications.	tonne capacity	16.22
15.9	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.	cubic centimetre	3.19
15.10	POT type bearing consisting of a metal piston supported by a disc, PTFE pads providing sliding surface against stainless steel mating together with cast steel assemblies/fabricated structural steel assemblies, Duly painted with all components as per clause 2006 as per drawing and technical specifications.	tonne capacity	505.27
15.11	Supplying, fitting and fixing in position true to line and level sliding plate bearing with stainless steel plate sliding on stainless steel plate with mild steel matrix complete including all accessories as per drawing and Technical Specifications.	tonne capacity	7.25
15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	445.75

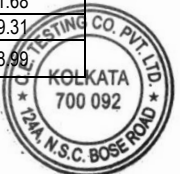



Code No	Descriptions	Unit	Rate
CHAPTER-16			
SUPER-STRUCTURE			
16.1	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification		
(a)	RCC Grade M25		
(i)	For solid slab super-structure		
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	11740.55
(ii)	Height 5m to 10m	cum	12229.74
(iii)	Height above 10m	cum	12718.93
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	10446.36
(ii)	Height 5m to 10m	cum	10881.62
(iii)	Height above 10m	cum	11316.89
(ii)	For T-beam & slab		
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	12229.74
(ii)	Height 5m to 10m	cum	12718.92
(iii)	Height above 10m	cum	12733.45
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	10881.62
(ii)	Height 5m to 10m	cum	11316.89
(iii)	Height above 10m	cum	11329.81
(b)	RCC Grade M30		
(i)	For solid slab super-structure		
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	14062.28
(ii)	Height 5m to 10m	cum	14648.21
(iii)	Height above 10m	cum	15234.13
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	12755.67
(ii)	Height 5m to 10m	cum	13287.15
(iii)	Height above 10m	cum	13818.64
(ii)	For T-beam & slab		
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	14648.21
(ii)	Height 5m to 10m	cum	15234.13
(iii)	Height above 10m	cum	15251.53
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	13287.15
(ii)	Height 5m to 10m	cum	13818.64
(iii)	Height above 10m	cum	13834.42
(c)	RCC/PSC Grade M35		
(i)	For solid slab super-structure		
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	14067.58
(ii)	Height 5m to 10m	cum	14663.67
(iii)	Height above 10m	cum	15259.75
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	12747.64
(ii)	Height 5m to 10m	cum	13287.79
(iii)	Height above 10m	cum	13827.95
(ii)	For T-beam & slab		
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	14663.67
(ii)	Height 5m to 10m	cum	15259.75
(iii)	Height above 10m	cum	15299.12
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	13287.79
(ii)	Height 5m to 10m	cum	13827.95
(iii)	Height above 10m	cum	13863.63
(iii)	For box girder abnd balance cantelever		

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Code No	Descriptions	Unit	Rate
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	16451.92
(ii)	Height 5m to 10m	cum	17644.09
(iii)	Height above 10m	cum	18836.26
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	14908.26
(ii)	Height 5m to 10m	cum	15988.57
(iii)	Height above 10m	cum	17068.87
(d)	PSC Grade M40		
(i)	For solid slab super-structure		
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	15122.49
(ii)	Height 5m to 10m	cum	15763.28
(iii)	Height above 10m	cum	16404.06
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	13811.60
(ii)	Height 5m to 10m	cum	14396.84
(iii)	Height above 10m	cum	14982.08
(ii)	For T-beam & slab		
Case-I	Using concrete mixture		
(i)	Height up to 5m	cum	15763.28
(ii)	Height 5m to 10m	cum	16404.06
(iii)	Height above 10m	cum	16446.38
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	14396.84
(ii)	Height 5m to 10m	cum	14982.08
(iii)	Height above 10m	cum	15020.73
(iii)	For box girder abnd balance cantelever		
Case-II	Using batching plant, transit mixer & concrete pump		
(i)	Height up to 5m	cum	16152.55
(ii)	Height 5m to 10m	cum	17323.02
(iii)	Height above 10m	cum	18493.50
(e)	PSC Grade M45		
	Using batching plant, transit mixer & concrete pump		
(i)	For solid slab super-structure		
(i)	Height up to 5m	cum	14189.73
(ii)	Height 5m to 10m	cum	14801.35
(iii)	Height above 10m	cum	15412.98
(ii)	For I-Beam & slab including launching of pre-cast girders by launching truss up to 40m span.		
(i)	Height up to 5m	cum	14801.35
(ii)	Height 5m to 10m	cum	15412.98
(iii)	Height above 10m	cum	15475.62
(iii)	For cast in situ box girder, segmental construction and balanced cantilever		
(i)	Height up to 5m	cum	16636.23
(ii)	Height 5m to 10m	cum	17859.48
(iii)	Height above 10m	cum	19082.74
(f)	PSC M50 grade		
	Using batching plant, transit mixer & concrete pump		
(i)	For cast in situ box girder, segmental construction and balanced cantilever		
(i)	Height up to 5m	cum	17022.83
(ii)	Height 5m to 10m	cum	18283.78
(iii)	Height above 10m	cum	19544.73
16.3	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	85183.86
16.4	High tensile steel wires/strands including all accessories for stressing, stressing operations and grouting complete as per drawing and Technical Specifications	MT	193515.71
16.5	Cement concrete wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications	cum	18782.51
16.6	Asphaltic concrete wearing coat of 25mm compacted thickness complete as per drawing and Technical Specifications	cum	16677.31
16.7	Bituminous Mastic wearing coat excluding tack coat complete as per drawing and Technical Specification	sqm	750.12
16.8	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	2711.68
16.9	Mild steel railing complete as per drawing and Technical Specifications	Rm	4559.31
16.11	Drainage Spouts complete as per drawing and Technical specification	each	2158.99



Code No	Descriptions	Unit	Rate
16.12	Reinforced cement concrete approach slab M-25 including reinforcement and formwork complete as per drawing and Technical specification	cum	14481.39
16.13	PCC M15 ordinary Grade leveling course below approach slab complete as per drawing and Technical specification	cum	8109.93
16.14	Painting in Kerb in black and yellow alternate bands complete as per drawing and Technical specification	metre	139.81
16.15	Providing Reinforced Elastomeric (neoprene) slab seal type of expansion joint complete as per approved design and standard i/c acceptable, testing as specified to be installed under supervision of a specialist manufacture i/c temp correction during installation		
(i)	Expansion joint for movement upto 50mm	Rm	77723.80
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 encourage assembly complete as per approved drawing and standard specification to be installed under supervision of a specialist manufacture	Rm	41863.77
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	532.56

CHAPTER-17

PROTECTIVE WORK

17.1	laying apron complete as per drawing and Technical specification.		
(a)	Boulder	cum	2280.25
(b)	Boulder in wire crates.	cum	2169.83
(c)	Cement concrete block (M-15grade)	cum	8348.21
17.2	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	2426.95
17.3	Pitching on slopes complete as per drawing and Technical specifications		
(a)	Stone	cum	1655.65
(b)	Cement concrete block (M-15grade)	cum	8515.17
10.2	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in superstructure upto 4m. Above ground/ bed level i/c formwork	cum	7496.35
10.16	Cement plaster- 12mm. Thick in concrete mortar 1:3	Sqm	223.49
10.19	Dry Boulder Pitching flooring	cum	1701.75
10.23	Reinforced cement concrete M-30 mix with stone aggtr. Nominal size	cum	14404.16
23	CI Grating 269x260mm	Each	231.00
40	Gextextile material (fine net)	sqm	25.50
	Galvanised Mild steel J /L hook	Kg	120.00
8.4	Boundary Piller M15	each	843.03
10.a	Painting on 5th Km stone	each	733.25
10.b	Painting on Ordinary stone	each	388.12
10.c	Painting on 200m stone	each	27.93
8.5	Painting on concrete surface two coats	sqm	93.41
47.1.d	NP-2 Pipe 300mm Dia	Rm	1650.00
47.2.d	NP Collier 300mm	Each	216.00

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LEAD CHART

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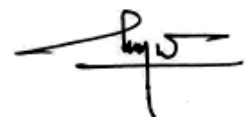


Leads for Various Materials

Sl. No.	Name of Material	Name of Source	Distance from Source to Start/ End Point of Project Road (Km)	Distance on Project Road (Km) (Half of Project)	Total Lead (Km)
1	Sand (Fine)	Barak Near Zuku	37	9.08	46.08
2	Filling Material	Local	-	-	10
3	Stone Metal	Barak Near Zuku	37	9.08	46.08
4	Stone Boulder	Barak Near Zuku	37	9.08	46.08
5	Stone Chips, Aggregate	Barak Near Zuku	37	9.08	46.08
6	Coarse Sand	Barak Near Zuku	37	9.08	46.08
7	Cement	Imphal	141.84	9.08	150.92
8	Steel	Imphal	141.84	9.08	150.92
9	Bitumen	Imphal	141.84	9.08	150.92
10	Bitumen Emulsion	Imphal	141.84	9.08	150.92
11	Structural Steel	Imphal	141.84	9.08	150.92




CARRIAGE COST

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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 1	per m ³		163.65	
		Upto 2	per m ³		190.55	
		Upto 3	per m ³		216.97	
		Upto 4	per m ³		242.32	
		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

Barak Near Zuku

Lead Upto Site (Km)=

46.08

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
2	46.08	Upto 1	per m ³		156.35	
		Upto 2	per m ³		182.05	
		Upto 3	per m ³		207.29	
		Upto 4	per m ³		231.51	
		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	10	20.42	204.20
		for Every km beyond 20 km	per m ³	26.08	16.51	430.58
					Total	1016.22

Sand

Name of Quarries

Barak Near Zuku

Lead Upto Site (Km)=

46.08

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
3	46.08	Upto 1	per m ³		156.35	
		Upto 2	per m ³		182.05	
		Upto 3	per m ³		207.29	
		Upto 4	per m ³		231.51	
		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	10	20.42	204.20
		for Every km beyond 20 km	per m ³	26.08	16.51	430.58
					Total	1016.22

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Boulder

Name of Quarries

Barak Near Zuku

Lead Upto Site (Km)=

46.08

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
4	46.08	Upto 1	per m ³		173.23	
		Upto 2	per m ³		201.95	
		Upto 3	per m ³		229.94	
		Upto 4	per m ³		256.81	
		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	10.00	22.65	226.50
		for Every km beyond 20 km	per m ³	26.08	18.31	477.52
					Total	1127.15

Cement, Steel

Name of Quarries

Imphal

Lead Upto Site (Km)=

150.92

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
5	150.92	Upto 1	per Tone		112.15	
		Upto 2	per Tone		130.59	
		Upto 3	per Tone		148.70	
		Upto 4	per Tone		166.07	
		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	130.92	11.84	1550.09
					Total	1970.21

Bitumen

Name of Quarries

Imphal

Lead Upto Site (Km)=

150.92

Lead upto 150 km/ 150.92						
Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
6	150.92	Upto 1	per Tone		112.15	
		Upto 2	per Tone		130.59	
		Upto 3	per Tone		148.70	
		Upto 4	per Tone		166.07	
		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	130.92	11.84	1550.09
					Total	1970.21




FINISHED RATE

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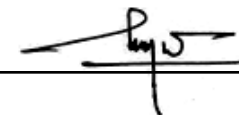
FINISHER RATE**Road Works**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
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	392.3
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	723.4
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	1,373.6
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	2,576.1

**Note: Finished Rate inclusive of 1% of 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	4,330.6
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	59,912.8
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	1,756.4
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	489.32					0.00	494.2
9	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	358.77					0.00	362.3

**Note: Finished Rate inclusive of 1% of 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/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	614.08					0.00	620.2
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	33.99					0.00	34.3
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 attatched with scarifier	sqm	57.08					0.00	57.6
13	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface	sqm	315.00					0.00	318.1
14	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	161.8

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

Item Rate Analysis has been done considering

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

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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
15	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	248.7
16	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	87.5
17	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	62.4
18	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	213.5

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

Item Rate Analysis has been done considering

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

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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
19	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	307.6
20	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					1,361.59	4,402.1
					Course Sand	0.380	cum	1,016.22		
					Stone	0.250	cum	1,016.22		
					Chips/Aggregate					
					Stone Metal Cat1	0.640	cum	1,127.15		
21	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	2,083.6

**Note: Finished Rate inclusive of 1% of 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
22	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					1,443.91	4,453.3
					Course Sand	0.396	cum	1,016.22		
					Stone Metal Cat1	0.924	cum	1,127.15		
23	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					280.27	1,671.3
					Cement	0.012	Ton	1,970.21		
					Sand	0.064	cum	1,016.22		
					Stone	0.112	cum	1,016.22		
					Chips/Aggregate					
					Stone Metal Cat1	0.069	cum	1,127.15		
24	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					1.38	59.5
					Bitumen Emulsion	0.001	Ton	1,970.21		

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

Item Rate Analysis has been done considering

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FINISHER RATE

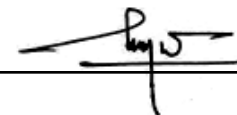
Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
25	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	1,970.21	0.39	16.1
26	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	1,970.21	0.49	17.8
27	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	1.440 0.104	cum Ton	1,016.22 1,970.21	1,684.23	13,077.7

**Note: Finished Rate inclusive of 1% of 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
					Filler	0.040	Ton	399.23		
28	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					1,747.72	14,259.9
					Aggregate	1.456	cum	1,016.22		
					Bitumen 30/40	0.130	Ton	1,970.21		
					Filler	0.030	Ton	399.23		
29	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	622.79					124.00	754.2
					Cement	0.016	Ton	1,970.21		
					Course Sand	0.030	cum	1,016.22		
					Stone Chips/Aggregate	0.061	cum	1,016.22		
30	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					758.24	5,368.2
					Cement	0.108	Ton	1,970.21		

**Note: Finished Rate inclusive of 1% of 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
					Sand	0.176	cum	1,016.22		
					Steel	0.004	Ton	1,970.21		
					Stone Chips/Aggregate	0.353	cum	1,016.22		
31	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	1,970.21	518.43	3,226.6
					Sand	0.121	cum	1,016.22		
					Steel	0.002	Ton	1,970.21		
					Stone Chips/Aggregate	0.242	cum	1,016.22		
32	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	1,016.22	1,901.45	2,771.9
					Steel	0.080	Ton	1,970.21		
					Stone Chips/Aggregate	1.150	cum	1,016.22		
33	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	94.3

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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
34	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					760.96	5,749.2
					Cement	0.033	Ton	1,970.21		
					Sand	0.540	cum	1,016.22		
					Steel	0.019	Ton	1,970.21		
					Stone	0.108	cum	1,016.22		
					Chips/Aggregate					
35	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					760.96	5,253.7
					Cement	0.033	Ton	1,970.21		
					Sand	0.540	cum	1,016.22		
					Steel	0.019	Ton	1,970.21		

**Note: Finished Rate inclusive of 1% of 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	1,016.22		
36	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					760.96	6,531.8
					Cement	0.033	Ton	1,970.21		
					Sand	0.540	cum	1,016.22		
					Steel	0.019	Ton	1,970.21		
					Stone Chips	0.108	cum	1,016.22		
37	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					760.96	5,060.2
					Cement	0.033	Ton	1,970.21		
					Sand	0.540	cum	1,016.22		

**Note: Finished Rate inclusive of 1% of 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
					Steel	0.019	Ton	1,970.21		
					Stone Chips	0.108	cum	1,016.22		
38	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					760.96	9,015.4
					Cement	0.033	Ton	1,970.21		
					Sand	0.540	cum	1,016.22		
					Steel	0.019	Ton	1,970.21		
					Stone Chips/Aggregate	0.108	cum	1,016.22		
39	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					297.19	12,645.4
					Cement	0.037	Ton	1,970.21		

**Note: Finished Rate inclusive of 1% of 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
					Sand	0.060	cum	1,016.22		
					Steel	0.021	Ton	1,970.21		
					Stone Chips/Aggregate	0.120	cum	1,016.22		
40	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					381.06	13,344.5
					Cement	0.044	Ton	1,970.21		
					Sand	0.072	cum	1,016.22		
					Steel	0.038	Ton	1,970.21		
					Stone Chips/Aggregate	0.144	cum	1,016.22		
41	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	1,002.14					0.00	1,012.1

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Item Rate Analysis has been done considering

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

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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
42	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	1,063.19					0.00	1,073.8
43	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	3,367.4

**Note: Finished Rate inclusive of 1% of 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	08.20/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	387.4
45	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	21,376.6
46	08/nsc/2	Convex Mirror For Blind Curve	nos	5,000.00					0.00	5,050.0
47	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					1,971.26	9,562.2
					Aggregate	0.850	cum	1,016.22		
					Cement	0.330	Ton	1,970.21		
					Sand	0.450	cum	1,016.22		

**Note: Finished Rate inclusive of 1% of 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
48	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	1,970.21	2,068.72	75,802.8
49	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	1,970.21	2,068.72	75,802.8
50	10.16	Cement Plaster 12mm Thick in Cement Mortar 1:3	sqm	223.49					0.00	225.7
51	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	1,016.22	1,219.46	2,417.7
52	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	1,016.22	1,219.46	2,400.5

**Note: Finished Rate inclusive of 1% of 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
53	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	0.850	cum	1,016.22	1,971.26	9,562.2
					Cement	0.330	Ton	1,970.21		
					Sand	0.450	cum	1,016.22		
54	12/Nsc2	Geo-synthetics and Reinforced Earth Facing elements of RCC	Sqm	3,342.00	Aggregate	0.180	cum	1,016.22	730.33	4,113.0
					Cement	0.180	Ton	1,970.21		
					Course Sand	0.180	cum	1,016.22		
					Steel	0.005	Ton	1,970.21		
55	18.03/b	Providing and inserting nipples with approved fixing compound after drilling holes for grouting as per technical specifications including subsequent cutting/removal and sealing of the hole as necessary of nipples after completion of grouting with epoxy grout.	Per hol	377.59					0.00	381.3
56	24/i/b	Galvanised Mild steel J /L hook	kg	120.00					0.00	121.2

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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
57	40	Gextextile material (fine net)	sqm	25.50					0.00	25.7
58	7.5(i)/Nsc	Stainless steel strips	m	625.90					0.00	632.1
59	BR/51	100 mm dia ac pipe	Rm	160.00					0.00	161.6

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

Item Rate Analysis has been done considering

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FINISHER RATE

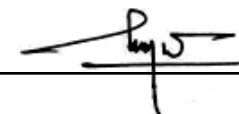
Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
1	13.01/a/i/N sc	Earth work in excavation Ordinary soil For Protection Work	cum	218.93					0.00	221.1
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	218.93					0.00	221.1
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	211.3
4	13.02/ii	Filling in Foundation Trenches as per drawing & technical specification using Sandy soil with PI value less than 6	cum	362.40					0.00	366.0
5	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	1,007.86					1,219.46	2,249.5

**Note: Finished Rate inclusive of 1% of 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	1.200	cum	1,016.22		
6	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	1,016.22	1,219.46	1,854.8
7	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	1,016.22	1,219.46	2,519.0
8	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	11,968.3
9	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 Sand Stone Metal Cat1	0.170 0.300 1.160	Ton cum cum	1,970.21 1,016.22 1,127.15	1,947.30	8,336.2
10	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	1,016.22	1,971.26	10,422.6

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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
					Cement	0.330	Ton	1,970.21		
					Sand	0.450	cum	1,016.22		
11	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					2,179.68	11,369.5
					Aggregate	0.900	cum	1,016.22		
					Cement	0.410	Ton	1,970.21		
					Sand	0.450	cum	1,016.22		
12	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	77,427.65					2,068.72	80,291.3
					Steel	1.050	Ton	1,970.21		
13	14/nsc2	Brick Flat Soling at Foundation	Sqm	1,077.89					40.00	1,129.0
					Brick	1.000	Sqm	40.00		
14	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	12,081.2
15	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					1,947.30	8,822.5
					Cement	0.170	Ton	1,970.21		

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Item Rate Analysis has been done considering

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

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FINISHER RATE

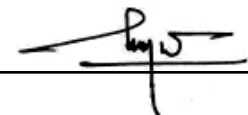
Minor Bridge

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	1,016.22		
					Stone Metal Cat1	1.160	cum	1,127.15		
16	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					2,049.65	11,228.1
					Cement	0.344	Ton	1,970.21		
					Sand	0.450	cum	1,016.22		
					Stone Chips/Aggregate	0.900	cum	1,016.22		
17	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					2,165.89	12,225.1
					Cement	0.403	Ton	1,970.21		
					Sand	0.450	cum	1,016.22		
					Stone Chips/Aggregate	0.900	cum	1,016.22		
18	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	77,427.65					2,068.72	80,291.3
					Steel	1.050	Ton	1,970.21		

**Note: Finished Rate inclusive of 1% of 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	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	445.75	Cement	0.001	Ton	1,970.21	3.60	453.8
					Sand	0.002	cum	1,016.22		
20	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	10,446.36	Cement	0.400	Ton	1,970.21	2,162.01	12,734.4
					Course Sand	0.452	cum	1,016.22		
					Stone Chips/Aggregate	0.900	cum	1,016.22		
21	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	85,183.86	Steel	1.050	Ton	1,970.21	2,068.72	88,125.1
22	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	2,711.68	Cement	0.035	Ton	1,970.21	221.41	2,962.4
					Sand	0.039	cum	1,016.22		
					Steel	0.018	Ton	1,970.21		

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

Item Rate Analysis has been done considering

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

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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
					Stone Chips/Aggregate	0.077	cum	1,016.22		
23	16.11	Drainage Spouts complete as per drawing and Technical specification	each	2,158.99					7.88	2,188.5
					Structural Steel	0.004	Ton	1,970.21		
24	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					21.23	559.3
					Bitumen	0.003	Ton	1,970.21		
					Lime	0.005	Ton	399.23		
					Stone Chips/Aggregate	0.014	cum	1,016.22		

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

Item Rate Analysis has been done considering

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

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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
25	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	1,970.21 1,016.22 1,016.22	2,049.65	11,228.1
26	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	1,655.65	Stone Bolder	1.200	cum	1,127.15	1,352.58	3,038.3
27	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	1,127.15	1,352.58	3,020.4

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

Item Rate Analysis has been done considering

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NON SCHEDULE ITEM

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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	25878.51
			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>

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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)

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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	183662.00	
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	695.00	
		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.					

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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	

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Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
14.18	2605		Filler joint					
		(i)	Providing & fixing 2 mm thick corrugated copper plate in expansion joint complete as per drawing & Technical Specification.					
			Unit = Running meter					
			Taking output = 12 m					
		a)	Labour					
			Cutting, bending, carrying & fixing etc.					
			Mate	day	0.04	550.00	22.00	L-12
			Mazdoor	day	0.50	400.00	200.00	L-13
			Mazdoor (Skilled)	day	0.50	450.00	225.00	L-15
		b)	Material					
			Copper plate - 12m long x 250 mm wide	kg	55.00	325.45	17899.75	M-086
			Area = 12 x 0.25 = 3 sqm					
			Weight = 3 x 0.002 x 8900 = 53.4 kg					
			Wastage @ 2.5 per cent = 1.33 kg/54.73 kg say = 55 kg.					
		c)	Overhead charges @ 0.25 on (a+b)				4586.69	
		d)	Contractor's profit @ 0.1 on (a+b+c)				2293.34	
			Cost for 12 m = (a+b+c+d)				25226.78	
			Rate per m = (a+b+c+d)/12				2102.23	
						say	2102.00	
							2102.00	
14.18		(ii)	Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification.					
			Unit = Running meter					
			Taking output = 12 m					
		a)	Labour					
			For carrying, placing & fixing.					
			Mate	day	0.01	550.00	4.40	L-12
			Mazdoor	day	0.10	400.00	40.00	L-13
			Mazdoor (Skilled)	day	0.10	450.00	45.00	L-15
		b)	Material					
			20 mm thick compressible fibre board 12 m long x 25 cm deep.	sqm	3.00	2042.05	6126.15	M-084
			Area = 12 x 0.25 = 3 sqm					
		c)	Overhead charges @ 0.25 on (a+b)				1553.89	
		d)	Contractor's profit @ 0.1 on (a+b+c)				776.94	
			Cost for 12 m = (a+b+c+d)				8546.38	
			Rate per m = (a+b+c+d)/12				712.20	
						say	712.00	
							712.00	
14.18		(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.					
			Unit = Running meter					
			Taking output = 12 m					
		a)	Labour					
			Mate	day	0.01	550.00	5.50	L-12
			Mazdoor	day	0.20	400.00	80.00	L-13
			Mazdoor (Skilled)	day	0.10	450.00	45.00	L-15
		b)	Material					
			Premoulded joint filler 12 m long, 20 mm thick and 300 mm deep.	sqm	3.60	516.12	1858.03	M-141
		c)	Overhead charges @ 0.25 on (a+b)				497.13	
		d)	Contractor's profit @ 0.1 on (a+b+c)				248.57	
			Cost for 12 m = (a+b+c+d)				2734.23	
			Rate per m = (a+b+c+d)/12				227.85	
						say	228.00	
							228.00	

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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					
			Unit = Running meter					
			Taking output = 12 m					
			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					

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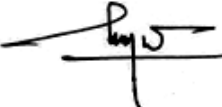


Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs
Rate Analysis performed on basis of sample analysis published in "Guidebook for Fabrication & Erection of Steel Structures" by Alok Baishya, BE(Civil), MBA and published by Institute for Steel Development & Growth (INSDAG)	Supply, fabrication, 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

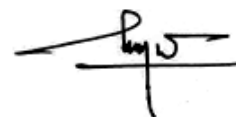
Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
15.11	2507.2	Flexible Apron :Construction of flexible apron 1 m thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall					
		<i>Unit = cum</i>					
		<i>Taking Output = 1 cum</i>					
		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					
		Unit = 1 cum					
		Taking output = 1 cum					
		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

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		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	

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		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.					

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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					

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		(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				

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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				

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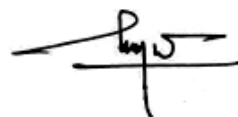


CHAPTER - 4						
SUB-BASES, BASES (NON- BITUMINOUS) AND SHOULDERS						
Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs
4.1	401	Granular Sub-Base with Close Graded Material (Table:- 400-1)				
	A	Plant Mix Method				
		Construction of granular sub-base by providing close graded Material, 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	2997.00
	Note	Any one of the grading for material may be adopted as per design				

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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

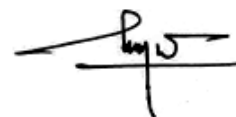



CHAPTER-7								
GEOSYNTHETICS AND REINFORCED EARTH								
Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
7.5	3100		Reinforced Earth Structures					
			Reinforced earth Structures have four main components as under:					
			a) Excavation for foundation, foundation concrete and cement concrete grooved seating in the foundation for facing elements (facia material).					
			b) Facia material and its placement.					
			c) Assembling, joining with facing elements and laying of the reinforcing elements.					
			d) Earth fill with granular material which is to be retained by the wall.					
			Each component is analysed separately as under:					
			considering Average height of wall = 8 m.					
7.5(i)		B	With reinforcing elements of synthetic geogrids					
			Unit = sqm					
			Taking output = 300 sqm					
			a) Labour					
			Mate	day	0.360	550.00	198.00	L-12
			Mazdoor	day	6.000	400.00	2400.00	L-13
			Mazdoor skilled	day	3.000	450.00	1350.00	L-15
			b) Material					
			Synthetic Geogrids as per clause 3102.8 and approved design and specifications.	sqm	300.000	380.00	114000.00	M-181
			Add 10 per cent of the cost of reinforcing elements (synthetic geogrids) for accessories like tie-strips, nuts and bolts and loops/lugs for joining reinforcing elements with the facia pannels, overlaps and other protective elements for synthetic geogrids.				11400.00	
			c) Overhead charges @ 0.08 on (a+b)				10347.84	
			d) Contractor's profit @ 0.1 on (a+b+c)				13969.58	
			Cost of 300 sqm of Synthetic geogrids = a+b+c+d				153665.42	
			Rate per sqm = (a+b+c+d)/ 300				512.22	
						say	512.00	
7.5	3104	(ii)	Facing elements of RCC					
			Unit = sqm					
			Taking output = 75 sqm					
			a) Labour					
			Mate	day	0.180	550.00	99.00	L-12
			Mazdoor	day	3.000	400.00	1200.00	L-13
			Mazdoor skilled	day	1.500	450.00	675.00	L-15
			b) Machinery					
			Light crane with lifting capacity upto 3 tonne	hour	6.000	1144.38	6866.25	P&M-013
			c) Material					
			Pre-cast RCC M-35 facing elements of size as per design and 18 cm thick for 75 sqm. (Refer Item 12.8 (H))	cu.m	13.500	13693.02	184855.78	Item 12.8 (H)
			HYSD steel @ 5 kg / sqm (Refer Item 12.6)	tonnes	0.380	78575.83	29858.81	Item 13.6
			Add 2 per cent of cost of facia pannels, for all necessary temporary form work, scaffolding and provision of loops/lugs for lifting of pannels and joining the reinforcing elements.				4294.29	
			d) Overhead charges @ 0.08 on (a+b)				707.22	
			e) Contractor's profit @ 0.1 on (a+b+d)				954.75	
			Cost for 75 sqm = a+b+c+d+e				229511.11	
			Rate per sqm = (a+b+c+d+e)/ 75				3060.15	
						say	3060.00	

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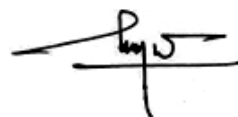


Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
		Note	1.The specification and construction details to be adopted shall be as per section 3100 of MoRTH Specification.					
			2.Drainage arrangement shall be made as per approved design and drawings.					
			3.The quantity of filler media shall be calculated as per approved design and specifications and shall be priced separately.The rate for same to be adopted from chapter 15.					
			4.Excavation for foundation including foundation concrete and groove in the foundation for seating of bottom most fascia panel and capping beam to be calculated as per design and priced separately. The rates for excavation and foundation concrete shall be taken from the chapter 12 & 13 in bridge section.					
			5.The earth fill to be retained is not included in this analysis. The same is to be worked out and provided separately complete as per clause 305.					
			6.For compaction of Earthwork, attention is invited to clause 3105.5 of MoRTH Specification.					
			7.Length of reinforcing strips will vary with the height of wall and will be as per approved design and drawings.					
			8.The type of reinforcing elements to be adopted shall be as per approved design and specifications.					
			9.The market rate for supply of reinforcing elements and their accessories are to be ascertained from reputed firms in the field of earth reinforcement.					
			10.The earth fill material shall be clean, free draining, granular with high friction and low cohesion, non-corrosive, coarse grained with not 10 per cent of particles passing 75 micron sieve, free of any deleterious matter, chlorides, salts, acids, alkalies, mineral oil, fungus and microbes and shall be of specified PH value.					
			11.Capping beam is to be priced separately as per approved design. The rate for cement concrete shall be taken from the chapter of sub-structure in bridge section.					
			12.The cost of reinforced earth retaining wall shall include following:					
			(i) Excavation for foundation including backfilling.					
			(ii) Foundation concrete as per approved design.					
			(iii) Cost of facial pannels and their erection .					
			(iv) Cost of reinforcing elements including their fixing and joining with the facial pannels.					
			(v) Drainage arrangement including filter media as per approved design and drawings.					
			13. The compacted earth filling to be retained shall form part of embankment.					

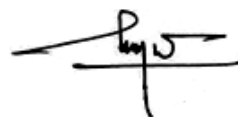



VOLUME VII

COST ESTIMATE

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ABSTRACT OF COST

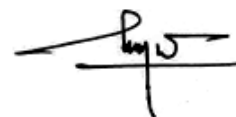
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Road name- Maram to Peren road section on NH-129A in the State of Manipur
(Package - IIB)
(56+840 km to 75+000 km)

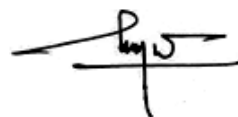
GENERAL ABSTRACT OF COST

Length of Road (KM) : 18.160

DESCRIPTION OF WORKS				
A.	ROAD WORKS	TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	% of Cost of Civil Works (% of C)
1	Site Clearance and Dismantling	0.97	0.05	0.58%
2	Earth work ,Subgrade and Erosion control	48.29	2.66	28.98%
3	Sub-Base & Base	36.65	2.02	22.00%
4	Bituminous Courses	20.96	1.15	12.58%
5	Junction Improvement (Major & Minor)	0.26	0.01	0.16%
6	Traffic signs, Road marking & other road appurtenances	1.81	0.10	1.09%
7	Passenger Shelter	0.17	0.01	0.10%
8	Busbay	1.22	0.07	0.73%
	Drainage and Protective Works			
9	Longitudinal Drains	15.42	0.85	9.26%
10	Retaining wall	16.91	0.93	10.15%
11	Breast wall	4.11	0.23	2.47%
12	Composit RE-Wall	10.05		
B.	BRIDGES & CULVERTS			
13	Culvert	9.79	0.54	5.88%
C.	COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)	166.61	9.17	
D.	Maintenance for 5 years, i.e 2.5% on civil cost (C)	4.17		
E.	GST @ 12% of (C)	19.99		
F.	Contingencies @ 2.8% over Civil Cost (C)	4.67		
G.	Supervision Charges @ 3% of (C)	5.00		
H.	Agency Charges @3% of (C)	5.00		
I.	Escalation Cost @ 10% during Construction Period	16.66		
J.	TOTAL CONSTRUCTION COST * (C+D+E+F+G+H+I)=J	222.10	12.23	
K.	DEPARTMENTAL COST			
a.	LA Cost	10.98		
b.	R&R Cost	2.70		
c.	Utility Shifting(Electrical+PHE)	1.67		
d.	Environmental Budget +Forest Clearance	2.01		
L.	Sub Total (K)	17.36		
M.	TOTAL CAPITAL COST (K+L)=M	239.46	13.19	
Note: * Total Construction cost of the project has been derived based on Circular No. of MoRT&H "NO RW -NH 33044/10/2019-S&R(P&B), Dated 7th March, 2019 "				




BILL
(ROAD PART)

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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/i	Cutting of Girth 300-600mm	Each	6.00	392.30	2,354
2	02.01/ii	Cutting of Girth 600-900mm	Each	5.00	723.48	3,617
3	02.01/iii	Cutting of Girth 900-1800mm	Each	37.00	1,373.64	50,825
4	02.01/iv	Cutting of Girth 1800-2700mm	Each	17.00	2,576.19	43,795
5	02.01/v	Cutting of Girth 2700mm more	Each	4.00	4,330.68	17,323
6	02.03/b	Clearing & grubbing(Mechanical - Light Jungle)	Ha	11.00	59,912.85	659,041
7	02.04/i/c	Dismantling Structure RCC	cum	235.00	1,756.40	412,754
8	02.04/iii/b	Dismantling Structure Rubble Stone Masonry Cement	Cum	1,603.00	494.21	792,219
9	02.04/vii/b	Morter Dismantle HP (upto 600 - 900 mm dia)	rm	210.00	362.36	76,096
10	02.04/vii/c	Dismantle HP (above 900 mm dia)	rm	790.00	620.22	489,974
11	02.04/viii/e	Dismantle Flexible Pavement Granular	sqm	139,462.00	34.33	4,787,730
12	02.04/viii/f/ii	Dismantle Flexible Pavement Bituminous(Roller & Scarifier)	sqm	40,928.00	57.65	2,359,499
Total of Bill						9,695,227

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	1,000.00	318.15	318,150
2	03.13	Embankment fill from Roadway Cutting	cum	150,381.00	161.80	24,331,646
3	03.14/Nsc	Subgrade and Earthen Shoulder Fill From Roadway	cum	63,908.80	248.74	15,896,675
4	03.15	Cutting Compacting original ground supporting sub-grade	cum	20,553.53	87.52	1,798,845
5	03.19	Turfing	sqm	76,074.00	62.49	4,753,864
6	03.31	Excavation in Hill in Soil For Roadway	cum	1,500,831.20	213.50	320,427,461
7	03.32	Excavation for Roadway Ordinary Rock Mechanical (Without Blasting)	cum	375,207.80	307.61	115,417,671
Total of Bill						482,944,312

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	40,756.70	4,402.18	179,418,334
2	04/nsc1	GSB Reuse	Cum	14,520.44	2,083.63	30,255,222
3	05.02	WMM	Cum	35,216.47	4,453.34	156,830,915



Summary of Bill of Quantity

						Total of Bill	366,504,471

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	06.01/a	Prime Coat	sqm	134,108.00	59.51	7,980,767
2	06.02/ii	Tack Coat(Granular Layer)	sqm	134,108.00	17.83	2,391,146
3	06/Nsc1	DBM GR II	cum	9,387.56	13,077.71	122,767,787
4	06/Nsc2	BC GR II	cum	5,364.32	14,259.91	76,494,720
					Total of Bill	209,634,420

Bill No : 05. Junction Improvement (Major & Minor)

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	04.01/Nsc1	GSB Close Graded GR V	Cum	112.95	4,402.18	497,204
2	04/nsc1	GSB Reuse	Cum	40.06	2,083.63	83,460
3	05.02	WMM	Cum	191.25	4,453.34	851,701
4	06.01/a	Prime Coat	sqm	765.00	59.51	45,525
5	06.02/i	Tack Coat(Bituminous Layer)	sqm	765.00	16.18	12,378
6	06/Nsc1	DBM GR II	cum	53.55	13,077.71	700,311
7	06/Nsc2	BC GR II	cum	30.60	14,259.91	436,353
					Total of Bill	2,626,933

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	05.03	Foothpath Area	sqm	450.00	1,671.33	752,099
2	08.01	Precast Concrete Kerb(M20) fix at site	rm	300.00	754.26	226,278
3	08.02/a	5 th km Stone	each	4.00	5,368.23	21,473
4	08.02/b	Ordinary km Stone	each	15.00	3,226.62	48,399
5	08.04	Boundary Stone	each	184.00	2,771.92	510,033
6	08.11/i	90 cm equilateral triangle	each	286.00	5,749.23	1,644,280
7	08.11/iii	60 cm circular	each	71.00	5,253.78	373,018
8	08.11/iv	80 cm x 60 cm rectangular	each	10.00	6,531.86	65,319
9	08.11/v	60 cm x 45 cm rectangular	each	136.00	5,060.21	688,189
10	08.11/vii	90 cm high octagon	each	8.00	9,015.47	72,124
11	08.12	Direction Sign(<.0.9 sqm)	sqm	14.00	12,645.43	177,036
12	08.13	Direction Sign(>.0.9 sqm)	sqm	16.00	13,344.58	213,513

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
13	08.14	Paint on Bituminous Surface	sqm	4,246.91	1,012.16	4,298,550
14	08.15/c/v	Road Delineators(100 cm long above Road)	each	1,700.00	1,073.82	1,825,494
15	08.18/A/b	Type-A, "W" Metal Beam Crash Barrier	Rm	443.00	3,367.42	1,491,767
16	08.20/ii	Road Stud/Road Markers	nos	8,982.00	387.48	3,480,345
17	08.22	Lighting on Bridges	nos	91.00	21,376.67	1,945,277
18	08/nsc/2	Convex Mirror for Blind Curve	nos	60.00	5,050.00	303,000
Total of Bill						18,136,194

Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	08.05	Paint on Concrete Surface(2 Coat)	sqm	528.54	94.34	49,862
2	10.16	Sub Structure Plaster with 1:3 Cement Morter	sqm	528.54	225.72	119,302
3	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	79.27	221.12	17,527
4	14.01	Foundation Brick Work C.M. 1:3	cum	12.15	11,968.37	145,416
5	14.03/a	Foundation PCC M15	cum	8.05	10,422.66	83,902
6	14.03/e/II	Foundation RCC M25	cum	5.55	11,369.50	63,101
7	14.08	Foundation Steel (HYSD)	MT	0.67	80,291.33	53,474
8	14/nsc2	Brick Flat Soling	Sqm	107.50	1,129.07	121,375
9	15.01	Sub Structure Brick Work	cum	25.91	12,081.21	313,024
10	16.01/a/i	Super Structure RCC M25 - Solid Slab Super	cum	33.21	12,734.45	422,937
11	16.03	Super Structure Steel(HYSD)	MT	3.32	88,125.11	292,663
Total of Bill						1,682,584

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	03.14/Nsc	Subgrade and Earthen Shoulder Fill From Roadway	cum	1,416.00	248.74	352,216
2	04.01/Nsc1	Cutting GSB Close Graded GR V	Cum	418.12	4,402.18	1,840,622
3	04/nsc1	GSB Reuse	Cum	148.28	2,083.63	308,969
4	05.02	WMM	Cum	708.00	4,453.34	3,152,965
5	05.03	Foothpath Area	sqm	1,180.00	1,671.33	1,972,169
6	06.01/a	Prime Coat	sqm	2,832.00	59.51	168,532

Summary of Bill of Quantity

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
7	06.02/i	Tack Coat(Bituminous Layer)	sqm	2,832.00	16.18	45,822
8	06/Nsc1	DBM GR II	cum	198.24	13,077.71	2,592,525
9	06/Nsc2	BC GR II	cum	113.28	14,259.91	1,615,363
10	08.14	Paint on Bituminous Surface	sqm	120.00	1,012.16	121,459
Total of Bill						12,170,642

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	33,203.47	221.12	7,341,952
2	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed) Cement Morter(1:3)	cum	12,991.66	8,336.20	108,301,101
3	14.03/a	Foundation PCC M15	cum	308.16	10,422.66	3,211,847
4	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	1,442.53	8,822.50	12,726,756
5	15.03/b/i	Sub Structure PCC M20	cum	29.39	11,228.15	329,962
6	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	1,335.36	12,225.18	16,325,016
7	15.05	Sub Structure Steel (HYSD)	MT	66.77	80,291.33	5,360,892
8	15.12	Sub Structure Weepholes per Meter	Rm	1,285.00	453.84	583,184
9	24/i/b	MS Hook(300gm each)	kg	205.44	121.20	24,899
10	40	Geotextile filter(75mm sqm)	sqm	231.12	25.76	5,954
Total of Bill						154,211,563

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	7,464.03	221.12	1,650,447
2	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	1,679.39	211.31	354,872
3	13.04	Sub Structure Filter Media	cum	7,496.10	2,519.05	18,883,038
4	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed) Cement Morter(1:3)	cum	4,353.93	8,336.20	36,295,215
5	14.03/a	Foundation PCC M15	cum	2,279.20	10,422.66	23,755,327
6	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	9,381.45	8,822.50	82,767,869
7	15.12	Sub Structure Weepholes per Meter	Rm	11,917.00	453.84	5,408,411
Total of Bill						169,115,179



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	3,625.28	221.12	801,621
2	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	906.32	211.31	191,514
3	13.03/a	Sub Structure Backfill Granular Material	cum	392.81	2,249.59	883,650
4	13.03/b	Sub Structure Backfill Sandy Material	cum	168.35	1,854.84	312,253
5	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed) Cement Morter(1:3)	cum	1,707.69	8,336.20	14,235,662
6	14.03/a	Foundation PCC M15	cum	823.02	10,422.66	8,578,058
7	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	1,776.98	8,822.50	15,677,362
8	15.12	Sub Structure Weepholes per Meter	Rm	997.60	453.84	452,751
Total of Bill						41,132,872

Bill No : 12. RE and Composite RE Wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	12/Nsc2	Reinforced Earth Facing elements	Sqm	7,450.00	4,113.05	30,642,223
2	13.02/ii	Filling in Foundation by Sandy Soil	cum	63,207.00	366.02	23,135,026
3	13.04	Sub Structure Filter Media	cum	16,244.00	2,519.05	40,919,448
4	15.03/b/i	Sub Structure PCC M20	cum	304.00	11,228.15	3,413,358
5	18.03/b	Composite RE Wall Drilling, grouting and fixing of Soil	Per hole	89.00	381.37	33,942
6	7.5(i)/Nsc	Nail Steel Strip	m	2,380.00	632.16	1,504,541
7	BR/51	PVC Pipe 100mm dia	Rm	5,100.00	161.60	824,160
Total of Bill						100,472,697

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
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	6.00	392.30	2,353.80
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	5.00	723.48	3,617.40
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	37.00	1373.64	50,824.68
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	17.00	2576.19	43,795.23
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	4.00	4330.68	17,322.72
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	11.00	59912.85	659,041.35

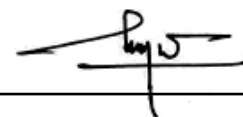
Item Rate Analysis has been done considering

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

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
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	235.00	1756.40	412,754.00
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	1,603.00	494.21	792,218.63
9	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	210.00	362.36	76,095.60
10	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	790.00	620.22	489,973.80
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	139,462.00	34.33	4,787,730.46
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	40,928.00	57.65	2,359,499.20
Total of Bill 01. Site Clearance and Dismantling						9,695,226.87

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	1,000.00	318.15	318,150.00
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	150,381.00	161.80	24,331,645.80
3	03.14/Ns c	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	63,908.80	248.74	15,896,674.91
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	20,553.53	87.52	1,798,844.86
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	76,074.00	62.49	4,753,864.26
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	1,500,831.20	213.50	320,427,461.20

Item Rate Analysis has been done considering

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

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	375,207.80	307.61	115,417,671.36
Total of Bill 02. Earth work,Subgrade and Erosion control						482,944,312.39



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	40,756.70	4402.18	179,418,334.01
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	14,520.44	2083.63	30,255,222.31
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	35,216.47	4453.34	156,830,914.51
Total of Bill 03. Sub-Base & Base Courses						366,504,470.83

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	134,108.00	59.51	7,980,767.08
2	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	134,108.00	17.83	2,391,145.64
3	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	9,387.56	13077.71	122,767,787.29

Item Rate Analysis has been done considering

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

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
4	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	5,364.32	14259.91	76,494,720.41
Total of Bill 04. Bituminous Courses						209,634,420.42



Bill No : 05. Junction Improvement (Major & Minor)

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Ns c1	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	112.95	4402.18	497,204.22
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	40.06	2083.63	83,459.80
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	191.25	4453.34	851,701.28
4	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	765.00	59.51	45,525.15

Item Rate Analysis has been done considering

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

Bill No : 05. Junction Improvement (Major & Minor)

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	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	765.00	16.18	12,377.70
6	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	53.55	13077.71	700,311.37
7	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	30.60	14259.91	436,353.25
Total of Bill 05. Junction Improvement (Major & Minor)						2,626,932.76

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	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	450.00	1671.33	752,098.50
2	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	300.00	754.26	226,278.00
3	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	4.00	5368.23	21,472.92
4	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	15.00	3226.62	48,399.30
5	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	184.00	2771.92	510,033.28
6	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	286.00	5749.23	1,644,279.78

Item Rate Analysis has been done considering

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



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	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	71.00	5253.78	373,018.38
8	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	10.00	6531.86	65,318.60
9	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	136.00	5060.21	688,188.56

Item Rate Analysis has been done considering

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

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	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 6mm 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	8.00	9015.47	72,123.76
11	08.12	Direction and Place Identification signs upto 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 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	14.00	12645.43	177,036.02
12	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 0.9 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	16.00	13344.58	213,513.28

Item Rate Analysis has been done considering

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

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
13	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	4,246.91	1012.16	4,298,550.40
14	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	1,700.00	1073.82	1,825,494.00
15	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	443.00	3367.42	1,491,767.06
16	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				

Item Rate Analysis has been done considering

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

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			nos	8,982.00	387.48	3,480,345.36
17	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	91.00	21376.67	1,945,276.97
18	08/nsc/2	Convex Mirror For Blind Curve	nos	60.00	5050.00	303,000.00
		Total of Bill 06. Traffic signs, Road marking & other road appurtenances				18,136,194.17



Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	528.54	94.34	49,862.46
2	10.16	Cement Plaster 12mm Thick in Cement Mortar 1:3	sqm	528.54	225.72	119,302.05
3	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	79.27	221.12	17,527.30
4	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications	cum	12.15	11968.37	145,415.70
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	8.05	10422.66	83,902.41
6	14.03/e/l	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.55	11369.50	63,100.73
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.67	80291.33	53,474.03
8	14/nsc2	Brick Flat Soling at Foundation	Sqm	107.50	1129.07	121,375.03
9	15.01	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications				

Item Rate Analysis has been done considering

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

Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	25.91	12081.21	313,024.15
10	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	33.21	12734.45	422,936.55
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	3.32	88125.11	292,663.49
		Total of Bill 07. Passenger Shelter				1,682,583.89



Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	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	1,416.00	248.74	352,215.84
2	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	418.12	4402.18	1,840,621.89
3	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	148.28	2083.63	308,968.99
4	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	708.00	4453.34	3,152,964.72

Item Rate Analysis has been done considering

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

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	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	1,180.00	1671.33	1,972,169.40
6	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	2,832.00	59.51	168,532.32
7	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	2,832.00	16.18	45,821.76
8	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	198.24	13077.71	2,592,525.23

Item Rate Analysis has been done considering

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

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
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	113.28	14259.91	1,615,362.60
10	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	120.00	1012.16	121,459.20
Total of Bill 08. Bus Bay						12,170,641.96



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	33,203.47	221.12	7,341,951.73
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	12,991.66	8336.20	108,301,101.10
3	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	308.16	10422.66	3,211,846.91
4	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	1,442.53	8822.50	12,726,756.22
5	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	29.39	11228.15	329,961.64
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	1,335.36	12225.18	16,325,016.36
7	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	66.77	80291.33	5,360,891.52

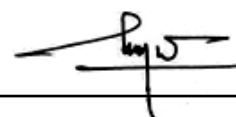
Item Rate Analysis has been done considering

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

Bill No : 09. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	1,285.00	453.84	583,184.40
9	24/i/b	Galvanised Mild steel J /L hook	kg	205.44	121.20	24,899.33
10	40	Gextextile material (fine net)	sqm	231.12	25.76	5,953.65
Total of Bill 09. Longitudinal Drains						154,211,562.86

Item Rate Analysis has been done considering




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	7,464.03	221.12	1,650,446.76
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	1,679.39	211.31	354,872.11
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	7,496.10	2519.05	18,883,038.11
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	4,353.93	8336.20	36,295,214.59
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	2,279.20	10422.66	23,755,326.67
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	9,381.45	8822.50	82,767,869.09
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	11,917.00	453.84	5,408,411.28
Total of Bill 10. Retaining wall						169,115,178.62



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	3,625.28	221.12	801,621.47
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	906.32	211.31	191,514.48
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	392.81	2249.59	883,650.20
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	168.35	1854.84	312,253.04
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	1,707.69	8336.20	14,235,662.05
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	823.02	10422.66	8,578,057.63
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	1,776.98	8822.50	15,677,361.94
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	997.60	453.84	452,750.78
Total of Bill 11. Breast wall						41,132,871.60

Item Rate Analysis has been done considering

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

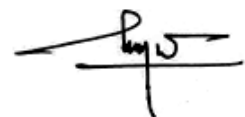


Bill No : 12. RE and Composite RE Wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	12/Nsc2	Geo-synthetics and Reinforced Earth Facing elements of RCC	Sqm	7,450.00	4113.05	30,642,222.50
2	13.02/ii	Filling in Foundation Trenches as per drawing & technical specification using Sandy soil with PI value less than 6	cum	63,207.00	366.02	23,135,026.14
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	16,244.00	2519.05	40,919,448.20
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	304.00	11228.15	3,413,357.60
5	18.03/b	Providing and inserting nipples with approved fixing compound after drilling holes for grouting as per technical specifications including subsequent cutting/removal and sealing of the hole as necessary of nipples after completion of grouting with epoxy grout.	Per hole	89.00	381.37	33,941.93
6	7.5(i)/Nsc	Stainless steel strips	m	2,380.00	632.16	1,504,540.80
7	BR/51	100 mm dia ac pipe	Rm	5,100.00	161.60	824,160.00
Total of Bill 12. RE and Composite RE Wall						100,472,697.17



BILL
(STRUCTURE PART)

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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	414.00	9,562.29	3,958,788
2	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	5,673.00	221.12	1,254,414
End of Sub Total Foundation						5,213,202
Sub Structure						
3	10.06/a	Steel culvert for Sub-Structure	Ton	173.00	75,802.83	13,113,890
4	10.20/b	Culvert Backfilling culvert by Gravelly materials	cum	620.00	2,417.71	1,498,980
5	10.20/c	Filter Media culvert behind abutment, wing and return wall	cum	1,991.00	2,400.51	4,779,415
6	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	2,469.00	12,225.18	30,183,969
7	15.12	Sub Structure Weepholes per Meter	Rm	1,347.00	453.84	611,322
End of Sub Total Sub Structure						50,187,577
Super Structure						
8	06.02/i	Tack Coat(Bituminous Layer)	sqm	1,014.00	16.18	16,407
9	06/Nsc2	BC GR II	cum	41.00	14,259.91	584,656
10	10.06/b	Steel culvert for Super-Structure	Ton	58.00	75,802.83	4,396,564
11	16.01/a/i	Super Structure RCC M25 - Solid Slab Super Structure(Upto 5m)	cum	779.00	12,734.45	9,920,137
12	16.08	Protection Work RCC Railing M30 (Precast 12mm Aggregate)	Rm	201.00	2,962.42	595,446
13	16.11	Super Structure Drainage Spout	each	76.00	2,188.54	166,329
14	16.17	Super Structure Mastic Asphalt	sqm	1,014.00	559.33	567,161
End of Sub Total Super Structure						16,246,700
Protection Work						
15	10.02/Nsc	Protection Work Culvert M15	cum	647.00	9,562.29	6,186,802
16	13.01/a/i/Nsc	Excavation For Protection work	cum	6,618.00	221.12	1,463,372
17	16/nsc	Protection Work Curtain Wall- PCC (M-15)	cum	1,333.00	11,228.15	14,967,124
18	17.03/a	Protection Work Pitching on slopes laid over prepared filter media(Stone)	cum	678.00	3,038.31	2,059,974
19	17/nsc1	Protection Work Flexible Apron	cum	496.00	3,020.49	1,498,163
End of Sub Total Protection Work						26,175,435
Miscellaneous Work						
20	08.05	Paint on Concrete Surface(2 Coat)	sqm	513.00	94.34	48,396
End of Sub Total Miscellaneous Work						48,396
Total						97,871,310

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	414.00	9562.29	3,958,788.06
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	5,673.00	221.12	1,254,413.76
Sub Total of Foundation						5,213,201.82
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	173.00	75802.83	13,113,889.59
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	620.00	2417.71	1,498,980.20
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	1,991.00	2400.51	4,779,415.41
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	2,469.00	12225.18	30,183,969.42

Item Rate Analysis has been done considering

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

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	1,347.00	453.84	611,322.48
Sub Total of Sub Structure						50,187,577.10
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	1,014.00	16.18	16,406.52
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	41.00	14259.91	584,656.31
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	58.00	75802.83	4,396,564.14
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	779.00	12734.45	9,920,136.55

Item Rate Analysis has been done considering

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

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
12	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	201.00	2962.42	595,446.42
13	16.11	Drainage Spouts complete as per drawing and Technical specification	each	76.00	2188.54	166,329.04
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	1,014.00	559.33	567,160.62
Sub Total of Super Structure						16,246,699.60
		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	647.00	9562.29	6,186,801.63
16	13.01/a/i/Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	6,618.00	221.12	1,463,372.16
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				

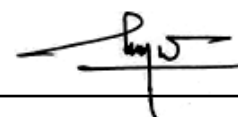
Item Rate Analysis has been done considering

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

Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	1,333.00	11228.15	14,967,123.95
18	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	678.00	3038.31	2,059,974.18
19	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	496.00	3020.49	1,498,163.04
Sub Total of Protection Work						26,175,434.96
		Miscellaneous Work				
20	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	513.00	94.34	48,396.42
Sub Total of Miscellaneous Work						48,396.42
Total of Bill 13. Culvert						97,871,309.90

Item Rate Analysis has been done considering




CIRCULAR

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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: N.S. Bose

Dated: 17th 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,

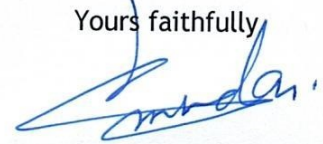
This is in supersession to Ministry's circular referred above. Standard EPC Agreement document incorporating the various amendments made from time to time is enclosed herewith.

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

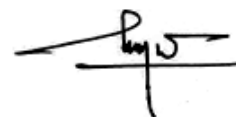
Article 14

Maintenance

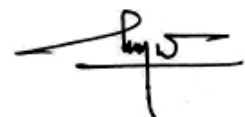
14.1 Maintenance obligations of the Contractor

- (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.



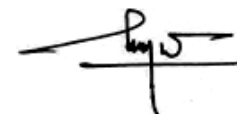
VOLUME VIII
BILL OF QUANTITY

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**VARIABLE NOTATION
&
CHAINAGE DETAILS
(ROAD PART)**

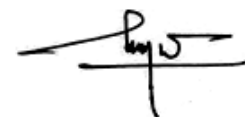
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TCS TYPE	DESCRIPTION	Length (m)
TCS-1	2 lane Carriageway in Built up area with both side footpath cum RCC Rectangular Drain (Reconstruction of Existing Pavement)	1283.9
TCS-2	2 Lane Carriageway in Rural Area with RR Masonry Trapezoidal Drain on Hill Side and Earthen Shoulder on valley side (Reconstruction of Existing Pavement)	5285.84
TCS-3	2 lane Carriageway in Rural area with breast wall on hill side and earthen shoulder on valley side (Reconstruction of Existing Pavement)	147.4
TCS-4	2 lane Carriageway at reconstruction stretch in rural area with one side retaining wall and other side RR masonry Trapezoidal drain (Reconstruction of Existing Pavement)	2950.5
TCS-6	2 lane Carriageway due to presence of hill in Rural area with both side RR Masonry Trapezoidal Drain (Reconstruction of Existing Pavement)	1975
TCS-7	2 lane Carriageway in Rural area with one side RR Masonry Trapezoidal Drain and earthen shoulder on valley side (New construction)	897.4
TCS-8	2 lane Carriageway at realignment stretch due to presence of hill in Rural area with both side RR Masonry Trapezoidal Drain (New construction)	2994.6
TCS-9	2 lane Carriageway in rural area with one side retaining wall and other side RR Masonry Trapezoidal Drain (New construction)	597.3
TCS-10	2 lane Carriageway in Built up area with both side footpath and open RR masonry trapezoidal drain(Reconstruction of Existing Pavement)	150
TCS-11	2 lane Carriageway in rural area with one side breast wall and other side RR masonry trapezoidal drain(Reconstruction of Existing Pavement)	900
TCS-12	2 lane Carriageway in rural area with both side breast wall (Reconstruction of Existing Pavement)	100
TCS-13	2 lane Carriageway in rural area with one side retaining wall (New Construction)	200
TCS-14	2 lane Carriageway in rural area with both side retaining wall (New Construction)	246.04
TCS-15	2 of Two lane Carriageway in rural area with composite RE wall (New Construction)	143.44
TCS-16	2 lane Carriageway paved shoulder in rural area on both side composite RE wall	150
Total length =		18021.42




List of TCS

Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
56840	57225	2.7	382	TCS-4
57225	57375		150	TCS-2
57375	57525	2.6	147	TCS-3
57525	57575		50	TCS-4
57575	57675		100	TCS-2
57675	57725		50	TCS-4
57725	57925	2.7	197	TCS-2
57925	57975		50	TCS-6
57975	58175	2.7	197	TCS-2
58175	58225		50	TCS-4
58225	58275		50	TCS-2
58275	58525	2.7	247	TCS-4
58525	58775	2.7	247	TCS-2
58775	60075	16.1	1284	TCS-1
60075	60225		150	TCS-2
60225	60325	2.7	97	TCS-4
60325	60575	3.96	246	TCS-14




Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
60575	60675		100	TCS-6
60675	60775		100	TCS-2
60775	61025	2.6	247	TCS-4
61025	62275		1250	TCS-6
62275	62675	2.6	397	TCS-2
62675	63325	7.9	642	TCS-4
63325	63525		200	TCS-2
63525	63625		100	TCS-4
63625	63675		50	TCS-2
63675	63875	2.6	197	TCS-4
63875	64875	21.96	978	TCS-2
64875	64925	2.6	47	TCS-15
64925	65175	2.6	247	TCS-4
65175	65275	2.6	97	TCS-2
65275	65525	2.7	247	TCS-4
65525	65925	2.6	397	TCS-2
65925	66075	2.7	147	TCS-4
66075	66225		150	TCS-2
66225	66275		50	TCS-15
66275	66525	2.6	247	TCS-2
66525	66675		150	TCS-11
66675	66775		100	TCS-12
66775	67525		750	TCS-11
67525	67975		450	TCS-6
67975	68175		200	TCS-13
68175	68325		150	TCS-16
68325	68375	3.96	46	TCS-15
68375	68425		50	TCS-4
68425	68525		100	TCS-2
68525	69525		1000	TCS-8
69525	70025	2.6	497	TCS-7
70025	70075		50	TCS-9
70075	70175		100	TCS-8
70175	70225		50	TCS-9
70225	70575	2.7	347	TCS-8
70575	70725		150	TCS-9
70725	70775		50	TCS-8
70775	70875		100	TCS-7
70875	71025	2.7	147	TCS-9
71025	71525		500	TCS-8
71525	71675		150	TCS-7
71675	71775		100	TCS-9
71775	71825		50	TCS-8
71825	71925		100	TCS-9

[Handwritten Signature]



Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
71925	71975		50	TCS-8
71975	72125		150	TCS-7
72125	73025	2.7	897	TCS-8
73025	73175	2.6	147	TCS-4
73175	73525	2.6	347	TCS-2
73525	73575	2.7	47	TCS-4
73575	74725	21.1	1129	TCS-2
74725	74850		125	TCS-6
74850	75000		150	TCS-10
Total Length		138.58	18021.42	

Summary of TCS Length

TCS No.	Length (m)
TCS-1	1284
TCS-2	5286
TCS-3	147
TCS-4	2951
TCS-6	1975
TCS-7	897
TCS-8	2995
TCS-9	597
TCS-10	150
TCS-11	900
TCS-12	100
TCS-13	200
TCS-14	246
TCS-15	143
TCS-16	150
Total=	18021

CD Length (m)	Total Length (m)
139	18160

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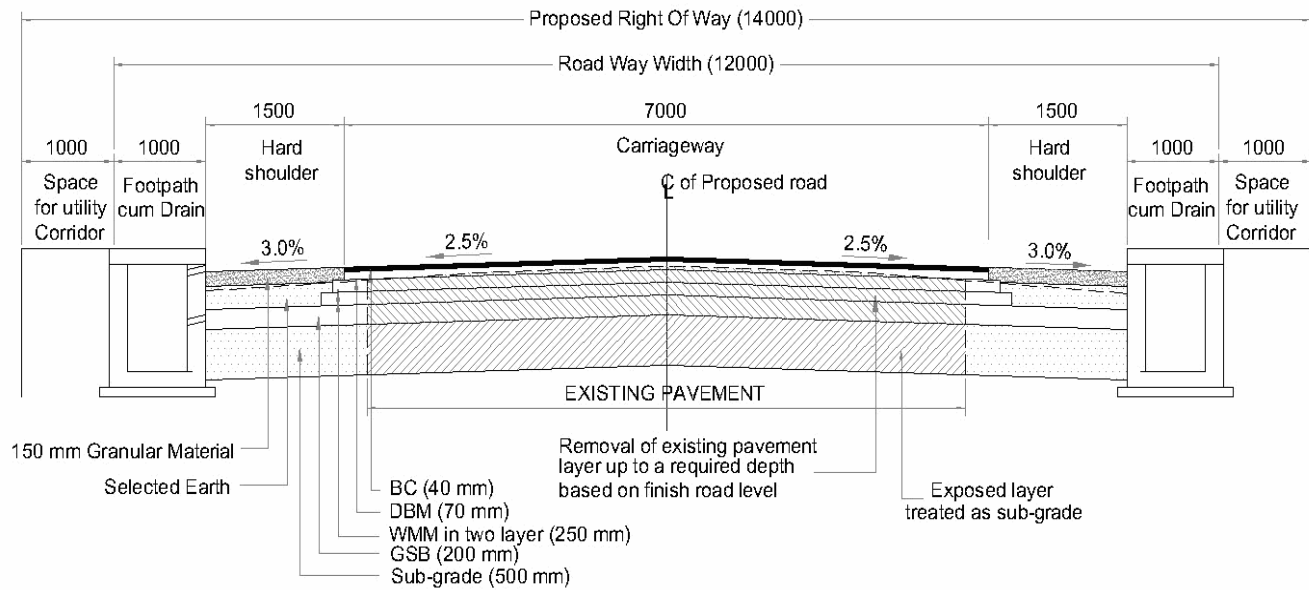


Variable Declaration

TCS-01

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Width of 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	1284.000	m
9	Existing Pavement Width	ext_pav	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Paved Shoulder	ps	0.000	
17	Gap between road marking	g	6.000	m

Variable Declaration



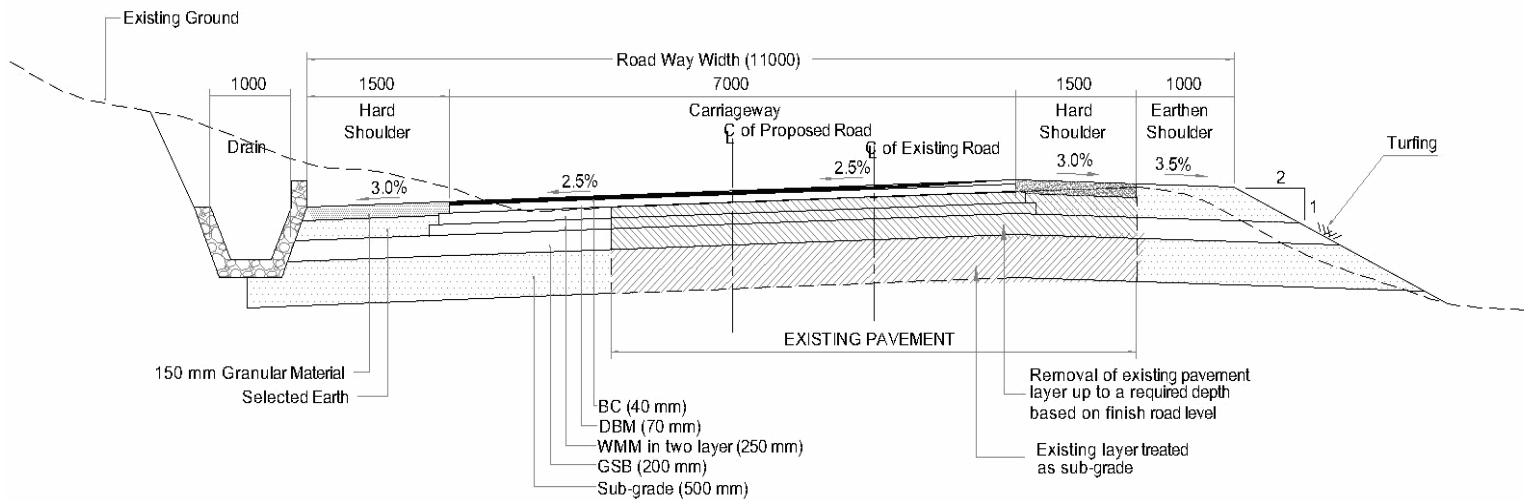
**TCS-1 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY
IN BUILT UP AREA WITH BOTH SIDE FOOTPATH CUM RCC RECTANGULAR DRAIN
(RECONSTRUCTION OF EXISTING PAVEMENT)**

Variable Declaration

TCS-02

Sl 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	5286.000	m
9	Existing Pavement Width	ext_pav	6.500	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	26.180	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m

Variable Declaration



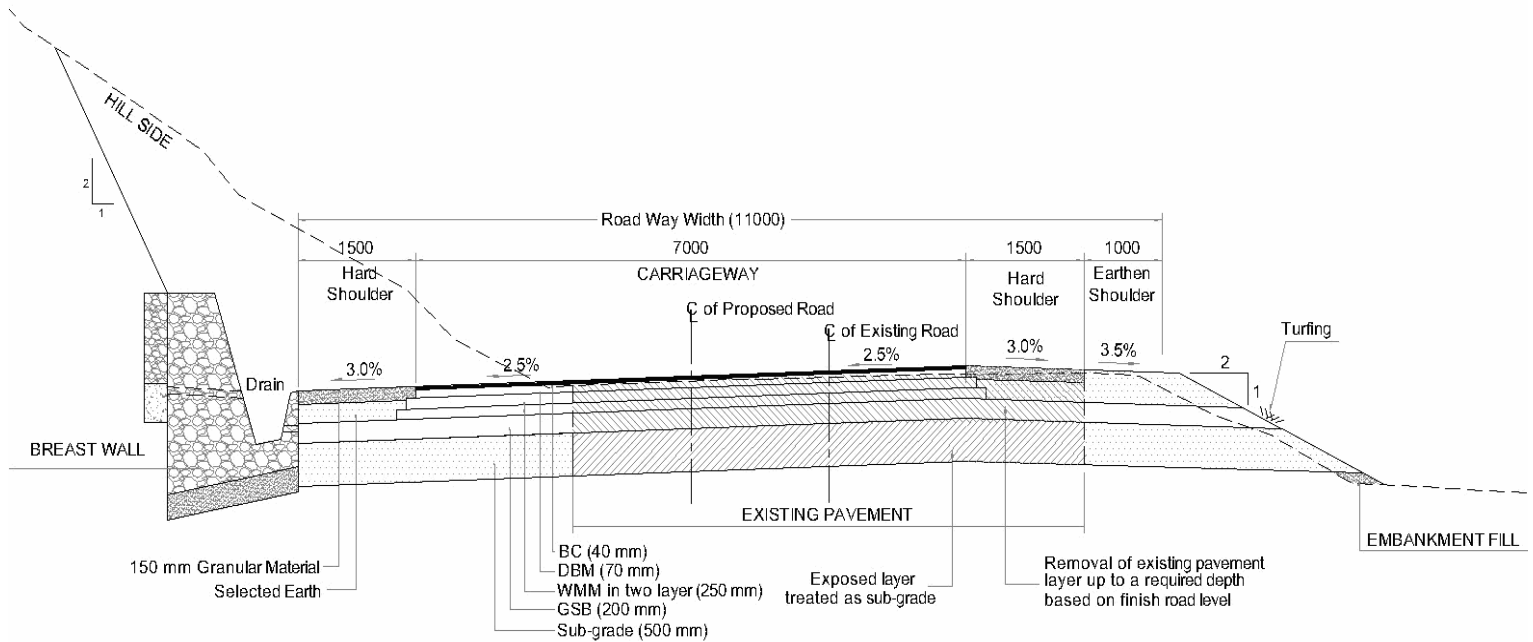
TCS-2 : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY
IN RURAL AREA WITH RR MASONRY TRAPEZOIDAL DRAIN HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE
{RECONSTRUCTION OF EXISTING PAVEMENT}

Variable Declaration

TCS-03

Sl 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	147.000	m
9	Existing Pavement Width	ext_pav	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	26.180	
17	Gap between road marking	g	6.000	m

Variable Declaration



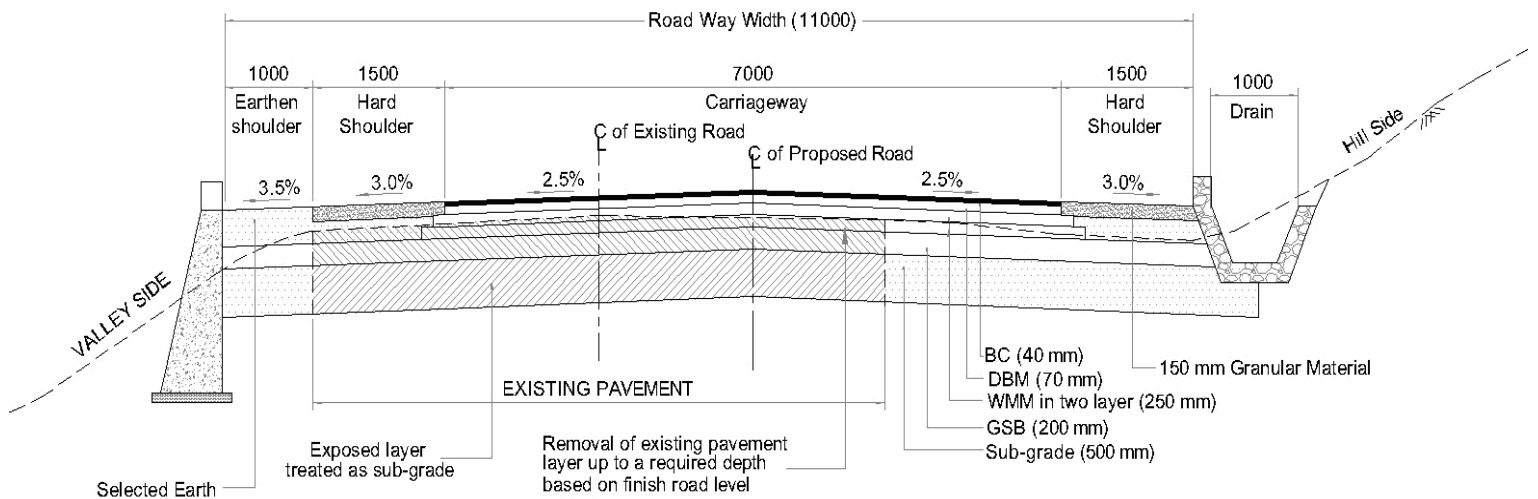
**TCS-3 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY
IN RURAL AREA WITH BREAST WALL ON HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE
(RECONSTRUCTION OF EXISTING PAVEMENT)**

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	2951.000	m
9	Existing Pavement Width	ext_pav	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m

Variable Declaration



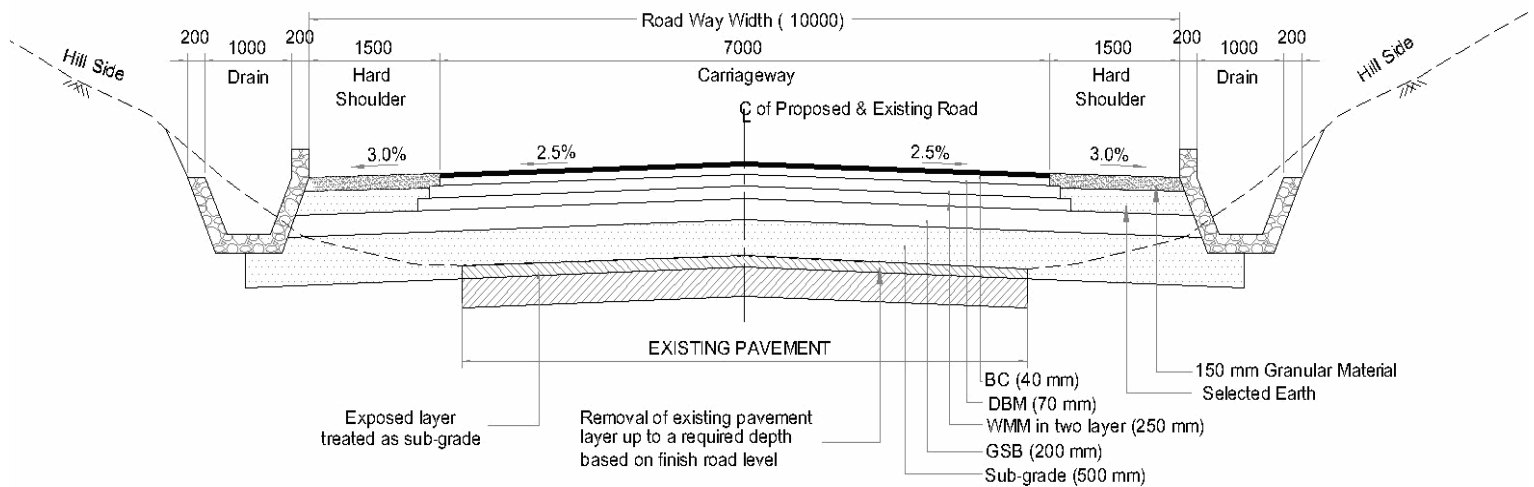
**TCS-4 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY AT RECONSTRUCTION STRETCH
IN RURAL AREA WITH ONE SIDE RETAINING WALL AND OTHER SIDE RR MASONRY TRAPEZOIDAL DRAIN
(RECONSTRUCTION OF EXISTING PAVEMENT)**

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	1975.000	m
9	Existing Pavement Width	ext_pav	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Gap between road marking	g	6.000	m

Variable Declaration



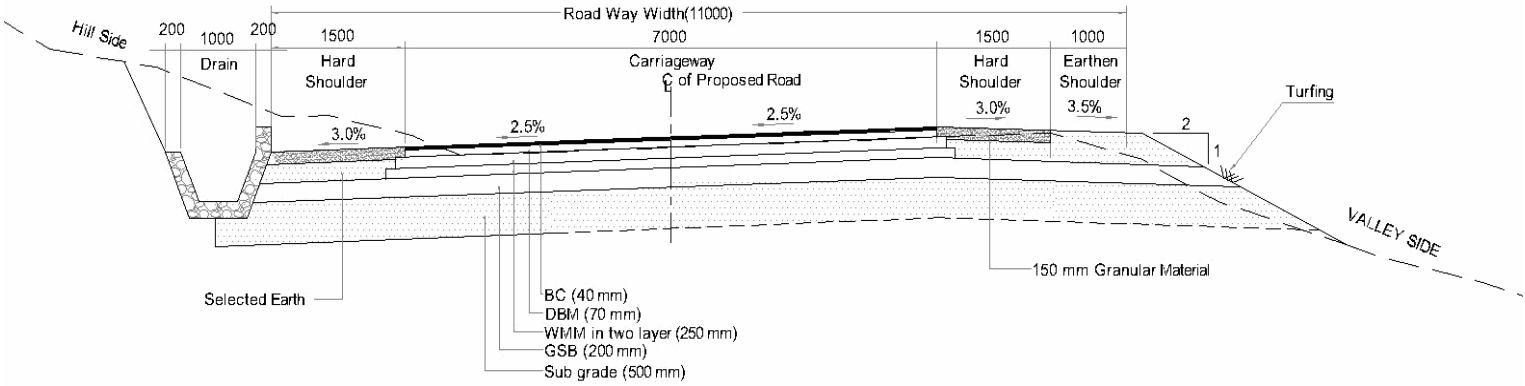
**TCS-6 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY DUE TO PRESENCE OF HILL IN RURAL AREA WITH BOTH SIDE RR MASONRY TRAPEZOIDAL DRAIN
(RECONSTRUCTION OF EXISTING PAVEMENT)**

Variable Declaration

TCS-07

Sl 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	897.000	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	26.180	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m

Variable Declaration

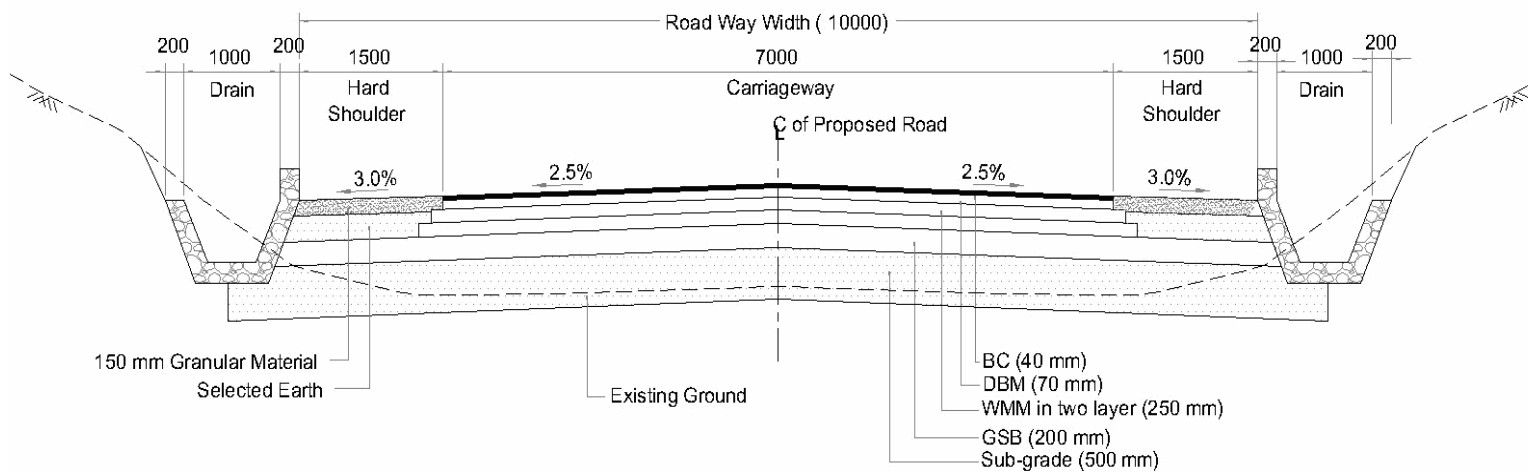


TCS-7 : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY IN RURAL AREA WITH ONE SIDE RR MASONRY TRAPEZOIDAL DRAIN AND EARTHEN SHOULDER ON VALLEY SIDE (NEW CONSTRUCTION)

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	2995.000	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Gap between road marking	g	6.000	m

Variable Declaration

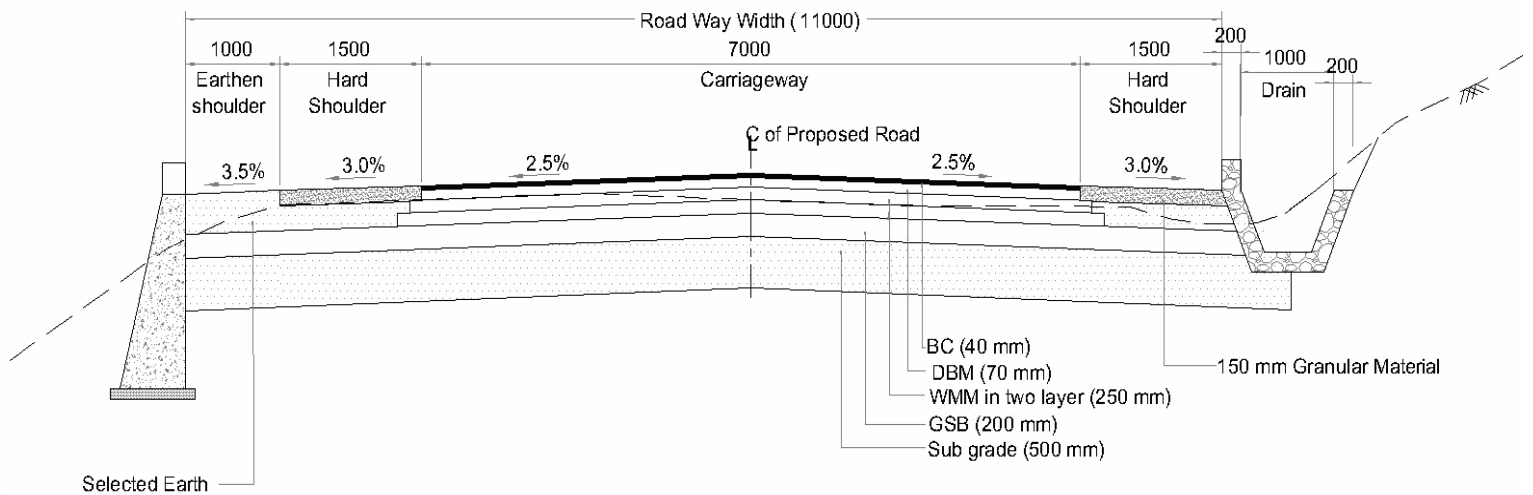
**TCS-8 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY AT REALIGNMENT STRETCH
DUE TO PRESENCE OF HILL IN RURAL AREA WITH BOTH SIDE RR MASONRY TRAPEZOIDAL DRAIN
(NEW CONSTRUCTION)**

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	597.000	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m

Variable Declaration



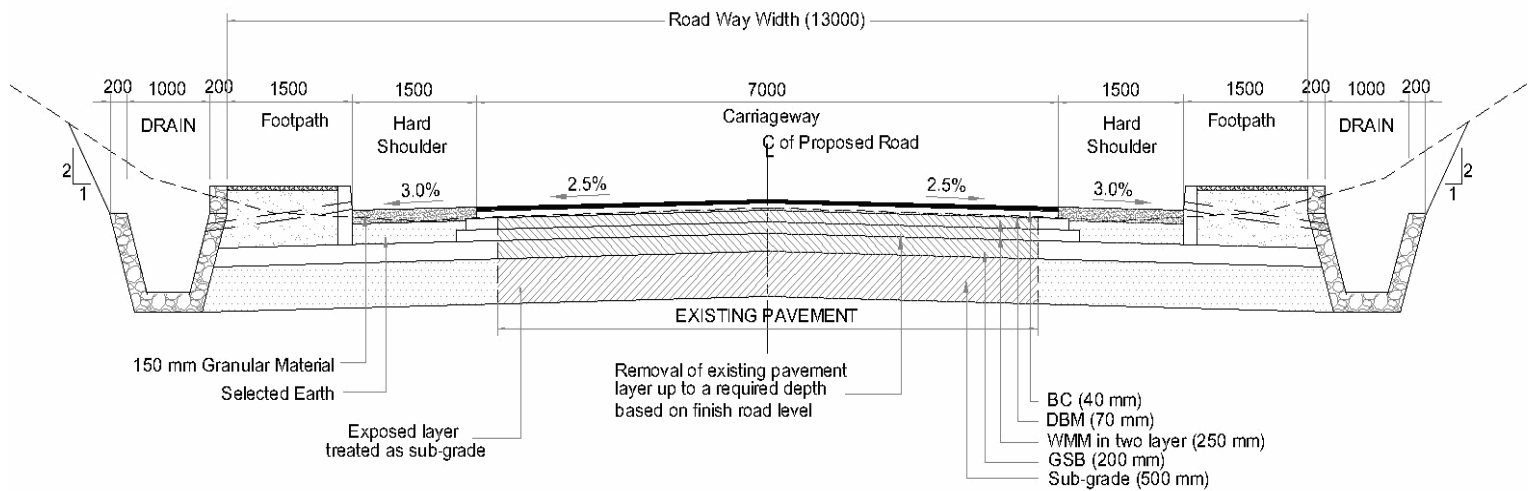
TCS-9 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY IN RURAL AREA WITH ONE SIDE RETAINING WALL AND OTHER SIDE RR MASONRY TRAPEZOIDAL DRAIN (NEW CONSTRUCTION)

Variable Declaration

TCS-10

Sl 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	150.000	m
9	Existing Pavement Width	ext_pav	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Gap between road marking	g	6.000	m
17	Footpath Width	fp	1.500	m

Variable Declaration



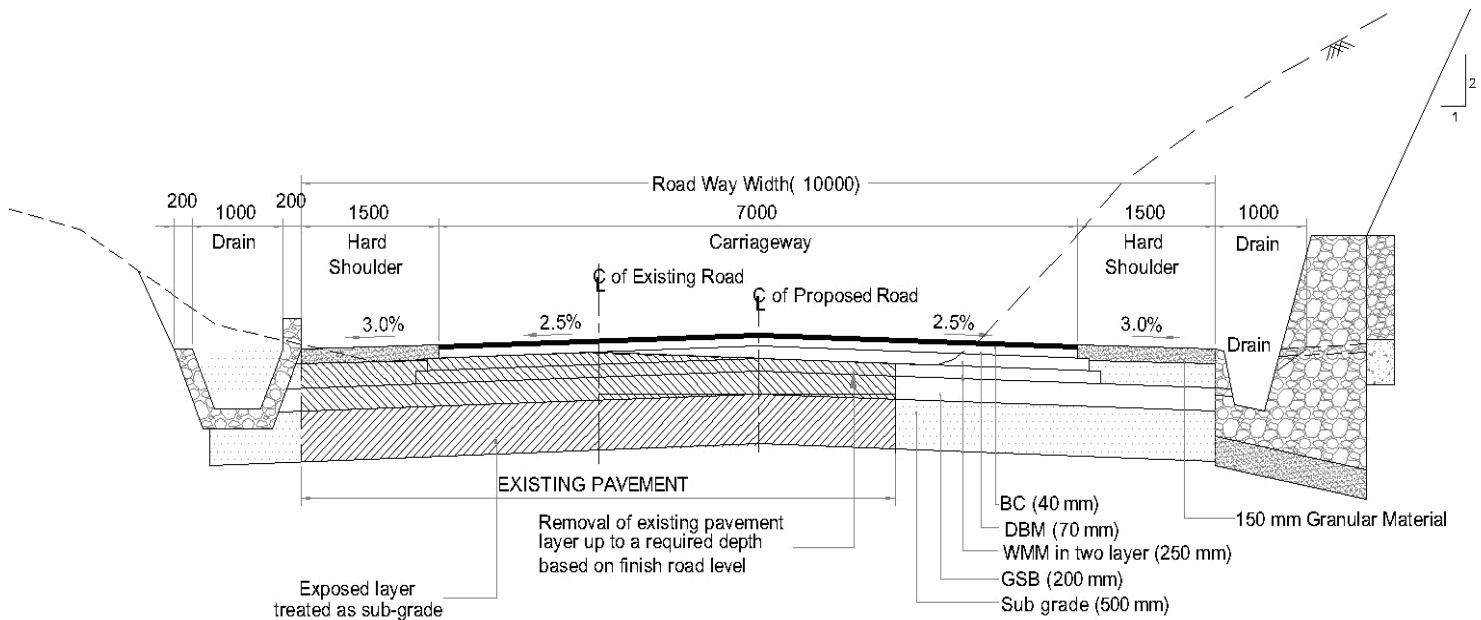
**TCS-10 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY
IN BUILT UP AREA WITH BOTH SIDE FOOTPATH AND OPEN RR MASONRY TRAPEZOIDAL DRAIN
(RECONSTRUCTION OF EXISTING PAVEMENT)**

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	900.000	m
9	Existing Pavement Width	ext_pav	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	0.000	m

Variable Declaration



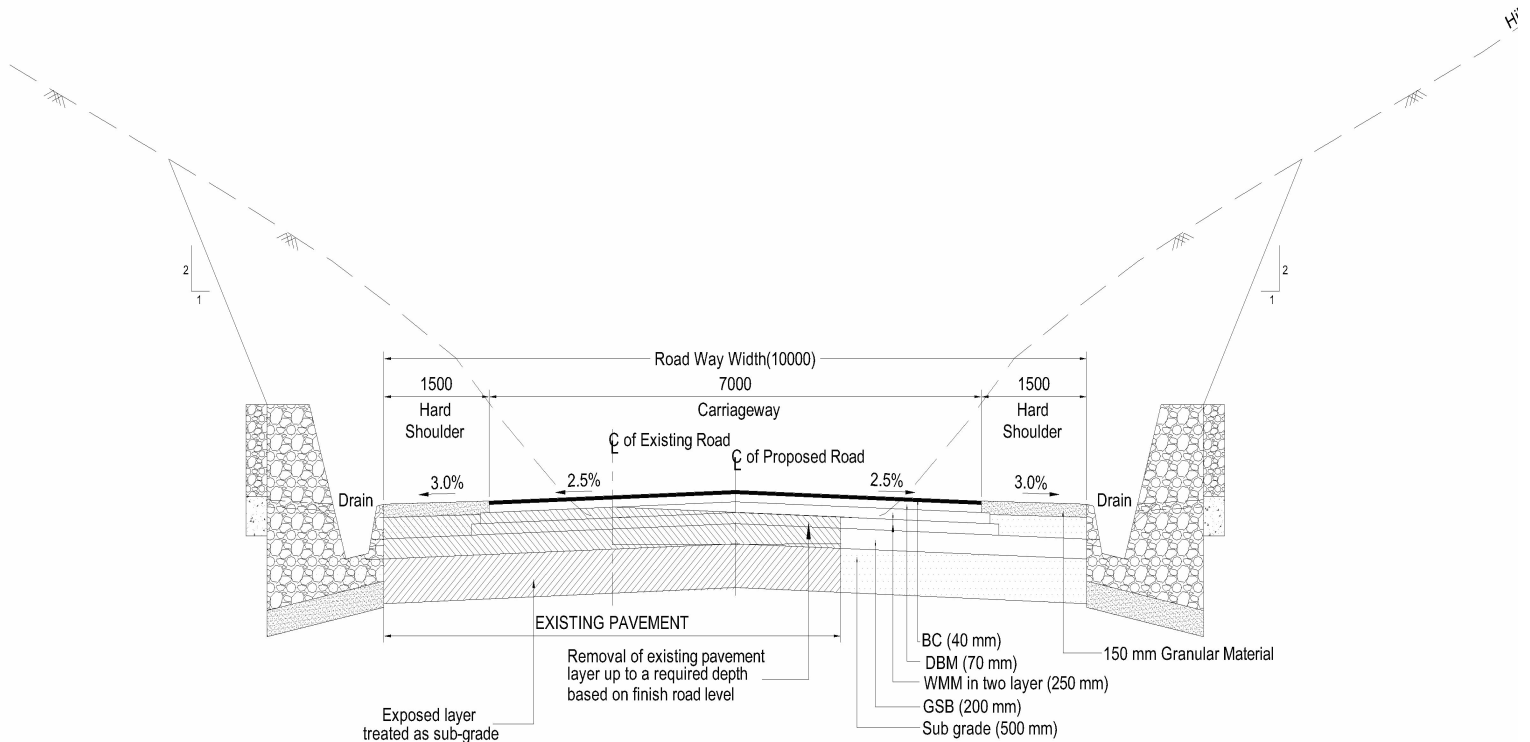
**TCS-11 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY
IN RURAL AREA WITH ONE SIDE BREAST WALL AND OTHER SIDE RR MASONRY TRAPEZOIDAL DRAIN
(RECONSTRUCTION OF EXISTING PAVEMENT)**

Variable Declaration

TCS-12

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Width of 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	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Paved Shoulder	ps	0.000	
17	Gap between road marking	g	6.000	m

Variable Declaration



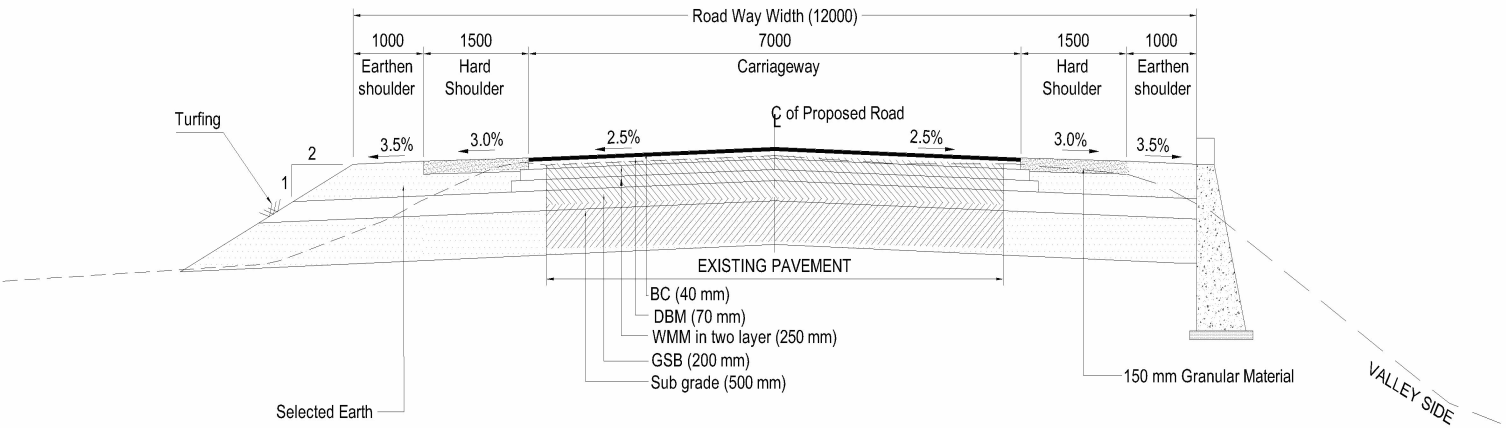
TCS-12 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY
IN RURAL AREA WITH BOTH SIDE BREAST WALL
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-13

Sl 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	200.000	m
9	Existing Pavement Width	ext_pav	6.500	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	26.180	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m

Variable Declaration



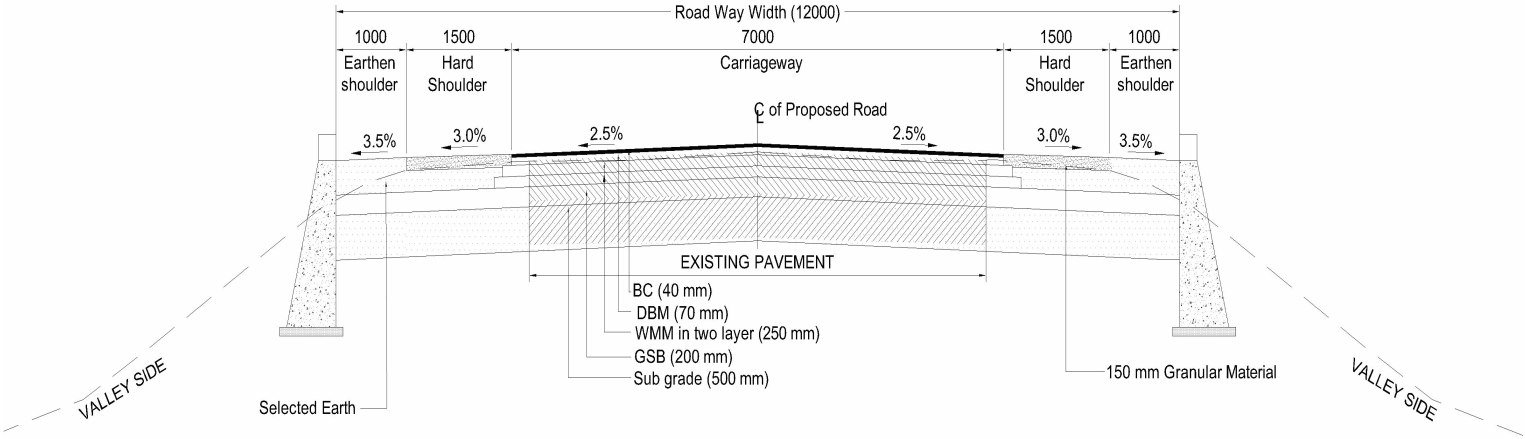
TCS-13 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY IN RURAL AREA
WITH ONE SIDE RETAINING WALL
(NEW CONSTRUCTION)

Variable Declaration

TCS-14

Sl 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	246.000	m
9	Existing Pavement Width	ext_pav	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m

Variable Declaration



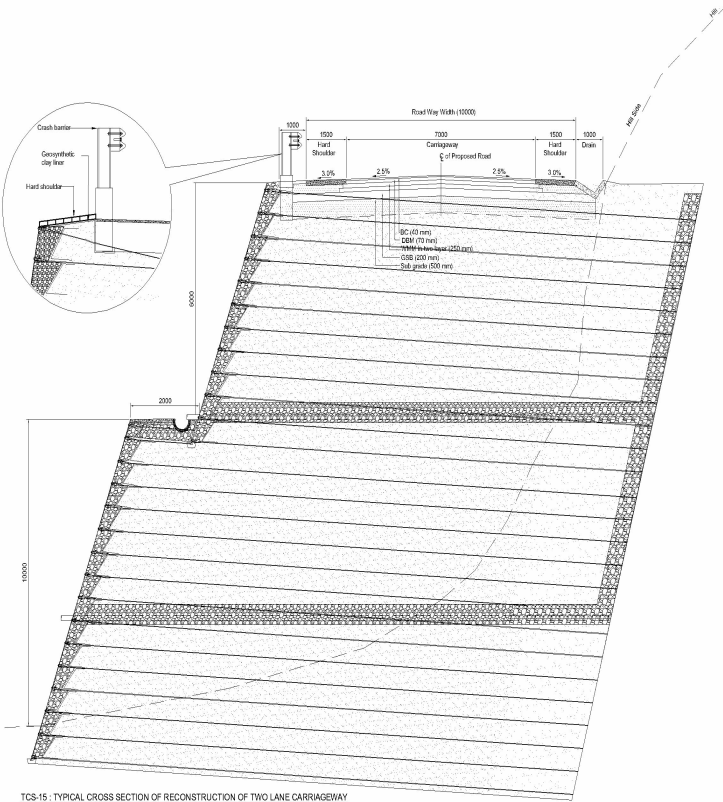
TCS-14 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY IN RURAL AREA
WITH BOTH SIDE RETAINING WALL
(NEW CONSTRUCTION)

Variable Declaration

TCS-15

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	143.000	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	0.000	m
18	Metal beam crash barrier	cb	143.000	m

Variable Declaration



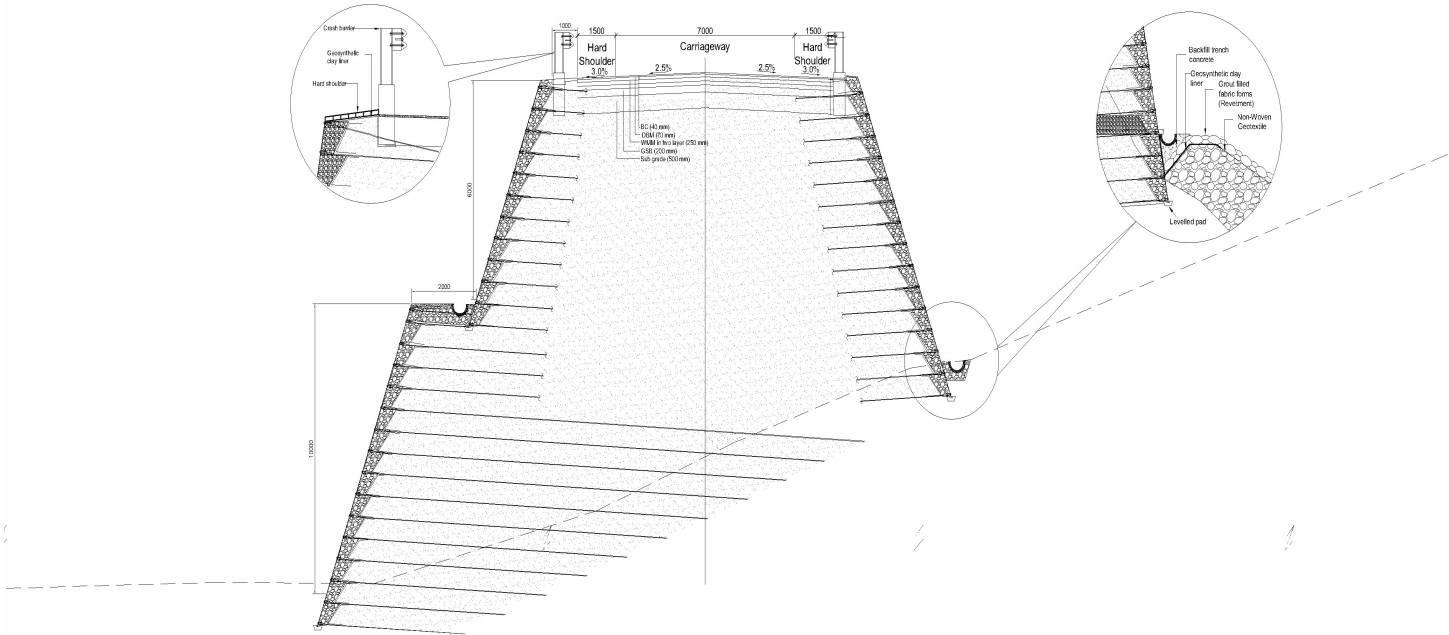
TCS-15 : TYPICAL CROSS SECTION OF RECONSTRUCTION OF TWO LANE CARRIAGEWAY
IN RURAL AREA WITH COMPOSITE RE WALL
(NEW CONSTRUCTION)

Variable Declaration

TCS-16

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Width of 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	150.000	m
9	Existing Pavement Width	ext_pav	6.500	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	0.100	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	26.180	
16	Paved Shoulder	ps	0.000	
17	Gap between road marking	g	6.000	m
18	Metal beam crash barrier	cb	150.000	m

Variable Declaration



TCS-16 :- Typical Cross Section of Reconstruction of Two lane Carriageway Paved Shoulder in Rural area with bothside Composite RE Wall

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Site Clearance and Dismantling

A.Tree Cutting

SI No	Girth Details	No.	Unit
1	Girth from 300 mm to 600 mm	6	Each
2	Girth from 600 mm to 900 mm	5	Each
3	Girth from 900 mm to 1800 mm	37	Each
4	Girth from 1800 mm to 2700 mm	17	Each
5	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
 Bill No- 01, Sl. No- 4

B.Clearing and grubbing

Clearing and Grubbing Area 11 Ha

..... Bill No- 01, Sl. No- 5

C. Dismantling

SI No A.Rubble stone masonry in cement mortar

1	Culvert =	1603	Cum
	Total=	1602.53	cum

..... Bill No- 01, Sl. No- 7

SI No B.Total Dismantling of Reinforced cement concrete

1	Culvert =	235.3	Cum
	Total=	235	cum

..... Bill No- 01, Sl. No- 6

SI No C.Total Dismantling Hume Pipe Culvert

1	up to 600 mm dia=	0	m
2	600-900 mm dia=	210	m
3	above 900 mm dia=	790	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

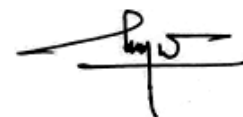
1	Road =	40928	sqm
	Total=	40928	sqm

..... Bill No- 01, Sl. No- 12

SI No E.Total Dismantling of Granular Layer

1	Road =	139462	sqm
	Total=	139462	sqm

..... Bill No- 01, Sl. No- 11





Site Clearance and Dismantling (Tree Cutting List)

SI No	CHAINAGE(KM)	EASTING(M)	NORTHING(M)	GIRTH (M)	SIDE
1	56+972	595863.24	2823198.243	1	RHS
2	58+014	595600.648	2824153.567	1.3	RHS
3	58+206	595571.554	2824326.51	2	RHS
4	58+218	595563.892	2824338.535	1.7	RHS
5	59+974	594235.043	2824914.089	1.5	RHS
6	61+982	593206.628	2823783.979	1.1	RHS
7	62+178	593063.459	2823661.256	1.1	RHS
8	62+312	592992.926	2823552.347	0.4	LHS
9	62+314	592992.186	2823550.077	0.5	LHS
10	62+392	592980.407	2823471.415	0.3	LHS
11	62+710	592722.2638	2823460.147	0.9	RHS
12	64+456	592232.302	2822387.844	1.9	RHS
13	64+916	591789.716	2822390.727	1.8	RHS
14	65+440	591443.567	2822661.129	0.8	RHS
15	66+306	590848.666	2823014.114	3	LHS
16	66+518	590745.453	2823011.547	3.6	LHS
17	66+804	590520.694	2822932.138	0.8	RHS
18	66+950	590474.5893	2823072.775	1.6	RHS
19	67+938	589700.326	2823054.189	1.3	RHS
20	68+168	589492.411	2822978.775	1.5	LHS
21	68+180	589488.947	2822972.49	1.2	LHS
22	68+206	589484.0183	2822947.602	1.1	LHS
23	68+284	589488.72	2822886.237	2.2	LHS
24	68+342	589521.249	2822836.394	1.5	LHS
25	70+090	589557.624	2822199.351	1.1	RHS
26	70+236	589509.454	2822067.572	2	RHS
27	70+236	589527.05	2822061.265	2.2	LHS
28	70+262	589515.933	2822037.296	1.5	LHS
29	70+308	589485.709	2822001.772	1.7	LHS
30	70+328	589491.503	2821980.329	2.1	LHS
31	70+740	589373.283	2821621.912	1.1	LHS
32	70+878	589379.379	2821501.207	1.9	LHS
33	71+022	589300.243	2821441.346	2.2	RHS
34	71+164	589271.411	2821484.396	1.8	RHS
35	71+224	589252.76	2821423.13	2.4	LHS
36	71+356	589190.99	2821424.838	2.6	LHS
37	71+384	589202.669	2821453.66	1.2	LHS
38	71+488	589245.625	2821551.756	2.1	RHS
39	71+516	589215.541	2821579.192	1.5	RHS
40	71+716	589080.1	2821602.39	0.5	LHS
41	71+724	589097.692	2821615.28	1.1	RHS
42	72+084	588947.018	2821541.053	1.2	LHS
43	72+186	588900.7	2821455.288	0.9	LHS
44	72+196	588898.1	2821444.475	1	LHS
45	72+200	588894.075	2821442.293	1.2	LHS
46	72+210	588891.423	2821432.339	1.3	LHS
47	72+236	588881.68	2821407.816	1	LHS
48	72+266	588871.196	2821382.413	1	LHS
49	72+602	588628.527	2821234.096	1.3	LHS
50	72+770	588472.649	2821244.984	0.9	LHS
51	72+858	588472.875	2821328.159	0.9	RHS
52	73+154	588404.841	2821411.906	2.9	RHS

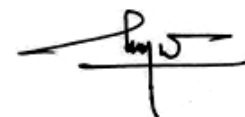


53	73+156	588404.499	2821407.735	3.2	RHS
54	73+328	588262.95	2821320.647	1.2	LHS
55	73+424	588196.461	2821347.968	2.1	LHS
56	74+238	588344.971	2821917.218	1.2	LHS
57	74+404	588373.837	2822043.886	0.9	LHS
58	74+464	588377.067	2822089.371	0.8	RHS
59	74+466	588356.858	2822055.916	1.1	LHS
60	74+484	588344.2	2822079.382	2.3	LHS
61	74+506	588372.437	2822129.927	0.6	RHS
62	74+512	588347.311	2822122.193	1	RHS
63	74+542	588312.454	2822104.648	0.4	LHS
64	74+554	588300.655	2822102.657	2	LHS
65	74+560	588293.725	2822100.929	1.3	LHS
66	74+566	588283.902	2822095.587	2.1	LHS
67	74+690	588170.475	2822172.955	0.6	RHS
68	74+706	588153.322	2822171.745	0.5	RHS
69	74+720	588139.901	2822163.865	0.9	RHS

Summary Girth

Girth from 300 mm to 600 mm	6	Nos
Girth from 600 mm to 900 mm	5	Nos
Girth from 900 mm to 1800 mm	37	Nos
Girth from 1800 mm to 2700 mm	17	Nos
Above 2700 mm	4	Nos

..... Bill No- 01, Sl. No- 1
..... Bill No- 01, Sl. No- 2
..... Bill No- 01, Sl. No- 3
..... Bill No- 01, Sl. No- 4
..... Bill No- 01, Sl. No- 5





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	1284	6.5	14	7.5	1.0
TCS-2	5286	6.5	11	4.5	2.4
TCS-3	147	6.5	12	5.5	0.1
TCS-4	2951	6.5	12	5.5	1.6
TCS-6	1975	6.5	10	3.5	0.7
TCS-7	897	0	10	10	0.9
TCS-8	2995	0	12	12	3.6
TCS-9	597	0	15.8	15.8	0.9
TCS-10	150	6.5	11	4.5	0.1
Total=				69	11

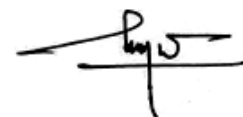
Total= 11

Total area of clearing & grubbing=

11 Ha

.....

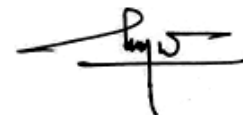
Bill No- 01, Sl. No- 4





Site Clearance and Dismantling
Calculation of Quantities for Dismantling

Sl. No.	Brief Description	Unit	Design 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	56.963	2	7	2.8	0.8	31.36	
			57.136	2	6.6	2.6	0.8	27.46	
			57.256	2	7	2.8	0.8	31.36	
			57.614	2	6.6	2.6	0.8	27.46	
			57.679	2	7	2.8	0.8	31.36	
			58.408	2	7	2.8	0.8	31.36	
			59.324	2	6.6	2.6	0.8	27.46	
			60.1	2	6.6	2.6	0.8	27.46	
			60.308	2	6.6	2.6	0.8	27.46	
			60.624	2	6.6	2.6	0.8	27.46	
			60.824	2	6.6	2.6	0.8	27.46	
			61.123	2	10.1	3	0.5	30.30	




A) Stone Masonry Head wall for existing pipe culve

cum	61.333	2	9.8	3	0.5	29.40	
	61.433	2	9.9	3	0.5	29.70	
	61.621	2	9.2	3	0.5	27.60	
	61.929	2	9.5	3	0.5	28.50	
	62.893	2	9.7	3	0.5	29.10	
	63.47	2	10.3	3	0.5	30.90	
	64.021	2	10	3	0.5	30.00	
	64.15	2	30.4	3	0.5	91.20	
	64.35	2	9.5	3	0.5	28.50	
	64.569	2	9.8	3	0.5	29.40	
	65.431	2	10.2	3	0.5	30.60	
	65.59	2	9.7	3	0.5	29.10	
	65.683	2	10	3	0.5	30.00	
	65.808	2	10.3	3	0.5	30.90	
	66.32	2	10.2	3	0.5	30.60	
	66.584	2	10.2	3	0.5	30.60	
	66.675	2	10.2	3	0.5	30.60	
	67.117	2	10	3	0.5	30.00	
	67.374	2	3.8	3	0.5	11.40	
	67.689	2	9	3	0.5	27.00	
	68.878	2	10.1	3	0.5	30.30	
	69.819	2	9.7	3	0.5	29.10	
	70.323	2	10.2	3	0.5	30.60	
	70.589	2	10	3	0.5	30.00	
	70.747	2	10.2	3	0.5	30.60	
	71.692	2	10	3	0.5	30.00	
	71.921	2	10.2	3	0.5	30.60	
	72.226	2	10.2	3	0.5	30.60	
	72.497	2	10	3	0.5	30.00	
	72.832	2	9.7	3	0.5	29.10	
	73.228	2	9.8	3	0.5	29.40	
	73.585	2	10	3	0.5	30.00	
	73.792	2	12.6	3	0.5	37.80	
	74.12	2	9.6	3	0.5	28.80	
	74.247	2	9.8	3	0.5	29.40	
	74.469	2	9.7	3	0.5	29.10	
	74.635	2	9.1	3	0.5	27.30	
	74.734	2	10.1	3	0.5	30.30	
	58.11	2	9.1	3	0.5	27.30	
	65.893	2	13.2	3	0.5	39.60	
	67.625	2	3.2	3	0.5	9.60	

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						TOTAL =			1602.53
C) RCC	For Slab culvert	Cum	58.11	1	9.1	2.0	2.0	36.40	
			65.893	1	10.7	3.0	3.0	96.30	
			67.625	1	11.4	3.0	3.0	102.60	
						TOTAL =			235.3
D) Hume Pipe	Hume Pipe								
	Dia from 600-900 mm =	m		21	10.00				210
	Dia above 900mm =	m		79	10.00				790

Quantity Summary of Dismantling of Existing Culvert::

Total Dismantling of Rubble stone masonry in cement mortar=	1602.53 cum	Bill No- 01, Sl. No- 8
Total Dismantling of Reinforced cement concrete=	235.3 cum	Bill No- 01, Sl. No- 7
Total Dismantling of above 600 mm to 900 mm dia Hume Pipe=	210 m	Bill No- 01, Sl. No- 9
Total Dismantling of above 900 mm dia Hume Pipe=	790 m	Bill No- 01, Sl. No- 10

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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 Bituminous Layer (Sqm)	Quantity of Base Layer (Sqm)	Quantity of Base Layer for reuse (cum)
TCS-1	1283.9	6.5	0.02	0.300	166.907	8345	8345	2504
TCS-2	5285.84	6.5	0.06	0.310	2061.478	34358	34358	10651
TCS-3	147.4	6.5	0.057	0.320	54.612	958	958	307
TCS-4	2950.5	6.5	0.04	0.300	767.130	19178	19178	5753
TCS-6	1975	6.5	0.028	0.110	0.000	12838	12838	1412
TCS-10	150	6.5	0.02	0.300	19.500	975	975	293
Total =					3069.626	76652	76652	20919

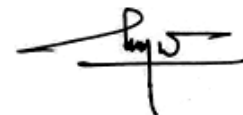
Total quantity for dismantling (Bituminous layer)=	3070	cum
Quantity of Dismantelled Bituminous Material(sqm) (Assume avg thickness 75mm)	40928	sqm

..... Bill No- 01, Sl. No- 11

Total quantity for dismantling (Granular Layer)=	20919	cum
Quantity of Granular Material(sqm) (Assume avg thickness 150mm)	139462	sqm

..... Bill No- 01, Sl. No- 10

Quantity of stone material for reuse (@ 70%) =	14643	cum




Earthwork
QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
56875	226.86	0.00	3863.00	0.00
56900	55.57	0.00	3530.00	0.00
56925	83.87	0.00	1743.00	0.00
56950	84.11	0.00	2100.00	0.00
56975	92.82	0.00	2212.00	0.00
57000	9.52	9.08	1279.00	114.00
57025	55.93	1.15	818.00	128.00
57050	57.70	2.86	1420.00	50.00
57075	37.24	3.19	1187.00	76.00
57100	14.66	4.68	649.00	98.00
57125	23.71	5.97	480.00	133.00
57150	13.27	0.00	462.00	75.00
57175	1.97	5.53	190.00	69.00
57200	2.87	12.58	60.00	226.00
57225	4.90	2.38	97.00	187.00
57250	27.27	0.75	402.00	39.00
57275	25.37	0.02	658.00	10.00
57300	13.48	0.02	486.00	0.00
57325	13.07	0.03	332.00	1.00
57350	5.11	0.04	227.00	1.00
57375	5.48	1.38	132.00	18.00
57400	2.13	6.45	95.00	98.00
57425	94.55	0.00	1209.00	81.00
57450	215.27	0.00	3873.00	0.00
57475	76.82	2.02	3651.00	25.00
57500	136.74	0.38	2669.00	30.00
57525	60.96	1.10	2471.00	19.00
57550	0.36	9.70	766.00	135.00
57575	8.95	0.00	116.00	121.00
57600	79.48	0.00	1105.00	0.00
57625	135.14	0.00	2683.00	0.00
57650	117.89	0.00	3163.00	0.00
57675	18.41	0.00	1704.00	0.00
57700	44.18	4.55	782.00	57.00
57725	11.37	1.27	694.00	73.00
57750	29.05	0.32	505.00	20.00
57775	8.25	0.00	466.00	4.00
57800	5.69	0.00	174.00	0.00
57825	4.11	0.00	122.00	0.00
57850	79.61	0.00	1047.00	0.00
57875	41.56	1.60	1515.00	20.00
57900	74.05	0.00	1445.00	20.00
57925	85.69	0.00	1997.00	0.00
57950	128.32	0.00	2675.00	0.00
57975	56.71	11.10	2313.00	139.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
58000	0.00	19.46	709.00	382.00
58025	7.04	3.86	88.00	291.00
58050	33.66	0.00	509.00	48.00
58075	90.47	0.00	1552.00	0.00
58100	135.14	0.00	2820.00	0.00
58125	220.20	0.00	4442.00	0.00
58150	263.68	0.00	6049.00	0.00
58175	352.63	0.00	7704.00	0.00
58200	169.30	4.88	6524.00	61.00
58225	196.74	1.60	4575.00	81.00
58250	127.18	3.98	4049.00	70.00
58275	69.27	17.86	2456.00	273.00
58300	2.58	42.58	898.00	756.00
58325	72.22	0.00	935.00	532.00
58350	64.20	0.00	1705.00	0.00
58375	0.32	41.61	807.00	520.00
58400	0.13	42.64	6.00	1053.00
58425	42.29	0.00	530.00	533.00
58450	37.82	0.00	1001.00	0.00
58475	32.34	18.16	877.00	227.00
58500	6.24	22.33	482.00	506.00
58525	9.66	13.38	199.00	446.00
58550	10.23	2.98	249.00	204.00
58575	9.32	0.00	244.00	37.00
58600	61.84	0.00	889.00	0.00
58625	182.45	0.00	3054.00	0.00
58650	100.52	0.00	3537.00	0.00
58675	100.41	0.00	2512.00	0.00
58700	67.73	2.13	2102.00	27.00
58725	65.68	0.05	1668.00	27.00
58750	73.31	0.00	1737.00	1.00
58775	5.20	0.46	981.00	6.00
58800	20.84	4.61	325.00	63.00
58825	18.26	0.00	489.00	58.00
58850	21.22	0.00	493.00	0.00
58875	62.73	0.00	1049.00	0.00
58900	17.27	0.00	1000.00	0.00
58925	20.03	0.30	466.00	4.00
58950	25.06	0.00	564.00	4.00
58975	0.00	20.29	313.00	254.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
59000	0.00	32.08	0.00	655.00
59025	7.56	5.15	95.00	465.00
59050	87.96	2.27	1194.00	93.00
59075	102.72	0.00	2384.00	28.00
59100	33.00	7.06	1697.00	88.00
59125	37.03	5.55	875.00	158.00
59150	50.77	0.98	1098.00	82.00
59175	66.29	0.00	1463.00	12.00
59200	37.53	2.10	1298.00	26.00
59225	3.88	0.12	518.00	28.00
59250	68.80	5.68	909.00	72.00
59275	13.22	11.16	1025.00	211.00
59300	2.89	16.18	201.00	342.00
59325	3.95	7.20	86.00	292.00
59350	13.11	2.28	213.00	119.00
59375	1.01	12.20	176.00	181.00
59400	6.88	0.50	99.00	159.00
59425	54.78	0.00	771.00	6.00
59450	7.53	7.97	779.00	100.00
59475	3.86	17.11	142.00	314.00
59500	64.74	10.73	857.00	348.00
59525	0.00	21.18	809.00	399.00
59550	27.83	0.00	348.00	265.00
59575	39.85	12.83	846.00	160.00
59600	201.02	0.00	3011.00	160.00
59625	207.44	0.00	5106.00	0.00
59650	158.60	0.00	4575.00	0.00
59675	205.06	0.00	4546.00	0.00
59700	43.45	0.00	3106.00	0.00
59725	56.92	0.00	1255.00	0.00
59750	128.79	0.00	2321.00	0.00
59775	0.37	5.36	1614.00	67.00
59800	27.67	5.23	350.00	132.00
59825	32.81	1.82	756.00	88.00
59850	74.93	0.00	1347.00	23.00
59875	28.85	3.28	1297.00	41.00
59900	27.04	0.00	699.00	41.00
59925	69.66	0.00	1209.00	0.00
59950	28.10	0.00	1222.00	0.00
59975	6.59	0.32	434.00	4.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
60000	3.30	10.83	124.00	139.00
60025	25.01	0.00	354.00	135.00
60050	0.00	45.32	313.00	566.00
60075	0.00	50.76	0.00	1201.00
60100	0.15	32.72	2.00	1043.00
60125	0.67	17.28	10.00	625.00
60150	25.04	0.00	321.00	216.00
60175	0.00	28.35	313.00	354.00
60200	20.61	0.00	258.00	354.00
60225	15.77	8.29	455.00	104.00
60250	14.30	14.42	376.00	284.00
60275	0.00	24.17	179.00	482.00
60300	21.17	0.00	265.00	302.00
60325	54.58	0.00	947.00	0.00
60350	0.00	71.84	682.00	898.00
60375	0.00	101.70	0.00	2169.00
60400	0.00	96.04	0.00	2472.00
60425	100.72	0.00	1259.00	1200.00
60450	137.06	0.00	2972.00	0.00
60475	0.00	156.93	1713.00	1962.00
60500	75.41	0.00	943.00	1962.00
60525	112.65	0.00	2351.00	0.00
60550	0.00	77.34	1408.00	967.00
60575	21.01	0.00	263.00	967.00
60600	53.70	0.00	934.00	0.00
60625	15.04	2.65	859.00	33.00
60650	30.92	0.00	575.00	33.00
60675	28.82	0.00	747.00	0.00
60700	23.48	0.00	654.00	0.00
60725	44.00	0.00	843.00	0.00
60750	40.52	0.00	1056.00	0.00
60775	23.66	10.31	802.00	129.00
60800	17.34	20.25	512.00	382.00
60825	26.92	0.00	553.00	253.00
60850	21.90	5.83	610.00	73.00
60875	17.76	12.58	496.00	230.00
60900	8.44	42.53	327.00	689.00
60925	15.95	22.20	305.00	809.00
60950	27.97	15.67	549.00	473.00
60975	32.19	0.00	752.00	196.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
61000	35.19	10.51	842.00	131.00
61025	74.39	0.00	1370.00	131.00
61050	85.20	0.00	1995.00	0.00
61075	80.90	0.19	2076.00	2.00
61100	119.31	0.00	2503.00	2.00
61125	219.69	0.00	4238.00	0.00
61150	256.16	0.00	5948.00	0.00
61175	341.57	0.00	7472.00	0.00
61200	371.53	0.00	8914.00	0.00
61225	197.77	0.00	7116.00	0.00
61250	130.52	0.00	4104.00	0.00
61275	172.86	0.00	3792.00	0.00
61300	194.91	0.00	4597.00	0.00
61325	114.45	0.00	3867.00	0.00
61350	129.50	0.00	3049.00	0.00
61375	108.06	0.00	2969.00	0.00
61400	142.73	0.00	3135.00	0.00
61425	181.42	0.00	4052.00	0.00
61450	147.07	0.00	4106.00	0.00
61475	52.25	0.86	2491.00	11.00
61500	76.30	0.00	1607.00	11.00
61525	155.81	0.00	2901.00	0.00
61550	186.09	0.00	4274.00	0.00
61575	199.93	0.00	4825.00	0.00
61600	313.93	0.00	6423.00	0.00
61625	367.16	0.00	8514.00	0.00
61650	499.02	0.00	10827.00	0.00
61675	435.41	0.00	11680.00	0.00
61700	350.30	0.00	9821.00	0.00
61725	241.14	0.00	7393.00	0.00
61750	491.82	0.00	9162.00	0.00
61775	468.06	0.00	11998.00	0.00
61800	457.96	0.00	11575.00	0.00
61825	445.93	0.00	11299.00	0.00
61850	486.40	0.00	11654.00	0.00
61875	573.82	0.00	13253.00	0.00
61900	450.47	0.00	12804.00	0.00
61925	382.24	0.00	10409.00	0.00
61950	330.27	0.00	8906.00	0.00
61975	267.80	0.00	7476.00	0.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
62000	345.38	0.00	7665.00	0.00
62025	326.90	0.00	8404.00	0.00
62050	237.17	0.00	7051.00	0.00
62075	198.96	0.00	5452.00	0.00
62100	282.44	0.00	6017.00	0.00
62125	271.41	0.00	6923.00	0.00
62150	284.85	0.00	6953.00	0.00
62175	172.80	0.00	5721.00	0.00
62200	213.04	0.00	4823.00	0.00
62225	123.12	0.00	4202.00	0.00
62250	82.32	0.00	2568.00	0.00
62275	44.13	0.00	1581.00	0.00
62300	55.74	0.00	1248.00	0.00
62325	102.11	0.00	1973.00	0.00
62350	54.42	0.00	1957.00	0.00
62375	39.23	0.04	1171.00	1.00
62400	18.99	0.82	728.00	11.00
62425	69.54	0.00	1107.00	10.00
62450	118.32	0.00	2348.00	0.00
62475	90.11	2.25	2605.00	28.00
62500	35.70	0.00	1573.00	28.00
62525	17.61	0.00	666.00	0.00
62550	84.30	0.66	1274.00	8.00
62575	142.98	4.37	2841.00	63.00
62600	82.86	9.82	2823.00	177.00
62625	541.12	8.10	7800.00	224.00
62650	561.43	0.00	13782.00	101.00
62675	44.48	11.81	7574.00	148.00
62700	31.30	19.82	947.00	395.00
62725	37.64	8.67	862.00	356.00
62750	38.42	6.67	951.00	192.00
62775	61.21	8.09	1245.00	184.00
62800	20.60	0.00	1023.00	101.00
62825	36.22	10.47	710.00	131.00
62850	35.36	0.00	895.00	131.00
62875	52.99	12.74	1104.00	159.00
62900	61.73	12.23	1434.00	312.00
62925	48.42	17.52	1377.00	372.00
62950	48.72	0.00	1214.00	219.00
62975	39.21	0.00	1099.00	0.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
63000	0.17	20.14	492.00	252.00
63025	6.98	15.34	89.00	443.00
63050	22.53	0.00	369.00	192.00
63075	112.56	0.00	1689.00	0.00
63100	64.29	0.00	2211.00	0.00
63125	35.16	0.00	1243.00	0.00
63150	30.12	2.09	816.00	26.00
63175	55.14	46.87	1066.00	612.00
63200	5.47	3.73	758.00	632.00
63225	9.51	14.30	187.00	225.00
63250	41.67	4.30	640.00	233.00
63275	33.84	0.00	944.00	54.00
63300	66.37	0.00	1253.00	0.00
63325	89.06	0.00	1943.00	0.00
63350	93.24	0.00	2279.00	0.00
63375	88.32	0.00	2270.00	0.00
63400	149.51	0.00	2973.00	0.00
63425	125.80	0.00	3441.00	0.00
63450	23.39	1.31	1865.00	16.00
63475	141.80	0.00	2065.00	16.00
63500	358.37	0.00	6252.00	0.00
63525	392.64	0.00	9388.00	0.00
63550	161.26	30.47	6924.00	381.00
63575	4.30	3.46	2070.00	424.00
63600	10.60	15.03	186.00	231.00
63625	74.16	0.00	1060.00	188.00
63650	226.24	0.00	3755.00	0.00
63675	175.02	0.00	5016.00	0.00
63700	72.86	0.00	3099.00	0.00
63725	29.33	0.00	1277.00	0.00
63750	173.96	8.55	2541.00	107.00
63775	93.02	5.92	3337.00	181.00
63800	2.91	15.43	1199.00	267.00
63825	0.00	32.64	36.00	601.00
63850	68.77	0.00	860.00	408.00
63875	0.95	27.95	872.00	349.00
63900	0.00	21.24	12.00	615.00
63925	11.88	0.00	149.00	265.00
63950	35.01	0.00	586.00	0.00
63975	43.00	0.00	975.00	0.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
64000	26.48	0.00	868.00	0.00
64025	13.80	0.00	503.00	0.00
64050	31.97	0.00	572.00	0.00
64075	12.96	0.00	562.00	0.00
64100	30.39	0.00	542.00	0.00
64125	24.47	0.00	686.00	0.00
64150	3.54	0.00	350.00	0.00
64175	12.29	0.00	198.00	0.00
64200	0.13	4.83	155.00	60.00
64225	0.08	6.01	3.00	136.00
64250	127.79	0.00	1598.00	75.00
64275	4.15	0.54	1649.00	7.00
64300	0.13	3.85	53.00	55.00
64325	0.61	2.98	9.00	85.00
64350	21.38	0.00	275.00	37.00
64375	8.90	0.00	378.00	0.00
64400	6.76	0.00	196.00	0.00
64425	2.76	0.00	119.00	0.00
64450	8.20	0.00	137.00	0.00
64475	90.40	4.72	1233.00	59.00
64500	0.00	36.37	1130.00	514.00
64525	0.00	83.78	0.00	1502.00
64550	0.00	48.86	0.00	1658.00
64575	131.97	0.00	1650.00	611.00
64600	89.56	11.16	2769.00	139.00
64625	63.56	0.00	1914.00	139.00
64650	17.03	0.00	1007.00	0.00
64675	19.40	0.00	455.00	0.00
64700	0.06	10.45	243.00	131.00
64725	7.43	0.22	94.00	133.00
64750	81.11	0.00	1107.00	3.00
64775	67.22	0.00	1854.00	0.00
64800	11.60	6.45	985.00	81.00
64825	7.98	2.19	245.00	108.00
64850	25.70	0.00	421.00	27.00
64875	44.81	11.80	881.00	147.00
64900	17.67	149.97	781.00	2022.00
64925	67.02	0.00	1059.00	1875.00
64950	85.31	0.00	1904.00	0.00
64975	32.79	4.02	1476.00	50.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
65000	43.98	0.00	960.00	50.00
65025	14.11	13.39	726.00	167.00
65050	3.68	44.24	222.00	720.00
65075	19.23	0.00	286.00	553.00
65100	90.36	0.00	1370.00	0.00
65125	79.07	5.85	2118.00	73.00
65150	0.29	10.06	992.00	199.00
65175	4.50	10.86	60.00	262.00
65200	78.20	0.00	1034.00	136.00
65225	130.14	0.00	2604.00	0.00
65250	123.12	0.00	3166.00	0.00
65275	29.45	0.47	1907.00	6.00
65300	3.48	20.32	412.00	260.00
65325	35.62	0.00	489.00	254.00
65350	2.74	38.80	479.00	485.00
65375	33.54	6.91	454.00	571.00
65400	22.09	13.48	695.00	255.00
65425	29.21	0.00	641.00	168.00
65450	0.00	24.03	365.00	300.00
65475	19.40	0.00	243.00	300.00
65500	54.79	0.00	927.00	0.00
65525	0.00	11.15	685.00	139.00
65550	34.87	1.09	436.00	153.00
65575	58.02	0.00	1161.00	14.00
65600	50.20	0.00	1353.00	0.00
65625	62.30	0.00	1406.00	0.00
65650	44.93	0.00	1340.00	0.00
65675	78.16	0.46	1539.00	6.00
65700	19.33	0.00	1219.00	6.00
65725	12.26	19.87	395.00	248.00
65750	14.23	0.00	331.00	248.00
65775	19.25	0.00	418.00	0.00
65800	34.50	0.00	672.00	0.00
65825	31.26	0.00	822.00	0.00
65850	61.85	0.00	1164.00	0.00
65875	175.31	0.00	2965.00	0.00
65900	29.61	0.00	2562.00	0.00
65925	5.49	0.00	439.00	0.00
65950	479.66	28.07	6064.00	351.00
65975	0.00	42.69	5996.00	885.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
66000	1.67	28.67	21.00	892.00
66025	0.00	38.39	21.00	838.00
66050	50.70	29.61	634.00	850.00
66075	198.40	8.51	3114.00	477.00
66100	340.71	0.00	6739.00	106.00
66125	321.35	10.16	8276.00	127.00
66150	415.67	0.00	9213.00	127.00
66175	24.06	4.22	5497.00	53.00
66200	0.00	113.69	301.00	1474.00
66225	2.17	66.64	27.00	2254.00
66250	100.22	0.00	1280.00	833.00
66275	0.19	26.34	1255.00	329.00
66300	197.56	0.00	2472.00	329.00
66325	18.90	0.00	2706.00	0.00
66350	339.88	0.00	4485.00	0.00
66375	101.68	0.00	5520.00	0.00
66400	42.27	0.00	1799.00	0.00
66425	131.67	0.00	2174.00	0.00
66450	128.34	0.00	3250.00	0.00
66475	115.40	0.00	3047.00	0.00
66500	31.70	0.00	1839.00	0.00
66525	247.51	0.00	3490.00	0.00
66550	247.61	0.00	6189.00	0.00
66575	522.37	0.00	9625.00	0.00
66600	329.77	0.00	10652.00	0.00
66625	477.33	0.00	10089.00	0.00
66650	421.86	0.00	11240.00	0.00
66675	389.89	0.00	10147.00	0.00
66700	673.51	0.00	13292.00	0.00
66725	529.01	0.00	15031.00	0.00
66750	537.98	0.00	13337.00	0.00
66775	559.41	0.00	13717.00	0.00
66800	524.52	0.00	13549.00	0.00
66825	371.49	0.00	11200.00	0.00
66850	382.85	0.00	9429.00	0.00
66875	345.68	0.00	9107.00	0.00
66900	271.46	0.00	7714.00	0.00
66925	293.78	0.00	7065.00	0.00
66950	286.68	0.00	7256.00	0.00
66975	224.07	0.00	6384.00	0.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
67000	300.09	0.00	6552.00	0.00
67025	309.46	0.00	7619.00	0.00
67050	284.78	0.00	7428.00	0.00
67075	245.71	0.00	6631.00	0.00
67100	290.09	0.00	6697.00	0.00
67125	283.84	0.00	7174.00	0.00
67150	211.25	0.00	6189.00	0.00
67175	407.85	0.00	7739.00	0.00
67200	387.22	0.00	9938.00	0.00
67225	291.09	0.00	8479.00	0.00
67250	339.71	0.00	7885.00	0.00
67275	422.11	0.00	9523.00	0.00
67300	523.60	0.00	11821.00	0.00
67325	323.87	0.00	10593.00	0.00
67350	285.76	0.00	7620.00	0.00
67375	398.24	0.00	8550.00	0.00
67400	380.26	0.00	9731.00	0.00
67425	212.24	0.00	7406.00	0.00
67450	323.73	0.00	6700.00	0.00
67475	453.76	0.00	9719.00	0.00
67500	544.40	0.00	12477.00	0.00
67525	449.36	0.00	12422.00	0.00
67550	298.53	0.00	9349.00	0.00
67575	288.39	0.00	7336.00	0.00
67600	286.55	0.00	7187.00	0.00
67625	272.01	0.00	6982.00	0.00
67650	254.77	0.00	6585.00	0.00
67675	290.26	0.00	6813.00	0.00
67700	201.35	0.00	6145.00	0.00
67725	257.59	0.00	5737.00	0.00
67750	196.35	0.00	5674.00	0.00
67775	214.48	0.00	5135.00	0.00
67800	105.48	0.00	4000.00	0.00
67825	169.76	0.00	3440.00	0.00
67850	167.72	0.00	4219.00	0.00
67875	171.35	0.00	4238.00	0.00
67900	76.33	0.00	3096.00	0.00
67925	99.09	0.00	2193.00	0.00
67950	170.42	0.00	3369.00	0.00
67975	63.15	0.00	2920.00	0.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
68000	15.74	14.67	986.00	183.00
68025	16.86	2.94	408.00	220.00
68050	4.21	7.47	263.00	130.00
68075	24.40	29.19	358.00	458.00
68100	3.08	34.79	344.00	800.00
68125	5.01	39.32	101.00	926.00
68150	0.00	53.85	63.00	1165.00
68175	0.00	72.42	0.00	1578.00
68200	0.00	235.58	0.00	3850.00
68225	0.00	313.73	0.00	6866.00
68250	268.68	0.00	3358.00	3922.00
68275	0.00	314.86	3358.00	3936.00
68300	282.51	0.00	3531.00	3936.00
68325	0.00	136.20	3531.00	1702.00
68350	88.54	0.00	1107.00	1702.00
68375	1.06	58.63	1120.00	733.00
68400	8.69	15.03	122.00	921.00
68425	16.91	0.00	320.00	188.00
68450	28.12	0.00	563.00	0.00
68475	69.85	0.00	1225.00	0.00
68500	88.94	0.00	1985.00	0.00
68525	109.38	2.29	2479.00	29.00
68550	168.37	0.00	3472.00	29.00
68575	220.20	0.00	4857.00	0.00
68600	301.48	0.00	6521.00	0.00
68625	494.01	0.00	9944.00	0.00
68650	676.08	0.00	14626.00	0.00
68675	582.40	0.00	15731.00	0.00
68700	506.31	6.56	13609.00	82.00
68725	369.97	0.00	10954.00	82.00
68750	246.53	0.00	7706.00	0.00
68775	80.44	0.89	4087.00	11.00
68800	3.09	10.82	1044.00	146.00
68825	16.80	8.82	249.00	246.00
68850	88.44	0.00	1316.00	110.00
68875	62.76	0.00	1890.00	0.00
68900	76.25	0.00	1738.00	0.00
68925	94.75	0.00	2137.00	0.00
68950	25.83	0.00	1507.00	0.00
68975	48.99	0.00	935.00	0.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
69000	39.04	0.00	1100.00	0.00
69025	17.15	0.00	702.00	0.00
69050	31.61	0.00	610.00	0.00
69075	32.75	0.00	805.00	0.00
69100	153.06	0.00	2323.00	0.00
69125	138.19	0.00	3641.00	0.00
69150	103.20	0.00	3017.00	0.00
69175	100.96	0.00	2552.00	0.00
69200	126.04	0.00	2837.00	0.00
69225	128.54	0.00	3182.00	0.00
69250	157.52	0.00	3576.00	0.00
69275	125.85	0.00	3542.00	0.00
69300	146.70	0.00	3407.00	0.00
69325	220.15	0.00	4586.00	0.00
69350	106.28	0.00	4080.00	0.00
69375	7.34	0.88	1420.00	11.00
69400	25.45	0.00	410.00	11.00
69425	84.40	0.00	1373.00	0.00
69450	79.46	0.86	2048.00	11.00
69475	63.26	0.54	1784.00	17.00
69500	134.92	0.00	2477.00	7.00
69525	84.37	0.00	2741.00	0.00
69550	0.00	47.84	1055.00	598.00
69575	66.44	0.00	830.00	598.00
69600	0.00	39.22	830.00	490.00
69625	2.17	16.24	27.00	693.00
69650	88.11	1.72	1128.00	224.00
69675	117.74	0.00	2573.00	22.00
69700	103.30	0.00	2763.00	0.00
69725	109.83	0.00	2664.00	0.00
69750	151.91	0.00	3272.00	0.00
69775	123.77	2.05	3446.00	26.00
69800	88.18	2.79	2649.00	60.00
69825	91.31	27.64	2244.00	380.00
69850	119.48	4.51	2635.00	402.00
69875	85.49	0.77	2562.00	66.00
69900	88.50	0.17	2175.00	12.00
69925	54.05	0.00	1782.00	2.00
69950	156.07	0.00	2626.00	0.00
69975	123.77	0.86	3498.00	11.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
70000	55.93	0.00	2246.00	11.00
70025	44.63	3.39	1257.00	42.00
70050	12.25	130.55	711.00	1674.00
70075	38.85	0.00	639.00	1632.00
70100	32.90	0.00	897.00	0.00
70125	127.53	0.00	2005.00	0.00
70150	144.84	0.29	3405.00	4.00
70175	118.18	0.00	3288.00	4.00
70200	39.95	0.00	1977.00	0.00
70225	106.78	0.00	1834.00	0.00
70250	124.18	0.00	2887.00	0.00
70275	54.86	0.00	2238.00	0.00
70300	99.45	3.16	1929.00	39.00
70325	210.24	0.00	3871.00	39.00
70350	140.13	0.00	4380.00	0.00
70375	130.05	0.00	3377.00	0.00
70400	199.62	6.33	4121.00	79.00
70425	247.51	0.00	5589.00	79.00
70450	195.36	0.00	5536.00	0.00
70475	182.48	0.00	4723.00	0.00
70500	212.57	0.00	4938.00	0.00
70525	236.70	0.00	5616.00	0.00
70550	168.55	0.00	5066.00	0.00
70575	195.51	13.46	4551.00	168.00
70600	77.16	16.88	3408.00	379.00
70625	15.25	81.94	1155.00	1235.00
70650	19.64	120.50	436.00	2531.00
70675	60.21	112.56	998.00	2913.00
70700	142.08	84.51	2529.00	2463.00
70725	280.61	7.64	5284.00	1152.00
70750	152.31	11.59	5412.00	240.00
70775	141.20	0.00	3669.00	145.00
70800	150.26	0.00	3643.00	0.00
70825	55.80	0.54	2576.00	7.00
70850	11.41	16.67	840.00	215.00
70875	58.05	29.51	868.00	577.00
70900	15.95	56.30	925.00	1073.00
70925	3.16	66.47	239.00	1535.00
70950	23.06	61.20	328.00	1596.00
70975	33.35	60.98	705.00	1527.00

[Handwritten Signature]



Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
71000	22.88	56.79	703.00	1472.00
71025	35.22	62.56	726.00	1492.00
71050	79.77	4.21	1437.00	835.00
71075	234.40	0.76	3927.00	62.00
71100	175.62	0.00	5125.00	10.00
71125	71.04	0.00	3083.00	0.00
71150	155.04	0.00	2826.00	0.00
71175	207.44	0.00	4531.00	0.00
71200	125.41	0.00	4161.00	0.00
71225	56.57	0.00	2275.00	0.00
71250	75.01	0.00	1645.00	0.00
71275	40.10	0.08	1439.00	1.00
71300	43.81	0.00	1049.00	1.00
71325	116.90	0.00	2009.00	0.00
71350	139.75	0.00	3208.00	0.00
71375	163.50	0.00	3791.00	0.00
71400	188.12	0.00	4395.00	0.00
71425	336.05	0.00	6552.00	0.00
71450	350.77	0.00	8585.00	0.00
71475	105.54	14.21	5704.00	178.00
71500	117.89	0.16	2793.00	180.00
71525	17.01	6.72	1686.00	86.00
71550	17.36	12.35	430.00	238.00
71575	24.95	18.85	529.00	390.00
71600	0.00	48.81	312.00	846.00
71625	73.22	19.62	915.00	855.00
71650	0.08	56.22	916.00	948.00
71675	1.36	32.54	18.00	1109.00
71700	23.98	4.69	317.00	465.00
71725	48.23	7.70	903.00	155.00
71750	78.04	23.29	1578.00	387.00
71775	178.55	0.00	3207.00	291.00
71800	78.55	0.00	3214.00	0.00
71825	2.11	14.41	1008.00	180.00
71850	36.17	12.90	479.00	341.00
71875	39.43	41.32	945.00	678.00
71900	56.18	23.12	1195.00	806.00
71925	125.29	0.00	2268.00	289.00
71950	198.22	0.00	4044.00	0.00
71975	186.99	0.00	4815.00	0.00

[Handwritten Signature]



Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
72000	43.52	0.01	2881.00	0.00
72025	77.63	0.00	1514.00	0.00
72050	87.62	0.00	2066.00	0.00
72075	55.60	1.90	1790.00	24.00
72100	45.74	0.44	1267.00	29.00
72125	38.73	0.00	1056.00	6.00
72150	35.31	0.00	926.00	0.00
72175	29.66	0.00	812.00	0.00
72200	33.29	0.00	787.00	0.00
72225	66.93	0.00	1253.00	0.00
72250	56.06	0.00	1537.00	0.00
72275	0.20	22.69	703.00	284.00
72300	0.22	30.93	5.00	670.00
72325	13.05	0.05	166.00	387.00
72350	48.88	0.00	774.00	1.00
72375	49.89	0.00	1235.00	0.00
72400	40.93	0.00	1135.00	0.00
72425	80.47	0.00	1517.00	0.00
72450	28.49	0.00	1362.00	0.00
72475	24.95	0.00	668.00	0.00
72500	14.07	0.00	488.00	0.00
72525	48.89	0.00	787.00	0.00
72550	102.14	0.00	1888.00	0.00
72575	109.66	0.00	2648.00	0.00
72600	108.63	0.00	2729.00	0.00
72625	126.80	0.00	2943.00	0.00
72650	139.84	0.00	3333.00	0.00
72675	101.07	0.00	3011.00	0.00
72700	126.08	0.03	2839.00	0.00
72725	190.53	0.00	3958.00	0.00
72750	170.01	0.00	4507.00	0.00
72775	166.69	0.00	4209.00	0.00
72800	156.06	0.00	4034.00	0.00
72825	161.86	0.00	3974.00	0.00
72850	144.10	0.00	3824.00	0.00
72875	30.53	0.00	2183.00	0.00
72900	0.55	1.57	388.00	20.00
72925	26.99	0.00	344.00	20.00
72950	63.24	0.00	1128.00	0.00
72975	66.03	0.00	1616.00	0.00
73000	29.49	0.00	1194.00	0.00
73025	2.12	5.72	395.00	72.00
73050	2.63	15.14	59.00	261.00
73075	34.42	14.17	463.00	366.00
73100	62.38	0.00	1210.00	177.00
73125	80.48	8.88	1786.00	111.00
73150	59.21	0.00	1746.00	111.00
73175	22.87	0.00	1026.00	0.00
73200	37.20	1.87	751.00	23.00
73225	11.65	0.16	611.00	25.00
73250	107.16	0.00	1485.00	2.00

[Handwritten Signature]



Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
73275	6.64	0.00	1423.00	0.00
73300	46.19	0.15	660.00	2.00
73325	200.94	0.00	3089.00	2.00
73350	225.58	0.00	5331.00	0.00
73375	177.34	0.00	5036.00	0.00
73400	211.33	0.00	4858.00	0.00
73425	139.97	0.00	4391.00	0.00
73450	107.66	0.00	3095.00	0.00
73475	58.02	7.87	2071.00	98.00
73500	0.00	37.16	725.00	563.00
73525	0.00	88.27	0.00	1568.00
73550	0.03	27.64	0.00	1449.00
73575	16.91	5.01	212.00	408.00
73600	28.32	2.33	565.00	92.00
73625	0.68	0.24	363.00	32.00
73650	21.55	0.00	278.00	3.00
73675	44.29	0.00	823.00	0.00
73700	23.29	0.00	845.00	0.00
73725	16.34	0.00	495.00	0.00
73750	19.77	0.00	451.00	0.00
73775	24.79	0.00	557.00	0.00
73800	7.07	2.59	398.00	32.00
73825	9.33	3.47	205.00	76.00
73850	28.29	0.00	470.00	43.00
73875	58.65	0.00	1087.00	0.00
73900	33.74	0.00	1155.00	0.00
73925	18.79	1.55	657.00	19.00
73950	30.74	0.17	619.00	21.00
73975	17.28	2.79	600.00	37.00
74000	44.42	0.00	771.00	35.00
74025	25.17	0.00	870.00	0.00
74050	31.00	1.38	702.00	17.00
74075	53.29	0.00	1054.00	17.00
74100	41.15	0.00	1180.00	0.00
74125	57.00	0.00	1227.00	0.00
74150	9.75	0.29	834.00	4.00
74175	31.71	0.00	518.00	4.00
74200	38.10	0.00	873.00	0.00
74225	44.67	0.00	1035.00	0.00
74250	79.76	0.00	1555.00	0.00
74275	10.54	0.00	1129.00	0.00
74300	68.03	0.00	982.00	0.00
74325	72.07	0.28	1751.00	3.00
74350	4.86	6.82	962.00	89.00
74375	17.49	0.00	279.00	85.00
74400	67.68	0.00	1065.00	0.00
74425	119.95	0.00	2345.00	0.00
74450	112.33	0.00	2904.00	0.00
74475	8.48	4.24	1510.00	53.00
74500	41.39	3.29	623.00	94.00
74525	5.15	11.28	582.00	182.00

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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
74550	10.05	0.00	190.00	141.00
74575	2.74	10.67	160.00	133.00
74600	7.23	2.30	125.00	162.00
74625	3.05	4.88	128.00	90.00
74650	5.23	0.00	103.00	61.00
74675	58.12	0.50	792.00	6.00
74700	35.88	0.00	1175.00	6.00
74725	8.55	0.73	555.00	9.00
74750	39.72	0.00	603.00	9.00
74775	27.27	0.00	837.00	0.00
74800	28.67	0.00	699.00	0.00
74825	25.01	0.00	671.00	0.00
74850	23.64	0.00	608.00	0.00
74875	22.05	0.00	571.00	0.00
74900	17.30	0.00	492.00	0.00
74925	14.16	0.00	393.00	0.00
74950	22.21	0.00	455.00	0.00
74975	22.48	0.00	559.00	0.00
75000	8.73	0.00	390.00	0.00
Total =			1876039	150381

Total Earthwork in cutting = 1876039 cum

Assume 20% total cutting Volume for

Ordinary Rock Cutting= 375208 cum

Bill No- 02, Sl. No- 7

Total earthwork in soil= 1500831 cum

Bill No- 02, Sl. No- 6

Total Earthwork in filling = 150381 cum

Bill No- 02, Sl. No- 2

Using 70% of cutting material for filling earthworks in embankment

Earthwork used from Roadway Cutting Material= 1050581.84 cum

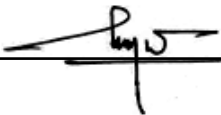
So no Earthwork required for embankment const from borrowpit ::




Variable Declaration

Earthwork

Sl No	Variable Description	Variable	Dimension	Unit
1	Total Earthwork In Cutting	tot_cut	1876039.000	cum
2	Total Earthwork In Filling (Consider Only Embankment)	tot_fill	150381.000	cum
3	Percentage of Rock	per_rock	20.000	percent





Calculation of Extra Widening on Flexible Pavement						
Extra Widening Calculation						
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	57129.648	57169.648	40	20	
516	Arc	57169.648	57192.472	22.824	22.824	200
	Transition	57192.472	57232.472	40	20	
	Transition	57327.496	57342.496	15	7.5	
517	Arc	57342.496	57411.563	69.067	69.067	200
	Transition	57411.563	57426.563	15	7.5	
	Transition	57510.745	57525.745	15	7.5	
518	Arc	57525.745	57620.114	94.37	94.37	200
	Transition	57620.114	57635.114	15	7.5	
519	Arc	57853.865	57948.019	94.154	94.154	300
	Transition	58009.573	58024.573	15	7.5	
520	Arc	58024.573	58180.58	156.007	156.007	125
	Transition	58180.58	58195.58	15	7.5	
	Transition	58231.944	58246.944	15	7.5	
521	Arc	58246.944	58263.302	16.358	16.358	150
	Transition	58263.302	58278.302	15	7.5	
	Transition	58544.302	58559.302	15	7.5	
524	Arc	58559.302	58667.402	108.1	108.1	200
	Transition	58667.402	58682.402	15	7.5	
	Transition	58717.993	58732.993	15	7.5	
525	Arc	58732.993	58768.844	35.851	35.851	125
	Transition	58768.844	58783.844	15	7.5	
	Transition	58843.496	58858.496	15	7.5	
526	Arc	58858.496	58896.294	37.798	37.798	200
	Transition	58896.294	58911.294	15	7.5	
	Transition	58957.347	58972.347	15	7.5	
527	Arc	58972.347	59008.774	36.427	36.427	200
	Transition	59008.774	59023.774	15	7.5	
	Transition	60774.641	60799.641	25	12.5	
546	Arc	60910.234	60927.047	16.813	16.813	200
	Transition	61040.836	61065.836	25	12.5	
	Transition	61890.438	61905.438	15	7.5	
554	Arc	61905.438	61971.023	65.585	65.585	120
	Transition	61971.023	61986.023	15	7.5	
	Transition	62059.671	62074.671	15	7.5	
556	Arc	62074.671	62086.24	11.57	11.57	125
	Transition	62086.24	62101.24	15	7.5	
	Transition	62261.823	62286.823	25	12.5	
559	Arc	62329.124	62356.595	27.471	27.471	300

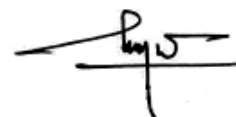
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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
561	Arc	62579.886	62715.258	135.371	135.371	300
	Transition	62765.505	62785.505	20	10	
	Transition	62977.349	62992.349	15	7.5	
563	Arc	62992.349	63135.303	142.954	142.954	250
	Transition	63135.303	63150.303	15	7.5	
	Transition	63251.735	63291.735	40	20	
564	Arc	63291.735	63314.367	22.632	22.632	200
	Transition	63314.367	63354.367	40	20	
	Transition	63457.759	63472.759	15	7.5	
565	Arc	63472.759	63639.413	166.654	166.654	250
	Transition	63639.413	63654.413	15	7.5	
	Transition	63717.757	63737.757	20	10	
567	Arc	63761.761	63848.433	86.672	86.672	300
	Transition	63860.577	63890.577	30	15	
	Transition	63900.212	63930.212	30	15	
569	Arc	64051.745	64073.132	21.387	21.387	300
	Transition	64076.814	64096.814	20	10	
	Transition	64179.781	64209.781	30	15	
572	Arc	64274.783	64295.082	20.299	20.299	300
	Transition	64325.024	64350.024	25	12.5	
	Transition	64960.874	64975.874	15	7.5	
577	Arc	64975.874	64990.25	14.375	14.375	200
	Transition	64990.25	65005.25	15	7.5	
	Transition	65297.837	65312.837	15	7.5	
579	Arc	65312.837	65342.036	29.198	29.198	200
	Transition	65342.036	65357.036	15	7.5	
	Transition	65580.226	65605.226	25	12.5	
582	Arc	65620.356	65644.912	24.556	24.556	200
	Transition	65678.647	65698.647	20	10	
	Transition	66685.467	66705.467	20	10	
600	Arc	66754.671	66780.497	25.826	25.826	170
601	Arc	66801.497	66819.614	18.117	18.117	170
	Transition	66875.144	66890.144	15	7.5	
	Transition	67428.762	67443.762	15	7.5	
611	Arc	67538.457	67599.709	61.253	61.253	300
	Transition	67950.41	67965.41	15	7.5	
613	Arc	67965.41	67979.347	13.937	13.937	125
	Transition	67979.347	67994.347	15	7.5	
	Transition	68071.467	68086.467	15	7.5	
614	Arc	68086.467	68092.19	5.723	5.723	150
	Transition	68092.19	68107.19	15	7.5	
	Transition	68206.659	68226.659	20	10	
618	Arc	68381.582	68404.682	23.1	23.1	300
	Transition	68475.138	68490.138	15	7.5	
619	Arc	68490.138	68506.9	16.761	16.761	150
	Transition	68506.9	68521.9	15	7.5	
	Transition	68854.122	68894.122	40	20	
623	Arc	68957.516	68999.584	42.068	42.068	300
	Transition	69073.427	69088.427	15	7.5	
	Transition	69329.584	69349.584	20	10	
627	Arc	69391.697	69420.033	28.336	28.336	125
	Transition	69492.149	69512.149	20	10	
	Transition	70391.913	70411.913	20	10	
639	Arc	70427.389	70452.942	25.553	25.553	170



HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	70519.495	70539.495	20	10	
Total Length of 0.6m Extra Widening=					2302	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	57009.977	57024.977	15	7.5	
515	Arc	57024.977	57070.563	45.586	45.586	100
	Transition	57070.563	57085.563	15	7.5	
	Transition	58355.816	58380.816	25	12.5	
522	Arc	58380.816	58394.01	13.194	0	80
	Transition	58394.01	58419.01	25	0	
	Transition	59075.308	59095.308	20	0	
528	Arc	59095.308	59117.895	22.587	7.5	100
	Transition	59117.895	59137.895	20	45.586	
	Transition	59307.263	59322.263	15	7.5	
530	Arc	59322.263	59331.401	9.138	12.5	80
	Transition	59331.401	59346.401	15	13.194	
	Transition	59375.523	59390.523	15	12.5	
531	Arc	59390.523	59406.007	15.484	10	80
	Transition	59406.007	59421.007	15	22.587	
	Transition	59441.425	59456.425	15	10	
532	Arc	59456.425	59462.964	6.54	7.5	100
	Transition	59462.964	59477.964	15	9.138	
	Transition	59934.794	59954.794	20	7.5	
537	Arc	59954.794	59985.63	30.835	7.5	100
	Transition	59985.63	60005.63	20	15.484	
	Transition	60051.69	60071.69	20	7.5	
538	Arc	60071.69	60102.402	30.712	7.5	100
	Transition	60102.402	60122.402	20	6.54	
	Transition	60155.973	60175.973	20	7.5	
539	Arc	60175.973	60192.965	16.992	10	100
	Transition	60192.965	60212.965	20	30.835	
	Transition	61452.063	61467.063	15	10	
550	Arc	61467.063	61471.957	4.894	10	80
	Transition	61471.957	61486.957	15	30.712	
	Transition	63659.904	63679.904	20	10	
566	Arc	63679.904	63717.757	37.853	10	100
	Transition	63717.757	63737.757	20	16.992	
	Transition	64076.814	64096.814	20	10	
570	Arc	64096.814	64114.798	17.984	7.5	100
	Transition	64114.798	64134.798	20	4.894	
	Transition	64325.024	64350.024	25	7.5	
573	Arc	64350.024	64359.476	9.453	10	80

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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	64359.476	64384.476	25	37.853	
	Transition	64392.049	64417.049	25	10	
574	Arc	64417.049	64440.486	23.437	10	80
	Transition	64440.486	64465.486	25	17.984	
	Transition	64550	64570	20	10	
575	Arc	64570	64593.095	23.095	12.5	100
	Transition	64593.095	64613.095	20	9.453	
	Transition	66186.992	66201.992	15	12.5	
592	Arc	66214.15	66235.646	21.495	12.5	80
	Transition	66242.48	66257.48	15	23.437	
	Transition	66978.875	66993.875	15	12.5	
604	Arc	67024.099	67038.249	14.149	10	100
	Transition	67044.992	67059.992	15	23.095	
	Transition	67062.917	67077.917	15	10	
606	Arc	67090.68	67100.885	10.205	7.5	100
607	Arc	67251.19	67264.719	13.529	21.495	100
608	Arc	67282.35	67311.723	29.373	7.5	100
609	Arc	67371.833	67400.355	28.522	7.5	80
616	Arc	68247.412	68276.21	28.797	14.149	80
617	Arc	68292.946	68324.471	31.525	7.5	80
	Transition	68601.981	68621.981	20	7.5	
620	Arc	68621.981	68656.839	34.859	10.205	100
	Transition	68656.839	68676.839	20	13.529	
630	Arc	69715.968	69742.832	26.864	29.373	80
641	Arc	70628.596	70654.949	26.352	28.522	80
	Transition	71193.858	71208.858	15	28.797	
647	Arc	71208.858	71217.752	8.894	31.525	100
	Transition	71217.752	71232.752	15	10	
	Transition	71489.948	71504.948	15	34.859	
650	Arc	71504.948	71516.021	11.073	10	80
	Transition	71516.021	71531.021	15	26.864	
	Transition	71901.356	71916.356	15	26.352	
654	Arc	71916.356	71939.659	23.303	7.5	80
	Transition	71939.659	71954.659	15	8.894	
661	Arc	72541.344	72577.207	35.863	7.5	80
663	Arc	72743.726	72769.109	25.382	7.5	80
	Transition	73940.353	73955.353	15	11.073	
672	Arc	73955.353	73975.107	19.754	7.5	80
	Transition	73975.107	73990.107	15	7.5	
	Transition	74192.378	74207.378	15	23.303	
676	Arc	74207.378	74225.129	17.751	7.5	100
	Transition	74225.129	74240.129	15	35.863	
	Transition	74830.674	74855.674	25	25.382	
684	Arc	74855.674	74873.804	18.13	7.5	90
	Transition	74873.804	74898.804	25	19.754	
	Transition	74955.729	74980.729	25	7.5	
Total Length of 0.9m Extra Widening=					1178	m

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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	56872.708	56892.708	20	10	
514	Arc	56892.708	56906.497	13.789	13.789	50
	Transition	56906.497	56926.497	20	10	
	Transition	59513.703	59533.703	20	10	
533	Arc	59533.703	59542.793	9.09	9.09	50
	Transition	59542.793	59562.793	20	10	
	Transition	61556.937	61571.937	15	7.5	
551	Arc	61571.937	61581.674	9.736	9.736	70
	Transition	61581.674	61596.674	15	7.5	
	Transition	61770.85	61790.85	20	10	
553	Arc	61790.85	61804.843	13.993	13.993	50
	Transition	61804.843	61824.843	20	10	
	Transition	61992.72	62012.72	20	10	
555	Arc	62012.72	62017.967	5.248	5.248	60
	Transition	62017.967	62037.967	20	10	
	Transition	62165.47	62185.47	20	10	
557	Arc	62185.47	62201.175	15.705	15.705	50
	Transition	62201.175	62221.175	20	10	
	Transition	64774.661	64814.661	40	20	
576	Arc	64814.661	64835.461	20.799	20.799	50
	Transition	64835.461	64875.461	40	20	
	Transition	65427.12	65452.12	25	12.5	
580	Arc	65452.12	65486.791	34.671	34.671	50
	Transition	65486.791	65511.791	25	12.5	
	Transition	66559.17	66574.17	15	7.5	
598	Arc	66574.17	66584.248	10.078	10.078	50
	Transition	66584.248	66599.248	15	7.5	
	Transition	66624.104	66644.104	20	10	
599	Arc	66644.104	66685.467	41.364	41.364	60
	Transition	66685.467	66705.467	20	10	
	Transition	67044.992	67059.992	15	7.5	
605	Arc	67059.992	67062.917	2.925	2.925	50
	Transition	67062.917	67077.917	15	7.5	
	Transition	67409.62	67424.62	15	7.5	
610	Arc	67424.62	67428.762	4.142	4.142	50
	Transition	67428.762	67443.762	15	7.5	
	Transition	68812.791	68852.791	40	20	
622	Arc	68852.791	68854.122	1.331	1.331	50
	Transition	68854.122	68894.122	40	20	
	Transition	69884.283	69904.283	20	10	
632	Arc	69904.283	69915.246	10.962	10.962	60
	Transition	69915.246	69935.246	20	10	
	Transition	70212.345	70232.345	20	10	
636	Arc	70232.345	70237.482	5.138	5.138	50
	Transition	70237.482	70257.482	20	10	
	Transition	70361.2	70381.2	20	10	
638	Arc	70381.2	70391.913	10.713	10.713	50
	Transition	70391.913	70411.913	20	10	
	Transition	70891.21	70911.21	20	10	
644	Arc	70911.21	70922.583	11.373	11.373	50
	Transition	70922.583	70942.583	20	10	
	Transition	71269.381	71289.381	20	10	
648	Arc	71289.381	71292.287	2.906	2.906	50



HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	71292.287	71312.287	20	10	
	Transition	71367.827	71387.827	20	10	
649	Arc	71387.827	71397.648	9.821	9.821	60
	Transition	71397.648	71417.648	20	10	
	Transition	71983.439	72003.439	20	10	
655	Arc	72003.439	72016.401	12.961	12.961	50
	Transition	72016.401	72036.401	20	10	
	Transition	72233.64	72253.64	20	10	
658	Arc	72253.64	72263.27	9.629	9.629	50
	Transition	72263.27	72283.27	20	10	
	Transition	72321.884	72341.884	20	10	
659	Arc	72341.884	72352.962	11.078	11.078	50
	Transition	72352.962	72372.962	20	10	
	Transition	72983.235	73003.235	20	10	
665	Arc	73003.235	73099.253	96.017	96.017	65
	Transition	73099.253	73119.253	20	10	
	Transition	73678.158	73698.158	20	10	
669	Arc	73698.158	73715.698	17.54	17.54	50
	Transition	73715.698	73735.698	20	10	
	Transition	73755.952	73775.952	20	10	
670	Arc	73775.952	73853.984	78.033	78.033	55
	Transition	73853.984	73873.984	20	10	
	Transition	73876.894	73891.894	15	7.5	
671	Arc	73891.894	73902.318	10.424	10.424	70
	Transition	73902.318	73917.318	15	7.5	
	Transition	73998.937	74018.937	20	10	
673	Arc	74018.937	74034.547	15.61	15.61	50
	Transition	74034.547	74054.547	20	10	
	Transition	74080.335	74095.335	15	7.5	
674	Arc	74095.335	74102.394	7.058	7.058	70
	Transition	74102.394	74117.394	15	7.5	
	Transition	74761.513	74781.513	20	10	
683	Arc	74781.513	74788.691	7.179	7.179	60
	Transition	74788.691	74808.691	20	10	
Total Length of 1.2m Extra Widening=					1094	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	58423.674	58443.674	20	10	
523	Arc	58443.674	58462.991	19.317	19.317	20
	Transition	58462.991	58482.991	20	10	
	Transition	59191.11	59211.11	20	10	
529	Arc	59211.11	59222.078	10.968	10.968	30
	Transition	59222.078	59242.078	20	10	
	Transition	59631.471	59651.471	20	10	
534	Arc	59651.471	59665.86	14.389	14.389	20
	Transition	59665.86	59685.86	20	10	
	Transition	59728.607	59748.607	20	10	
535	Arc	59748.607	59777.032	28.425	28.425	25
	Transition	59777.032	59797.032	20	10	
	Transition	59805.385	59825.385	20	10	
536	Arc	59825.385	59828.322	2.937	2.937	20
	Transition	59828.322	59848.322	20	10	
	Transition	60233.096	60248.096	15	7.5	
540	Arc	60248.096	60256.835	8.739	8.739	30
	Transition	60256.835	60271.835	15	7.5	
	Transition	60362.183	60377.183	15	7.5	
541	Arc	60377.183	60386.191	9.007	9.007	40
	Transition	60386.191	60401.191	15	7.5	
	Transition	60424.157	60439.157	15	7.5	
542	Arc	60439.157	60454.11	14.952	14.952	30
	Transition	60454.11	60469.11	15	7.5	
	Transition	60533.248	60548.248	15	7.5	
543	Arc	60548.248	60566.254	18.005	18.005	30
	Transition	60566.254	60581.254	15	7.5	
	Transition	60611.282	60626.282	15	7.5	
544	Arc	60626.282	60642.812	16.529	16.529	30
	Transition	60642.812	60657.812	15	7.5	
	Transition	60744.843	60769.843	25	12.5	
545	Arc	60769.843	60774.641	4.798	4.798	40
	Transition	60774.641	60799.641	25	12.5	
	Transition	61040.836	61065.836	25	12.5	
547	Arc	61065.836	61073.563	7.727	7.727	40
	Transition	61073.563	61098.563	25	12.5	
	Transition	61216.391	61236.391	20	10	
548	Arc	61236.391	61262.972	26.581	26.581	20
	Transition	61262.972	61282.972	20	10	
	Transition	61363.72	61378.72	15	7.5	
549	Arc	61378.72	61400.095	21.375	21.375	30
	Transition	61400.095	61415.095	15	7.5	
	Transition	61721.168	61736.168	15	7.5	
552	Arc	61736.168	61746.468	10.3	10.3	30
	Transition	61746.468	61761.468	15	7.5	
	Transition	62229.892	62254.892	25	12.5	
558	Arc	62254.892	62261.823	6.932	6.932	40
	Transition	62261.823	62286.823	25	12.5	
	Transition	62765.505	62785.505	20	10	
562	Arc	62785.505	62819.458	33.953	33.953	20
	Transition	62819.458	62839.458	20	10	
	Transition	63860.577	63890.577	30	15	
568	Arc	63890.577	63900.212	9.635	9.635	30



HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	63900.212	63930.212	30	15	
	Transition	64140.663	64170.663	30	15	
571	Arc	64170.663	64179.781	9.118	9.118	30
	Transition	64179.781	64209.781	30	15	
	Transition	65103.886	65128.886	25	12.5	
578	Arc	65128.886	65199.774	70.888	70.888	40
	Transition	65199.774	65224.774	25	12.5	
	Transition	65544.43	65569.43	25	12.5	
581	Arc	65569.43	65580.226	10.796	10.796	40
	Transition	65580.226	65605.226	25	12.5	
	Transition	65678.647	65698.647	20	10	
583	Arc	65698.647	65705.838	7.191	7.191	20
	Transition	65705.838	65725.838	20	10	
	Transition	65748.068	65763.068	15	7.5	
584	Arc	65763.068	65766.874	3.806	3.806	35
	Transition	65766.874	65781.874	15	7.5	
	Transition	65791.718	65806.718	15	7.5	
585	Arc	65806.718	65815.686	8.967	8.967	35
	Transition	65815.686	65830.686	15	7.5	
	Transition	65848.94	65863.94	15	7.5	
586	Arc	65863.94	65870.434	6.494	6.494	25
	Transition	65870.434	65885.434	15	7.5	
	Transition	65891.516	65911.516	20	10	
587	Arc	65911.516	65915.689	4.173	4.173	20
	Transition	65915.689	65935.689	20	10	
	Transition	65941.672	65956.672	15	7.5	
588	Arc	65956.672	65961.256	4.584	4.584	20
	Transition	65961.256	65976.256	15	7.5	
	Transition	65984.53	65999.53	15	7.5	

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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
589	Arc	65999.53	66016.07	16.541	16.541	40
	Transition	66016.07	66031.07	15	7.5	
	Transition	66076.604	66091.604	15	7.5	
590	Arc	66091.604	66101.054	9.449	9.449	30
	Transition	66101.054	66116.054	15	7.5	
	Transition	66171.741	66186.741	15	7.5	
591	Arc	66186.741	66186.992	0.251	0.251	40
	Transition	66186.992	66201.992	15	7.5	
	Transition	66242.48	66257.48	15	7.5	
593	Arc	66257.48	66259.552	2.072	2.072	20
	Transition	66259.552	66274.552	15	7.5	
	Transition	66305.387	66320.387	15	7.5	
594	Arc	66320.387	66323.945	3.558	3.558	30
	Transition	66323.945	66338.945	15	7.5	
	Transition	66354.987	66369.987	15	7.5	
595	Arc	66369.987	66374.03	4.044	4.044	30
	Transition	66374.03	66389.03	15	7.5	
	Transition	66434.057	66449.057	15	7.5	
596	Arc	66449.057	66456.008	6.951	6.951	15
	Transition	66456.008	66471.008	15	7.5	
	Transition	66480.916	66495.916	15	7.5	
597	Arc	66495.916	66524.955	29.039	29.039	20
	Transition	66524.955	66539.955	15	7.5	
	Transition	66875.144	66890.144	15	7.5	
602	Arc	66890.144	66903.962	13.818	13.818	30
	Transition	66903.962	66918.962	15	7.5	
	Transition	66941.307	66956.307	15	7.5	
603	Arc	66956.307	66978.875	22.568	22.568	40
	Transition	66978.875	66993.875	15	7.5	
	Transition	68147.203	68167.203	20	10	
615	Arc	68167.203	68206.659	39.455	39.455	20
	Transition	68206.659	68226.659	20	10	
	Transition	68695.351	68715.351	20	10	
621	Arc	68715.351	68753.904	38.553	38.553	20
	Transition	68753.904	68773.904	20	10	
	Transition	69073.427	69088.427	15	7.5	
624	Arc	69088.427	69102.835	14.408	14.408	40
	Transition	69102.835	69117.835	15	7.5	
	Transition	69151.805	69171.805	20	10	
625	Arc	69171.805	69209.912	38.108	38.108	20
	Transition	69209.912	69229.912	20	10	
	Transition	69278.311	69298.311	20	10	
626	Arc	69298.311	69329.584	31.273	31.273	20
	Transition	69329.584	69349.584	20	10	
	Transition	69492.149	69512.149	20	10	
628	Arc	69512.149	69548.854	36.705	36.705	19
	Transition	69548.854	69568.854	20	10	
	Transition	69594.075	69614.075	20	10	
629	Arc	69614.075	69650.67	36.595	36.595	19
	Transition	69650.67	69670.67	20	10	
	Transition	69785.06	69810.06	25	12.5	
631	Arc	69810.06	69842.367	32.306	32.306	40
	Transition	69842.367	69867.367	25	12.5	
	Transition	69984.276	69999.276	15	7.5	



HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
633	Arc	69999.276	70009.555	10.279	10.279	25
	Transition	70009.555	70024.555	15	7.5	
	Transition	70037.097	70057.097	20	10	
634	Arc	70057.097	70095.284	38.188	38.188	19
	Transition	70095.284	70115.284	20	10	
	Transition	70129.446	70149.446	20	10	
635	Arc	70149.446	70166.144	16.698	16.698	20
	Transition	70166.144	70186.144	20	10	
	Transition	70264.179	70289.179	25	12.5	
637	Arc	70289.179	70295.731	6.551	6.551	40
	Transition	70295.731	70320.731	25	12.5	
	Transition	70519.495	70539.495	20	10	
640	Arc	70539.495	70576.004	36.509	36.509	19
	Transition	70576.004	70596.004	20	10	
	Transition	70723.062	70738.062	15	7.5	
642	Arc	70738.062	70748.146	10.083	10.083	30
	Transition	70748.146	70763.146	15	7.5	
	Transition	70793.074	70813.074	20	10	
643	Arc	70813.074	70849.757	36.683	36.683	20
	Transition	70849.757	70869.757	20	10	
	Transition	70963.693	70988.693	25	12.5	
645	Arc	70988.693	70991.814	3.121	3.121	40
	Transition	70991.814	71016.814	25	12.5	
	Transition	71093.774	71113.774	20	10	
646	Arc	71113.774	71150.403	36.629	36.629	20
	Transition	71150.403	71170.403	20	10	
	Transition	71557.836	71577.836	20	10	
651	Arc	71577.836	71615.741	37.905	37.905	20
	Transition	71615.741	71635.741	20	10	
	Transition	71653.917	71668.917	15	7.5	
652	Arc	71668.917	71679.085	10.168	10.168	30
	Transition	71679.085	71694.085	15	7.5	
	Transition	71737.504	71757.504	20	10	
653	Arc	71757.504	71807.353	49.849	49.849	24

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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	71807.353	71827.353	20	10	
	Transition	72047.656	72072.656	25	12.5	
656	Arc	72072.656	72083.486	10.83	10.83	40
	Transition	72083.486	72108.486	25	12.5	
	Transition	72144.428	72164.428	20	10	
657	Arc	72164.428	72197.488	33.06	33.06	19
	Transition	72197.488	72217.488	20	10	
	Transition	72426.665	72446.665	20	10	
660	Arc	72446.665	72483.343	36.678	36.678	20
	Transition	72483.343	72503.343	20	10	
	Transition	72634.647	72654.647	20	10	
662	Arc	72654.647	72688.512	33.865	33.865	20
	Transition	72688.512	72708.512	20	10	
	Transition	72833.391	72853.391	20	10	
664	Arc	72853.391	72882.721	29.331	29.331	20
	Transition	72882.721	72902.721	20	10	
	Transition	73226.858	73256.858	30	15	
666	Arc	73256.858	73310.813	53.955	53.955	30
	Transition	73310.813	73340.813	30	15	
	Transition	73506.46	73536.46	30	15	
667	Arc	73536.46	73563.046	26.586	26.586	35
	Transition	73563.046	73593.046	30	15	
	Transition	73604.718	73634.718	30	15	
668	Arc	73634.718	73638.782	4.064	4.064	30
	Transition	73638.782	73668.782	30	15	
	Transition	74124.406	74149.406	25	12.5	
675	Arc	74149.406	74158.033	8.627	8.627	40
	Transition	74158.033	74183.033	25	12.5	
	Transition	74244.716	74274.716	30	15	
677	Arc	74274.716	74278.727	4.011	4.011	30
	Transition	74278.727	74308.727	30	15	
	Transition	74311.594	74336.594	25	12.5	
678	Arc	74336.594	74345.138	8.545	8.545	40
	Transition	74345.138	74370.138	25	12.5	
	Transition	74444.704	74469.704	25	12.5	
679	Arc	74469.704	74479.469	9.765	9.765	40
	Transition	74479.469	74504.469	25	12.5	
	Transition	74506.817	74526.817	20	10	
680	Arc	74526.817	74536.796	9.979	9.979	20
	Transition	74536.796	74556.796	20	10	
	Transition	74584.25	74614.25	30	15	
681	Arc	74614.25	74633.459	19.209	19.209	30
	Transition	74633.459	74663.459	30	15	
	Transition	74692.328	74717.328	25	12.5	
682	Arc	74717.328	74724.051	6.723	6.723	40
	Transition	74724.051	74749.051	25	12.5	
Total Length of 1.5m Extra Widening=					2804	m

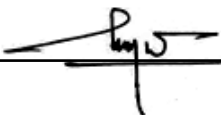
Total Length of 0.6m Extra Widening= 2302 m
 Total Length of 0.9m Extra Widening= 1178 m
 Total Length of 1.2m Extra Widening= 1094 m
 Total Length of 1.5m Extra Widening= 2804 m
Total Area of Extra Widening= 7961 Sqm




Variable Declaration

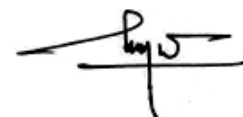
Extra Widening on Flexible Pavement

SI No	Variable Description	Variable	Dimension	Unit
1	Total Area of Extra Widening	ew_area	7961.000	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	26.180	percentage



RCC Cover Drain

TCS Type	Net Length (m)	Side	Drain Length (m)
TCS-1	1283.9	Both side	2568
Total Length=			2568

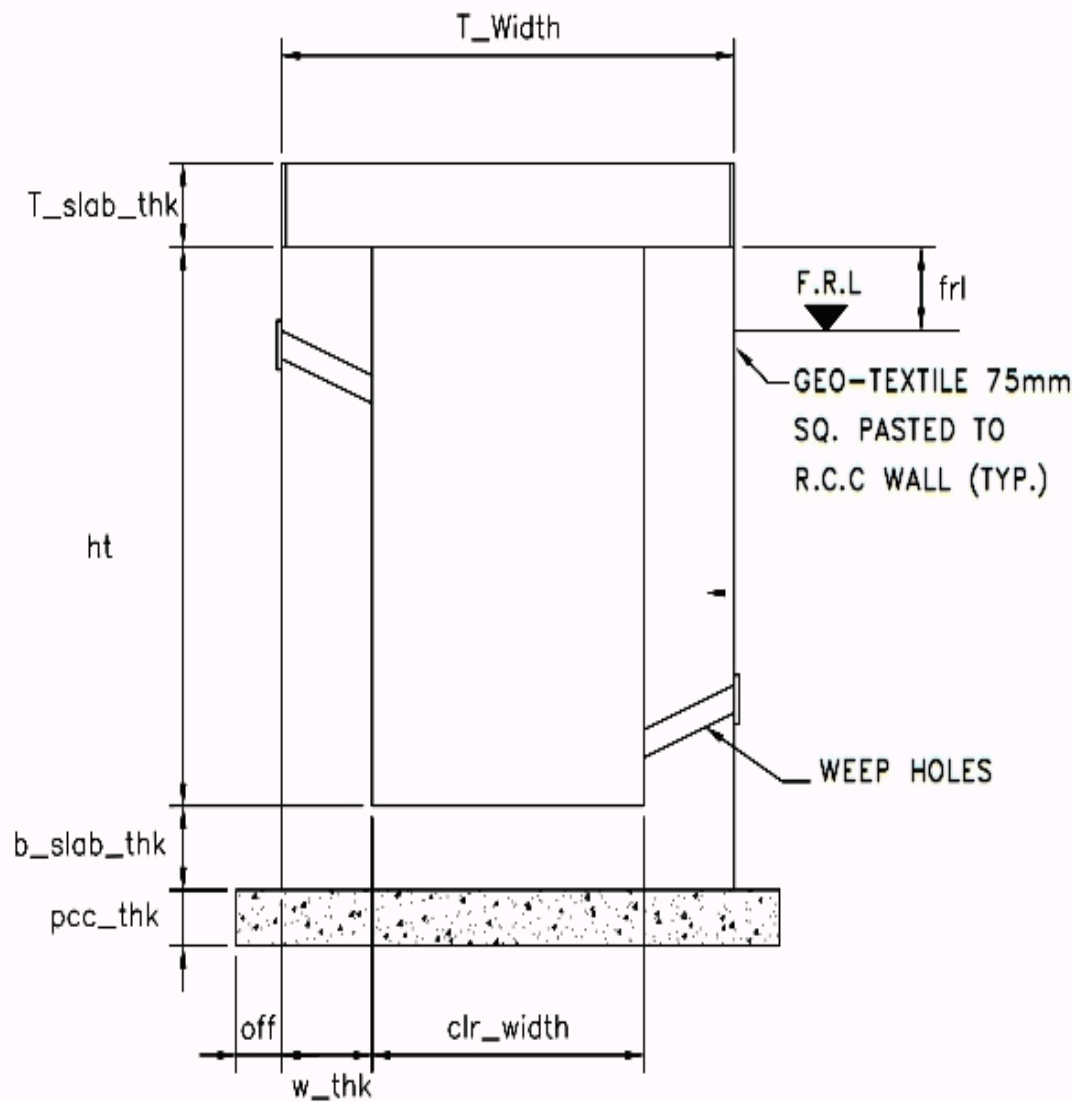


Variable Declaration

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	2568.000	m
9	Reinforcement Per Cum RCC	s	0.050	MT/Cum RCC
10	Finished Road Level	fri	0.300	m

Variable Declaration



RR Masonary Trapezoidal Drain :-

TCS Type	Net Length(m)	Side	Total Length (m)
TCS-2	5285.84	Single side	5286
TCS-4	2950.5	Single side	2951
TCS-6	1975	Both side	3950
TCS-7	897.4	Single side	897
TCS-8	2994.6	Both side	5989
TCS-9	597.3	Single side	597
TCS-10	150	Both side	300
TCS-11	900	Single side	900
Total length =			20870

Length of Side Drain	20870 m
Length of catch water Drain=	2087.024 m
Length of Outlet=	2087 m
Total Length of Drain=	25044 m

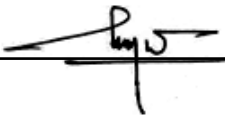
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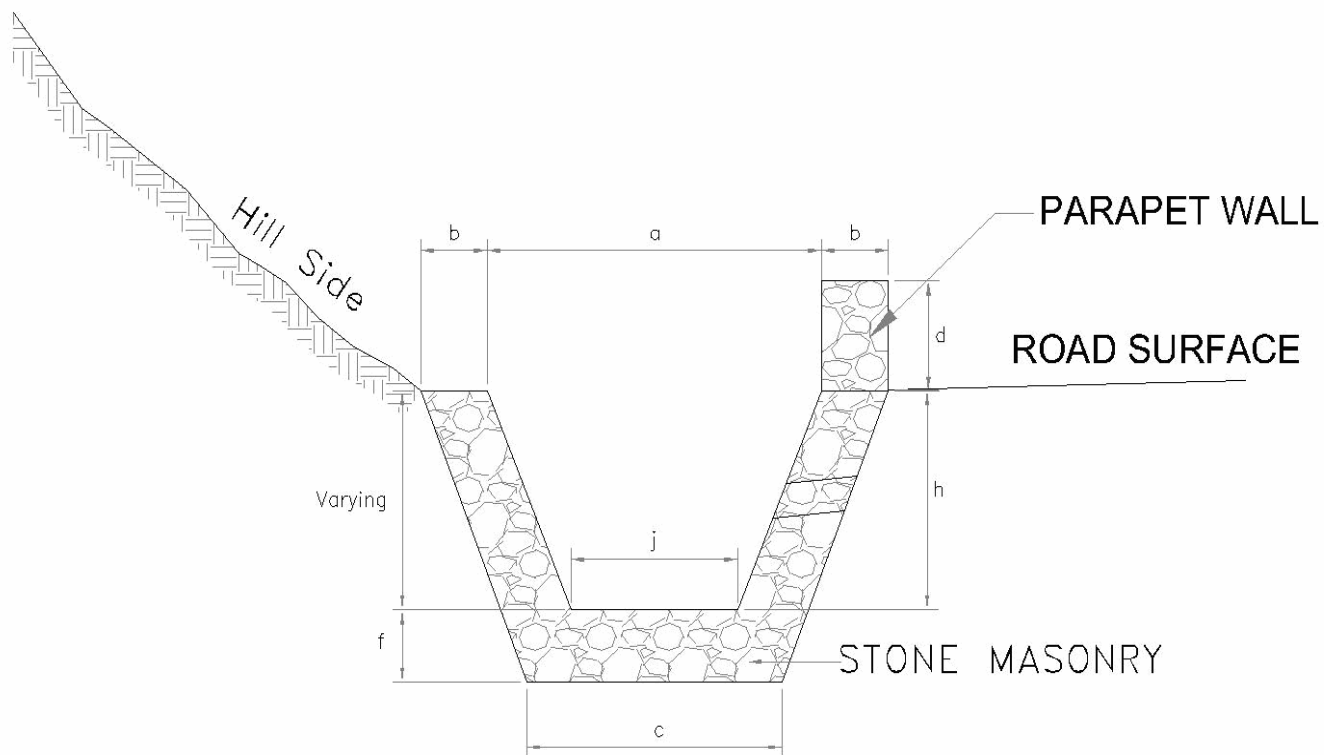
Variable Declaration

RR Masonry Trapezoidal Drain

Sl 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	25044.000	m



Variable Declaration



SECTION OF STONE MASONRY TRAPEZOIDAL DRAIN

Breast Wall

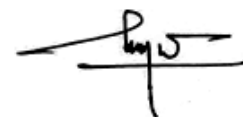
TCS Type	Total Length (m)	Side	Net Length (m)
TCS-3	147	Hill	147
TCS-11	150	Hill	150
TCS-12	100	Both	200
TCS-11	750	Hill	750

Total=

1247

Total Length of Breast Wall=

1247 m

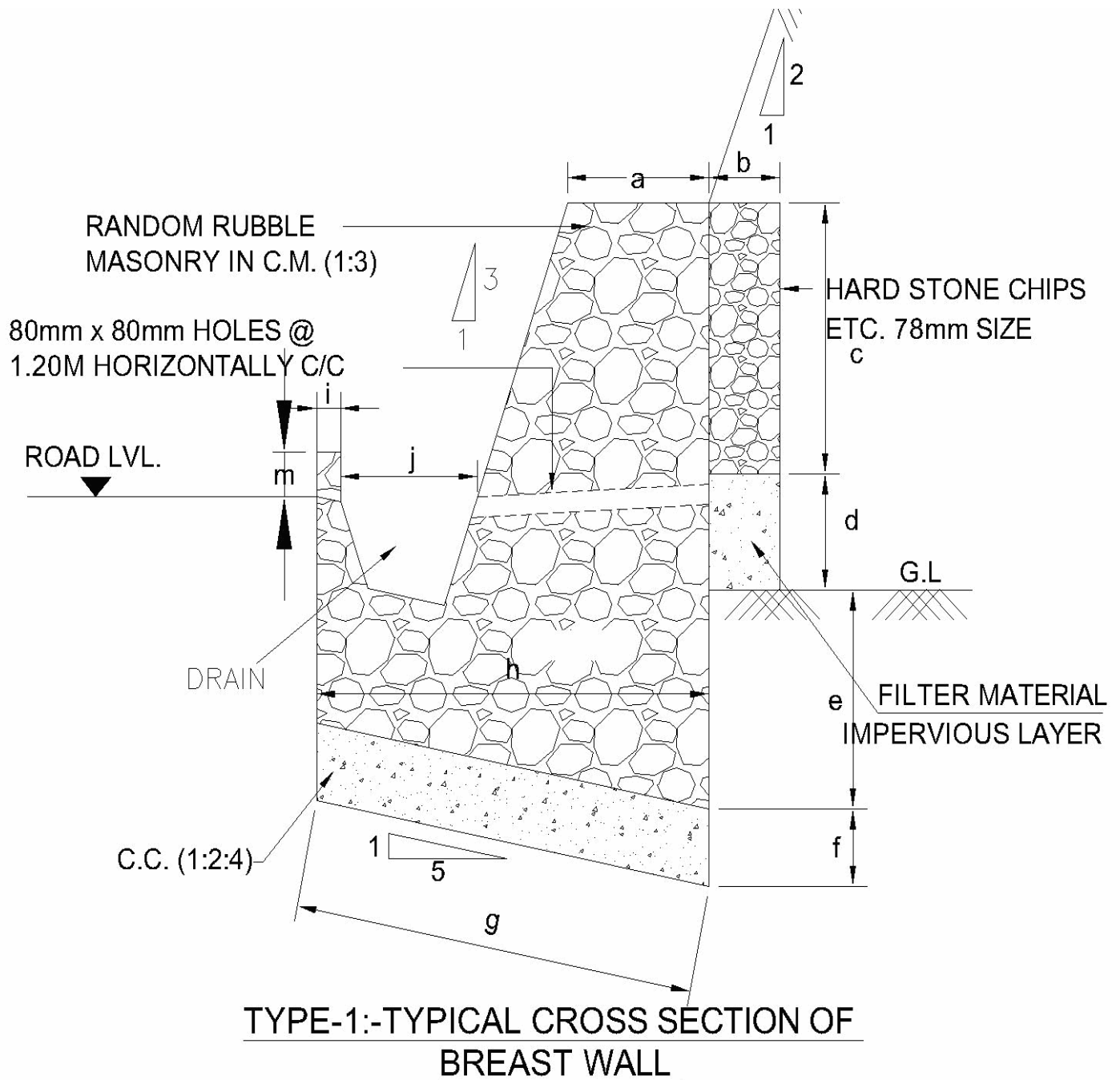


Variable Declaration

Breast Wall

Sl 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	1247.000	m
12	Percentage of Earthwork in Ordinary Rock(20%)	p	0.200	
13	From Diagram	m	0.300	m

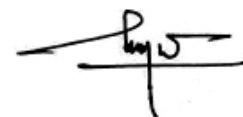
Variable Declaration



RETAINING WALL

Chainage		Side	Avg. Height (m)	CD Length (m)	Total Length (m)	Net Length (m)	TCS
From	To						
56975	57225	Valley	3	2.7	250	247.3	TCS-4
57525	57575	Valley	3		50	50	TCS-4
57675	57725	Valley	1.5		50	50	TCS-4
58175	58225	Valley	2		50	50	TCS-4
58275	58525	Valley	3	2.7	250	247.3	TCS-4
60225	60325	Valley	4	2.7	100	97.3	TCS-4
60325	60575	Both	4	3.96	500	492.08	TCS-14
60775	61025	Valley	1.5	2.6	250	247.4	TCS-4
62675	63325	Valley	1.5	7.9	650	642.1	TCS-4
63525	63625	Valley	4		100	100	TCS-4
63675	63875	Valley	2	2.6	200	197.4	TCS-4
64925	65175	Valley	3	2.6	250	247.4	TCS-4
65275	65525	Valley	4	2.7	250	247.3	TCS-4
65925	66075	Valley	3	2.7	150	147.3	TCS-4
67975	68175	Valley	3		200	200	TCS-13
68375	68425	Valley	4		50	50	TCS-4
70025	70075	Valley	3		50	50	TCS-9
70175	70225	Valley	3		50	50	TCS-9
70575	70725	Valley	3		150	150	TCS-9
70875	71025	Valley	2	2.7	150	147.3	TCS-9
71675	71775	Valley	2		100	100	TCS-9
71825	71925	Valley	3		100	100	TCS-9
73025	73175	Valley	3	2.6	150	147.4	TCS-4
73525	73575	Valley	4	2.7	50	47.3	TCS-4
Total=				41.16	4150	4105	

Length of 1.5m Retaining Wall= 940
 Length of 2.0m Retaining Wall= 495
 Length of 3.0m Retaining Wall= 1637
 Length of 4.0m Retaining Wall= 1034

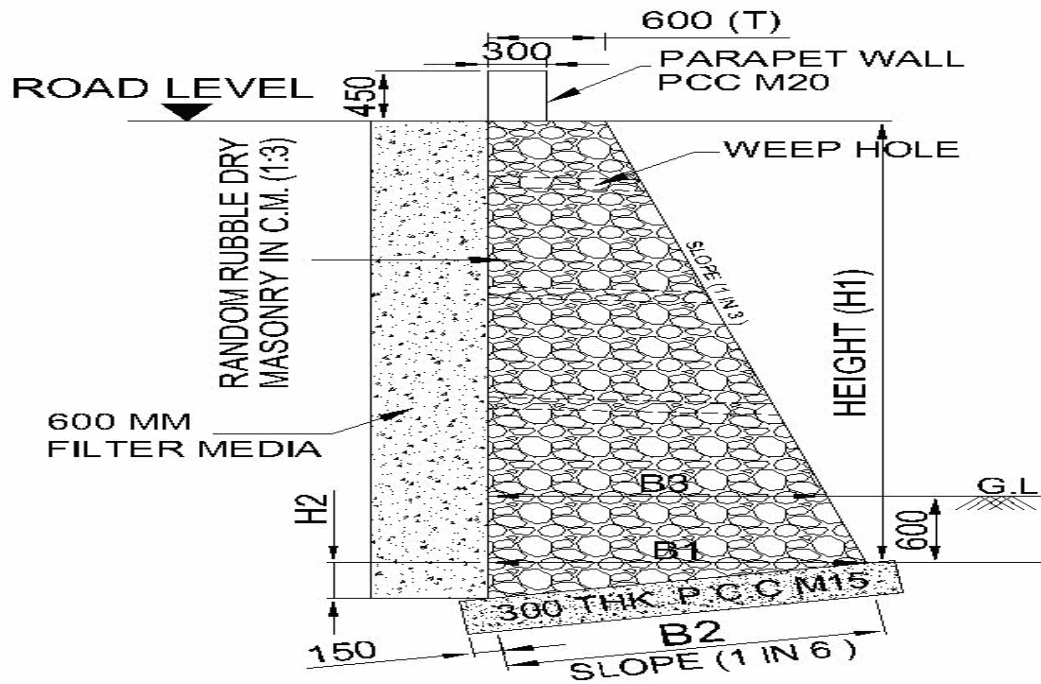



Variable Declaration

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	940.000	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



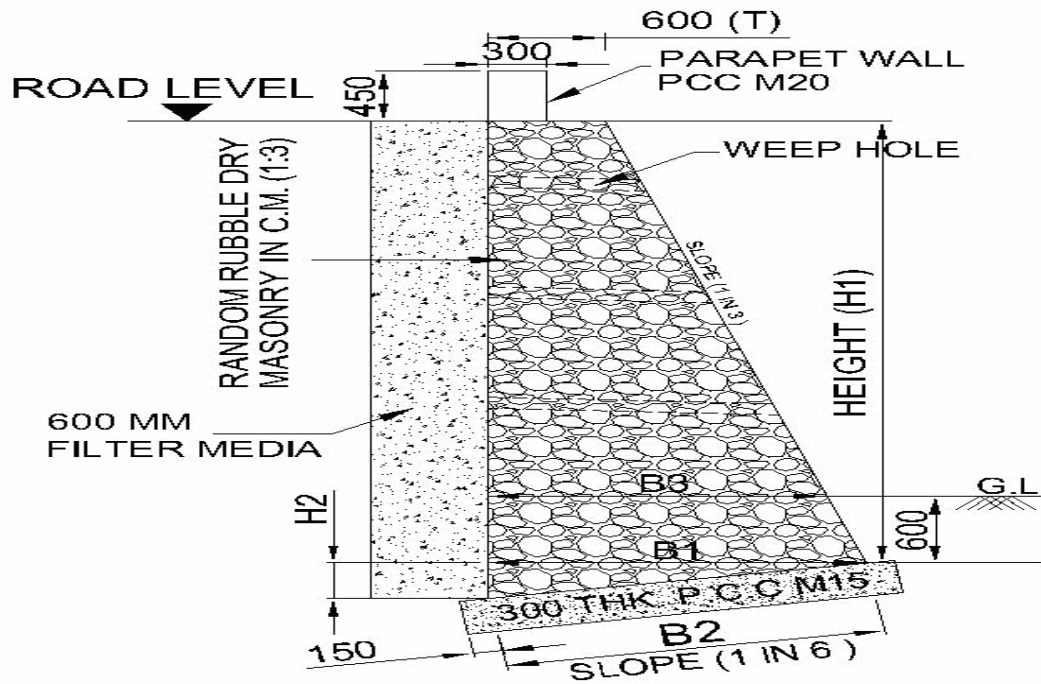
TYPICAL CROSS SECTION OF
RETAINING WALL (1.5M TO 4.0M HIGHT)
(SCALE 1:50)

Variable Declaration

Retaining Wall 2.0m

Sl 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	495.000	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



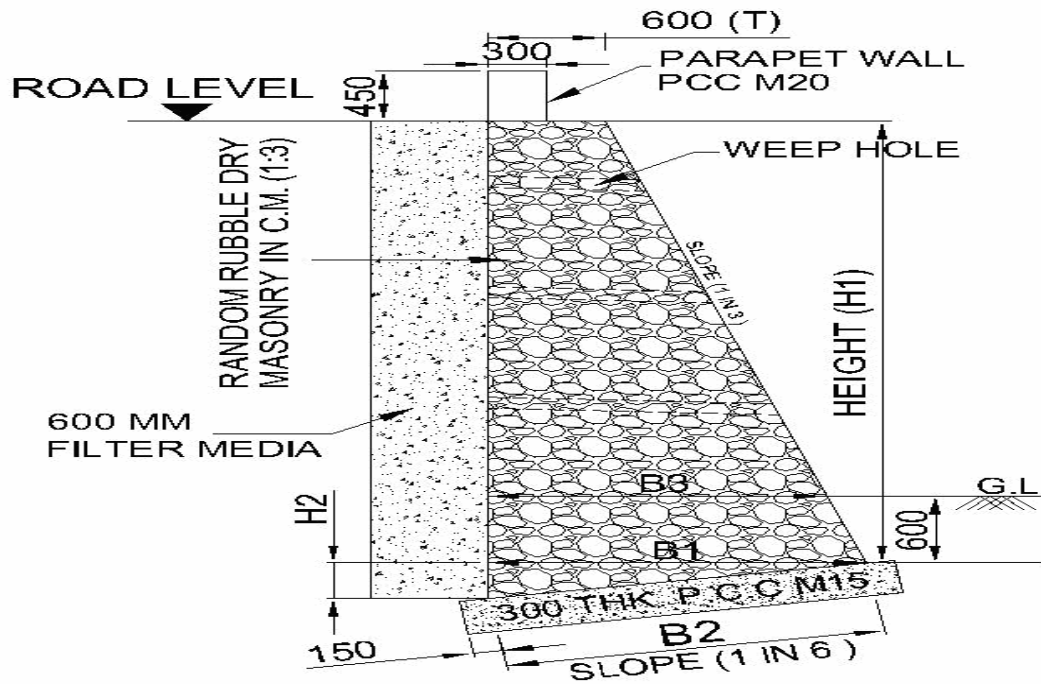
**TYPICAL CROSS SECTION OF
RETAINING WALL (1.5M TO 4.0M HIGH)**
(SCALE 1:50)

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	1637.000	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



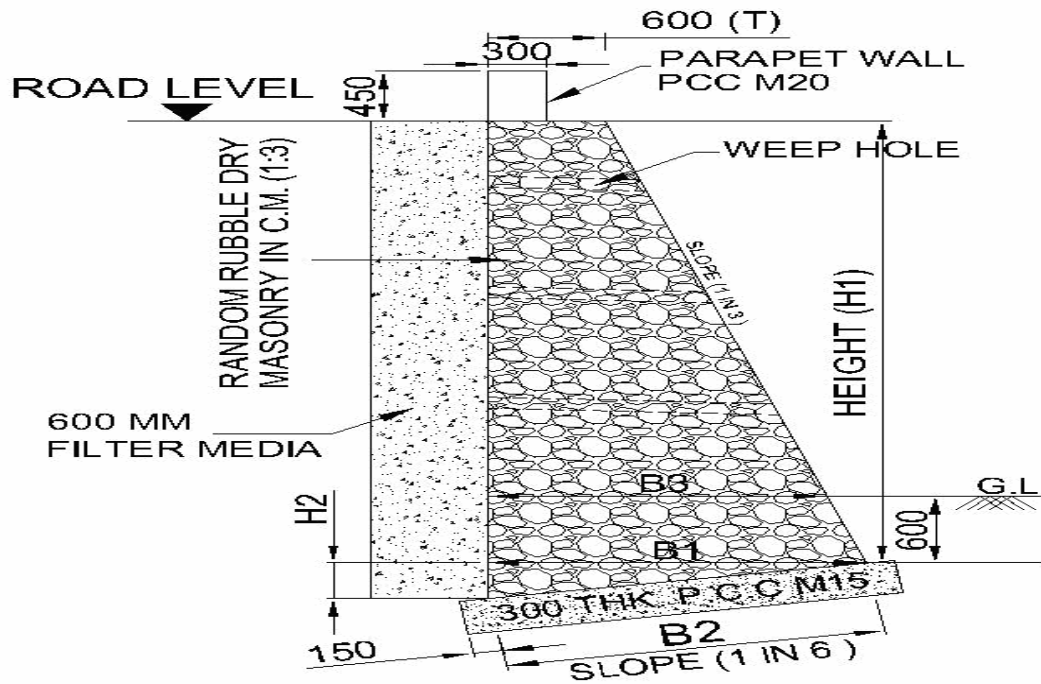
**TYPICAL CROSS SECTION OF
RETAINING WALL (1.5M TO 4.0M HIGH)**
(SCALE 1:50)

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	$H2 = B1.\tan Z$	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	1034.000	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

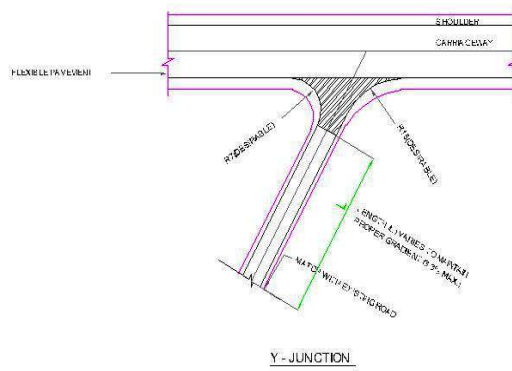
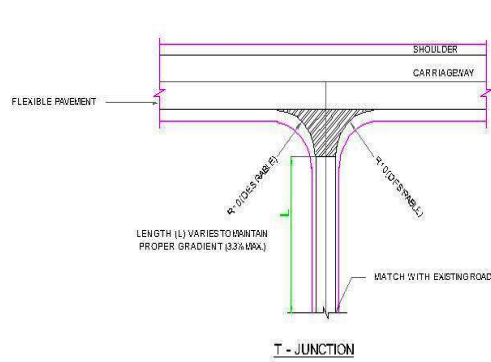
Variable Declaration



TYPICAL CROSS SECTION OF
RETAINING WALL (1.5M TO 4.0M HIGHT)
(SCALE 1:50)

Minor Junction

Minor Junction			
Sl No	Design Chainage (km)	Junction Type	Type
1	58.5	Y	3-legged
2	59	Y	3-legged
3	59.01	Y	3-legged
4	59.6	Y	3-legged
5	60.51	Y	3-legged
6	61.9	Y	3-legged
7	64	Y	3-legged
8	64.15	Y	3-legged





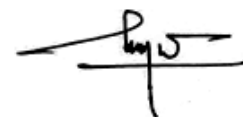


Junction Type-2

Hatch Area= $(3.5 \times 5) + (0.5 \times 5 \times 5) + (0.5 \times 7.5 \times 7.5) = 58.13 \text{ sqm}$
Existing Road Area= $10 \times 3.75 = 37.5 \text{ sqm}$
Total Area= 96 sqm
(Note: L=10m)

Quantity Calculation for Minor Junction

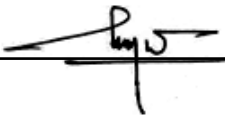
Junction-Type	Total No.	Each Junction area (sqm)	Total area (sqm)
Y-Type	8	96	765
Total	8		765



Variable Declaration

Minor Junction

Sl No	Variable Description	Variable	Dimension	Unit
1	Total_area	tot_area	765.000	area
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	26.180	percentage

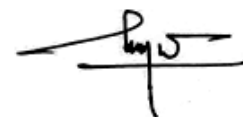


PASSENGER SHELTER

Chainage of Passenger Shelter

<i>Sl. No.</i>	<i>Chainage</i>	<i>Side</i>	<i>Total No.</i>
4	56+960	Both side	2
5	59+590	Both side	2
6	63+420	Both side	2
7	71+050	Right side	1
8	72+400	Right side	1

Total Number of Bus Bay = 8 No



Variable Declaration

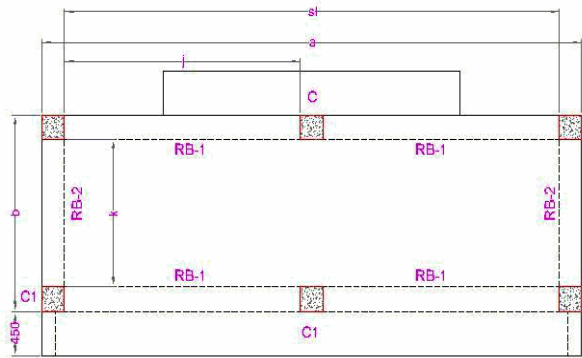
Passenger Shelter

Sl No	Variable Description	Variable	Dimension	Unit
1	No of Passenger Shelter	n	8.000	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

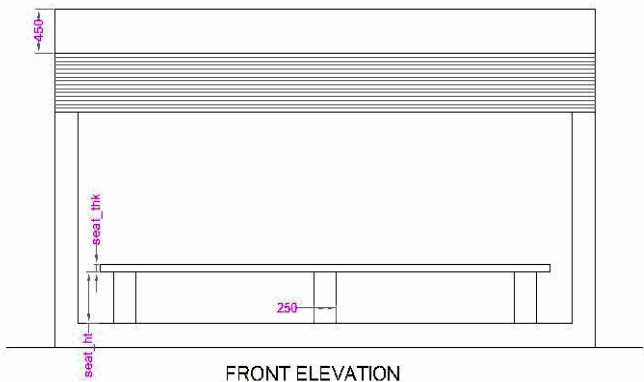
Variable Declaration

37	Thickness of Roof slab	roof_thk	0.110	m
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

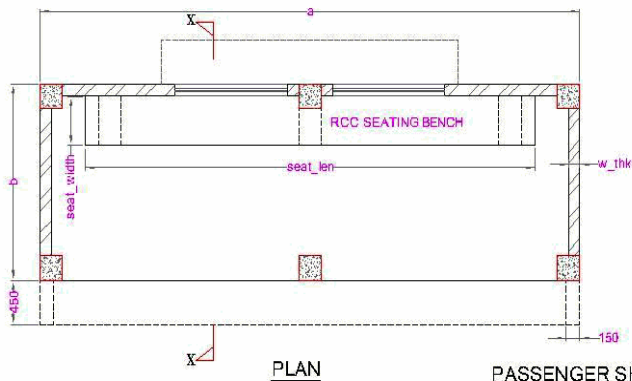
Variable Declaration



STRUCTURAL ARRANGEMENT PLAN

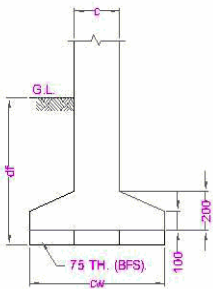


FRONT ELEVATION

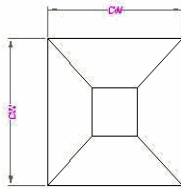


PLAN

PASSENGER SHELTER

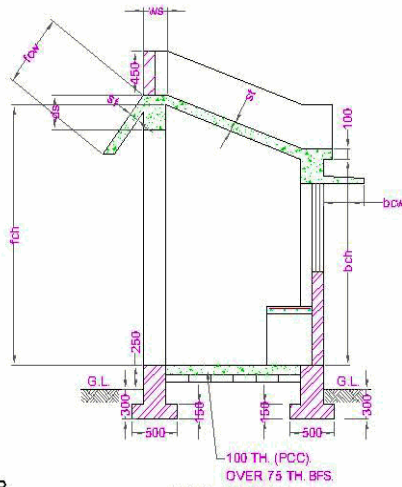


SECTION



PLAN

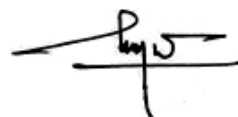
COLUMN FOUNDATION DETAILS



SECTION X-X

Traffic Signs and Other Appurtenance

Summary Of Traffic Signs			
Total No of Street Light=	106	Nos	Bill No- 06, Sl. No- 17
Kilometer stones=	15	Nos	Bill No- 06, Sl. No- 2
5th Kilometer stones=	4	Nos	Bill No- 06, Sl. No- 3
Boundary Stones=	184	Nos	Bill No- 06, Sl. No- 5
Delineators (100 cm long and circular s	1700	Nos	Bill No- 06, Sl. No- 14
Road Stud=	8511	Nos	Bill No- 06, Sl. No- 16
900 mm Octagonal	8	Nos	Bill No- 06, Sl. No- 10
600 mm circular	71	Nos	Bill No- 06, Sl. No- 7
900 mm Tringular	286	Nos	Bill No- 06, Sl. No- 6
800 mm x 600 mm rectangular	10	Nos	Bill No- 06, Sl. No- 8
500x600 Rectangular (Chevron)	471	Nos	Bill No- 06, Sl. No- 2
450 mm x 600 mm rectangular	136	Nos	Bill No- 06, Sl. No- 9
Direction Sign < 0.9 sqm	14.4	sqm	Bill No- 06, Sl. No- 11
Direction Sign > 0.9 sqm	16	sqm	Bill No- 06, Sl. No- 12
Convex Mirror for Blind Curve	60	Nos	Bill No- 06, Sl. No- 18




Traffic Signs and Other Appurtenance

Sl No	Type	IRC-67 2012 Specification	Dimension	Chainage / Location	No	Remarks
1	Right Hand Side Curve	fig 15.02	900 mm Tringular	Right Hand Side Curve: 56.895, 57.176, 57.860, 58.250, 58.862, 59.099, 59.396, 60.180, 60.914, 61.797, 62.018, 62.258, 62.331, 63.297, 63.684, 63.896, 64.100, 64.355, 64.574, 64.820, 65.317, 65.456, 65.570, 65.627, 66.760, 67.065, 67.287, 67.428, 67.540, 67.662, 67.969, 68.494, 69.909, 70.235, 70.387, 70.740, 70.991, 71.393, 71.920, 72.009, 72.077, 73.008, 73.540, 73.700, 73.780, 73.897	92	@ 2per location
2	Left Hand Side Curve	fig 15.01	900 mm Tringular	Left hand Side Curve : 57.030, 57.347, 57.530, 58.030, 58.562, 58.738, 58.977, 59.218, 59.328, 59.460, 59.959, 60.077, 61.071, 61.470, 61.578, 61.740, 61.909, 62.080, 62.189, 62.437, 62.585, 63.474, 63.766, 64.057, 64.178, 64.280, 64.423, 64.981, 65.132, 66.808, 66.895, 66.960, 67.029, 67.097, 67.255, 67.376, 68.387, 68.963, 69.815, 70.294, 70.917, 71.212, 71.291, 71.760, 72.547, 73.640, 74.860, 74.980,	98	@ 2per location
3	Built-up area	fig 15.35	900 mm Tringular	Built Up area- 4 (58.790, 60.060, 74.850, 75.000)	8	@ 2per location
4	School	fig 15.34	900 mm Tringular	School- 60.660	2	@ 2per location
7	Side road	fig 15.09 & 15.10	900 mm Tringular	Side Road- 9 (ch.58.500, 59.000, 59.010, 59.600, 60.510, 61.900, 64.000, 64.150)	16	@ 2per location
8	Pedestain Crossing		900 mm Tringular	Bus bay- (56.960, 59.590, 63.420, 71.050, 72.400) Side Road- (ch.58.500, 59.000, 59.010, 59.600, 60.510, 61.900, 64.000, 64.150)	24	@ 2per location
9	Bus Stop	fig 17.35	800x600 rectangular	56.960, 59.590, 63.420, 71.050, 72.400	10	@ 2per location
10	Direction Sign	Fig 16.04	<.0.9 sqm	Side Road-(ch.58.500, 59.000, 59.010, 59.600, 60.510, 61.900, 64.000, 64.150)	16	@ 2per location
11	Direction Sign	Fig 16.06	>0.9 sqm	Built Up area- 58.790, 60.060, 74.850, 75.000	8	@ 2per location
12	Hazard Marker	fig 15.76 & fig 15.77	900x300 mm rectangular	Culvert- 57.125, 57.426, 57.75, 58.025, 58.435, 58.732, 58.985, 59.298, 59.495, 59.776, 59.975, 60.075, 60.26, 60.4, 60.805, 62.672, 62.8, 62.995, 63.212, 63.815, 64.065, 64.168, 64.222, 64.315, 64.44, 64.515, 64.668, 64.914, 65.175, 65.27, 65.433, 65.708, 65.952, 66.51, 68.35, 69.64, 70.28, 70.912, 72.486, 73.05, 73.285, 73.527, 73.63, 73.835, 74.158, 74.28, 74.376, 74.475, 74.628, 74.722)	200	@ 4 per structure
13	Stop Sign	fig 14.01	900 mm Octagonal	Side Road- (ch.58.500, 59.000, 59.010, 59.600, 60.510, 61.900, 64.000, 64.150)	8	@ 1per location
14	Speed limit	fig 14.37	600mm Cicular	Built Up area- 4 (58.790, 60.060, 74.850, 75.000,) Min Design Speed- 57.070, 58.443, 58.560, 59.650, 59.830, 60.250, 61.746, 62.785, 62.992, 65.700, 67.430, 68.167, 68.325, 68.715, 68.815, 69.088, 72.885, 74.526, 74.630	46	@ 2per location
15	Horn prohibited	fig 14.18	600mm Cicular	School- 60.660	2	@ 2per location
16	Rumble strip	fig 15.50	900 Tringular	Built Up area- (58.790, 60.060, 74.850, 75.000)	4	@ 1per location
17	Right & Left Hair Pin bend	fig 15.03 & 15.04	900 mm Tringular	58.350, 58.550, 61.100, 61.400, 62.650, 63.000, 68.050, 68.300, 68.600, 68.900, 69.950, 70.150, 70.450, 70.650, 70.750, 70.900, 71.050, 71.200, 71.500, 71.670, 72.100, 72.270, 72.400, 72.500, 72.600, 72.750, 72.800, 72.970, 73.180, 73.400	30	@ 1per location
18	Right & Left Reverse bend	Fig 15.05 & Fig 15.06	900 mm Tringular	59.500, 59.870, 69.000, 69.400, 69.460, 69.750	6	@ 1per location
19	Seriese of bends	Fig 15.07	900 mm Tringular	60.200, 60.800, 65.650, 66.700, 73.950, 74.850	6	@ 1per location
20	Convex Mirror for Blind Curve			58.400, 58.500, 61.200, 61.300, 62.750, 62.850, 68.130, 68.220, 68.700, 68.780, 70.030, 70.120, 70.520, 70.600, 70.800, 70.865, 71.100, 71.160, 71.565, 71.540, 72.140, 72.220, 72.420, 72.510, 72.630, 72.710, 72.840, 72.910, 72.250, 72.320	60	@ 2per location

[Signature]



21	Restriction Ends	Fig 14.40	600 mm circular	Built Up area- 4 (58.790, 60.060, 74.850, 75.000,) Min Design Speed- 57.070, 58.443, 58.560, 59.650, 59.830, 60.250, 61.746, 62.785, 62.992, 65.700, 67.430, 68.167, 68.325, 68.715, 68.815, 69.088, 72.885, 74.526, 74.630	23	@ 1per location
22	Place/ City identification	Fig 16.06	Direction Sign > 0.9 sqm	Built Up area- 4 (58.790, 60.060, 74.850, 75.000)	8	@ 2per location
23	National Highway route marker sign	Fig 20.02	450x600 mm Rectangular plate	1. Built-up a) 58.790 to 60.060= $\{(1270/150)+1\} \times 2$ = Approx 18 nos, b) 74.850 to 75.000= $\{(150/150)+1\} \times 2$ = Approx 4 nos., 2. Junction (one number per junction) a) 8 (ch 58.500, 59.000, 59.010, 59.600, 60.510, 61.900, 64.000, 64.150) So, 8 no. 3. For Through Traffic (Considering one number per 1 km) So, $\{(18.160 \text{ km}/1)+1\} \times 2 = 38 \text{ nos}$	136	@ 2per location

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SUMMARY				
90 cm equilateral triangle		286	nos	...Bill No- 06, Sl. No- 5
Stop Sign (90 cm high octagon)		8	nos	...Bill No- 06, Sl. No- 8
60 cm circular		71	nos	...Bill No- 06, Sl. No- 6
80 cm x 60 cm rectangular		10	nos	...Bill No- 06, Sl. No- 7
45 cm x 60 cm rectangular		136	nos	
Direction Sign	<.0.9 sqm	14.4	nos	...Bill No- 06, Sl. No- 9
Direction Sign	>0.9 sqm	16	nos	...Bill No- 06, Sl. No- 10
Hazard Marker		200	nos	...Bill No- 06, Sl. No- 12
Convex Mirror for Blind Curve		60	nos	...Bill No- 06, Sl. No- 16

Calculation of km Stone, Hectometer Stone and Boundary Stone

Item	Remarks	Nos
Kilometer stones	Total KM Stone- No. of 5th KM stone	15
	(km stone 5th, 10th, 15th, 20th etc)	4
Boundary stones	(Total Lengthx5x2) + 2x1	184

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Traffic Signs and Other Appurtenance

CALCULATION FOR STREET LIGHTING

Street light in Built Up Location:

TCS Type	Length	Length (m)
TCS-1	1283.9	2567.80
TCS-10	150	300.00
Total =		2867.8

Total length = 2868 m

Assuming , street lights @= 50m interval

for 2868 m 58 nos

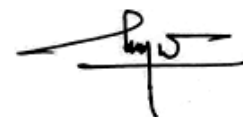
At Busbay location=
(@ 5 nos per Busbay) 40 nos

At Bridge Portion =
(@ 4 nos per Bridge) 4 nos

At Bridge Approach=
(@ 4 nos per Approach) 4 nos

Total nos of street light= 106 nos

Bill No- 06, Sl. No- 15



CALCULATION FOR DELINEATOR

Refer to BOQ Item Sl.No.- 6.7/c/v

Traffic Signs and Other Appurtenance Details of Delinotor (radius > 1000m)													
HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	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									
514	56892.708	56906.497	50	8	13.789	2	1	1	1	1	1	1	0
515	57024.977	57070.563	100	12	45.586	4	2	1	1	1	0	1	0
516	57169.648	57192.472	200	20	22.824	2	1	1	1	1	0	1	0
517	57342.496	57411.563	200	20	69.067	4	2	1	1	1	0	1	0
518	57525.745	57620.114	200	20	94.369	5	3	1	1	1	1	1	0
519	57853.865	57948.019	300	25	94.154	4	2	1	0	1	0	1	0
520	58024.573	58180.58	125	12	156.007	14	7	1	1	1	0	1	0
521	58246.944	58263.302	150	12	16.358	2	1	1	1	1	1	1	0
522	58380.816	58394.01	80	8	13.194	2	1	1	1	1	0	1	0
523	58443.674	58462.991	20	6	19.317	4	2	1	1	1	1	1	0
524	58559.302	58667.402	200	20	108.100	6	3	1	0	1	0	1	0
525	58732.993	58768.844	125	12	35.851	3	2	1	1	1	0	1	0
526	58858.496	58896.294	200	20	37.798	2	1	1	1	1	0	1	0
527	58972.347	59008.774	200	20	36.427	2	1	1	1	1	0	1	0
528	59095.308	59117.895	100	12	22.587	2	1	1	1	1	0	1	0
529	59211.11	59222.078	30	6	10.968	2	1	1	1	1	1	1	0
530	59322.263	59331.401	80	8	9.138	2	1	1	1	1	0	1	0
531	59390.523	59406.007	80	8	15.484	2	1	1	1	1	0	1	0
532	59456.425	59462.964	100	12	6.539	1	1	1	1	1	0	1	0
533	59533.703	59542.793	50	8	9.090	2	1	1	1	1	1	1	0
534	59651.471	59665.86	20	6	14.389	3	2	1	1	1	1	1	0
535	59748.607	59777.032	25	8	28.425	4	2	1	1	1	0	1	0
536	59825.385	59828.322	20	6	2.937	1	1	1	1	1	1	1	0
537	59954.794	59985.63	100	12	30.836	3	2	1	1	1	0	1	0
538	60071.69	60102.402	100	12	30.712	3	2	1	1	1	0	1	0



HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	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									
539	60175.973	60192.965	100	12	16.992	2	1	1	1	1	0	1	0
540	60248.096	60256.835	30	6	8.739	2	1	1	1	1	1	1	0
541	60377.183	60386.191	40	6	9.008	2	1	1	1	1	0	1	0
542	60439.157	60454.11	30	6	14.953	3	2	1	1	1	1	1	0
543	60548.248	60566.254	30	6	18.006	4	2	1	1	1	1	1	0
544	60626.282	60642.812	30	6	16.530	3	2	1	1	1	1	1	0
545	60769.843	60774.641	40	6	4.798	1	1	1	1	1	1	1	1
546	60910.234	60927.047	200	20	16.813	1	1	1	1	1	0	1	0
547	61065.836	61073.563	40	6	7.727	2	1	1	1	1	1	1	1
548	61236.391	61262.972	20	6	26.581	5	3	1	1	1	1	1	0
549	61378.72	61400.095	30	6	21.375	4	2	1	1	1	1	1	0
550	61467.063	61471.957	80	8	4.894	1	1	1	1	1	1	1	0
551	61571.937	61581.674	70	8	9.737	2	1	1	1	1	1	1	0
552	61736.168	61746.468	30	6	10.300	2	1	1	1	1	0	1	0
553	61790.85	61804.843	50	8	13.993	2	1	1	1	1	1	1	0
554	61905.438	61971.023	120	12	65.585	6	3	1	0	1	0	1	0
555	62012.72	62017.967	60	8	5.247	1	1	1	1	1	0	1	0
556	62074.671	62086.24	125	12	11.569	1	1	1	1	1	0	1	0
557	62185.47	62201.175	50	8	15.705	2	1	1	1	1	0	1	0
558	62254.892	62261.823	40	6	6.931	2	1	1	1	1	1	1	0
559	62329.124	62356.595	300	25	27.471	2	1	0	0	1	0	1	0
560	62432.202	62538.427	400	30	106.225	4	2	0	0	1	0	1	0
561	62579.886	62715.258	300	25	135.372	6	3	0	0	1	0	1	0
562	62785.505	62819.458	20	6	33.953	6	3	1	1	1	1	1	1
563	62992.349	63135.303	250	20	142.954	8	4	1	1	1	0	1	0
564	63291.735	63314.367	200	20	22.632	2	1	1	1	1	0	1	0
565	63472.759	63639.413	250	20	166.654	9	5	1	0	1	0	1	0
566	63679.904	63717.757	100	12	37.853	4	2	0	1	1	0	1	0
567	63761.761	63848.433	300	25	86.672	4	2	0	0	1	0	1	0
568	63890.577	63900.212	30	6	9.635	2	1	1	1	1	1	1	1
569	64051.745	64073.132	300	25	21.387	1	1	1	0	1	0	1	0
570	64096.814	64114.798	100	12	17.984	2	1	0	1	1	0	1	0
571	64170.663	64179.781	30	6	9.118	2	1	1	1	1	1	1	0



HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	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									
572	64274.783	64295.082	300	25	20.299	1	1	1	0	1	0	1	0
573	64350.024	64359.476	80	8	9.452	2	1	1	1	1	0	1	0
574	64417.049	64440.486	80	8	23.437	3	2	1	1	1	1	1	0
575	64570	64593.095	100	12	23.095	2	1	1	1	1	1	1	0
576	64814.661	64835.461	50	8	20.800	3	2	1	1	1	1	1	0
577	64975.874	64990.25	200	20	14.376	1	1	1	1	1	0	1	0
578	65128.886	65199.774	40	6	70.888	12	6	1	1	1	1	1	0
579	65312.837	65342.036	200	20	29.199	2	1	1	1	1	0	1	0
580	65452.12	65486.791	50	8	34.671	5	3	1	1	1	1	1	0
581	65569.43	65580.226	40	6	10.796	2	1	1	1	1	0	1	0
582	65620.356	65644.912	200	20	24.556	2	1	0	0	1	0	1	0
583	65698.647	65705.838	20	6	7.191	2	1	1	1	1	0	1	0
584	65763.068	65766.874	35	6	3.806	1	1	1	1	1	0	1	0
585	65806.718	65815.686	35	6	8.968	2	1	1	1	1	0	1	0
586	65863.94	65870.434	25	8	6.494	1	1	1	1	1	0	1	0
587	65911.516	65915.689	20	6	4.173	1	1	1	1	1	0	1	0
588	65956.672	65961.256	20	6	4.584	1	1	1	1	1	0	1	0
589	65999.53	66016.07	40	6	16.540	3	2	1	1	1	1	1	0
590	66091.604	66101.054	30	6	9.450	2	1	1	1	1	1	1	0
591	66186.741	66186.992	40	6	0.251	1	1	1	1	1	0	1	0
592	66214.15	66235.646	80	8	21.496	3	2	0	0	1	0	1	0
593	66257.48	66259.552	20	6	2.072	1	1	1	1	1	1	1	0
594	66320.387	66323.945	30	6	3.558	1	1	1	1	1	0	1	0
595	66369.987	66374.03	30	6	4.043	1	1	1	1	1	1	1	0
597	66495.916	66524.955	20	6	29.039	5	3	1	1	1	0	1	0
598	66574.17	66584.248	50	8	10.078	2	1	1	1	1	0	1	0
599	66644.104	66685.467	60	8	41.363	6	3	1	1	1	0	1	0
600	66754.671	66780.497	170	12	25.826	3	2	1	0	1	0	1	0
601	66801.497	66819.614	170	12	18.117	2	1	0	1	1	0	1	0
602	66890.144	66903.962	30	6	13.818	3	2	1	1	1	0	1	0
603	66956.307	66978.875	40	6	22.568	4	2	1	1	1	0	1	0
604	67024.099	67038.249	100	12	14.150	2	1	1	0	1	0	1	0
605	67059.992	67062.917	50	8	2.925	1	1	0	0	1	0	1	0



HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	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									
606	67090.68	67100.885	100	12	10.205	1	1	0	1	1	1	1	0
607	67251.19	67264.719	100	12	13.529	2	1	1	0	1	0	1	0
608	67282.35	67311.723	100	12	29.373	3	2	0	1	1	0	1	0
609	67371.833	67400.355	80	8	28.522	4	2	1	0	1	0	1	0
610	67424.62	67428.762	50	8	4.142	1	1	0	1	1	1	1	0
611	67538.457	67599.709	300	25	61.252	3	2	1	0	1	0	1	0
612	67657.653	67718.215	500	35	60.562	2	1	0	1	1	0	1	0
613	67965.41	67979.347	125	12	13.937	2	1	1	1	1	0	1	0
614	68086.467	68092.19	150	12	5.723	1	1	1	1	1	0	1	0
615	68167.203	68206.659	20	6	39.456	7	4	1	1	1	0	1	0
616	68247.412	68276.21	80	8	28.798	4	2	1	0	1	0	1	0
617	68292.946	68324.471	80	8	31.525	4	2	0	1	1	0	1	0
618	68381.582	68404.682	300	25	23.100	1	1	0	0	1	0	1	0
619	68490.138	68506.9	150	12	16.762	2	1	1	1	1	0	1	0

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HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	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									
620	68621.981	68656.839	100	12	34.858	3	2	1	1	1	0	1	0
621	68715.351	68753.904	20	6	38.553	7	4	1	1	1	1	1	0
622	68852.791	68854.122	50	8	1.331	1	1	1	1	1	1	1	0
623	68957.516	68999.584	300	25	42.068	2	1	1	0	1	0	1	0
624	69088.427	69102.835	40	6	14.408	3	2	1	1	1	1	1	0
625	69171.805	69209.912	20	6	38.107	7	4	1	1	1	1	1	0
626	69298.311	69329.584	20	6	31.273	6	3	1	1	1	1	1	0
627	69391.697	69420.033	125	12	28.336	3	2	1	1	1	1	1	1
630	69715.968	69742.832	80	8	26.864	4	2	1	1	1	0	1	0
631	69810.06	69842.367	40	6	32.307	6	3	1	1	1	1	1	0
632	69904.283	69915.246	60	8	10.963	2	1	1	1	1	1	1	0
633	69999.276	70009.555	25	8	10.279	2	1	1	1	1	1	1	0
635	70149.446	70166.144	20	6	16.698	3	2	1	1	1	1	1	0
636	70232.345	70237.482	50	8	5.137	1	1	1	1	1	0	1	0
637	70289.179	70295.731	40	6	6.552	2	1	1	1	1	1	1	0
638	70381.2	70391.913	50	8	10.713	2	1	1	1	1	0	1	0
639	70427.389	70452.942	170	12	25.553	3	2	0	1	1	1	1	0
641	70628.596	70654.949	80	8	26.353	4	2	1	1	1	1	1	0
642	70738.062	70748.146	30	6	10.084	2	1	1	1	1	1	1	0
643	70813.074	70849.757	20	6	36.683	7	4	1	1	1	1	1	0
644	70911.21	70922.583	50	8	11.373	2	1	1	1	1	0	1	0
645	70988.693	70991.814	40	6	3.121	1	1	1	1	1	1	1	0
646	71113.774	71150.403	20	6	36.629	7	4	1	1	1	1	1	0
647	71208.858	71217.752	100	12	8.894	1	1	1	1	1	0	1	0
648	71289.381	71292.287	50	8	2.906	1	1	1	1	1	1	1	0
649	71387.827	71397.648	60	8	9.821	2	1	1	1	1	1	1	0
650	71504.948	71516.021	80	8	11.073	2	1	1	1	1	0	1	0
651	71577.836	71615.741	20	6	37.905	7	4	1	1	1	0	1	0
652	71668.917	71679.085	30	6	10.168	2	1	1	1	1	1	1	1
654	71916.356	71939.659	80	8	23.303	3	2	1	1	1	0	1	0
655	72003.439	72016.401	50	8	12.962	2	1	1	1	1	0	1	0
656	72072.656	72083.486	40	6	10.830	2	1	1	1	1	1	1	1



HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	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									
658	72253.64	72263.27	50	8	9.630	2	1	1	1	1	1	1	0
659	72341.884	72352.962	50	8	11.078	2	1	1	1	1	1	1	0
660	72446.665	72483.343	20	6	36.678	7	4	1	1	1	1	1	0
661	72541.344	72577.207	80	8	35.863	5	3	1	1	1	1	1	0
662	72654.647	72688.512	20	6	33.865	6	3	1	1	1	0	1	0
663	72743.726	72769.109	80	8	25.383	4	2	1	1	1	1	1	0
664	72853.391	72882.721	20	6	29.330	5	3	1	1	1	1	1	0
665	73003.235	73099.253	65	8	96.018	13	7	1	1	1	1	1	0
666	73256.858	73310.813	30	6	53.955	9	5	1	1	1	1	1	1
667	73536.46	73563.046	35	6	26.586	5	3	1	1	1	1	1	0
668	73634.718	73638.782	30	6	4.064	1	1	1	1	1	1	1	0
669	73698.158	73715.698	50	8	17.540	3	2	1	1	1	0	1	0
670	73775.952	73853.984	55	8	78.032	10	5	1	1	1	0	1	0
671	73891.894	73902.318	70	8	10.424	2	1	1	1	1	0	1	0
672	73955.353	73975.107	80	8	19.754	3	2	1	1	1	0	1	0
673	74018.937	74034.547	50	8	15.610	2	1	1	1	1	0	1	0
674	74095.335	74102.394	70	8	7.059	1	1	1	1	1	0	1	0
675	74149.406	74158.033	40	6	8.627	2	1	1	1	1	0	1	0
676	74207.378	74225.129	100	12	17.751	2	1	1	1	1	0	1	0
677	74274.716	74278.727	30	6	4.011	1	1	1	1	1	1	1	0
678	74336.594	74345.138	40	6	8.544	2	1	1	1	1	1	1	0
679	74469.704	74479.469	40	6	9.765	2	1	1	1	1	0	1	0
680	74526.817	74536.796	20	6	9.979	2	1	1	1	1	1	1	0
681	74614.25	74633.459	30	6	19.209	4	2	1	1	1	1	1	0
682	74717.328	74724.051	40	6	6.723	2	1	1	1	1	0	1	0
683	74781.513	74788.691	60	8	7.178	1	1	1	1	1	0	1	0
684	74855.674	74873.804	90	8	18.130	3	2	1	1	1	1	1	0
685	74980.729	75023.786	80	8	43.057	6	3	1	0	1	0	1	0
				TOTAL	=	510	291	148	143	165	70	165	8

Total No of Road Delineators =

1500 nos.

[Signature]

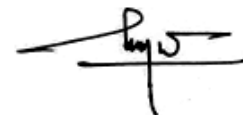


Traffic Signs and Other Appurtenance

Quantity Calculation for Road Stud

Traffic Signs and Other Appurtenance Details of Road stud

SL. No.	Description of section	START CHAINAGE	END CHAINAGE	Transition length	START CH. Road Stud	END CH. Road stud	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
1	Horizontal curve :: Cur	56892.708	56906.497		56872.708	56926.497	53.79	50	6	9	18
		57024.977	57070.563	15	56989.977	57105.563	115.59	100	6	20	40
		57169.648	57192.472	25	57124.648	57237.472	112.82	200	6	19	38
		57342.496	57411.563	20	57302.496	57451.563	149.07	200	6	25	50
		57525.745	57620.114	20	57485.745	57660.114	174.37	200	6	30	60
		57853.865	57948.019	20	57813.865	57988.019	174.15	300	6	30	60
		58024.573	58180.58	15	57989.573	58215.58	226.01	125	6	38	76
		58246.944	58263.302	40	58186.944	58323.302	136.36	150	6	23	46
		58380.816	58394.01	15	58345.816	58429.01	83.19	80	6	14	28
		58443.674	58462.991	15	58408.674	58497.991	89.32	20	6	15	30
		58559.302	58667.402		58539.302	58687.402	148.10	200	6	25	50
		58732.993	58768.844	15	58697.993	58803.844	105.85	125	6	18	36
		58858.496	58896.294	15	58823.496	58931.294	107.80	200	6	18	36
		58972.347	59008.774	25	58927.347	59053.774	126.43	200	6	22	44
		59095.308	59117.895	20	59055.308	59157.895	102.59	100	6	18	36
		59211.11	59222.078	15	59176.11	59257.078	80.97	30	6	14	28
		59322.263	59331.401	15	59287.263	59366.401	79.14	80	6	14	28
		59390.523	59406.007	15	59355.523	59441.007	85.48	80	6	15	30
		59456.425	59462.964	15	59421.425	59497.964	76.54	100	6	13	26
		59533.703	59542.793	20	59493.703	59582.793	89.09	50	6	15	30
		59651.471	59665.86	20	59611.471	59705.86	94.39	20	6	16	32
		59748.607	59777.032	15	59713.607	59812.032	98.42	25	6	17	34
		59825.385	59828.322	15	59790.385	59863.322	72.94	20	6	13	26
		59954.794	59985.63	15	59919.794	60020.63	100.84	100	6	17	34
		60071.69	60102.402	20	60031.69	60142.402	110.71	100	6	19	38
		60175.973	60192.965	20	60135.973	60232.965	96.99	100	6	17	34





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					
		60248.096	60256.835	20	60208.096	60296.835	88.74	30	6	15	30
		60377.183	60386.191	20	60337.183	60426.191	89.01	40	6	15	30
		60439.157	60454.11	20	60399.157	60494.11	94.95	30	6	16	32
		60548.248	60566.254	20	60508.248	60606.254	98.01	30	6	17	34
		60626.282	60642.812	20	60586.282	60682.812	96.53	30	6	17	34
		60769.843	60774.641	15	60734.843	60809.641	74.80	40	6	13	26
		60910.234	60927.047	15	60875.234	60962.047	86.81	200	6	15	30
		61065.836	61073.563	15	61030.836	61108.563	77.73	40	6	13	26
		61236.391	61262.972	15	61201.391	61297.972	96.58	20	6	17	34
		61378.72	61400.095	15	61343.72	61435.095	91.38	30	6	16	32
		61467.063	61471.957	25	61422.063	61516.957	94.89	80	6	16	32
		61571.937	61581.674		61551.937	61601.674	49.74	70	6	9	18
		61736.168	61746.468	25	61691.168	61791.468	100.30	30	6	17	34
		61790.85	61804.843	20	61750.85	61844.843	93.99	50	6	16	32
		61905.438	61971.023	15	61870.438	62006.023	135.58	120	6	23	46
		62012.72	62017.967	15	61977.72	62052.967	75.25	60	6	13	26
		62074.671	62086.24	15	62039.671	62121.24	81.57	125	6	14	28
		62185.47	62201.175	15	62150.47	62236.175	85.71	50	6	15	30
		62254.892	62261.823	20	62214.892	62301.823	86.93	40	6	15	30
		62329.124	62356.595	15	62294.124	62391.595	97.47	300	6	17	34
		62432.202	62538.427	20	62392.202	62578.427	186.23	400	6	32	64
	Horizontal curve :: Cu	62579.886	62715.258	15	62544.886	62750.258	205.37	300	6	35	70
		62785.505	62819.458	20	62745.505	62859.458	113.95	20	6	19	38
		62992.349	63135.303	25	62947.349	63180.303	232.95	250	6	39	78
		63291.735	63314.367		63271.735	63334.367	62.63	200	6	11	22
		63472.759	63639.413		63452.759	63659.413	206.65	250	6	35	70
		63679.904	63717.757		63659.904	63737.757	77.85	100	6	13	26
		63761.761	63848.433	20	63721.761	63888.433	166.67	300	6	28	56
		63890.577	63900.212	15	63855.577	63935.212	79.64	30	6	14	28
		64051.745	64073.132	40	63991.745	64133.132	141.39	300	6	24	48
		64096.814	64114.798	15	64061.814	64149.798	87.98	100	6	15	30
		64170.663	64179.781	20	64130.663	64219.781	89.12	30	6	15	30
		64274.783	64295.082		64254.783	64315.082	60.30	300	6	11	22
		64350.024	64359.476	30	64300.024	64409.476	109.45	80	6	19	38

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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					
		64417.049	64440.486		64397.049	64460.486	63.44	80	6	11	22
		64570	64593.095	20	64530	64633.095	103.10	100	6	18	36
		64814.661	64835.461	30	64764.661	64885.461	120.80	50	6	21	42
		64975.874	64990.25		64955.874	65010.25	54.38	200	6	10	20
		65128.886	65199.774	25	65083.886	65244.774	160.89	40	6	27	54
		65312.837	65342.036	25	65267.837	65387.036	119.20	200	6	20	40
		65452.12	65486.791	20	65412.12	65526.791	114.67	50	6	20	40
		65569.43	65580.226	40	65509.43	65640.226	130.80	40	6	22	44
		65620.356	65644.912	15	65585.356	65679.912	94.56	200	6	16	32
		65698.647	65705.838	25	65653.647	65750.838	97.19	20	6	17	34
		65763.068	65766.874	15	65728.068	65801.874	73.81	35	6	13	26
		65806.718	65815.686	25	65761.718	65860.686	98.97	35	6	17	34
		65863.94	65870.434	25	65818.94	65915.434	96.49	25	6	17	34
		65911.516	65915.689		65891.516	65935.689	44.17	20	6	8	16
		65956.672	65961.256	20	65916.672	66001.256	84.58	20	6	15	30
		65999.53	66016.07	15	65964.53	66051.07	86.54	40	6	15	30
		66091.604	66101.054	15	66056.604	66136.054	79.45	30	6	14	28
		66186.741	66186.992	15	66151.741	66221.992	70.25	40	6	12	24
		66214.15	66235.646	20	66174.15	66275.646	101.50	80	6	17	34
		66257.48	66259.552	15	66222.48	66294.552	72.07	20	6	13	26
		66320.387	66323.945	15	66285.387	66358.945	73.56	30	6	13	26
		66369.987	66374.03	15	66334.987	66409.03	74.04	30	6	13	26
	Horizontal curve :: Cu	66495.916	66524.955	15	66460.916	66559.955	99.04	20	6	17	34
		66574.17	66584.248		66554.17	66604.248	50.08	50	6	9	18
		66644.104	66685.467	15	66609.104	66720.467	111.36	60	6	19	38
		66754.671	66780.497	15	66719.671	66815.497	95.83	170	6	16	32
		66801.497	66819.614	15	66766.497	66854.614	88.12	170	6	15	30
		66890.144	66903.962	15	66855.144	66938.962	83.82	30	6	14	28
		66956.307	66978.875	15	66921.307	67013.875	92.57	40	6	16	32
		67024.099	67038.249	15	66989.099	67073.249	84.15	100	6	15	30
		67059.992	67062.917	20	67019.992	67102.917	82.93	50	6	14	28
		67090.68	67100.885		67070.68	67120.885	50.21	100	6	9	18
		67251.19	67264.719		67231.190	67284.719	53.53	100	6	9	18

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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 :: Cu	67282.35	67311.723	15	67247.350	67346.723	99.37	100	6	17	34
		67371.833	67400.355	15	67336.833	67435.355	98.52	80	6	17	34
		67424.62	67428.762		67404.62	67448.762	44.14	50	6	8	16
		67538.457	67599.709	15	67503.457	67634.709	131.25	300	6	22	44
		67657.653	67718.215		67637.653	67738.215	100.56	500	9	12	24
		67965.41	67979.347		67945.41	67999.347	53.94	125	6	9	18
		68086.467	68092.19		68066.467	68112.19	45.72	150	6	8	16
		68167.203	68206.659		68147.203	68226.659	79.46	20	6	14	28
	Horizontal curve ::	68247.412	68276.21	15	68212.412	68311.21	98.80	80	6	17	34
		68292.946	68324.471		68272.946	68344.471	71.53	80	6	12	24
		68381.582	68404.682		68361.582	68424.682	63.10	300	6	11	22
		68490.138	68506.9	15	68455.138	68541.9	86.76	150	6	15	30
		68621.981	68656.839	15	68586.981	68691.839	104.86	100	6	18	36
		68715.351	68753.904	20	68675.351	68793.904	118.55	20	6	20	40
		68852.791	68854.122		68832.791	68874.122	41.33	50	6	7	14
		68957.516	68999.584		68937.516	69019.584	82.07	300	6	14	28
		69088.427	69102.835		69068.427	69122.835	54.41	40	6	10	20
		69171.805	69209.912	15	69136.805	69244.912	108.11	20	6	19	38
	Curve radii upto 450 , spacing =6m.	69298.311	69329.584	20	69258.311	69369.584	111.27	20	6	19	38
		69391.697	69420.033	20	69351.697	69460.033	108.34	125	6	19	38
		69715.968	69742.832	40	69655.968	69802.832	146.86	80	6	25	50
		69810.06	69842.367		69790.06	69862.367	72.31	40	6	13	26
	Curve radii 451 to 750 , spacing =9m.	69904.283	69915.246	15	69869.283	69950.246	80.96	60	6	14	28
		69999.276	70009.555	20	69959.276	70049.555	90.28	25	6	16	32
		70149.446	70166.144	20	70109.446	70206.144	96.70	20	6	17	34
		70232.345	70237.482		70212.345	70257.482	45.14	50	6	8	16
	Curve radii 751 to 2000m & critical sections, spacing =18m	70289.179	70295.731	20	70249.179	70335.731	86.55	40	6	15	30
		70381.2	70391.913	20	70341.2	70431.913	90.71	50	6	16	32
		70427.389	70452.942		70407.389	70472.942	65.55	170	6	11	22
		70628.596	70654.949	25	70583.596	70699.949	116.35	80	6	20	40
		70738.062	70748.146	20	70698.062	70788.146	90.08	30	6	16	32
		70813.074	70849.757	15	70778.074	70884.757	106.68	20	6	18	36
		70911.21	70922.583	20	70871.21	70962.583	91.37	50	6	16	32
		70988.693	70991.814	20	70948.693	71031.814	83.12	40	6	14	28

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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					
		71113.774	71150.403	20	71073.774	71190.403	116.63	20	6	20	40
		71208.858	71217.752	25	71163.858	71262.752	98.89	100	6	17	34
		71289.381	71292.287	20	71249.381	71332.287	82.91	50	6	14	28
		71387.827	71397.648		71367.827	71417.648	49.82	60	6	9	18
		71504.948	71516.021	20	71464.948	71556.021	91.07	80	6	16	32
	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	71577.836	71615.741		71557.836	71635.741	77.90	20	6	13	26
		71668.917	71679.085	15	71633.917	71714.085	80.17	30	6	14	28
		71916.356	71939.659	20	71876.356	71979.659	103.30	80	6	18	36
		72003.439	72016.401	20	71963.439	72056.401	92.96	50	6	16	32
		72072.656	72083.486	25	72027.656	72128.486	100.83	40	6	17	34
		72253.64	72263.27	20	72213.64	72303.27	89.63	50	6	15	30
		72341.884	72352.962	15	72306.884	72387.962	81.08	50	6	14	28
		72446.665	72483.343	20	72406.665	72523.343	116.68	20	6	20	40
		72541.344	72577.207	20	72501.344	72617.207	115.86	80	6	20	40
		72654.647	72688.512	15	72619.647	72723.512	103.87	20	6	18	36
		72743.726	72769.109	20	72703.726	72809.109	105.38	80	6	18	36
		72853.391	72882.721	15	72818.391	72917.721	99.33	20	6	17	34
		73003.235	73099.253	20	72963.235	73139.253	176.02	65	6	30	60
		73256.858	73310.813	15	73221.858	73345.813	123.96	30	6	21	42
		73536.46	73563.046	20	73496.46	73603.046	106.59	35	6	18	36
		73634.718	73638.782	25	73589.718	73683.782	94.06	30	6	16	32
		73698.158	73715.698	20	73658.158	73755.698	97.54	50	6	17	34
		73775.952	73853.984	20	73735.952	73893.984	158.03	55	6	27	54
		73891.894	73902.318	20	73851.894	73942.318	90.42	70	6	16	32
		73955.353	73975.107	20	73915.353	74015.107	99.75	80	6	17	34
		74018.937	74034.547		73998.937	74054.547	55.61	50	6	10	20
		74095.335	74102.394	20	74055.335	74142.394	87.06	70	6	15	30
		74149.406	74158.033		74129.406	74178.033	48.63	40	6	9	18
		74207.378	74225.129	20	74167.378	74265.129	97.75	100	6	17	34
		74274.716	74278.727	20	74234.716	74318.727	84.01	30	6	15	30
		74336.594	74345.138	30	74286.594	74395.138	108.54	40	6	19	38
		74469.704	74479.469	30	74419.704	74529.469	109.76	40	6	19	38
		74526.817	74536.796	30	74476.817	74586.796	109.98	20	6	19	38
		74614.25	74633.459	20	74574.25	74673.459	99.21	30	6	17	34

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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					
		74717.328	74724.051	20	74677.328	74764.051	86.72	40	6	15	30
		74781.513	74788.691	15	74746.513	74823.691	77.18	60	6	13	26
		74855.674	74873.804	15	74820.674	74908.804	88.13	90	6	15	30
		74980.729	75023.786	20	74940.729	75063.786	123.06	80	6	21	42
2	Major/Minor Bridge	structure					6.00		9	1	2
3	Builtup sections						1284		18	72	144
Total=										2837	5674

Total no. of Road stud = 8511 no.

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CALCULATION FOR DELINEATOR

Refer to BOQ Item Sl.No.- 6.7/c/v

Traffic Signs and Other Appurtenance								
Details of Single Chevron Sign (radius > 50m)								
HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	Spacing before Curve (S)	Length	Nos in outside curve (s)	Nos in beginning of curve (2s)
				as per IRC:67-2012	as per IRC:67-2012			
514	56892.71	56906.497	50	15	30	13.789	1	1
515	57024.98	57070.563	100	20	40	45.586	3	2
516	57169.65	57192.472	200	30	60	22.824	1	1
517	57342.5	57411.563	200	30	60	69.067	3	2
518	57525.75	57620.114	200	30	60	94.369	4	2
519	57853.87	57948.019	300	45	90	94.154	3	2
520	58024.57	58180.58	125	30	60	156.007	6	3
521	58246.94	58263.302	150	30	60	16.358	1	1
522	58380.82	58394.01	80	20	40	13.194	1	1
523	58443.67	58462.991	20	15	30	19.317	2	1
524	58559.3	58667.402	200	30	60	108.1	4	2
525	58732.99	58768.844	125	30	60	35.851	2	1
526	58858.5	58896.294	200	30	60	37.798	2	1
527	58972.35	59008.774	200	30	60	36.427	2	1
528	59095.31	59117.895	100	20	40	22.587	2	1
529	59211.11	59222.078	30	15	30	10.968	1	1
530	59322.26	59331.401	80	20	40	9.138	1	1
531	59390.52	59406.007	80	20	40	15.484	1	1
532	59456.43	59462.964	100	20	40	6.539	1	1
533	59533.7	59542.793	50	15	30	9.09	1	1
534	59651.47	59665.86	20	15	30	14.389	1	1
535	59748.61	59777.032	25	15	30	28.425	2	1
536	59825.39	59828.322	20	15	30	2.937	1	1
537	59954.79	59985.63	100	20	40	30.836	2	1
538	60071.69	60102.402	100	20	40	30.712	2	1
539	60175.97	60192.965	100	20	40	16.992	1	1
540	60248.1	60256.835	30	15	30	8.739	1	1
541	60377.18	60386.191	40	15	30	9.008	1	1
542	60439.16	60454.11	30	15	30	14.953	1	1
543	60548.25	60566.254	30	15	30	18.006	2	1
544	60626.28	60642.812	30	15	30	16.53	2	1
545	60769.84	60774.641	40	15	30	4.798	1	1
546	60910.23	60927.047	200	30	60	16.813	1	1
547	61065.84	61073.563	40	15	30	7.727	1	1
548	61236.39	61262.972	20	15	30	26.581	2	1
549	61378.72	61400.095	30	15	30	21.375	2	1
550	61467.06	61471.957	80	20	40	4.894	1	1
551	61571.94	61581.674	70	20	40	9.737	1	1
552	61736.17	61746.468	30	15	30	10.3	1	1
553	61790.85	61804.843	50	15	30	13.993	1	1
554	61905.44	61971.023	120	30	60	65.585	3	2
555	62012.72	62017.967	60	20	40	5.247	1	1
556	62074.67	62086.24	125	30	60	11.569	1	1
557	62185.47	62201.175	50	15	30	15.705	2	1
558	62254.89	62261.823	40	15	30	6.931	1	1
559	62329.12	62356.595	300	45	90	27.471	1	1
560	62432.2	62538.427	400	60	120	106.225	2	1
561	62579.89	62715.258	300	45	90	135.372	4	2
562	62785.51	62819.458	20	15	30	33.953	3	2
563	62992.35	63135.303	250	45	90	142.954	4	2
564	63291.74	63314.367	200	30	60	22.632	1	1
565	63472.76	63639.413	250	45	90	166.654	4	2



HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	Spacing before Curve (S)	Length	Nos in outside curve (s)	Nos in beginning of curve (2s)
				as per IRC:67-2012	as per IRC:67-2012			
568	63890.58	63900.212	30	15	30	9.635	1	1
569	64051.75	64073.132	300	45	90	21.387	1	1
570	64096.81	64114.798	100	20	40	17.984	1	1
571	64170.66	64179.781	30	15	30	9.118	1	1
572	64274.78	64295.082	300	45	90	20.299	1	1
573	64350.02	64359.476	80	20	40	9.452	1	1
574	64417.05	64440.486	80	20	40	23.437	2	1
575	64570	64593.095	100	20	40	23.095	2	1
576	64814.66	64835.461	50	15	30	20.8	2	1
577	64975.87	64990.25	200	30	60	14.376	1	1
578	65128.89	65199.774	40	15	30	70.888	5	3
579	65312.84	65342.036	200	30	60	29.199	1	1
580	65452.12	65486.791	50	15	30	34.671	3	2
581	65569.43	65580.226	40	15	30	10.796	1	1
582	65620.36	65644.912	200	30	60	24.556	1	1
583	65698.65	65705.838	20	15	30	7.191	1	1
584	65763.07	65766.874	35	15	30	3.806	1	1
585	65806.72	65815.686	35	15	30	8.968	1	1
586	65863.94	65870.434	25	15	30	6.494	1	1
587	65911.52	65915.689	20	15	30	4.173	1	1
588	65956.67	65961.256	20	15	30	4.584	1	1
589	65999.53	66016.07	40	15	30	16.54	2	1
590	66091.6	66101.054	30	15	30	9.45	1	1
591	66186.74	66186.992	40	15	30	0.251	1	1
592	66214.15	66235.646	80	20	40	21.496	2	1
593	66257.48	66259.552	20	15	30	2.072	1	1
594	66320.39	66323.945	30	15	30	3.558	1	1
595	66369.99	66374.03	30	15	30	4.043	1	1
597	66495.92	66524.955	20	15	30	29.039	2	1
598	66574.17	66584.248	50	15	30	10.078	1	1
599	66644.1	66685.467	60	20	40	41.363	3	2
600	66754.67	66780.497	170	30	60	25.826	1	1
601	66801.5	66819.614	170	30	60	18.117	1	1
602	66890.14	66903.962	30	15	30	13.818	1	1
603	66956.31	66978.875	40	15	30	22.568	2	1
604	67024.1	67038.249	100	20	40	14.15	1	1
605	67059.99	67062.917	50	15	30	2.925	1	1
606	67090.68	67100.885	100	20	40	10.205	1	1
607	67251.19	67264.719	100	20	40	13.529	1	1
608	67282.35	67311.723	100	20	40	29.373	2	1
609	67371.83	67400.355	80	20	40	28.522	2	1
610	67424.62	67428.762	50	15	30	4.142	1	1
611	67538.46	67599.709	300	45	90	61.252	2	1
612	67657.65	67718.215	500	70	140	60.562	1	1
613	67965.41	67979.347	125	30	60	13.937	1	1
614	68086.47	68092.19	150	30	60	5.723	1	1
615	68167.2	68206.659	20	15	30	39.456	3	2
616	68247.41	68276.21	80	20	40	28.798	2	1
617	68292.95	68324.471	80	20	40	31.525	2	1
618	68381.58	68404.682	300	45	90	23.1	1	1
619	68490.14	68506.9	150	30	60	16.762	1	1
620	68621.98	68656.839	100	20	40	34.858	2	1
621	68715.35	68753.904	20	15	30	38.553	3	2
622	68852.79	68854.122	50	15	30	1.331	1	1
623	68957.52	68999.584	300	45	90	42.068	1	1

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HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	Spacing before Curve (S)	Length	Nos in outside curve (s)	Nos in beginning of curve (2s)
				as per IRC:67-2012	as per IRC:67-2012			
624	69088.43	69102.835	40	15	30	14.408	1	1
625	69171.81	69209.912	20	15	30	38.107	3	2
626	69298.31	69329.584	20	15	30	31.273	3	2
627	69391.7	69420.033	125	30	60	28.336	1	1
630	69715.97	69742.832	80	20	40	26.864	2	1
631	69810.06	69842.367	40	15	30	32.307	3	2
632	69904.28	69915.246	60	20	40	10.963	1	1
633	69999.28	70009.555	25	15	30	10.279	1	1
635	70149.45	70166.144	20	15	30	16.698	2	1
636	70232.35	70237.482	50	15	30	5.137	1	1
637	70289.18	70295.731	40	15	30	6.552	1	1
638	70381.2	70391.913	50	15	30	10.713	1	1
639	70427.39	70452.942	170	30	60	25.553	1	1
641	70628.6	70654.949	80	20	40	26.353	2	1
642	70738.06	70748.146	30	15	30	10.084	1	1
643	70813.07	70849.757	20	15	30	36.683	3	2
644	70911.21	70922.583	50	15	30	11.373	1	1
645	70988.69	70991.814	40	15	30	3.121	1	1
646	71113.77	71150.403	20	15	30	36.629	3	2
647	71208.86	71217.752	100	20	40	8.894	1	1
648	71289.38	71292.287	50	15	30	2.906	1	1
649	71387.83	71397.648	60	20	40	9.821	1	1
650	71504.95	71516.021	80	20	40	11.073	1	1
651	71577.84	71615.741	20	15	30	37.905	3	2
652	71668.92	71679.085	30	15	30	10.168	1	1
654	71916.36	71939.659	80	20	40	23.303	2	1
655	72003.44	72016.401	50	15	30	12.962	1	1
656	72072.66	72083.486	40	15	30	10.83	1	1
658	72253.64	72263.27	50	15	30	9.63	1	1
659	72341.88	72352.962	50	15	30	11.078	1	1
660	72446.67	72483.343	20	15	30	36.678	3	2
661	72541.34	72577.207	80	20	40	35.863	2	1
662	72654.65	72688.512	20	15	30	33.865	3	2
663	72743.73	72769.109	80	20	40	25.383	2	1
664	72853.39	72882.721	20	15	30	29.33	2	1
665	73003.24	73099.253	65	20	40	96.018	5	3
666	73256.86	73310.813	30	15	30	53.955	4	2
667	73536.46	73563.046	35	15	30	26.586	2	1
668	73634.72	73638.782	30	15	30	4.064	1	1
669	73698.16	73715.698	50	15	30	17.54	2	1
670	73775.95	73853.984	55	20	40	78.032	4	2
671	73891.89	73902.318	70	20	40	10.424	1	1
672	73955.35	73975.107	80	20	40	19.754	1	1
673	74018.94	74034.547	50	15	30	15.61	2	1
674	74095.34	74102.394	70	20	40	7.059	1	1
675	74149.41	74158.033	40	15	30	8.627	1	1
676	74207.38	74225.129	100	20	40	17.751	1	1
677	74274.72	74278.727	30	15	30	4.011	1	1
678	74336.59	74345.138	40	15	30	8.544	1	1
679	74469.7	74479.469	40	15	30	9.765	1	1
680	74526.82	74536.796	20	15	30	9.979	1	1
681	74614.25	74633.459	30	15	30	19.209	2	1
682	74717.33	74724.051	40	15	30	6.723	1	1
683	74781.51	74788.691	60	20	40	7.178	1	1
684	74855.67	74873.804	90	20	40	18.13	1	1
685	74980.73	75023.786	80	20	40	43.057	3	2
TOTAL				=			275	196

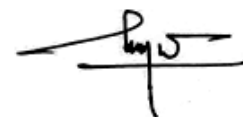


Busbay

Chainage of Busbay

<i>Sl. No.</i>	<i>Chainage</i>	<i>Side</i>	<i>Total No.</i>
1	56+960	Both side	2
2	59+590	Both side	2
3	63+420	Both side	2
4	71+050	Right side	1
5	72+400	Right side	1

Total Number of Bus Bay = 8 No

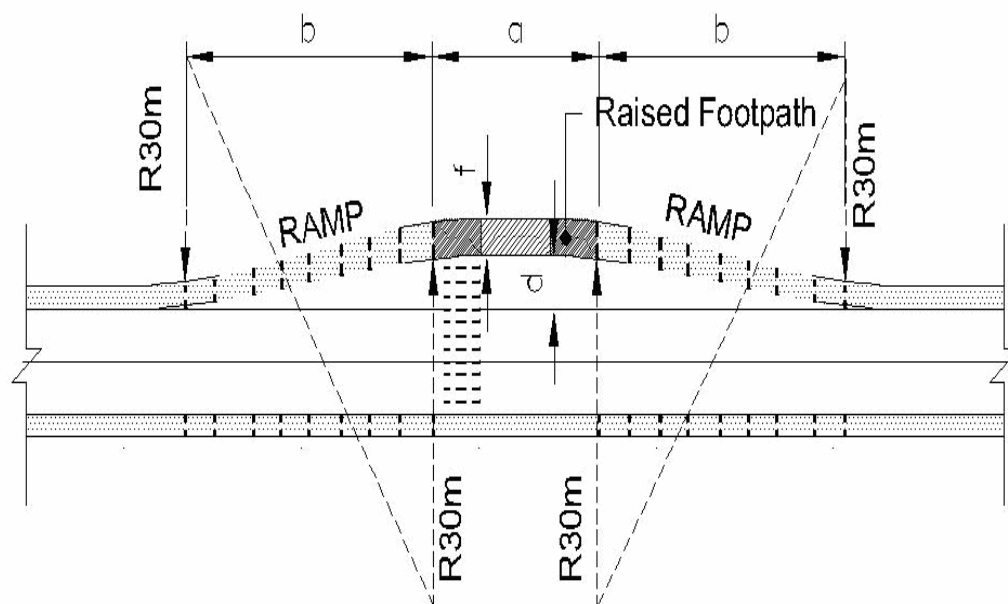


Variable Declaration

Busbay (2 Lane) at Hill

Sl 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	8.000	nos
8	Width Foothpath	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	26.180	percentage
13	Eech Pedestrain 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

Errosion Control

A. QUANTITY CALCULATION OF TURFING

Turfing with Sods ::

Turfing is provided on TCS 2, TCS 3, TCS 7 & TCS 13

Length of Turfing for TCS 2(single side) = 5285.84 m
Length of Turfing for TCS 3(single side) = 147.40 m
Length of Turfing for TCS 7(Single side)= 897.40 m
Length of Turfing for TCS 13(Both side)= 200.00 m

Assume ht. of embankment = 2.0 m
Width of Turfing = 4.47 m

Quantity of Turfing = 29206 sqm

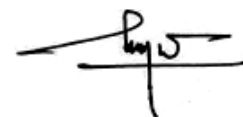
B . Quantity Calculation For Hydro Seeding

Chainage		Net Length (m)	side	Total Length (m)
From	To			
57410	57535	125	Right	125
Total=				125.00

Avg Width of Hydro Seeding = 8.00 m
Total Area of Hydro Seeding= 1000 sqm

Summary

<u>Turfing=</u>	29206 sqm	Bill No- 02, Sl. No- 5
<u>Hydroseeding=</u>	1000 sqm	Bill No- 02, Sl. No- 1



GSB Reuse Calculation

Description	Required GSB Qty	Reusable GSB Quantity	Unit
TCS-01	3834.345	1004	Cum
TCS-02	15785.32	4133	Cum
TCS-03	495.427	130	Cum
TCS-04	8812.424	2307	Cum
TCS-06	5897.844	1544	Cum
TCS-07	2678.666	701	Cum
TCS-08	8943.819	2341	Cum
TCS-09	1782.791	467	Cum
TCS-10	195	51	Cum
TCS-11	2687.625	704	Cum
TCS-12	298.625	78	Cum
TCS-13	597.25	156	Cum
TCS-14	734.618	192	Cum
TCS-15	427.034	112	Cum
TCS-16	447.938	117	Cum
Busbay (2 Lane) at Hill	566.4	148	Cum
Extra Widening on Flexible Pavement	1592.2	417	Cum
Minor Junction	153	40	Cum
Total=	55930	14643	

Reuseable GSB Quantity= **26.18%**

Total Dismantle Granular Quantity(cum)= **20919**
 use 70% of Total Dismantle Granular Quantity for GSB (cum)= **14643**

Refer backup calculation sheet
 $\cong$

Total Required GSB Qty (Cum)= **55930**
 26.18 % of this required quantity will be bought from dismantle material i.e **14643**

Re Useable Quantity of GSB Material(cum)= **14643**
 Remaining Quantity of GSB(cum) = **41288**




PCC V- Shaped Drain :-

TCS Type	Net Length(m)	Side	Total Length (m)
TCS-15	143	Single side	143
Total length =			143

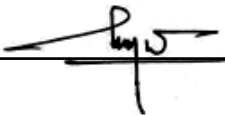
Total Length of PCC V- Shaped drain= 143 m



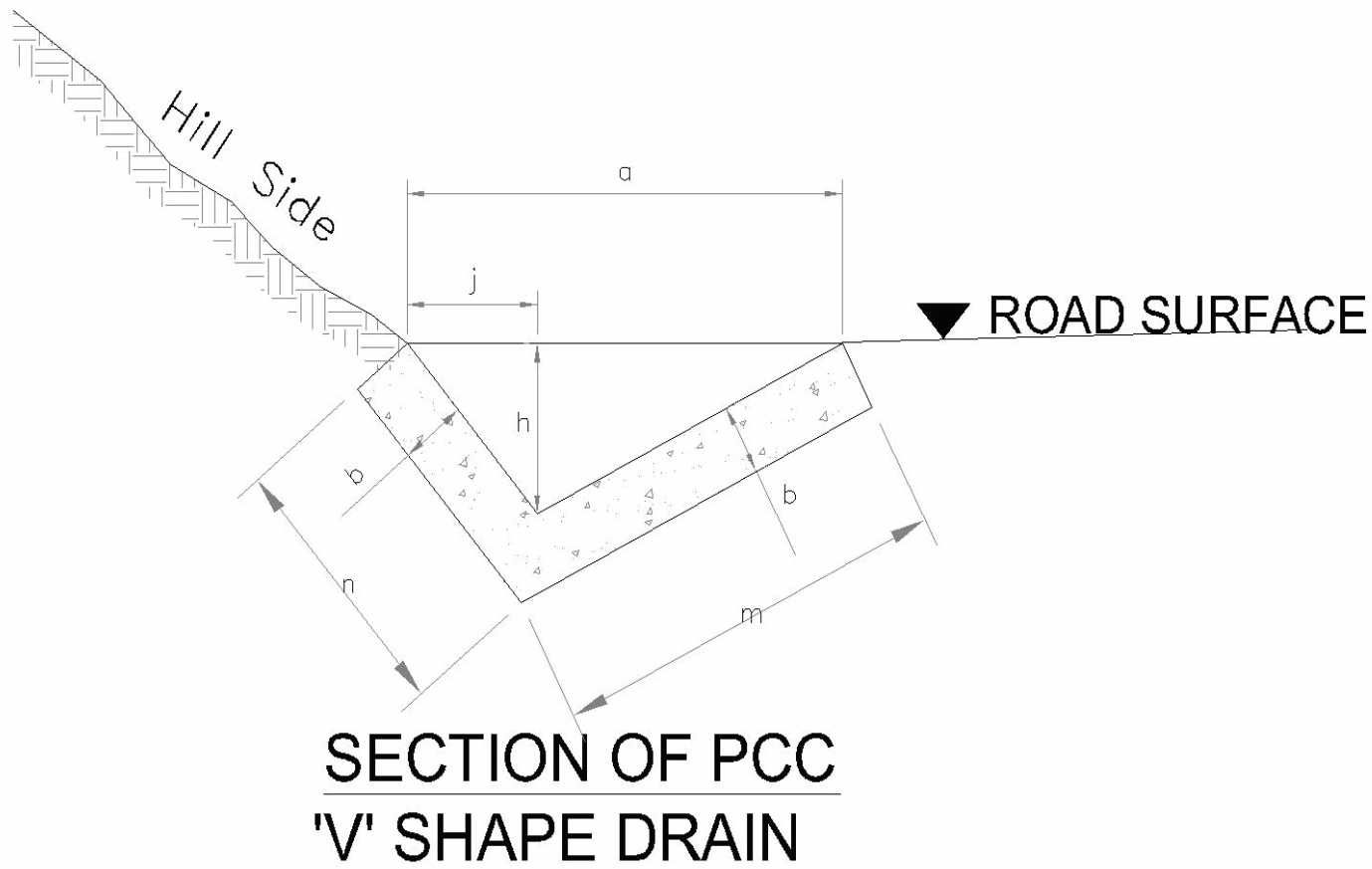
Variable Declaration

PCC V Shaped Drain 1.0 m

Sl No	Variable Description	Variable	Dimension	Unit
1	Ref Drawing	a	1.000	m
2	Ref Drawing	h	0.550	m
3	Ref Drawing	j	0.300	m
4	Length	l	143.000	m
5	Ref Drawing	b	0.150	m
6	Ref Drawing $m = \sqrt{h^2 + (a - j)^2}$	m	0.890	m
7	Ref Drawing $n = \sqrt{h^2 + j^2}$	n	0.630	m



Variable Declaration



Composite RE Wall Summary

Summary Of Composite RE Wall

Sand Filling=	63207	cum		Bill No- 12, Sl. No- 2
Facing Element of RCC=	7450	sqm		Bill No- 12, Sl. No- 1
steel strips=	2380	m		Bill No- 12, Sl. No- 6
PCC Grade M20=	304	cum		Bill No- 12, Sl. No- 4
Filter Media=	16244	cum		Bill No- 12, Sl. No- 3
Metal Beam Crash Barrier=	450	m		Bill No- 12, Sl. No- 9
PVC Pipe 100mm dia=	5100	m		Bill No- 12, Sl. No- 7
Stainless steel strips grouting=	89	nos		Bill No- 12, Sl. No- 5

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QUANTITY CALCULATION FOR RE WALL (TCS-15)

From Chainage	To Chainage	Length	Avg. Height	CD Length	Net Length	TCS Type
64875	64925	50	15		50	TCS 15
66225	66275	50	10		50	TCS 15
68325	68375	50	10		50	TCS 15

Length of composite RE Wall= 150 m

Total width with drain = 12.4 m

RE Wall Facing Element

	From Chainage	To Chainage	Unit	nos	Length (m)	Height (m)	Quantity
	64875	64925	Sqm	1	50	17	850
	66225	66275	Sqm	1	50	12	600
	68325	68375	Sqm	1	50	12	600
						Total	2050

Total Quantity of Facing Element= **2050** Sqm

Stainless steel strips

	From Chainage	To Chainage	Unit	nos	width (m)	Height (m)	Quantity
	64875	64925	m	31	22		682
	66225	66275	m	21	22		462
	68325	68375	m	21	22		462
						Total	1606

Total Quantity of Facing Element= **1606** m

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QUANTITY CALCULATION FOR RE WALL (TCS-15)

Backfilling Behind the facing Elements of RE Wall

From Chainage	To Chainage	Unit	nos	Length (m)	width (m)	Height (m)	Quantity
64875	64925	Cum	1	50	15.8	13.94	11012.6
66225	66275	Cum	1	50	15.8	8.94	7062.6
68325	68375	Cum	1	50	15.8	8.94	7062.6
					Total		25137.8

Total Quantity of Backfilling Material=

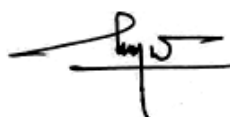
25137.8 Cum

Filter Media

	From Chainage	To Chainage	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
	64875	64925	Cum	2	50	1.6	17	2720
	66225	66275	Cum	2	50	2.6	12	3120
	68325	68375	Cum	2	50	3.6	12	4320
	64875	64925	Cum	2	50	15.8	0.6	948
	66225	66275	Cum	2	50	15.8	0.6	948
	68325	68375	Cum	2	50	15.8	0.6	948
						Total		13004

Total Quantity of Filter Media=

13004 Cum





QUANTITY CALCULATION FOR RE WALL (TCS-15)

W Beam Crash Barrier

	From Chainage	To Chainage	Unit	nos	Length (m)	Quantity
	64875	64925	m	1	50	50
	66225	66275	m	1	50	50
	68325	68375	m	1	50	50
				Total		150

Total Quantity of Crash Barrier= 150 m

PCC M 20 under Crash Barrier

	From Chainage	To Chainage	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
	64875	64925	Cum	1	50	0.45	1.5	33.75
	66225	66275	Cum	1	50	0.45	1.5	33.75
	68325	68375	Cum	1	50	0.45	1.5	33.75
						Total		101.25

Total Quantity of PCC M20= 101.25 Cum

PVC Pipe 100mm dia

	From Chainage	To Chainage	Unit	ver.nos	hor. nos	Breadth (m)	Height (m)	Quantity
	64875	64925	m	2	50	17		1700
	66225	66275	m	2	50	17		1700
	68325	68375	m	2	50	17		1700
						Total		5100

Total Quantity of PVC Pipe = 5100 m





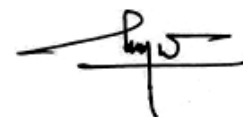
QUANTITY CALCULATION FOR RE WALL (TCS-15)

Stainless steel strips grouting

	From Chainage	To Chainage	Unit	nos	Quantity
	64875	64925	Cum	31	31
	66225	66275	Cum	21	21
	68325	68375	Cum	21	21
				Total	73

Total Quantity of PVC Pipe =

73 nos



QUANTITY CALCULATION FOR RE WALL (TCS-16)

From Chainage	To Chainage	Length	Avg. Height (m)	Avg. Height (m)	CD Length	Net Length	TCS Type
68175	68325	150	20	12		150	TCS 16

Length of composite RE Wall= 150 m

Total width with drain = 12 m

RE Wall Facing Element

	From Chainage	To Chainage	Unit	nos	Length (m)	Height (m)	Quantity
	68175	68325	Sqm	1	150	22	3300
			Sqm	1	150	14	2100
						Total	5400

Total Quantity of Facing Element= **5400** Sqm

Stainless steel strips

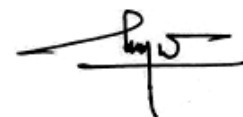
	From Chainage	To Chainage	Unit	nos	width (m)	Height (m)	Quantity
	68175	68325	m	16	19.6		313.6
			m	24	19.2		460.8
						Total	774.4

Total Quantity of Facing Element= **774.4** m

Backfilling Behind the facing Elements of RE Wall

From Chainage	To Chainage	Unit	nos	Length (m)	width (m)	Height (m)	Quantity
68175	68325	Cum	1	150	13.4	18.94	38069.4
						Total	38069.4

Total Quantity of Backfilling Material= **38069.4** Cum





QUANTITY CALCULATION FOR RE WALL (TCS-16)

Filter Media

	From Chainage	To Chainage	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
	68175	68325	Cum	1	150	0.6	22	1980
				1	150	0.6	14	1260
						Total		3240

Total Quantity of Filter Media= 3240 Cum

W Beam Crash Barrier

	From Chainage	To Chainage	Unit	nos	Length (m)	Quantity
	68175	68325	m	2	150	300
					Total	300

Total Quantity of Crash Barrier= 300 m

PCC M 20 under Crash Barrier

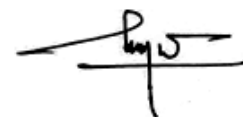
	From Chainage	To Chainage	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
	68175	68325	Cum	2	150	0.45	1.5	202.5
						Total		202.5

Total Quantity of PCC M20= 202.5 Cum

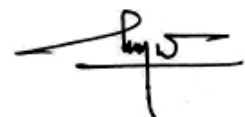
Stainless steel strips grouting

	From Chainage	To Chainage	Unit	nos	Quantity
	68175	68325	Cum	16	16
				Total	16

Total Quantity of PVC Pipe = 16 nos




BILL OF QUANTITY (ROAD PART)

A handwritten signature in black ink, consisting of a stylized 'P' followed by a horizontal line and a vertical line.

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
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	6.00		
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	5.00		
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	37.00		
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	17.00		
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	4.00		
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	11.00		

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
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	235.00		
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	1,603.00		
9	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	210.00		
10	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	790.00		
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	139,462.00		
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	40,928.00		
		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/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			
		Refer: Site Clearance and Dismantling Formula: 6	6	6.00	Each
			Total :	6.00	Each
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			
		Refer: Site Clearance and Dismantling Formula: 5	5	5.00	Each
			Total :	5.00	Each
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			
		Refer: Site Clearance and Dismantling Formula: 37	37	37.00	Each
			Total :	37.00	Each
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			
		Refer: Site Clearance and Dismantling Formula: 17	17	17.00	Each
			Total :	17.00	Each

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
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			
		Refer: Site Clearance and Dismantling Formula: 4	4	4.00	Each
			Total :	4.00	Each
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)			
		Refer: Site Clearance and Dismantling Formula: 11	11	11.00	Ha
			Total :	11.00	Ha
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			
		Refer: Site Clearance and Dismantling Formula: 235	235	235.00	cum
			Total :	235.00	cum
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar			
		Refer: Site Clearance and Dismantling Formula: 1603	1603	1,603.00	Cum

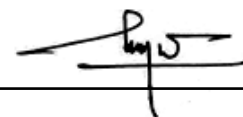
SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	1,603.00	Cum
9	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia			
		Refer: Site Clearance and Dismantling Formula: 210	210	210.00	rm
			Total :	210.00	rm
10	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia			
		Refer: Site Clearance and Dismantling Formula: 790	790	790.00	rm
			Total :	790.00	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: 139462	139462	139,462.00	sqm
			Total :	139,462.00	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: 40928	40928	40,928.00	sqm
			Total :	40,928.00	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	1,000.00		
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	150,381.00		
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	63,908.80		
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	20,553.53		
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	76,074.00		
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	1,500,831.20		

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	375,207.80		
		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: 1000	1000	1,000.00	sqm
			Total :	1,000.00	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	150381.000	150,381.00	cum
			Total :	150,381.00	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-01 Formula: (cw-ext_pav+2*hs)*sg*I	(7.000-6.500+2*1.500)*0.500*1284.000	2,247.00	cum
		Refer: TCS-02 Formula: (cw+2*hs+es+1.62-ext_pav)*sg*I	(7.000+2*1.500+1.000+1.62-6.500)*0.500*5286.000	16,175.16	cum
		Refer: TCS-03 Formula: (cw+2*hs+es+1.62-ext_pav)*sg*I	(7.000+2*1.500+1.000+1.62-6.500)*0.500*147.000	449.82	cum
		Refer: TCS-04 Formula: (cw+2*hs+es-ext_pav)*sg*I	(7.000+2*1.500+1.000-6.500)*0.500*2951.000	6,639.75	cum
		Refer: TCS-06 Formula: (cw+2*hs)*sg*I	(7.000+2*1.500)*0.500*1975.000	9,875.00	cum

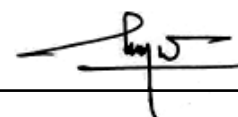
SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-07 Formula: (cw+2*hs+es+1.62-ext_pav)*sg*I	(7.000+2*1.500+1.000+1.62-0.000) *0.500*897.000	5,660.07	cum
		Refer: TCS-08 Formula: (cw+2*hs)*sg*I	(7.000+2*1.500)*0.500*2995.000	14,975.00	cum
		Refer: TCS-09 Formula: (cw+2*hs+es-ext_pav)*sg*I	(7.000+2*1.500+1.000-0.000) *0.500*597.000	3,283.50	cum
		Refer: TCS-10 Formula: (cw+2*hs+2*fp-ext_pav)*sg*I	(7.000+2*1.500+2*1.500-6.500) *0.500*150.000	487.50	cum
		Refer: TCS-11 Formula: (cw+2*hs+es-ext_pav)*sg*I	(7.000+2*1.500+0.000-6.500) *0.500*900.000	1,575.00	cum
		Refer: TCS-12 Formula: (cw-ext_pav+2*hs)*sg*I	(7.000-6.500+2*1.500)*0.500*100.000	175.00	cum
		Refer: TCS-13 Formula: (cw+2*hs+2*es+1.62-ext_pav)*sg*I	(7.000+2*1.500+2*1.000+1.62-6.500) *0.500*200.000	712.00	cum
		Refer: TCS-14 Formula: (cw+2*hs+2*es-ext_pav)*sg*I	(7.000+2*1.500+2*1.000-6.500) *0.500*246.000	676.50	cum
		Refer: TCS-15 Formula: (cw+2*hs+2*es-ext_pav)*sg*I	(7.000+2*1.500+2*0.000-0.000) *0.500*143.000	715.00	cum
		Refer: TCS-16 Formula: (cw-ext_pav+2*hs)*sg*I	(7.000-6.500+2*1.500)*0.500*150.000	262.50	cum
			Total :	63,908.80	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-01 Formula: (cw-ext_pav+2*hs)*sg*I	(7.000-6.500+2*1.500)*0.500*1284.000	2,247.00	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-02 Formula: $((cw\_ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2))*sg*I$	$((7.000-6.500+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2))*0.500*5286.000$	12,104.94	cum
		Refer: TCS-03 Formula: $((cw\_ext\_pav+2*hs+es+((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2)*sg*I)+(es*(bc+dbm+wmm1+wmm2+gsb))+((0.5*(bc+dbm+wmm1+wmm2+gsb)*((bc+dbm+wmm1+wmm2+gsb)*2))*I)$	$((7.000-6.500+2*1.500+1.000+((0.040+0.070+0.125+0.125+0.200+(0.500/2))*2)*0.500*147.000)+(1.000*(0.040+0.070+0.125+0.125+0.200))+((0.5*(0.040+0.070+0.125+0.125+0.200)*((0.040+0.070+0.125+0.125+0.200)*2))*147.000)$	170.23	cum
		Refer: TCS-04 Formula: $((cw\_ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2)-ext\_pav)*sg*I$	$((7.000-6.500+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2)-6.500)*0.500*2951.000$	-2,832.96	cum
		Refer: TCS-07 Formula: $((cw\_ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2)-ext\_pav)*sg*I$	$((7.000-0.000+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2)-0.000)*0.500*897.000$	4,969.38	cum
		Refer: TCS-09 Formula: $((cw\_ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2)-ext\_pav)*sg*I$	$((7.000-0.000+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2)-0.000)*0.500*597.000$	3,307.38	cum
		Refer: TCS-11 Formula: $((cw\_ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2)-ext\_pav)*sg*I$	$((7.000-6.500+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2)-6.500)*0.500*900.000$	-864.00	cum
		Refer: TCS-12 Formula: $(cw\_ext\_pav+2*hs)*sg*I$	$(7.000-6.500+2*1.500)*0.500*100.000$	175.00	cum
		Refer: TCS-13 Formula: $((cw\_ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2))*sg*I$	$((7.000-6.500+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2))*0.500*200.000$	458.00	cum
		Refer: TCS-14 Formula: $((cw\_ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2)-ext\_pav)*sg*I$	$((7.000-6.500+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2)-6.500)*0.500*246.000$	-236.16	cum
		Refer: TCS-15 Formula: $((cw\_ext\_pav+2*hs)+(hs*(bc+dbm+wmm1+wmm2)*2)-ext\_pav)*sg*I$	$((7.000-0.000+2*1.500)+(1.500*(0.040+0.070+0.125+0.125)*2)-0.000)*0.500*143.000$	792.22	cum
		Refer: TCS-16 Formula: $(cw\_ext\_pav+2*hs)*sg*I$	$(7.000-6.500+2*1.500)*0.500*150.000$	262.50	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	20,553.53	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: 76074	76074	76,074.00	sqm
			Total :	76,074.00	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			
		Refer: Earthwork Formula: $\text{tot\_cut} * (1 - \text{per\_rock} / 100)$	$1876039.000 * (1 - 20.000 / 100)$	1,500,831.20	cum
			Total :	1,500,831.20	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: $\text{tot\_cut} * (\text{per\_rock} / 100)$	$1876039.000 * (20.000 / 100)$	375,207.80	cum
			Total :	375,207.80	cum

Bill No : 03. Sub-Base & Base Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Ns c1	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	40,756.70		
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	14,520.44		
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	35,216.47		
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)	$(7961.000*0.200)*(1-26.180/100)$	1,175.36	Cum
		Refer: TCS-01 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*1284.000*2+(7.000+2*1.500)$ $*0.200*1284.000)*(1-26.180/100)$	2,830.51	Cum
		Refer: TCS-02 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*5286.000*2+(7.000+2*1.500)$ $*0.200*5286.000)*(1-26.180/100)$	11,652.72	Cum
		Refer: TCS-03 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)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*147.000*2+$ $(7.000+2*1.500+1*1.000+2*$ $(0.040+0.070+0.125+0.125+0.5*0.200)$ $*1)*0.200*147.000)*(1-26.180/100)$	365.72	Cum
		Refer: TCS-04 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*2951.000*2+(7.000+2*1.500)$ $*0.200*2951.000)*(1-26.180/100)$	6,505.33	Cum
		Refer: TCS-06 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*1975.000*2+(7.000+2*1.500)$ $*0.200*1975.000)*(1-26.180/100)$	4,353.79	Cum
		Refer: TCS-07 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(1-gsb_per/100)	$((1.500*(0.040+0.070+0.125+0.125)-$ $(0.125*0.125)-(0.125*0.250))$ $*897.000*2+(7.000+2*1.500)$ $*0.200*897.000)*(1-26.180/100)$	1,977.39	Cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*2995.000*2+(7.000+2*1.500)*0.200*2995.000)*(1-26.180/100)$	6,602.33	Cum
		Refer: TCS-09 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*597.000*2+(7.000+2*1.500)*0.200*597.000)*(1-26.180/100)$	1,316.06	Cum
		Refer: TCS-10 Formula: $(cw+2*hs+2*fp-ext\_pav)*gsb*I*(1-gsb\_per/100)$	$(7.000+2*1.500+2*1.500-6.500)*0.200*150.000*(1-26.180/100)$	143.95	Cum
		Refer: TCS-11 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*900.000*2+(7.000+2*1.500)*0.200*900.000)*(1-26.180/100)$	1,984.01	Cum
		Refer: TCS-12 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*100.000*2+(7.000+2*1.500)*0.200*100.000)*(1-26.180/100)$	220.45	Cum
		Refer: TCS-13 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*200.000*2+(7.000+2*1.500)*0.200*200.000)*(1-26.180/100)$	440.89	Cum
		Refer: TCS-14 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*246.000*2+(7.000+2*1.500)*0.200*246.000)*(1-26.180/100)$	542.30	Cum
		Refer: TCS-15 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*143.000*2+(7.000+2*1.500)*0.200*143.000)*(1-26.180/100)$	315.24	Cum
		Refer: TCS-16 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(1-gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*150.000*2+(7.000+2*1.500)*0.200*150.000)*(1-26.180/100)$	330.67	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	40,756.70	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)	$(7961.000 \times 0.200) \times (26.180/100)$	416.84	Cum
		Refer: TCS-01 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(gsb_per/100)	$((1.500 \times (0.040 + 0.070 + 0.125 + 0.125) - (0.125 \times 0.125) - (0.125 \times 0.250)) \times 1284.000 \times 2 + (7.000 + 2 \times 1.500) \times 0.200 \times 1284.000) \times (26.180/100)$	1,003.83	Cum
		Refer: TCS-02 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(gsb_per/100)	$((1.500 \times (0.040 + 0.070 + 0.125 + 0.125) - (0.125 \times 0.125) - (0.125 \times 0.250)) \times 5286.000 \times 2 + (7.000 + 2 \times 1.500) \times 0.200 \times 5286.000) \times (26.180/100)$	4,132.60	Cum
		Refer: TCS-03 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)	$((1.500 \times (0.040 + 0.070 + 0.125 + 0.125) - (0.125 \times 0.125) - (0.125 \times 0.250)) \times 147.000 \times 2 + (7.000 + 2 \times 1.500 + 1 \times 1.000 + 2 \times (0.040 + 0.070 + 0.125 + 0.125 + 0.5 \times 0.200) \times 1) \times 0.200 \times 147.000) \times (26.180/100)$	129.70	Cum
		Refer: TCS-04 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(gsb_per/100)	$((1.500 \times (0.040 + 0.070 + 0.125 + 0.125) - (0.125 \times 0.125) - (0.125 \times 0.250)) \times 2951.000 \times 2 + (7.000 + 2 \times 1.500) \times 0.200 \times 2951.000) \times (26.180/100)$	2,307.09	Cum
		Refer: TCS-06 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(gsb_per/100)	$((1.500 \times (0.040 + 0.070 + 0.125 + 0.125) - (0.125 \times 0.125) - (0.125 \times 0.250)) \times 1975.000 \times 2 + (7.000 + 2 \times 1.500) \times 0.200 \times 1975.000) \times (26.180/100)$	1,544.06	Cum
		Refer: TCS-07 Formula: ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*I*2+ (cw+2*hs)*gsb*I)*(gsb_per/100)	$((1.500 \times (0.040 + 0.070 + 0.125 + 0.125) - (0.125 \times 0.125) - (0.125 \times 0.250)) \times 897.000 \times 2 + (7.000 + 2 \times 1.500) \times 0.200 \times 897.000) \times (26.180/100)$	701.28	Cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*2995.000*2+(7.000+2*1.500)*0.200*2995.000)*(26.180/100)$	2,341.49	Cum
		Refer: TCS-09 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*597.000*2+(7.000+2*1.500)*0.200*597.000)*(26.180/100)$	466.74	Cum
		Refer: TCS-10 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*150.000*2+(7.000+2*1.500)*0.200*150.000)*(26.180/100)$	117.27	Cum
		Refer: TCS-11 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*900.000*2+(7.000+2*1.500)*0.200*900.000)*(26.180/100)$	703.62	Cum
		Refer: TCS-12 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*100.000*2+(7.000+2*1.500)*0.200*100.000)*(26.180/100)$	78.18	Cum
		Refer: TCS-13 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*200.000*2+(7.000+2*1.500)*0.200*200.000)*(26.180/100)$	156.36	Cum
		Refer: TCS-14 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*246.000*2+(7.000+2*1.500)*0.200*246.000)*(26.180/100)$	192.32	Cum
		Refer: TCS-15 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*143.000*2+(7.000+2*1.500)*0.200*143.000)*(26.180/100)$	111.80	Cum
		Refer: TCS-16 Formula: $((hs*(bc+dbm+wmm1+wmm2)-(wmm1*0.125)-(wmm2*0.250))*I*2+(cw+2*hs)*gsb*I)*(gsb\_per/100)$	$((1.500*(0.040+0.070+0.125+0.125)-(0.125*0.125)-(0.125*0.250))*150.000*2+(7.000+2*1.500)*0.200*150.000)*(26.180/100)$	117.27	Cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	14,520.44	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 $ew\_area*(wmm1+wmm2)$	$7961.000*(0.125+0.125)$	1,990.25	Cum
		Refer: TCS-01 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*1284.000$	2,367.38	Cum
		Refer: TCS-02 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*5286.000$	9,746.06	Cum
		Refer: TCS-03 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*147.000$	271.03	Cum
		Refer: TCS-04 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*2951.000$	5,440.91	Cum
		Refer: TCS-06 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*1975.000$	3,641.41	Cum
		Refer: TCS-07 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*897.000$	1,653.84	Cum
		Refer: TCS-08 Formula: $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l$	$(((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*2995.000$	5,522.03	Cum

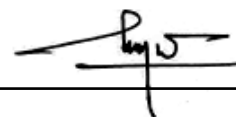
SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-09 Formula: $((((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*597.000)$	1,100.72	Cum
		Refer: TCS-10 Formula: $((((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*150.000)$	276.56	Cum
		Refer: TCS-11 Formula: $((((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*900.000)$	1,659.38	Cum
		Refer: TCS-12 Formula: $((((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*100.000)$	184.38	Cum
		Refer: TCS-13 Formula: $((((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*200.000)$	368.75	Cum
		Refer: TCS-14 Formula: $((((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*246.000)$	453.56	Cum
		Refer: TCS-15 Formula: $((((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*143.000)$	263.66	Cum
		Refer: TCS-16 Formula: $((((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.125)+((7.000+0.250*2)*0.125))*150.000)$	276.56	Cum
			Total :	35,216.47	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	134,108.00		
2	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	134,108.00		
3	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	9,387.56		

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
4	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	5,364.32		
		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	7961.000	7,961.00	sqm
		Refer: TCS-01 Formula: cw*I	7.000*1284.000	8,988.00	sqm
		Refer: TCS-02 Formula: cw*I	7.000*5286.000	37,002.00	sqm
		Refer: TCS-03 Formula: cw*I	7.000*147.000	1,029.00	sqm
		Refer: TCS-04 Formula: cw*I	7.000*2951.000	20,657.00	sqm
		Refer: TCS-06 Formula: cw*I	7.000*1975.000	13,825.00	sqm
		Refer: TCS-07 Formula: cw*I	7.000*897.000	6,279.00	sqm
		Refer: TCS-08 Formula: cw*I	7.000*2995.000	20,965.00	sqm
		Refer: TCS-09 Formula: cw*I	7.000*597.000	4,179.00	sqm
		Refer: TCS-10 Formula: cw*I	7.000*150.000	1,050.00	sqm
		Refer: TCS-11 Formula: cw*I	7.000*900.000	6,300.00	sqm
		Refer: TCS-12 Formula: cw*I	7.000*100.000	700.00	sqm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-13 Formula: $cw * l$	$7.000 * 200.000$	1,400.00	sqm
		Refer: TCS-14 Formula: $cw * l$	$7.000 * 246.000$	1,722.00	sqm
		Refer: TCS-15 Formula: $cw * l$	$7.000 * 143.000$	1,001.00	sqm
		Refer: TCS-16 Formula: $cw * l$	$7.000 * 150.000$	1,050.00	sqm
			Total :	134,108.00	sqm
2	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: Extra Widening on Flexible Formula: Pavement ew_area	7961.000	7,961.00	sqm
		Refer: TCS-01 Formula: $cw * l$	$7.000 * 1284.000$	8,988.00	sqm
		Refer: TCS-02 Formula: $cw * l$	$7.000 * 5286.000$	37,002.00	sqm
		Refer: TCS-03 Formula: $cw * l$	$7.000 * 147.000$	1,029.00	sqm
		Refer: TCS-04 Formula: $cw * l$	$7.000 * 2951.000$	20,657.00	sqm
		Refer: TCS-06 Formula: $cw * l$	$7.000 * 1975.000$	13,825.00	sqm
		Refer: TCS-07 Formula: $cw * l$	$7.000 * 897.000$	6,279.00	sqm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 Formula: cw*I	7.000*2995.000	20,965.00	sqm
		Refer: TCS-09 Formula: cw*I	7.000*597.000	4,179.00	sqm
		Refer: TCS-10 Formula: cw*I	7.000*150.000	1,050.00	sqm
		Refer: TCS-11 Formula: cw*I	7.000*900.000	6,300.00	sqm
		Refer: TCS-12 Formula: cw*I	7.000*100.000	700.00	sqm
		Refer: TCS-13 Formula: cw*I	7.000*200.000	1,400.00	sqm
		Refer: TCS-14 Formula: cw*I	7.000*246.000	1,722.00	sqm
		Refer: TCS-15 Formula: cw*I	7.000*143.000	1,001.00	sqm
		Refer: TCS-16 Formula: cw*I	7.000*150.000	1,050.00	sqm
			Total :	134,108.00	sqm
3	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 $ew\_area * dbm$	$7961.000 * 0.070$	557.27	cum
		Refer: TCS-01 Formula: $cw * dbm * l$	$7.000 * 0.070 * 1284.000$	629.16	cum
		Refer: TCS-02 Formula: $cw * dbm * l$	$7.000 * 0.070 * 5286.000$	2,590.14	cum
		Refer: TCS-03 Formula: $cw * dbm * l$	$7.000 * 0.070 * 147.000$	72.03	cum
		Refer: TCS-04 Formula: $cw * dbm * l$	$7.000 * 0.070 * 2951.000$	1,445.99	cum
		Refer: TCS-06 Formula: $cw * dbm * l$	$7.000 * 0.070 * 1975.000$	967.75	cum
		Refer: TCS-07 Formula: $cw * dbm * l$	$7.000 * 0.070 * 897.000$	439.53	cum
		Refer: TCS-08 Formula: $cw * dbm * l$	$7.000 * 0.070 * 2995.000$	1,467.55	cum
		Refer: TCS-09 Formula: $cw * dbm * l$	$7.000 * 0.070 * 597.000$	292.53	cum
		Refer: TCS-10 Formula: $cw * dbm * l$	$7.000 * 0.070 * 150.000$	73.50	cum
		Refer: TCS-11 Formula: $cw * dbm * l$	$7.000 * 0.070 * 900.000$	441.00	cum
		Refer: TCS-12 Formula: $cw * dbm * l$	$7.000 * 0.070 * 100.000$	49.00	cum
		Refer: TCS-13 Formula: $cw * dbm * l$	$7.000 * 0.070 * 200.000$	98.00	cum
		Refer: TCS-14 Formula: $cw * dbm * l$	$7.000 * 0.070 * 246.000$	120.54	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-15 Formula: $cw*dbm*I$	$7.000*0.070*143.000$	70.07	cum
		Refer: TCS-16 Formula: $cw*dbm*I$	$7.000*0.070*150.000$	73.50	cum
			Total :	9,387.56	cum
4	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 $ew\_area*bc$	$7961.000*0.040$	318.44	cum
		Refer: TCS-01 Formula: $cw*bc*I$	$7.000*0.040*1284.000$	359.52	cum
		Refer: TCS-02 Formula: $cw*bc*I$	$7.000*0.040*5286.000$	1,480.08	cum
		Refer: TCS-03 Formula: $cw*bc*I$	$7.000*0.040*147.000$	41.16	cum
		Refer: TCS-04 Formula: $cw*bc*I$	$7.000*0.040*2951.000$	826.28	cum
		Refer: TCS-06 Formula: $cw*bc*I$	$7.000*0.040*1975.000$	553.00	cum
		Refer: TCS-07 Formula: $cw*bc*I$	$7.000*0.040*897.000$	251.16	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 Formula: $cw*bc*I$	$7.000*0.040*2995.000$	838.60	cum
		Refer: TCS-09 Formula: $cw*bc*I$	$7.000*0.040*597.000$	167.16	cum
		Refer: TCS-10 Formula: $cw*bc*I$	$7.000*0.040*150.000$	42.00	cum
		Refer: TCS-11 Formula: $cw*bc*I$	$7.000*0.040*900.000$	252.00	cum
		Refer: TCS-12 Formula: $cw*bc*I$	$7.000*0.040*100.000$	28.00	cum
		Refer: TCS-13 Formula: $cw*bc*I$	$7.000*0.040*200.000$	56.00	cum
		Refer: TCS-14 Formula: $cw*bc*I$	$7.000*0.040*246.000$	68.88	cum
		Refer: TCS-15 Formula: $cw*bc*I$	$7.000*0.040*143.000$	40.04	cum
		Refer: TCS-16 Formula: $cw*bc*I$	$7.000*0.040*150.000$	42.00	cum
			Total :	5,364.32	cum

Bill No : 05. Junction Improvement (Major & Minor)

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Ns c1	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	112.95		
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	40.06		
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	191.25		
4	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	765.00		

Bill No : 05. Junction Improvement (Major & Minor)

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	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	765.00		
6	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	53.55		
7	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	30.60		
Total of Bill 05. Junction Improvement (Major & Minor)						

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: Minor Junction Formula: (tot_area*gsb)*(1-gsb_per/100)	(765.000*0.200)*(1-26.180/100)	112.95	Cum
			Total :	112.95	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: Minor Junction Formula: (tot_area*gsb)*(gsb_per/100)	(765.000*0.200)*(26.180/100)	40.06	Cum
			Total :	40.06	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: Minor Junction Formula: tot_area*(wmm1+wmm2)	765.000*(0.125+0.125)	191.25	Cum
			Total :	191.25	Cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
4	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: Minor Junction Formula: tot_area	765.000	765.00	sqm
			Total :	765.00	sqm
5	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: Minor Junction Formula: tot_area	765.000	765.00	sqm
			Total :	765.00	sqm
6	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			
		Refer: Minor Junction Formula: tot_area*dbm	765.000*0.070	53.55	cum
			Total :	53.55	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
7	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: Minor Junction Formula: tot_area*bc	765.000*0.040	30.60	cum
			Total :	30.60	cum

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	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	450.00		
2	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	300.00		
3	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	4.00		
4	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	15.00		
5	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	184.00		
6	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	286.00		

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	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	71.00		
8	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	10.00		
9	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	136.00		

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

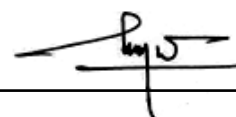
SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6mm 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	8.00		
11	08.12	Direction and Place Identification signs upto 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 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	14.00		
12	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 0.9 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	16.00		

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
13	08.14	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	4,246.91		
14	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	1,700.00		
15	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	443.00		
16	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				

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			nos	8,982.00		
17	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	91.00		
18	08/nsc/2	Convex Mirror For Blind Curve	nos	60.00		
		Total of Bill 06. Traffic signs, Road marking & other road appurtenances				




SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	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.			
		Refer: TCS-10 Formula: $fp \times l \times 2$	$1.500 \times 150.000 \times 2$	450.00	sqm
			Total :	450.00	sqm
2	08.01	Precast Cement concrete M20 Kerb including fixing at site			
		Refer: TCS-10 Formula: $l \times 2$	150.000×2	300.00	rm
			Total :	300.00	rm
3	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: 4	4	4.00	each
			Total :	4.00	each
4	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: 15	15	15.00	each
			Total :	15.00	each
5	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Traffic Signs Formula: 184	184	184.00	each
			Total :	184.00	each
6	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: 286	286	286.00	each
			Total :	286.00	each
7	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: 71	71	71.00	each
			Total :	71.00	each

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
8	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: 10	10	10.00	each
			Total :	10.00	each
9	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			
		Refer: Traffic Signs Formula: 136	136	136.00	each
			Total :	136.00	each

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
10	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: 8	8	8.00	each
			Total :	8.00	each
11	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: 14	14	14.00	sqm
			Total :	14.00	sqm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
12	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: 16	16	16.00	sqm
			Total :	16.00	sqm
13	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.)			
		Refer: TCS-01 Formula: $\frac{(((l \times l)/(l+g)) \times wc) + (l \times 2 \times wid\_mar)}{((3.000 \times 1284.000)/(1284.000+6.000)) \times 0.100 + (1284.000 \times 2 \times 0.100)}$		257.10	sqm
		Refer: TCS-02 Formula: $\frac{(((l \times l)/(l+g)) \times wc) + (l \times 2 \times wid\_mar)}{((3.000 \times 5286.000)/(5286.000+6.000)) \times 0.100 + (5286.000 \times 2 \times 0.150)}$		1,586.10	sqm
		Refer: TCS-03 Formula: $\frac{(((l \times l)/(l+g)) \times wc) + (l \times 2 \times wid\_mar)}{((3.000 \times 147.000)/(147.000+6.000)) \times 0.100 + (147.000 \times 2 \times 0.100)}$		29.69	sqm
		Refer: TCS-04 Formula: $\frac{(((l \times l)/(l+g)) \times wc) + (l \times 2 \times wid\_mar)}{((3.000 \times 2951.000)/(2951.000+6.000)) \times 0.100 + (2951.000 \times 2 \times 0.100)}$		590.50	sqm
		Refer: TCS-06 Formula: $\frac{(((l \times l)/(l+g)) \times wc) + (l \times 2 \times wid\_mar)}{((3.000 \times 1975.000)/(1975.000+6.000)) \times 0.100 + (1975.000 \times 2 \times 0.100)}$		395.30	sqm

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-07 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 897.000) / (897.000 + 6.000)) \cdot 0.100 + (897.000^2 \cdot 0.150)$	269.40	sqm
		Refer: TCS-08 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 2995.000) / (2995.000 + 6.000)) \cdot 0.100 + (2995.000^2 \cdot 0.100)$	599.30	sqm
		Refer: TCS-09 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 597.000) / (597.000 + 6.000)) \cdot 0.100 + (597.000^2 \cdot 0.100)$	119.70	sqm
		Refer: TCS-10 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 150.000) / (150.000 + 6.000)) \cdot 0.100 + (150.000^2 \cdot 0.100)$	30.29	sqm
		Refer: TCS-11 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 900.000) / (900.000 + 6.000)) \cdot 0.100 + (900.000^2 \cdot 0.100)$	180.30	sqm
		Refer: TCS-12 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 100.000) / (100.000 + 6.000)) \cdot 0.100 + (100.000^2 \cdot 0.100)$	20.28	sqm
		Refer: TCS-13 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 200.000) / (200.000 + 6.000)) \cdot 0.100 + (200.000^2 \cdot 0.150)$	60.29	sqm
		Refer: TCS-14 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 246.000) / (246.000 + 6.000)) \cdot 0.100 + (246.000^2 \cdot 0.100)$	49.49	sqm
		Refer: TCS-15 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 143.000) / (143.000 + 6.000)) \cdot 0.100 + (143.000^2 \cdot 0.100)$	28.89	sqm
		Refer: TCS-16 Formula: $((l \cdot c) / (l + g)) \cdot wc + (l^2 \cdot wid\_mar)$	$((3.000 \cdot 150.000) / (150.000 + 6.000)) \cdot 0.100 + (150.000^2 \cdot 0.100)$	30.29	sqm
			Total :	4,246.91	sqm
14	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			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Traffic Signs Formula: 1700	1700	1,700.00	each
			Total :	1,700.00	each
15	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: TCS-15 Formula: (cb*1)	(143.000*1)	143.00	Rm
		Refer: TCS-16 Formula: cb*2	150.000*2	300.00	Rm
			Total :	443.00	Rm
16	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: 8511+471	8511+471	8,982.00	nos
			Total :	8,982.00	nos

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
17	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: 91	91	91.00	nos
			Total :	91.00	nos
18	08/nsc/2	Convex Mirror For Blind Curve			
		Refer: Traffic Signs Formula: 60	60	60.00	nos
			Total :	60.00	nos

Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	528.54		
2	10.16	Cement Plaster 12mm Thick in Cement Mortar 1:3	sqm	528.54		
3	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	79.27		
4	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications	cum	12.15		
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	8.05		
6	14.03/e/l	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.55		
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.67		
8	14/nsc2	Brick Flat Soling at Foundation	Sqm	107.50		
9	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	25.91		

Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	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	33.21		
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	3.32		
		Total of Bill 07. Passenger Shelter				

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.			
		Refer: Passenger Shelter Formula: $((sw\_in*sw\_ht*2)+(w\_pass*sw\_ht*2)+(bw\_in*bw\_ht)+(l\_pass*bw\_ht)+(col\_l*fc\_h*6)+(l\_pass*roof\_w)-(2*win\_n*win\_l*win\_h))*n$	$((1.875*3.830*2)+(2.000*3.830*2)+(5.800*2.350)+(6.000*2.350)+(0.250*2.650*6)+(6.000*1.530)-(2*2.000*1.250*0.900))*8.000$	528.54	sqm
			Total :	528.54	sqm
2	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3			
		Refer: Passenger Shelter Formula: $((sw\_in*sw\_ht*2)+(w\_pass*sw\_ht*2)+(bw\_in*bw\_ht)+(l\_pass*bw\_ht)+(col\_l*fc\_h*6)+(l\_pass*roof\_w)-(2*win\_n*win\_l*win\_h))*n$	$((1.875*3.830*2)+(2.000*3.830*2)+(5.800*2.350)+(6.000*2.350)+(0.250*2.650*6)+(6.000*1.530)-(2*2.000*1.250*0.900))*8.000$	528.54	sqm
			Total :	528.54	sqm
3	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: Passenger Shelter Formula: $(((a+0.25*2)*(b+0.25*2)*df*col\_n)+((l+2*0.1)*(w+2*0.1)*db))*n$	$(((0.750+0.25*2)*(0.750+0.25*2)*0.750*6.000)+((13.500+2*0.1)*(0.500+2*0.1)*0.300))*8.000$	79.27	cum
			Total :	79.27	cum
4	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications			
		Refer: Passenger Shelter Formula: $((l*w*wb\_tm\_thk)+(l*fw\_wall*w\_top\_thk))*n$	$((13.500*0.500*0.150)+(13.500*0.250*0.150))*8.000$	12.15	cum
			Total :	12.15	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: Passenger Shelter Formula: (l_pass-2*w_wall)*(w_pass-2*w_wall) *pcc_thk*n	(6.000-2*0.125)*(2.000-2*0.125) *0.100*8.000	8.05	cum
			Total :	8.05	cum
6	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade			
		Refer: Passenger Shelter Formula: (((a*b*btm_thk)+((a+col_l)*0.5)*((b+col_w)*0.5)*top_thk)+(col_l*col_w*(df-btm_thk-top_thk)))*col_n*n	((((0.750*0.750*0.100)+((0.750+0.250)*0.5)*((0.750+0.250)*0.5)*0.100)+(0.250*0.250*(0.750-0.100-0.100)))*6.000*8.000	5.55	cum
			Total :	5.55	cum
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification			
		Refer: Passenger Shelter Formula: (((a*b*btm_thk)+((a+col_l)*0.5)*((b+col_w)*0.5)*top_thk)+(col_l*col_w*(df-btm_thk-top_thk)))*col_n*n)*rf/1000	(((((0.750*0.750*0.100)+((0.750+0.250)*0.5)*((0.750+0.250)*0.5)*0.100)+(0.250*0.250*(0.750-0.100-0.100)))*6.000*8.000)*120.000/1000	0.67	MT
			Total :	0.67	MT
8	14/nsc2	Brick Flat Soling at Foundation			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Passenger Shelter Formula: $((l_{pass}-2*w_{wall})*(w_{pass}-2*w_{wall}))+ (a*b*col_n)*n$	$((6.000-2*0.125)*(2.000-2*0.125))+ (0.750*0.750*6.000))*8.000$	107.50	Sqm
			Total :	107.50	Sqm
9	15.01	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications			
		Refer: Passenger Shelter Formula: $((l*w_{wall}*wall_h)+(sw_l*2*w_{wall}*sw_h)+(bw_l*4*w_{wall}*bw_h)+(rail_l*w_{wall}*rail_h))*n-(win_l*w_{wall}*win_h*2*n)$	$((13.500*0.125*0.550)+(1.500*2*0.125*2.130)+(2.650*4*0.125*0.950)+(9.500*0.125*0.450))*8.000-(1.250*0.125*0.900*2*8.000)$	25.91	cum
			Total :	25.91	cum
10	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			
		Refer: Passenger Shelter Formula: $((col_l*col_w*col_h*col_n*0.5)+(col_l*col_w*bcol_h*col_n*0.5)+(sb_l*sb_w*sb_thk*2)+(sb_a*sb_w*sb_thk*4)+(l_{pass}*roof_w*roof_thk)+(l_{pass}*fchj_w*roof_thk)+(l_{pass}*bchj_w*roof_thk)+(bch_l*bch_w*bch_thk))*n$	$((0.250*0.250*2.650*6.000*0.5)+(0.250*0.250*2.100*6.000*0.5)+(1.530*0.250*0.350*2)+(3.000*0.250*0.350*4)+(6.000*1.530*0.110)+(6.000*0.680*0.110)+(6.000*0.450*0.110)+(5.000*0.500*0.075))*8.000$	33.21	cum
			Total :	33.21	cum
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Passenger Shelter Formula: $((col\_l * col\_w * fcol\_h * col\_n * 0.5) +$ $(col\_l * col\_w * bcol\_h * col\_n * 0.5) +$ $(sb\_l * sb\_w * sb\_thk * 2) +$ $(sb\_a * sb\_w * sb\_thk * 4) +$ $(l\_pass * roof\_w * roof\_thk) +$ $(l\_pass * fchj\_w * roof\_thk) +$ $(l\_pass * bchj\_w * roof\_thk) +$ $(bch\_l * bch\_w * bch\_thk)) * n * srf / 1000$	$((0.250 * 0.250 * 2.650 * 6.000 * 0.5) +$ $(0.250 * 0.250 * 2.100 * 6.000 * 0.5) +$ $(1.530 * 0.250 * 0.350 * 2) +$ $(3.000 * 0.250 * 0.350 * 4) +$ $(6.000 * 1.530 * 0.110) +$ $(6.000 * 0.680 * 0.110) +$ $(6.000 * 0.450 * 0.110) +$ $(5.000 * 0.500 * 0.075))$ $* 8.000 * 100.000 / 1000$	3.32	MT
			Total :	3.32	MT

Bill No : 08. Bus Bay

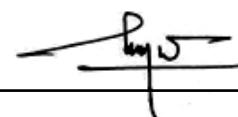
SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	1,416.00		
2	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	418.12		
3	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	148.28		
4	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	708.00		

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	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	1,180.00		
6	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	2,832.00		
7	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	2,832.00		
8	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	198.24		

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
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	113.28		
10	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	120.00		
		Total of Bill 08. Bus Bay				




SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	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: Busbay (2 Lane) at Hill Formula: $((2*b+a)*(d+f))*n*sg$	$((2*22.000+15.000)*(3.500+2.500))*8.000*0.500$	1,416.00	cum
			Total :	1,416.00	cum
2	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: Busbay (2 Lane) at Hill Formula: $((2*b+a)*(d+f))*n*gsb*(1-gsb\_per/100)$	$((2*22.000+15.000)*(3.500+2.500))*8.000*0.200*(1-26.180/100)$	418.12	Cum
			Total :	418.12	Cum
3	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: Busbay (2 Lane) at Hill Formula: $((2*b+a)*(d+f))*n*gsb*(gsb\_per/100)$	$((2*22.000+15.000)*(3.500+2.500))*8.000*0.200*(26.180/100)$	148.28	Cum
			Total :	148.28	Cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
4	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: Busbay (2 Lane) at Hill Formula: $((2*b+a)*(d+f))*n*(wmm1+wmm2)$	$((2*22.000+15.000)*(3.500+2.500))*8.000*(0.125+0.125)$	708.00	Cum
			Total :	708.00	Cum
5	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.			
		Refer: Busbay (2 Lane) at Hill Formula: $((2*b+a)*f)*n$	$((2*22.000+15.000)*2.500)*8.000$	1,180.00	sqm
			Total :	1,180.00	sqm
6	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: Busbay (2 Lane) at Hill Formula: $((2*b+a)*(d+f))*n$	$((2*22.000+15.000)*(3.500+2.500))*8.000$	2,832.00	sqm
			Total :	2,832.00	sqm
7	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			

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Busbay (2 Lane) at Hill Formula: $((2*b+a)*(d+f))*n$	$((2*22.000+15.000)*(3.500+2.500))$ $*8.000$	2,832.00	sqm
			Total :	2,832.00	sqm
8	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			
		Refer: Busbay (2 Lane) at Hill Formula: $((2*b+a)*(d+f))*n*dbm$	$((2*22.000+15.000)*(3.500+2.500))$ $*8.000*0.070$	198.24	cum
			Total :	198.24	cum
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			
		Refer: Busbay (2 Lane) at Hill Formula: $((2*b+a)*(d+f))*n*bc$	$((2*22.000+15.000)*(3.500+2.500))$ $*8.000*0.040$	113.28	cum
			Total :	113.28	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
10	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.)			
		Refer: Busbay (2 Lane) at Hill Formula: $\text{ped\_mar} * (n/2)$	$30.000 * (8.000/2)$	120.00	sqm
			Total :	120.00	sqm

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	33,203.47		
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	12,991.66		
3	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	308.16		
4	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	1,442.53		
5	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	29.39		
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	1,335.36		
7	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	66.77		

Bill No : 09. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	1,285.00		
9	24/i/b	Galvanised Mild steel J /L hook	kg	205.44		
10	40	Gextextile material (fine net)	sqm	231.12		
		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: PCC V Shaped Drain 1.0 m Formula: $((m*b)+((n-b)*b)+(0.5*a*h))*l$	$((0.890*0.150)+((0.630-0.150)*0.150)+(0.5*1.000*0.550))*143.000$	68.71	cum
		Refer: RCC Cover Drain Formula: $(t\_width+off*2)*((ht+b\_slab\_thk)/2)*l$	$(1.000+0.100*2)*((0.900+0.125)/2)*2568.000$	1,579.32	cum
		Refer: RR Masonry Trapezoidal Drain Formula: $(a+2*b)*(h+f)*l$	$(0.800+2*0.200)*(0.850+0.200)*25044.000$	31,555.44	cum
			Total :	33,203.47	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: $((0.5*(c+j+2*b)*f)+(((a-j)/2)^2+h^2)^{(1/2}))*b*2)*l$	$((0.5*(0.835+0.500+2*0.200)*0.200)+(((0.800-0.500)/2)^2+0.850^2)^{(1/2}))*0.200*2)*25044.000$	12,991.66	cum
			Total :	12,991.66	cum
3	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: RCC Cover Drain Formula: $(t\_width+off*2)*pcc\_thk*l$	$(1.000+0.100*2)*0.100*2568.000$	308.16	cum
			Total :	308.16	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
4	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: $(l-(l/5*0.2))*b*d$	$(25044.000-(25044.000/5*0.2))$ $*0.200*0.300$	1,442.53	cum
			Total :	1,442.53	cum
5	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: PCC V Shaped Drain 1.0 m Formula: $((m*b)+((n-b)*b))*l$	$((0.890*0.150)+((0.630-0.150)*0.150))$ $*143.000$	29.39	cum
			Total :	29.39	cum
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			
		Refer: RCC Cover Drain Formula: $(ht*w_{thk}*2+t_{width}*b_{slab_{thk}}+t_{width}*t_{slab_{thk}})*l$	$(0.900*0.150*2+1.000*0.125+1.000*0.125)*2568.000$	1,335.36	cum
			Total :	1,335.36	cum
7	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification			
		Refer: RCC Cover Drain Formula: $(ht*w_{thk}*2+t_{width}*b_{slab_{thk}}+t_{width}*t_{slab_{thk}})*l*s$	$(0.900*0.150*2+1.000*0.125+1.000*0.125)*2568.000*0.050$	66.77	MT

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	66.77	MT
8	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)	(2568.000/2+1)	1,285.00	Rm
			Total :	1,285.00	Rm
9	24/i/b	Galvanised Mild steel J /L hook			
		Refer: RCC Cover Drain Formula: l/15*4*.3	2568.000/15*4*.3	205.44	kg
			Total :	205.44	kg
10	40	Gextextile material (fine net)			
		Refer: RCC Cover Drain Formula: (l/1)*4*(150*150/1000^2)	(2568.000/1)*4*(150*150/1000^2)	231.12	sqm
			Total :	231.12	sqm

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	7,464.03		
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	1,679.39		
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	7,496.10		
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	4,353.93		
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	2,279.20		
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	9,381.45		
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	11,917.00		
		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))* (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))) *940.000)*(1-0.200)	1,308.82	cum
		Refer: Retaining Wall 2.0m Formula: (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (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))) *495.000)*(1-0.200)	769.66	cum
		Refer: Retaining Wall 3.0m Formula: (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (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))) *1637.000)*(1-0.200)	3,082.54	cum
		Refer: Retaining Wall 4.0m Formula: (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (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))) *1034.000)*(1-0.200)	2,303.02	cum
			Total :	7,464.03	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: Retaining Wall 1.5m Formula: (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (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))) *940.000)*0.200	327.21	cum
		Refer: Retaining Wall 2.0m Formula: (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (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))) *495.000)*0.200	192.42	cum
		Refer: Retaining Wall 3.0m Formula: (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*I)*p_c	(((0.5*((0.267+0.600)+(+0.600))* (1.600+2*0.150))+((0.267+0.600)* (0.600-0.150))) *1637.000)*0.200	584.02	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Retaining Wall 4.0m Formula: $(((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*((0.322+0.600)*(0.600-0.150)))+(B1+2*o))+((H2+d)*(mw-o))*I)*p\_c$	$(((0.5*((0.300+0.322+0.600)+(0.300+0.600))*(1.933+2*0.150))+((0.322+0.600)*(0.600-0.150)))*1034.000)*0.200$	575.76	cum
			Total :	1,679.39	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: $mw*(H2+H1)*I$	$0.600*(0.183+1.500)*940.000$	949.21	cum
		Refer: Retaining Wall 2.0m Formula: $mw*(H2+H1)*I$	$0.600*(0.211+2.000)*495.000$	656.67	cum
		Refer: Retaining Wall 3.0m Formula: $mw*(H2+H1)*I$	$0.600*(0.267+3.000)*1637.000$	3,208.85	cum
		Refer: Retaining Wall 4.0m Formula: $mw*(H2+H1)*I$	$0.600*(0.322+4.000)*1034.000$	2,681.37	cum
			Total :	7,496.10	cum
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)			
		Refer: Retaining Wall 1.5m Formula: $(((0.5*(B1+e)*d)+(0.5*B1*H2))*I$	$(((0.5*(1.100+0.900)*0.600)+(0.5*1.100*0.183))*940.000$	658.61	cum
		Refer: Retaining Wall 2.0m Formula: $(((0.5*(B1+e)*d)+(0.5*B1*H2))*I$	$(((0.5*(1.270+1.067)*0.600)+(0.5*1.270*0.211))*495.000$	413.37	cum
		Refer: Retaining Wall 3.0m Formula: $(((0.5*(B1+B3)*d)+(0.5*B1*H2))*I$	$(((0.5*(1.600+1.400)*0.600)+(0.5*1.600*0.267))*1637.000$	1,822.96	cum
		Refer: Retaining Wall 4.0m Formula: $(((0.5*(B1+B3)*d)+(0.5*B1*H2))*I$	$(((0.5*(1.933+1.733)*0.600)+(0.5*1.933*0.322))*1034.000$	1,458.99	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	4,353.93	cum
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*940.000	399.03	cum
		Refer: Retaining Wall 2.0m Formula: (B2+2*o)*pcc_thk*I	(1.284+2*0.150)*0.300*495.000	235.22	cum
		Refer: Retaining Wall 3.0m Formula: (B2+2*o)*pcc_thk*I	(1.622+2*0.150)*0.300*1637.000	943.89	cum
		Refer: Retaining Wall 4.0m Formula: (B2+2*o)*pcc_thk*I	(1.960+2*0.150)*0.300*1034.000	701.05	cum
			Total :	2,279.20	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))*940.000	634.50	cum
		Refer: Retaining Wall 2.0m Formula: (0.5*(T+e)*(H1-d))*I	(0.5*(0.600+1.067)*(2.000-0.600))*495.000	577.62	cum
		Refer: Retaining Wall 3.0m Formula: (0.5*(T+B3)*(H1-d))*I	(0.5*(0.600+1.400)*(3.000-0.600))*1637.000	3,928.80	cum
		Refer: Retaining Wall 4.0m Formula: ((0.5*(T+b3)*(H1-d))+(para_ht*para_w))*I	((0.5*(0.600+1.733)*(4.000-0.600))+(0.450*0.300))*1034.000	4,240.54	cum
			Total :	9,381.45	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
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: $n \times l$	2.000×940.000	1,880.00	Rm
		Refer: Retaining Wall 2.0m Formula: $n \times l$	2.000×495.000	990.00	Rm
		Refer: Retaining Wall 3.0m Formula: $n \times l$	3.000×1637.000	4,911.00	Rm
		Refer: Retaining Wall 4.0m Formula: $n \times l$	4.000×1034.000	4,136.00	Rm
			Total :	11,917.00	Rm

Bill No : 11. Breast wall

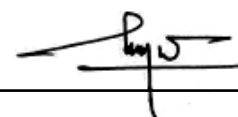
SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	3,625.28		
2	13.01/b/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	906.32		
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	392.81		
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	168.35		
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	1,707.69		
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	823.02		
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	1,776.98		
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	997.60		
		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: $(h+2*0.5)*(e+f)*(1-p)*l$	$(2.160+2*0.5)*(0.850+0.300)*(1-0.200)*1247.000$	3,625.28	cum
			Total :	3,625.28	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: $(h+2*0.5)*(e+f)*p*l$	$(2.160+2*0.5)*(0.850+0.300)*0.200*1247.000$	906.32	cum
			Total :	906.32	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: $c*b*l$	$1.050*0.300*1247.000$	392.81	cum
			Total :	392.81	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: $d*b*l$	$0.450*0.300*1247.000$	168.35	cum
			Total :	168.35	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: $0.5*(e+(e-(h/5)))*h*I$	$0.5*(0.850+(0.850-(2.160/5)))$ $*2.160*1247.000$	1,707.69	cum
			Total :	1,707.69	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: $g*f*I$	$2.200*0.300*1247.000$	823.02	cum
			Total :	823.02	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: $(0.5*((a+(c+d)/3)+a)*(d+c)+i*d+i*m)*I$	$(0.5*((0.600+(1.050+0.450)/3)+0.600)*$ $(0.450+1.050)$ $+0.200*0.450+0.200*0.300)*1247.000$	1,776.98	cum
			Total :	1,776.98	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: $(l/1.2)*(h-j-i)$	$(1247.000/1.2)*(2.160-1.000-0.200)$	997.60	Rm
			Total :	997.60	Rm

Bill No : 12. RE and Composite RE Wall

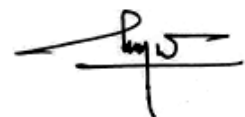
SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	12/Nsc2	Geo-synthetics and Reinforced Earth Facing elements of RCC	Sqm	7,450.00		
2	13.02/ii	Filling in Foundation Trenches as per drawing & technical specification using Sandy soil with PI value less than 6	cum	63,207.00		
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	16,244.00		
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	304.00		
5	18.03/b	Providing and inserting nipples with approved fixing compound after drilling holes for grouting as per technical specifications including subsequent cutting/removal and sealing of the hole as necessary of nipples after completion of grouting with epoxy grout.	Per hole	89.00		
6	7.5(i)/Nsc	Stainless steel strips	m	2,380.00		
7	BR/51	100 mm dia ac pipe	Rm	5,100.00		
Total of Bill 12. RE and Composite RE Wall						




SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	12/Nsc2	Geo-synthetics and Reinforced Earth Facing elements of RCC			
		Refer: Composite RE Wall Formula: 7450	7450	7,450.00	Sqm
			Total :	7,450.00	Sqm
2	13.02/ii	Filling in Foundation Trenches as per drawing & technical specification using Sandy soil with PI value less than 6			
		Refer: Composite RE Wall Formula: 63207	63207	63,207.00	cum
			Total :	63,207.00	cum
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .			
		Refer: Composite RE Wall Formula: 16244	16244	16,244.00	cum
			Total :	16,244.00	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: Composite RE Wall Formula: 304	304	304.00	cum
			Total :	304.00	cum

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	18.03/b	Providing and inserting nipples with approved fixing compound after drilling holes for grouting as per technical specifications including subsequent cutting/removal and sealing of the hole as necessary of nipples after completion of grouting with epoxy grout.			
		Refer: Composite RE Wall Formula: 89	89	89.00	Per hole
			Total :	89.00	Per hole
6	7.5(i)/Nsc	Stainless steel strips			
		Refer: Composite RE Wall Formula: 2380	2380	2,380.00	m
			Total :	2,380.00	m
7	BR/51	100 mm dia ac pipe			
		Refer: Composite RE Wall Formula: 5100	5100	5,100.00	Rm
			Total :	5,100.00	Rm

BILL OF QUANTITY (STRUCTURE PART)

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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	414.00		
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	5,673.00		
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	173.00		
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	620.00		
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	1,991.00		
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	2,469.00		
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	1,347.00		
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	1,014.00		
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	41.00		
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	58.00		
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	779.00		
12	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	201.00		
13	16.11	Drainage Spouts complete as per drawing and Technical specification				

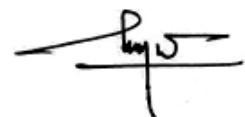
Bill No : 13. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			each	76.00		
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	1,014.00		
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	647.00		
16	13.01/a/i /Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	6,618.00		
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	1,333.00		
18	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	678.00		

Bill No : 13. Culvert

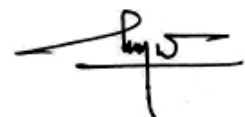
SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
19	17/nsc1	Flexible Apron - Construction of flexible apron 750mm thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall.	cum	496.00		
Sub Total of Protection Work						
		Miscellaneous Work				
20	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	513.00		
Sub Total of Miscellaneous Work						
		Total of Bill 13. Culvert				

***QUANTITY ESTIMATE
of
CULVERTS (PKG_II)***





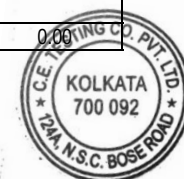
Culvert Estimate Summary

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Summary sheet of Small Culvert (Quantities & amount)

		Span (m) X Height (m) =	TYPE 1_2.0 X 2.0 M_1 CELL_BOX C_Flex Ap_TW- 12M	TYPE 2_2.0 X 2.0 M_1 CELL_BOX C_STEPPED Ap_NC_TW-11M	TYPE 3_2.0 X 2.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	TYPE 4_2.0 X 3.0 M_1 CELL_BOX C_Flex Ap_TW- 12M	TYPE 5_2.0 X 3.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M	TYPE 6_2.0 X 3.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	TYPE 8_3.0 X 4.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	TYPE 10_3.0 X 3.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	TYPE 11_5.0 X 4.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC
	No. of Culverts =		1	44	1	3	33	20	4	3	2
ITEM NO.	Description	Unit									
	A. Foundation										
Item no 1(a)	Excavation (upto 3 m depth)	cum	62.61	98.00	101.78	87.76	135.73	122.42	165.43	139.22	204.66
Item no 3	P.C.C (M-15)	cum	7.05	6.51	7.09	10.30	9.51	8.88	11.70	9.66	13.41
	B. SubStructure										
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	36.22	34.10	36.70	63.14	58.80	52.84	89.59	63.81	116.37
Item no 1(b)	R.C.C M30 (Substructure) from 5m to 10m	cum									
Item no 1(c)	R.C.C M30 (Substructure) above 10m	cum									
Item no 2	R.C.C M35 (Substructure) upto 5m	cum									
Item no 3	Steel (Substructure)	ton	2.54	2.39	2.57	4.42	4.12	3.70	6.27	4.47	8.15
Item no 4	Weep Holes	metre	22.20	20.40	27.00	31.60	28.80	33.60	43.20	36.00	51.00
Item no 5	Backfilling - Granular Material	cum	9.26	11.22	10.67	11.82	14.00	12.02	16.30	14.49	20.54
Item no 7	Filter Media	cum	32.71	27.78	30.79	46.10	47.95	50.85	63.55	47.37	62.50
	C. Super Structure										
Item no 1(b)	R.C.C M30 (Superstructure) upto 5m	cum	13.34	12.05	17.88	14.49	13.09	20.39	29.05	28.35	54.56
Item no 2	Steel (Superstructure)	ton	1.00	0.90	1.34	1.09	0.98	1.53	2.18	2.13	4.09
Item no 3(a)	Bituminous Concrete Wearing Coat(40mm)	cum	1.14	1.04	0.00	1.19	1.08	0.00	0.00	0.00	0.00
Item no 3(b)	Mastic Asphalt (12mm)	sqm	28.60	26.00	0.00	29.70	27.00	0.00	0.00	0.00	0.00
Item no 3(c)	Tack Coat	sqm	28.60	26.00	0.00	29.70	27.00	0.00	0.00	0.00	0.00
Item no 4	RCC railing	metre									
Item no 5	Crash Barrier	metre	5.20	5.20	0.00	5.40	5.40	0.00	0.00	0.00	0.00
Item no 6	Drainage Spout	each	2.00	2.00	0.00	2.00	2.00	0.00	0.00	0.00	0.00
Item no 9	Strip Seal Expansion Joint	metre									
	D. Protection Work										
Item no 1	Eathr work for excavation	cum	305.24	100.49	100.49	362.68	100.49	100.49	115.95	115.95	146.85
Item no 2	Catch Pit PCC M15 slab	cum		1.08	1.44		1.44	1.44	2.04	2.04	3.24
Item no 3	Catch Pit Stone Masonry	cum		1.94	1.94		1.94	1.94	2.30	2.30	3.02
Item no 4	300 mm thick Rubble stone flooring laid over 100mm thick cement concrete bedding	cum		13.10	13.10		13.10	13.10	16.05	16.05	21.96
Item no 5	750 mm thick Flexible apron	cum	64.8675			86.1975					
Item no 6	Curtain Wall & Guide Wall- PCC (M-20)	cum	64.38	20.09	20.09	75.09	20.09	20.09	21.99	21.99	25.78
Item no 7	PCC M15	cum	9.51	11.65	11.65	11.10	11.65	11.65	13.92	13.92	18.45
	D. Miscellaneous										
Item no 1	Painting	cum	13.30	13.30	0.00	13.81	13.81	0.00	0.00	0.00	0.00

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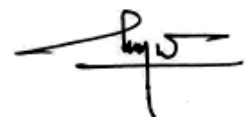


Summary sheet of Small Culvert (Quantities & amount)

		Span (m) X Height (m) =	TYPE 12_2.0 X 3.0 M_1 CELL_BOX C_Flex Ap_TW- 12M with EC	TYPE 13_2.0 X 3.0 M_1 CELL_BOX C_Flex Ap_TW- 11M with EC	TYPE 14_5.0 X 3.0 M_1 CELL_BOX C_STEPPED Ap_NC_TW-11M	TYPE 15_3.0 X 4.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with 4m EC_RE wall Encasing	TYPE 16_3.0 X 4.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with 6.5m EC_RE wall Encasing	TYPE 17_3.0 X 4.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with 8.5m EC_RE wall Encasing	Total Quantity
	No. of Culverts =		1	1	2	1	1	3	
ITEM NO.	Description	Unit							
	A. Foundation								
Item no 1(a)	Excavation (upto 3 m depth)	cum	87.76	82.28	175.06	111.56	113.60	116.64	14250.915
Item no 3	P.C.C (M-15)	cum	10.30	9.51	11.93	7.14	7.21	7.27	1005.222
	B. SubStructure								
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	63.14	58.80	86.61	70.79	74.24	78.66	6218.340
Item no 1(b)	R.C.C M30 (Substructure) from 5m to 10m	cum							0.000
Item no 1(c)	R.C.C M30 (Substructure) above 10m	cum							0.000
Item no 2	R.C.C M35 (Substructure) upto 5m	cum							0.000
Item no 3	Steel (Substructure)	ton	4.42	4.12	6.06	4.96	5.20	5.51	435.284
Item no 4	Weep Holes	metre	31.60	31.60	39.36	30.00	31.50	33.00	3349.220
Item no 5	Backfilling - Granular Material	cum	11.82	11.40	17.74	13.50	13.87	14.54	1530.607
Item no 7	Filter Media	cum	46.10	42.06	39.96	49.92	49.92	49.92	4962.636
	C. Super Structure								
Item no 1(b)	R.C.C M30 (Superstructure) upto 5m	cum	22.77	22.44	38.24	24.01	25.46	26.90	2006.730
Item no 2	Steel (Superstructure)	ton	1.71	1.68	2.87	1.80	1.91	2.02	150.505
Item no 3(a)	Bituminous Concrete Wearing Coat(40mm)	cum	0.00	0.00	2.46	0.00	0.00	0.00	91.020
Item no 3(b)	Mastic Asphalt (12mm)	sqm	0.00	0.00	61.40	0.00	0.00	0.00	2275.500
Item no 3(c)	Tack Coat	sqm	0.00	0.00	61.40	0.00	0.00	0.00	2275.500
Item no 4	RCC railing	metre							0.000
Item no 5	Crash Barrier	metre	0.00	0.00	12.28	0.00	0.00	0.00	452.960
Item no 6	Drainage Spout	each	0.00	0.00	2.00	0.00	0.00	0.00	166.000
Item no 9	Strip Seal Expansion Joint	metre							0.000
	D. Protection Work								
Item no 1	Eathr work for excavation	cum	362.68	362.68	146.85	115.95	115.95	115.95	13945.785
Item no 2	Catch Pit PCC M15 slab	cum			3.24	2.04	2.04	2.04	162.720
Item no 3	Catch Pit Stone Masonry	cum			3.02	2.30	2.30	2.30	230.256
Item no 4	300 mm thick Rubble stone flooring laid over 100mm thick cement concrete bedding	cum			21.96	16.05	16.05	16.05	1563.846
Item no 5	750 mm thick Flexible aprron	cum	86.1975	86.1975					495.855
Item no 6	Curtain Wall & Guide Wall- PCC (M-20)	cum	75.09	75.09	25.78	21.99	21.99	21.99	2775.853
Item no 7	PCC M15	cum	11.10	11.10	18.45	13.92	13.92	13.92	1447.744
	D. Miscellaneous								
Item no 1	Painting	cum	0.00	0.00	31.41	0.00	0.00	0.00	1158.672



***1 Cell Box Culvert_2m x 2m
with
Flexible Apron
TW - 12m***

A handwritten signature in black ink, consisting of a stylized 'P' followed by a horizontal line and a vertical line.

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2 m x 2 m
with Flexible Apron

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

A. FOUNDATION

1	Excavation(up to 3m)						
	Box Bridge	cum	1	4.600	13.000	0.830	49.634
	Shear Key	cum	2	4.600	1.720	0.820	12.976
Total							62.610

2	PCC-M15						
	Box Bridge	cum	1	3.600	9.760	0.150	5.270
	Shear Key	cum	2	3.800	1.560	0.150	1.778
Total							7.048

B. SUBSTRUCTURE

3	RCC-M30 (upto 5m)						
	Bottom Slab	cum	1	3.600	12.000	0.380	16.416
	Box Side Wall	cum	2	12.000	0.300	2.000	14.400
	Return wall I	cum	4	0.500	0.200	2.350	0.940
	Shear key	cum	2	3.600	0.582		4.192
	Haunch	cum	2	12.000	0.011		0.270
Total=							36.218

4	Substructure Steel						
	70 kg/cum of Concrete	ton	1	2.535			2.535
Total							2.535

5	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 = $11.6/2+1 =$						7
	No of weep holes in vertical direction per abutment = $1.8/1+1 =$						3
	No of weep holes in horizontal direction per return wall = $4/2+1 =$						3
	No of weep holes in vertical direction per return wall = $2.3/1 +1=$						4
	Total no of Weep holes per abutment = 7×3						21
	Total no of Weep holes per return wall = 3×4						12
	Total length of weep holes = $21 \times 2 + 12 \times 4$						22.20

6	Backfilling - Granular Material						
	Box	cum	1	16.600		0.380	6.308
	Shear key	cum	2	1.800		0.820	2.952
Total							9.260

7	Filter media						
	Behind Side wall	cum	2	11.600	0.600	2.350	32.712
Total							32.712

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ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2 m x 2 m
with Flexible Apron

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

C. SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Box Bridge	cum	1	2.600	12.000	0.419	13.065
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	13.335

9	Superstructure Steel						
	75 kg/cum of concrete	ton	1		1.000		1.000
						Total	1.000

10	Bituminious Concrete wearing course						
		cum	1	2.600	11.000	0.040	1.144
						Total	1.144

11	Mastic Asphalt						
		sqm	1	2.600	11.000		28.600
						Total	28.600

12	Tack Coat						
		sqm	1	2.600	11.000		28.600
						Total	28.600

13	Crash Barrier R.C.C. M40	m	2	2.600			5.200
						Total	5.200

14	Drainage Spout	nos.	2				2

D. PROTECTION WORK

15	750 mm thick Flexible apron						
	Upstream	cum	1	9.610	3.000	0.750	21.623
	Downstream	cum	1	9.610	6.000	0.750	43.245
						Total	64.868

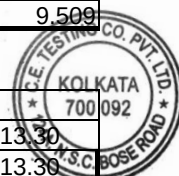
16	Curtain Wall- PCC (M-20)						
	Downstream side	cum	1	21.610	1.910		41.275
	Upstream side	cum	1	15.610	1.480		23.103
						Total	64.378

17	Excavation in Soil						
	Curtain Wall (downstream)	cum	1	22.610	2.850	2.650	170.762
	Curtain Wall (upstream)	cum	1	16.610	2.500	2.150	89.279
	Flexible apron(downstream)	cum	1	8.610	5.000	0.750	32.288
	Flexible apron(upstream)	cum	1	8.610	2.000	0.750	12.915
						Total	305.243

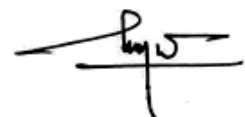
18	PCC (M-15)						
	Below Curtain Wall						
	Downstream side	cum	1	21.610	1.850	0.150	5.997
	Upstream side	cum	1	15.610	1.500	0.150	3.512
						Total	9.509

Miscellaneous

19	Painting						
	Crash Barrier	sqm	2	2.60		2.558	13.30
						Total	13.30



***1 Cell Box Culvert_2m x 2m
with
Stepped Footing
TW - 11m***

A handwritten signature in black ink, consisting of a stylized 'P' followed by a horizontal line and a vertical line.

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	12.00	1.530	84.46
	Shear Key	cum	2	4.80	1.720	0.820	13.54
Total							98.00

2	PCC-M15						
	Box culvert	cum	1	3.60	8.76	0.15	4.73
	Shear Key	cum	2	3.80	1.560	0.15	1.78
Total							6.51

SUBSTRUCTURE

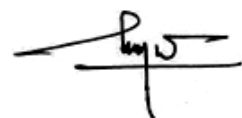
3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall $=10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall $=2/1+1 =$					3	
	No of weep holes in horizontal direction per return wall $=0.5/2+1 =$					2	
	No of weep holes in vertical direction per return wall $=2.4/1+1 =$					4	
	Total no of Weep holes per side wall = 6 x 3					18	
	Total no of Weep holes per return wall $= 2 \times 4$					8	
	Total length of weep holes = 18 x 2 + 8 x 4						20.40

4	RCC-M30						
	Bottom Slab	cum	1	3.60	11.00	0.38	15.05
	Box Side Wall	cum	2	11.00	0.30	2.00	13.20
	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	11.000	0.011		0.25
Total=							34.10

5	Steel						
	@70 Kg per cum of concrete	ton					2.387
Total							2.387

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	2.000	24.96
	Behind Return Wall I	cum	4	0.500	0.60	2.350	2.82
Total							27.78

7	Backfilling by granular material						
	Box culvert	cum	1	15.60		0.53	8.27
	Shear Key	cum	2	1.80		0.82	2.95
Total							11.22





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

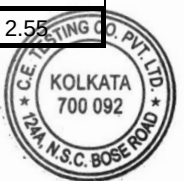
8	RCC-M30(up to 5m)						
	Top Slab	cum	1	2.600	11.000	0.413	11.798
	(+)Haunch	cum	2	11.000	0.011		0.248
						Total	12.045
9	Steel						
	@ 75 Kg per cum of concrete	ton					0.903
						Total	0.903
10	Crash Barrier	m	2	2.60			5.20
						Total	5.20
11	Drainage Spout	nos.	2				2.00
12	Bituminas Concrete Wearing Coat						
		cum	1	2.60	10.00	0.040	1.04
						Total	1.04
13	Tack Coat						
		sqm	1	2.60	10.00		26.00
						Total	26.00
14	Mastic Asphalt						
		sqm	1	2.60	10.00		26.00
						Total	26.00

PROTECTION WORK

Upstream side

15	Eathr 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

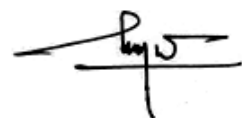
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ESTIMATE OF QUANTITY OF BOX CULVERT

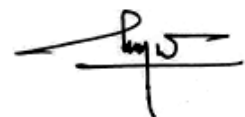
Box Size:- 1 cell of 2m x2m
2.0x2.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
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	Eatrh work for excavation						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
	stone Pitching	cum	1	3.23		1.100	3.55
		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
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





***1 Cell Box Culvert_2m x 2m
with
Stepped Footing &
Earth Cushion
TW - 11m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x 2m
1 cell of 2m x 2m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	4.90	12.00	1.450	85.26
	Shear Key	cum	2	5.10	1.800	0.900	16.52
						Total	101.78

2	PCC-M15						
	Box culvert	cum	1	3.90	8.60	0.15	5.03
	Shear Key	cum	2	4.10	1.673	0.15	2.06
						Total	7.09

SUBSTRUCTURE

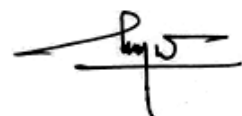
3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $2/1+1 =$					3	
	No of weep holes in horizontal direction per return wall I = $0.6/2+1 =$					2	
	No of weep holes in vertical direction per return wall I = $4.1/1+1 =$					6	
	Total no of Weep holes per side wall = 6×3					18	
	Total no of Weep holes per return wall I = 2×6					12	
	Total length of weep holes = $18 \times 2 + 12 \times 4$						27.00

4	RCC-M30						
	Bottom Slab	cum	1	3.90	11.00	0.30	12.87
	Box Side Wall	cum	2	11.00	0.35	2.00	15.40
	Return wall I	cum	4	0.600	0.30	4.05	2.92
	Shear key	cum	2	3.900	0.675		5.27
	Haunch	cum	2	11.000	0.011		0.25
						Total=	36.70

5	Steel						
	@70 Kg per cum of concrete	ton					2.569
						Total	2.569

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	2.000	24.96
	Behind Return Wall I	cum	4	0.600	0.60	4.050	5.83
						Total	30.79

7	Backfilling by granular material						
	Box culvert	cum	1	15.90		0.45	7.16
	Shear Key	cum	2	1.95		0.90	3.51
						Total	10.67





ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x 2m
1 cell of 2m x 2m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

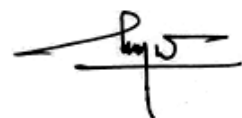
SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	2.700	11.000	0.250	7.425
	(+)Haunch	cum	2	11.000	0.011		0.248
	RCC wall	cum	2	3.90	0.30	2.70	6.32
	RCC column beside Wall	cum	4	0.60	0.90	1.80	3.89
						Total	17.879
9	Steel						
	@ 75 Kg per cum of concrete	ton					1.341
						Total	1.341

PROTECTION WORK

Upstream side

10	Eatrh work for excavation						
		cum	1	3.40	2.00	1.00	6.80
						Total	6.80
11	Catch Pit PCC M15 slab						
		cum	1	2.40	2.00	0.30	1.44
						Total	1.44
12	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
13	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
14	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

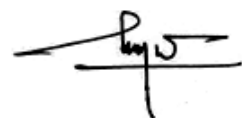




ESTIMATE OF QUANTITY OF BOX CULVERT

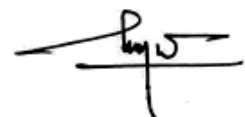
Box Size:- 1 cell of 2m x 2m
1 cell of 2m x 2m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
15	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
16	Eatrh 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
17	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
18	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





***1 Cell Box Culvert_2m x 3m
with
Flexible Apron
TW - 12m***

A handwritten signature in black ink, consisting of a stylized 'P' followed by a horizontal line and a vertical line.

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2 m x 3 m
with Flexible Apron

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

A. FOUNDATION

1	Excavation(up to 3m)						
	Box Bridge	cum	1	6.300	13.000	0.870	71.253
	Shear Key	cum	2	6.300	1.680	0.780	16.511
Total							87.764

2	PCC-M15						
	Box Bridge	cum	1	5.300	9.840	0.150	7.823
	Shear Key	cum	2	5.500	1.503	0.150	2.480
Total							10.303

B. SUBSTRUCTURE

3	RCC-M30 (upto 5m)						
	Bottom Slab	cum	1	5.300	12.000	0.420	26.712
	Box Side Wall	cum	2	12.000	0.350	3.000	25.200
	Return wall I	cum	4	1.300	0.300	3.370	5.257
	Shear key	cum	2	5.300	0.538		5.705
	Haunch	cum	2	12.000	0.011		0.270
Total=							63.144

4	Substructure Steel						
	70 kg/cum of Concrete	ton	1	4.420			4.420
Total							4.420

5	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 = $11.4/2+1 =$						7
	No of weep holes in vertical direction per abutment = $2.8/1+1 =$						4
	No of weep holes in horizontal direction per return wall = $2/2+1 =$						2
	No of weep holes in vertical direction per return wall = $3.3/1 +1=$						5
	Total no of Weep holes per abutment = 7×4						28
	Total no of Weep holes per return wall = 2×5						10
	Total length of weep holes in metre = $28 \times 2 + 10 \times 4$						31.60

6	Backfilling - Granular Material						
	Box	cum	1	18.300		0.420	7.686
	Shear key	cum	2	2.650		0.780	4.134
Total							11.820

7	Backfilling - Sandy Material						
	Behind the side wall and return wall	cum	2	11.40	5.035	3.490	400.645
	Deduct for the filter media	cum					46.102
Total							354.543

8	Filter media						
	Behind Side wall	cum	2	11.400	0.600	3.370	46.102
Total							46.102

[Handwritten Signature]



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2 m x 3 m
with Flexible Apron

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

C. SUPERSTRUCTURE

9	RCC-M30(up to 5m)						
	Box Bridge	cum	1	2.700	12.000	0.439	14.216
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	14.486

10	Superstructure Steel						
	75 kg/cum of concrete	ton	1		1.086		1.086
						Total	1.086

11	Bituminious Concrete wearing course						
		cum	1	2.700	11.000	0.040	1.188
						Total	1.188

12	Mastic Asphalt						
		sqm	1	2.700	11.000		29.700
						Total	29.700

13	Tack Coat						
		sqm	1	2.700	11.000		29.700
						Total	29.700

14	Crash Barrier R.C.C. M40	m	2	2.700			5.400
						Total	5.400

15	Drainage Spout	nos.	2				2

D. PROTECTION WORK

16	750 mm thick Flexible apron						
	Upstream	cum	1	12.770	3.000	0.750	28.733
	Downstream	cum	1	12.770	6.000	0.750	57.465
						Total	86.198

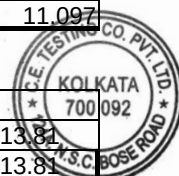
17	Curtain Wall- PCC (M-20)						
	Downstream side	cum	1	24.770	1.910		47.311
	Upstream side	cum	1	18.770	1.480		27.780
						Total	75.090

18	Excavation in Soil						
	Curtain Wall (downstream)	cum	1	25.770	2.850	2.650	194.628
	Curtain Wall (upstream)	cum	1	19.770	2.500	2.150	106.264
	Flexible apron(downstream)	cum	1	11.770	5.000	0.750	44.138
	Flexible apron(upstream)	cum	1	11.770	2.000	0.750	17.655
						Total	362.684

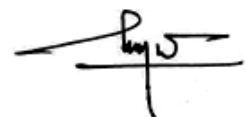
19	PCC (M-15)						
	Below Curtain Wall						
	Downstream side	cum	1	24.770	1.850	0.150	6.874
	Upstream side	cum	1	18.770	1.500	0.150	4.223
						Total	11.097

Miscellaneous

20	Painting						
	Crash Barrier	sqm	2	2.70		2.558	13.81
						Total	13.81



***1 Cell Box Culvert_2m x 3m
with
Stepped Footing
TW - 11m***

A handwritten signature in black ink, consisting of a stylized 'P' followed by a horizontal line and a vertical line.

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	12.00	1.570	118.69
	Shear Key	cum	2	6.50	1.680	0.780	17.04
Total							135.73

2	PCC-M15						
	Box culvert	cum	1	5.30	8.84	0.15	7.03
	Shear Key	cum	2	5.50	1.503	0.15	2.48
Total							9.51

SUBSTRUCTURE

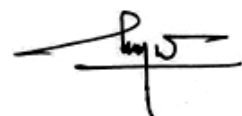
3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $3/1+1 =$					4	
	No of weep holes in horizontal direction per return wall = $1.3/2+1 =$					2	
	No of weep holes in vertical direction per return wall = $3.4/1+1 =$					5	
	Total no of Weep holes per side wall = 6×4					24	
	Total no of Weep holes per return wall = 2×5					10	
	Total length of weep holes = $24 \times 2 + 10 \times 4$						28.80

4	RCC-M30						
	Bottom Slab	cum	1	5.30	11.00	0.42	24.49
	Box Side Wall	cum	2	11.00	0.35	3.00	23.10
	Return wall I	cum	4	1.300	0.30	3.37	5.26
	Shear key	cum	2	5.300	0.538		5.70
	Haunch	cum	2	11.000	0.011		0.25
Total=							58.80

5	Steel						
	@70 Kg per cum of concrete	ton					4.116
Total							4.116

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	3.000	37.44
	Behind Return Wall I	cum	4	1.300	0.60	3.370	10.51
Total							47.95

7	Backfilling by granular material						
	Box culvert	cum	1	17.30		0.57	9.86
	Shear Key	cum	2	2.65		0.78	4.13
Total							14.00





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

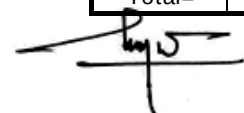
SUPERSTRUCTURE

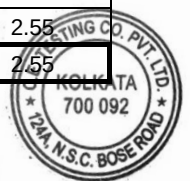
8	RCC-M30(up to 5m)						
	Top Slab	cum	1	2.700	11.000	0.433	12.845
	(+)Haunch	cum	2	11.000	0.011		0.248
						Total	13.093
9	Steel						
	@ 75 Kg per cum of concrete	ton					0.982
						Total	0.982
10	Crash Barrier	m	2	2.70			5.40
						Total	5.40
11	Drainage Spout	nos.	2				2.00
12	Bituminas Concrete Wearing Coat						
		cum	1	2.70	10.00	0.040	1.08
						Total	1.08
13	Tack Coat						
		sqm	1	2.70	10.00		27.00
						Total	27.00
14	Mastic Asphalt						
		sqm	1	2.70	10.00		27.00
						Total	27.00

PROTECTION WORK

Upstream side

15	Eathr 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	2.00	0.30	1.44
						Total	1.44
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

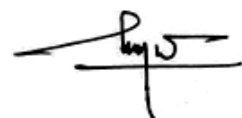




ESTIMATE OF QUANTITY OF BOX CULVERT

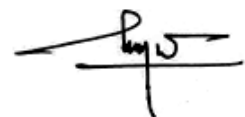
Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
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
21	Eatrh work for excavation						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
	stone Pitching	cum	1	3.23		1.100	3.55
		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
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





***1 Cell Box Culvert_2m x 3m
with
Stepped Footing &
Earth Cushion
TW - 11m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	5.90	12.00	1.450	102.66
	Shear Key	cum	2	6.10	1.800	0.900	19.76
						Total	122.42

2	PCC-M15						
	Box culvert	cum	1	4.90	8.60	0.15	6.32
	Shear Key	cum	2	5.10	1.673	0.15	2.56
						Total	8.88

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 = $10.4/2+1 =$					6	
	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 = $1.1/2+1 =$					2	
	No of weep holes in vertical direction per return wall I = $5.1/1+1 =$					7	
	Total no of Weep holes per side wall = 6×4					24	
	Total no of Weep holes per return wall I = 2×7					14	
	Total length of weep holes = $24 \times 2 + 14 \times 4$						33.60

4	RCC-M30						
	Bottom Slab	cum	1	4.90	11.00	0.30	16.17
	Box Side Wall	cum	2	11.00	0.35	3.00	23.10
	Return wall I	cum	4	1.100	0.30	5.08	6.71
	Shear key	cum	2	4.900	0.675		6.62
	Haunch	cum	2	11.000	0.011		0.25
						Total=	52.84

5	Steel						
	@70 Kg per cum of concrete	ton					3.699
						Total	3.699

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	3.000	37.44
	Behind Return Wall I	cum	4	1.100	0.60	5.080	13.41
						Total	50.85

7	Backfilling by granular material						
	Box culvert	cum	1	16.90		0.45	7.61
	Shear Key	cum	2	2.45		0.90	4.41
						Total	12.02

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ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

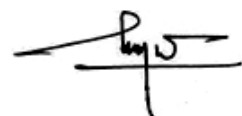
SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	2.700	11.000	0.280	8.316
	(+)Haunch	cum	2	11.000	0.011		0.248
	RCC wall	cum	2	4.90	0.30	2.70	7.94
	RCC column beside Wall	cum	4	0.60	0.90	1.80	3.89
						Total	20.390
9	Steel						
	@ 75 Kg per cum of concrete	ton					1.529
						Total	1.529

PROTECTION WORK

Upstream side

10	Eatrh work for excavation						
		cum	1	3.40	2.00	1.00	6.80
						Total	6.80
11	Catch Pit PCC M15 slab						
		cum	1	2.40	2.00	0.30	1.44
						Total	1.44
12	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
13	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
14	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

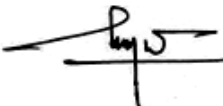




ESTIMATE OF QUANTITY OF BOX CULVERT

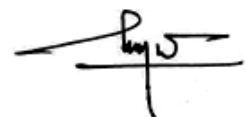
Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
15	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
16	Eatrh 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
17	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
18	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





***1 Cell Box Culvert_3m x 4m
with
Stepped Footing &
Earth Cushion
TW - 11m***

A handwritten signature in black ink, consisting of a stylized 'P' followed by a horizontal line and a vertical line.

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	7.56	12.00	1.620	146.97
	Shear Key	cum	2	7.76	1.630	0.730	18.47
Total							165.43

2	PCC-M15						
	Box culvert	cum	1	6.56	8.94	0.15	8.80
	Shear Key	cum	2	6.76	1.432	0.15	2.90
Total							11.70

SUBSTRUCTURE

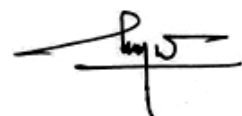
3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $4/1+1 =$					5	
	No of weep holes in horizontal direction per return wall = $1.3/2+1 =$					2	
	No of weep holes in vertical direction per return wall = $4.4/1+1 =$					6	
	Total no of Weep holes per side wall = 6×5					30	
	Total no of Weep holes per return wall = 2×6					12	
	Total length of weep holes = $30 \times 2 + 12 \times 4$						43.20

4	RCC-M30						
	Bottom Slab	cum	1	6.56	11.00	0.47	33.92
	Box Side Wall	cum	2	11.00	0.48	4.00	42.24
	Return wall I	cum	4	1.300	0.30	4.37	6.82
	Shear key	cum	2	6.560	0.485		6.37
	Haunch	cum	2	11.000	0.011		0.25
Total=							89.59

5	Steel						
	@70 Kg per cum of concrete	ton					6.271
Total							6.271

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	4.000	49.92
	Behind Return Wall I	cum	4	1.300	0.60	4.370	13.63
Total							63.55

7	Backfilling by granular material						
	Box culvert	cum	1	18.56		0.62	11.51
	Shear Key	cum	2	3.28		0.73	4.79
Total							16.30





ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

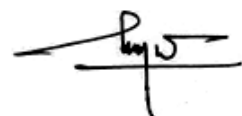
SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	3.960	11.000	0.370	16.117
	(+)Haunch	cum	2	11.000	0.011		0.248
	RCC wall	cum	2	6.56	0.30	2.40	9.45
	RCC column beside Wall	cum	4	0.60	0.90	1.50	3.24
						Total	29.051
9	Steel						
	@ 75 Kg per cum of concrete	ton					2.179
						Total	2.179

PROTECTION WORK

Upstream side

10	Eathr work for excavation						
		cum	1	4.40	2.00	1.00	8.80
						Total	8.80
11	Catch Pit PCC M15 slab						
		cum	1	3.40	2.00	0.30	2.04
						Total	2.04
12	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	3.40	0.36		1.22
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	2.30
13	300 mm thick Boulder Pitching						
		cum	1	3.00	1.30	0.30	1.17
		cum	1	5.89	5.00	0.30	8.83
						Total=	10.00
14	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

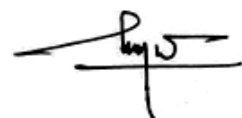




ESTIMATE OF QUANTITY OF BOX CULVERT

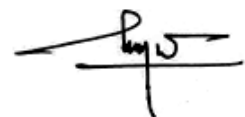
Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
15	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	8.912	1.85	0.15	2.47
	For PCC wall						
		cum	1	4.184	0.35	1.00	1.46
		cum	1	5.569	0.35	1.60	3.12
		cum	1	6.955	0.35	1.60	3.89
	Below PCC Wall						
		cum	1	4.38	0.55	0.10	0.24
		cum	1	5.77	0.55	0.10	0.32
		cum	1	7.15	0.55	0.10	0.39
	On trades						
		cum	1	3.491	0.85	0.10	0.30
		cum	1	4.876	0.85	0.10	0.41
		cum	1	6.262	0.85	0.10	0.53
		cum	1	7.734	1.00	0.10	0.77
						Total	13.92
16	Eatrh work for excavation						
	Curtain Wall	cum	1	9.91	2.85	2.65	74.86
		cum	1	4.43		1.100	4.87
	stone Pitching	cum	1	6.09		1.700	10.36
		cum	1	7.76		1.700	13.19
		cum	1	7.73		0.500	3.87
						Total	107.15
17	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	8.912	1.898		16.910
	Guide wall	cum	2	4.22		0.300	2.533
						Total	19.443
18	300 MM thk stone pitching						
	Below trades						
		cum	1	3.491	0.85	0.30	0.89
		cum	1	4.876	0.85	0.30	1.24
		cum	1	6.262	0.85	0.30	1.60
		cum	1	7.734	1.00	0.30	2.32
						Total	6.05





***1 Cell Box Culvert_3m x 3m
with
Stepped Footing &
Earth Cushion
TW - 11m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 3m
1 cell of 3m x 3m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	6.40	12.00	1.600	122.88
	Shear Key	cum	2	6.60	1.650	0.750	16.34
						Total	139.22

2	PCC-M15						
	Box culvert	cum	1	5.40	8.90	0.15	7.21
	Shear Key	cum	2	5.60	1.461	0.15	2.45
						Total	9.66

SUBSTRUCTURE

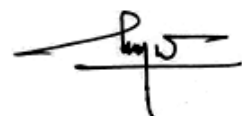
3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $3/1+1 =$					4	
	No of weep holes in horizontal direction per return wall I = $0.8/2+1 =$					2	
	No of weep holes in vertical direction per return wall I = $5.2/1+1 =$					7	
	Total no of Weep holes per side wall = 6×4					24	
	Total no of Weep holes per return wall I = 2×7					14	
	Total length of weep holes = $24 \times 2 + 14 \times 4$						36.00

4	RCC-M30						
	Bottom Slab	cum	1	5.40	11.00	0.45	26.73
	Box Side Wall	cum	2	11.00	0.40	3.00	26.40
	Return wall I	cum	4	0.800	0.30	5.17	4.96
	Shear key	cum	2	5.400	0.506		5.47
	Haunch	cum	2	11.000	0.011		0.25
						Total=	63.81

5	Steel						
	@70 Kg per cum of concrete	ton					4.467
						Total	4.467

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	3.000	37.44
	Behind Return Wall I	cum	4	0.800	0.60	5.170	9.93
						Total	47.37

7	Backfilling by granular material						
	Box culvert	cum	1	17.40		0.60	10.44
	Shear Key	cum	2	2.70		0.75	4.05
						Total	14.49





ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 3m
1 cell of 3m x 3m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

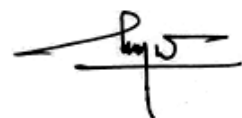
SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	3.800	11.000	0.370	15.466
	(+)Haunch	cum	2	11.000	0.011		0.248
	RCC wall	cum	2	5.40	0.30	2.70	8.75
	RCC column beside Wall	cum	4	0.60	0.90	1.80	3.89
						Total	28.350
9	Steel						
	@ 75 Kg per cum of concrete	ton					2.126
						Total	2.126

PROTECTION WORK

Upstream side

10	Eatrh work for excavation						
		cum	1	4.40	2.00	1.00	8.80
						Total	8.80
11	Catch Pit PCC M15 slab						
		cum	1	3.40	2.00	0.30	2.04
						Total	2.04
12	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	3.40	0.36		1.22
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	2.30
13	300 mm thick Boulder Pitching						
		cum	1	3.00	1.30	0.30	1.17
		cum	1	5.89	5.00	0.30	8.83
						Total=	10.00
14	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

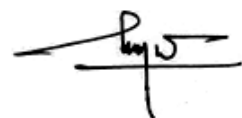




ESTIMATE OF QUANTITY OF BOX CULVERT

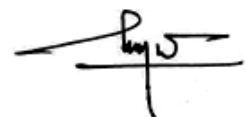
Box Size:- 1 cell of 3m x 3m
1 cell of 3m x 3m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
15	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	8.912	1.85	0.15	2.47
	For PCC wall						
		cum	1	4.184	0.35	1.00	1.46
		cum	1	5.569	0.35	1.60	3.12
		cum	1	6.955	0.35	1.60	3.89
	Below PCC Wall						
		cum	1	4.38	0.55	0.10	0.24
		cum	1	5.77	0.55	0.10	0.32
		cum	1	7.15	0.55	0.10	0.39
	On trades						
		cum	1	3.491	0.85	0.10	0.30
		cum	1	4.876	0.85	0.10	0.41
		cum	1	6.262	0.85	0.10	0.53
		cum	1	7.734	1.00	0.10	0.77
						Total	13.92
16	Eatrh work for excavation						
	Curtain Wall	cum	1	9.91	2.85	2.65	74.86
		cum	1	4.43		1.100	4.87
	stone Pitching	cum	1	6.09		1.700	10.36
		cum	1	7.76		1.700	13.19
		cum	1	7.73		0.500	3.87
						Total	107.15
17	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	8.912	1.898		16.910
	Guide wall	cum	2	4.22		0.300	2.533
						Total	19.443
18	300 MM thk stone pitching						
	Below trades						
		cum	1	3.491	0.85	0.30	0.89
		cum	1	4.876	0.85	0.30	1.24
		cum	1	6.262	0.85	0.30	1.60
		cum	1	7.734	1.00	0.30	2.32
						Total	6.05





***1 Cell Box Culvert_5m x 4m
with
Stepped Footing &
Earth Cushion
TW - 11m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 5m x 4m
1 cell of 5m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	8.66	12.00	1.850	192.25
	Shear Key	cum	2	8.86	1.400	0.500	12.40
						Total	204.66

2	PCC-M15						
	Box culvert	cum	1	7.66	9.40	0.15	10.80
	Shear Key	cum	2	7.86	1.107	0.15	2.61
						Total	13.41

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 = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $4/1+1 =$					5	
	No of weep holes in horizontal direction per return wall I = $0.8/2+1 =$					2	
	No of weep holes in vertical direction per return wall I = $6.6/1+1 =$					8	
	Total no of Weep holes per side wall = 6 x 5					30	
	Total no of Weep holes per return wall I = 2 x 8					16	
	Total length of weep holes = 30 x 2 + 16 x 4						51.00

4	RCC-M30						
	Bottom Slab	cum	1	7.66	11.00	0.70	58.98
	Box Side Wall	cum	2	11.00	0.53	4.00	46.64
	Return wall I	cum	4	0.800	0.30	6.55	6.29
	Shear key	cum	2	7.660	0.275		4.21
	Haunch	cum	2	11.000	0.011		0.25
						Total=	116.37

5	Steel						
	@70 Kg per cum of concrete	ton					8.146
						Total	8.146

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	4.000	49.92
	Behind Return Wall I	cum	4	0.800	0.60	6.550	12.58
						Total	62.50

7	Backfilling by granular material						
	Box culvert	cum	1	19.66		0.85	16.71
	Shear Key	cum	2	3.83		0.50	3.83
						Total	20.54

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ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 5m x 4m
1 cell of 5m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

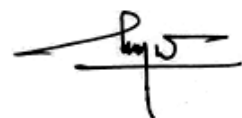
SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	6.060	11.000	0.550	36.663
	(+)Haunch	cum	2	11.000	0.011		0.248
	RCC wall	cum	2	7.66	0.30	2.90	13.33
	RCC column beside Wall	cum	4	0.60	0.90	2.00	4.32
						Total	54.559
9	Steel						
	@ 75 Kg per cum of concrete	ton					4.092
						Total	4.092

PROTECTION WORK

Upstream side

10	Eatrh work for excavation						
		cum	1	6.40	2.00	1.00	12.80
						Total	12.80
11	Catch Pit PCC M15 slab						
		cum	1	5.40	2.00	0.30	3.24
						Total	3.24
12	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	5.40	0.36		1.94
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	3.02
13	300 mm thick Boulder Pitching						
		cum	1	5.00	1.30	0.30	1.95
		cum	1	7.89	5.00	0.30	11.83
						Total=	13.78
14	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

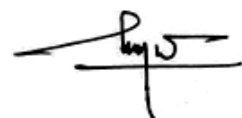




ESTIMATE OF QUANTITY OF BOX CULVERT

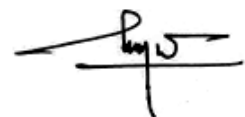
Box Size:- 1 cell of 5m x 4m
1 cell of 5m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
15	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	10.912	1.85	0.15	3.03
	For PCC wall						
		cum	1	6.184	0.35	1.00	2.16
		cum	1	7.569	0.35	1.60	4.24
		cum	1	8.955	0.35	1.60	5.01
	Below PCC Wall						
		cum	1	6.38	0.55	0.10	0.35
		cum	1	7.77	0.55	0.10	0.43
		cum	1	9.15	0.55	0.10	0.50
	On trades						
		cum	1	5.491	0.85	0.10	0.47
		cum	1	6.876	0.85	0.10	0.58
		cum	1	8.262	0.85	0.10	0.70
		cum	1	9.734	1.00	0.10	0.97
						Total	18.45
16	Eatrh work for excavation						
	Curtain Wall	cum	1	11.91	2.85	2.65	89.96
	stone Pitching	cum	1	6.83		1.100	7.51
		cum	1	8.49		1.700	14.44
		cum	1	10.16		1.700	17.27
		cum	1	9.73		0.500	4.87
						Total	134.05
17	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	10.912	1.898		20.705
	Guide wall	cum	2	4.22		0.300	2.533
						Total	23.238
18	300 MM thk stone pitching						
	Below trades						
		cum	1	5.491	0.85	0.30	1.40
		cum	1	6.876	0.85	0.30	1.75
		cum	1	8.262	0.85	0.30	2.11
		cum	1	9.734	1.00	0.30	2.92
						Total	8.18





***1 Cell Box Culvert_2m x 3m
with
Flexible Apron &
Earth Cushion
TW - 12m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2 m x 3 m
with Flexible Apron & EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

A. FOUNDATION

1	Excavation(up to 3m)						
	Box Bridge	cum	1	6.300	13.000	0.870	71.253
	Shear Key	cum	2	6.300	1.680	0.780	16.511
Total							87.764

2	PCC-M15						
	Box Bridge	cum	1	5.300	9.840	0.150	7.823
	Shear Key	cum	2	5.500	1.503	0.150	2.480
Total							10.303

B. SUBSTRUCTURE

3	RCC-M30 (upto 5m)						
	Bottom Slab	cum	1	5.300	12.000	0.420	26.712
	Box Side Wall	cum	2	12.000	0.350	3.000	25.200
	Return wall I	cum	4	1.300	0.300	3.370	5.257
	Shear key	cum	2	5.300	0.538		5.705
	Haunch	cum	2	12.000	0.011		0.270
Total=							63.144

4	Substructure Steel						
	70 kg/cum of Concrete	ton	1	4.420			4.420
Total							4.420

5	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 = $11.4/2+1 =$						7
	No of weep holes in vertical direction per abutment = $2.8/1+1 =$						4
	No of weep holes in horizontal direction per return wall = $2/2+1 =$						2
	No of weep holes in vertical direction per return wall = $3.3/1 +1=$						5
	Total no of Weep holes per abutment = 7×4						28
	Total no of Weep holes per return wall = 2×5						10
	Total length of weep holes in metre = $28 \times 2 + 10 \times 4$						31.60

6	Backfilling - Granular Material						
	Box	cum	1	18.300		0.420	7.686
	Shear key	cum	2	2.650		0.780	4.134
Total							11.820

7	Backfilling - Sandy Material						
	Behind the side wall and return wall	cum	2	11.40	5.035	3.490	400.645
	Deduct for the filter media	cum					46.102
Total							354.543

8	Filter media						
	Behind Side wall	cum	2	11.400	0.600	3.370	46.102
Total							46.102

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ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2 m x 3 m
with Flexible Apron & EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

C. SUPERSTRUCTURE

9	RCC-M30(up to 5m)						
	Box Bridge	cum	1	2.700	12.000	0.441	14.297
	RCC wall	cum	2	5.300	0.300	1.900	6.042
	RCC column beside Wall	cum	4	0.600	0.900	1.000	2.160
	(+)Haunch	cum	2	12.000	0.011		0.270
Total							22.769

10	Superstructure Steel						
	75 kg/cum of concrete	ton	1		1.708		1.708
Total							1.708

D. PROTECTION WORK

11	750 mm thick Flexible apron						
	Upstream	cum	1	12.770	3.000	0.750	28.733
	Downstream	cum	1	12.770	6.000	0.750	57.465
Total							86.198

12	Curtain Wall- PCC (M-20)						
	Downstream side	cum	1	24.770	1.910		47.311
	Upstream side	cum	1	18.770	1.480		27.780
Total							75.090

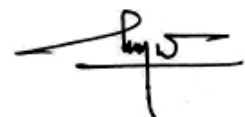
13	Excavation in Soil						
	Curtain Wall (downstream)	cum	1	25.770	2.850	2.650	194.628
	Curtain Wall (upstream)	cum	1	19.770	2.500	2.150	106.264
	Flexible apron(downstream)	cum	1	11.770	5.000	0.750	44.138
	Flexible apron(upstream)	cum	1	11.770	2.000	0.750	17.655
Total							362.684

14	PCC (M-15)						
	Below Curtain Wall						
	Downstream side	cum	1	24.770	1.850	0.150	6.874
	Upstream side	cum	1	18.770	1.500	0.150	4.223
Total							11.097

[Signature]



***1 Cell Box Culvert_2m x 3m
with
Flexible Apron &
Earth Cushion
TW - 11m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2 m x 3 m
with Flexible Apron & EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

A. FOUNDATION

1	Excavation(up to 3m)						
	Box Bridge	cum	1	6.300	12.000	0.870	65.772
	Shear Key	cum	2	6.300	1.680	0.780	16.511
Total							82.283

2	PCC-M15						
	Box Bridge	cum	1	5.300	8.840	0.150	7.028
	Shear Key	cum	2	5.500	1.503	0.150	2.480
Total							9.508

B. SUBSTRUCTURE

3	RCC-M30 (upto 5m)						
	Bottom Slab	cum	1	5.300	11.000	0.420	24.486
	Box Side Wall	cum	2	11.000	0.350	3.000	23.100
	Return wall I	cum	4	1.300	0.300	3.370	5.257
	Shear key	cum	2	5.300	0.538		5.705
	Haunch	cum	2	11.000	0.011		0.248
Total=							58.796

4	Substructure Steel						
	70 kg/cum of Concrete	ton	1	4.116			4.116
Total							4.116

5	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 = $10.4/2+1 =$						7
	No of weep holes in vertical direction per abutment = $2.8/1+1 =$						4
	No of weep holes in horizontal direction per return wall = $2/2+1 =$						2
	No of weep holes in vertical direction per return wall = $3.3/1 +1 =$						5
	Total no of Weep holes per abutment = 7×4						28
	Total no of Weep holes per return wall = 2×5						10
	Total length of weep holes in metre = $28 \times 2 + 10 \times 4$						31.60

6	Backfilling - Granular Material						
	Box	cum	1	17.300		0.420	7.266
	Shear key	cum	2	2.650		0.780	4.134
Total							11.400

7	Backfilling - Sandy Material						
	Behind the side wall and return wall	cum	2	10.40	5.035	3.490	365.501
	Deduct for the filter media	cum					42.058
Total							323.443

8	Filter media						
	Behind Side wall	cum	2	10.400	0.600	3.370	42.058
Total							42.058

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ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 2 m x 3 m
with Flexible Apron & EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

C. SUPERSTRUCTURE

9	RCC-M30(up to 5m)						
	Box Bridge	cum	1	2.700	11.000	0.435	12.920
	RCC wall	cum	2	5.300	0.300	2.100	6.678
	RCC column beside Wall	cum	4	0.600	0.900	1.200	2.592
	(+)Haunch	cum	2	11.000	0.011		0.248
Total							22.437

10	Superstructure Steel						
	75 kg/cum of concrete	ton	1		1.683		1.683
Total							1.683

D. PROTECTION WORK

11	750 mm thick Flexible apron						
	Upstream	cum	1	12.770	3.000	0.750	28.733
	Downstream	cum	1	12.770	6.000	0.750	57.465
Total							86.198

12	Curtain Wall- PCC (M-20)						
	Downstream side	cum	1	24.770	1.910		47.311
	Upstream side	cum	1	18.770	1.480		27.780
Total							75.090

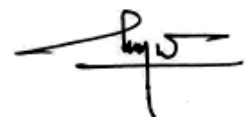
13	Excavation in Soil						
	Curtain Wall (downstream)	cum	1	25.770	2.850	2.650	194.628
	Curtain Wall (upstream)	cum	1	19.770	2.500	2.150	106.264
	Flexible apron(downstream)	cum	1	11.770	5.000	0.750	44.138
	Flexible apron(upstream)	cum	1	11.770	2.000	0.750	17.655
Total							362.684

14	PCC (M-15)						
	Below Curtain Wall						
	Downstream side	cum	1	24.770	1.850	0.150	6.874
	Upstream side	cum	1	18.770	1.500	0.150	4.223
Total							11.097

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***1 Cell Box Culvert_2m x 3m
with
Stepped Footing
TW - 11m***

A handwritten signature in black ink, consisting of a stylized 'P' followed by a horizontal line and a vertical line.

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	7.74	12.00	1.720	159.75
	Shear Key	cum	2	7.94	1.530	0.630	15.31
Total							175.06

2	PCC-M15						
	Box culvert	cum	1	6.74	9.14	0.15	9.24
	Shear Key	cum	2	6.94	1.291	0.15	2.69
Total							11.93

SUBSTRUCTURE

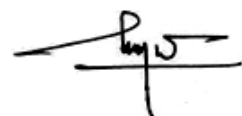
3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $3/1+1 =$					4	
	No of weep holes in horizontal direction per return wall = $0.3/2+1 =$					2	
	No of weep holes in vertical direction per return wall = $3.5/1+1 =$					5	
	Total no of Weep holes per side wall = 6×4					24	
	Total no of Weep holes per return wall = 2×5					10	
	Total length of weep holes = $24 \times 2 + 10 \times 4$						39.36

4	RCC-M30						
	Bottom Slab	cum	1	6.74	11.00	0.57	42.26
	Box Side Wall	cum	2	11.00	0.57	3.00	37.62
	Return wall I	cum	4	0.300	0.30	3.50	1.26
	Shear key	cum	2	6.740	0.387		5.22
	Haunch	cum	2	11.000	0.011		0.25
Total=							86.61

5	Steel						
	@70 Kg per cum of concrete	ton					6.063
Total							6.063

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	3.000	37.44
	Behind Return Wall I	cum	4	0.300	0.60	3.500	2.52
Total							39.96

7	Backfilling by granular material						
	Box culvert	cum	1	18.74		0.72	13.49
	Shear Key	cum	2	3.37		0.63	4.25
Total							17.74





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

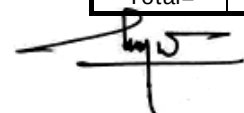
SUPERSTRUCTURE

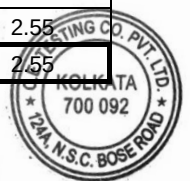
8	RCC-M30(up to 5m)						
	Top Slab	cum	1	6.140	11.000	0.563	37.991
	(+)Haunch	cum	2	11.000	0.011		0.248
						Total	38.239
9	Steel						
	@ 75 Kg per cum of concrete	ton					2.868
						Total	2.868
10	Crash Barrier	m	2	6.14			12.28
						Total	12.28
11	Drainage Spout	nos.	2				2.00
12	Bituminas Concrete Wearing Coat						
		cum	1	6.14	10.00	0.040	2.46
						Total	2.46
13	Tack Coat						
		sqm	1	6.14	10.00		61.40
						Total	61.40
14	Mastic Asphalt						
		sqm	1	6.14	10.00		61.40
						Total	61.40

PROTECTION WORK

Upstream side

15	Eathr work for excavation						
		cum	1	6.40	2.00	1.00	12.80
						Total	12.80
16	Catch Pit PCC M15 slab						
		cum	1	5.40	2.00	0.30	3.24
						Total	3.24
17	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	5.40	0.36		1.94
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	3.02
18	300 mm thick Boulder Pitching						
		cum	1	5.00	1.30	0.30	1.95
		cum	1	7.89	5.00	0.30	11.83
						Total=	13.78
19	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55





ESTIMATE OF QUANTITY OF BOX CULVERT

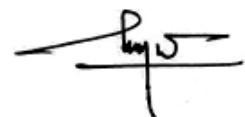
Box Size:- 1 cell of 2m x3m
2.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
20	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	10.912	1.85	0.15	3.03
	For PCC wall						
		cum	1	6.184	0.35	1.00	2.16
		cum	1	7.569	0.35	1.60	4.24
		cum	1	8.955	0.35	1.60	5.01
	Below PCC Wall						
		cum	1	6.38	0.55	0.10	0.35
		cum	1	7.77	0.55	0.10	0.43
		cum	1	9.15	0.55	0.10	0.50
	On trades						
		cum	1	5.491	0.85	0.10	0.47
		cum	1	6.876	0.85	0.10	0.58
		cum	1	8.262	0.85	0.10	0.70
		cum	1	9.734	1.00	0.10	0.97
							Total
21	Eatrh work for excavation						
	Curtain Wall	cum	1	11.91	2.85	2.65	89.96
	stone Pitching	cum	1	6.83		1.100	7.51
		cum	1	8.49		1.700	14.44
		cum	1	10.16		1.700	17.27
		cum	1	9.73		0.500	4.87
							Total
22	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	10.912	1.898		20.705
	Guide wall	cum	2	4.22		0.300	2.533
						Total	23.238
23	300 MM thk stone pitching						
	Below trades						
		cum	1	5.491	0.85	0.30	1.40
		cum	1	6.876	0.85	0.30	1.75
		cum	1	8.262	0.85	0.30	2.11
		cum	1	9.734	1.00	0.30	2.92
						Total	8.18
Miscellaneous							
24	Painting						
	Crash Barrier	sqm	2	6.14	2.558		31.41
						Total	31.41

[Signature]



***1 Cell Box Culvert_3m x 4m
with
Stepped Footing,Earth Cushion
& RE Wall Encasing
TW - 11m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	5.00	12.00	1.675	100.50
	Shear Key	cum	2	5.20	1.575	0.675	11.06
						Total	111.56

2	PCC-M15						
	Box culvert	cum	1	4.00	9.05	0.15	5.43
	Shear Key	cum	2	4.20	1.355	0.15	1.71
						Total	7.14

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 = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $4/1+1 =$					5	
	Total no of Weep holes per side wall = 6×5					30	
	Total length of weep holes = $30 \times 2 + 0 \times 4$						30.00

4	RCC-M30						
	Bottom Slab	cum	1	4.00	11.00	0.53	23.10
	Box Side Wall	cum	2	11.00	0.50	4.00	44.00
	Shear key	cum	2	4.000	0.430		3.44
	Haunch	cum	2	11.000	0.011		0.25
						Total=	70.79

5	Steel						
	@70 Kg per cum of concrete	ton					4.955
						Total	4.955

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	4.000	49.92
						Total	49.92

7	Backfilling by granular material						
	Box culvert	cum	1	16.00		0.68	10.80
	Shear Key	cum	2	2.00		0.68	2.70
						Total	13.50

[Signature]



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

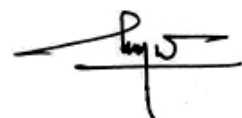
SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	4.000	11.000	0.540	23.760
	(+)Haunch	cum	2	11.000	0.011		0.248
						Total	24.008
9	Steel						
	@ 75 Kg per cum of concrete	ton					1.801
						Total	1.801

PROTECTION WORK

Upstream side

10	Eatrh work for excavation						
		cum	1	4.40	2.00	1.00	8.80
						Total	8.80
11	Catch Pit PCC M15 slab						
		cum	1	3.40	2.00	0.30	2.04
						Total	2.04
12	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	3.40	0.36		1.22
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	2.30
13	300 mm thick Boulder Pitching						
		cum	1	3.00	1.30	0.30	1.17
		cum	1	5.89	5.00	0.30	8.83
						Total=	10.00
14	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55





ESTIMATE OF QUANTITY OF BOX CULVERT

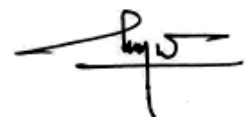
Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
15	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	8.912	1.85	0.15	2.47
	For PCC wall						
		cum	1	4.184	0.35	1.00	1.46
		cum	1	5.569	0.35	1.60	3.12
		cum	1	6.955	0.35	1.60	3.89
	Below PCC Wall						
		cum	1	4.38	0.55	0.10	0.24
		cum	1	5.77	0.55	0.10	0.32
		cum	1	7.15	0.55	0.10	0.39
	On trades						
		cum	1	3.491	0.85	0.10	0.30
		cum	1	4.876	0.85	0.10	0.41
		cum	1	6.262	0.85	0.10	0.53
		cum	1	7.734	1.00	0.10	0.77
						Total	13.92
16	Eatrh work for excavation						
	Curtain Wall	cum	1	9.91	2.85	2.65	74.86
		cum	1	4.43		1.100	4.87
	stone Pitching	cum	1	6.09		1.700	10.36
		cum	1	7.76		1.700	13.19
		cum	1	7.73		0.500	3.87
						Total	107.15
17	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	8.912	1.898		16.910
	Guide wall	cum	2	4.22		0.300	2.533
						Total	19.443
18	300 MM thk stone pitching						
	Below trades						
		cum	1	3.491	0.85	0.30	0.89
		cum	1	4.876	0.85	0.30	1.24
		cum	1	6.262	0.85	0.30	1.60
		cum	1	7.734	1.00	0.30	2.32
						Total	6.05

[Signature]



***1 Cell Box Culvert_3m x 4m
with
Stepped Footing,Earth Cushion
& RE Wall Encasing
TW - 11m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	5.05	12.00	1.700	103.02
	Shear Key	cum	2	5.25	1.550	0.650	10.58
						Total	113.60

2	PCC-M15						
	Box culvert	cum	1	4.05	9.10	0.15	5.53
	Shear Key	cum	2	4.25	1.319	0.15	1.68
						Total	7.21

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 = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $4/1+1 =$					5	
	Total no of Weep holes per side wall = 6×5					30	
	Total length of weep holes = $30 \times 2 + 0 \times 4$						31.50

4	RCC-M30						
	Bottom Slab	cum	1	4.05	11.00	0.55	24.50
	Box Side Wall	cum	2	11.00	0.53	4.00	46.20
	Shear key	cum	2	4.050	0.406		3.29
	Haunch	cum	2	11.000	0.011		0.25
						Total=	74.24

5	Steel						
	@70 Kg per cum of concrete	ton					5.197
						Total	5.197

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	4.000	49.92
						Total	49.92

7	Backfilling by granular material						
	Box culvert	cum	1	16.05		0.70	11.24
	Shear Key	cum	2	2.03		0.65	2.63
						Total	13.87

[Signature]



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

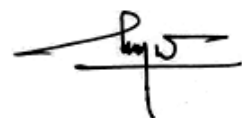
SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	4.050	11.000	0.566	25.215
	(+)Haunch	cum	2	11.000	0.011		0.248
						Total	25.463
9	Steel						
	@ 75 Kg per cum of concrete	ton					1.910
						Total	1.910

PROTECTION WORK

Upstream side

10	Eatrh work for excavation						
		cum	1	4.40	2.00	1.00	8.80
						Total	8.80
11	Catch Pit PCC M15 slab						
		cum	1	3.40	2.00	0.30	2.04
						Total	2.04
12	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	3.40	0.36		1.22
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	2.30
13	300 mm thick Boulder Pitching						
		cum	1	3.00	1.30	0.30	1.17
		cum	1	5.89	5.00	0.30	8.83
						Total=	10.00
14	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

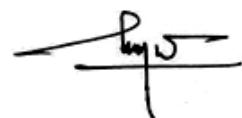




ESTIMATE OF QUANTITY OF BOX CULVERT

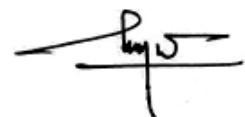
Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
15	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	8.912	1.85	0.15	2.47
	For PCC wall						
		cum	1	4.184	0.35	1.00	1.46
		cum	1	5.569	0.35	1.60	3.12
		cum	1	6.955	0.35	1.60	3.89
	Below PCC Wall						
		cum	1	4.38	0.55	0.10	0.24
		cum	1	5.77	0.55	0.10	0.32
		cum	1	7.15	0.55	0.10	0.39
	On trades						
		cum	1	3.491	0.85	0.10	0.30
		cum	1	4.876	0.85	0.10	0.41
		cum	1	6.262	0.85	0.10	0.53
		cum	1	7.734	1.00	0.10	0.77
						Total	13.92
16	Eatrh work for excavation						
	Curtain Wall	cum	1	9.91	2.85	2.65	74.86
		cum	1	4.43		1.100	4.87
	stone Pitching	cum	1	6.09		1.700	10.36
		cum	1	7.76		1.700	13.19
		cum	1	7.73		0.500	3.87
						Total	107.15
17	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	8.912	1.898		16.910
	Guide wall	cum	2	4.22		0.300	2.533
						Total	19.443
18	300 MM thk stone pitching						
	Below trades						
		cum	1	3.491	0.85	0.30	0.89
		cum	1	4.876	0.85	0.30	1.24
		cum	1	6.262	0.85	0.30	1.60
		cum	1	7.734	1.00	0.30	2.32
						Total	6.05





***1 Cell Box Culvert_3m x 4m
with
Stepped Footing,Earth Cushion
& RE Wall Encasing
TW - 11m***



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

FOUNDATION

1	Excavation						
	Box culvert	cum	1	5.10	12.00	1.750	107.10
	Shear Key	cum	2	5.30	1.500	0.600	9.54
Total							116.64

2	PCC-M15						
	Box culvert	cum	1	4.10	9.20	0.15	5.66
	Shear Key	cum	2	4.30	1.249	0.15	1.61
Total							7.27

SUBSTRUCTURE

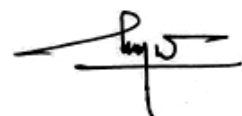
3	Weep holes						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall = $10.4/2+1 =$					6	
	No of weep holes in vertical direction per side wall = $4/1+1 =$					5	
	Total no of Weep holes per side wall = 6×5					30	
	Total length of weep holes = $30 \times 2 + 0 \times 4$						33.00

4	RCC-M30						
	Bottom Slab	cum	1	4.10	11.00	0.60	27.06
	Box Side Wall	cum	2	11.00	0.55	4.00	48.40
	Shear key	cum	2	4.100	0.360		2.95
	Haunch	cum	2	11.000	0.011		0.25
Total=							78.66

5	Steel						
	@70 Kg per cum of concrete	ton					5.506
Total							5.506

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	4.000	49.92
Total							49.92

7	Backfilling by granular material						
	Box culvert	cum	1	16.10		0.75	12.08
	Shear Key	cum	2	2.05		0.60	2.46
Total							14.54





ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity

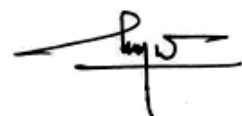
SUPERSTRUCTURE

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	4.100	11.000	0.591	26.654
	(+)Haunch	cum	2	11.000	0.011		0.248
						Total	26.902
9	Steel						
	@ 75 Kg per cum of concrete	ton					2.018
						Total	2.018

PROTECTION WORK

Upstream side

10	Eatrh work for excavation						
		cum	1	4.40	2.00	1.00	8.80
						Total	8.80
11	Catch Pit PCC M15 slab						
		cum	1	3.40	2.00	0.30	2.04
						Total	2.04
12	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	3.40	0.36		1.22
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	2.30
13	300 mm thick Boulder Pitching						
		cum	1	3.00	1.30	0.30	1.17
		cum	1	5.89	5.00	0.30	8.83
						Total=	10.00
14	Guide wall- PCC (M-20)						
		cum	2	4.24		0.30	2.55
						Total=	2.55

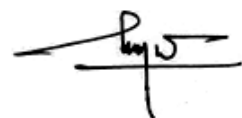




ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x 4m
1 cell of 3m x 4m With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
15	PCC M15 Down stream side						
	Below curtain wall						
		cum	1	8.912	1.85	0.15	2.47
	For PCC wall						
		cum	1	4.184	0.35	1.00	1.46
		cum	1	5.569	0.35	1.60	3.12
		cum	1	6.955	0.35	1.60	3.89
	Below PCC Wall						
		cum	1	4.38	0.55	0.10	0.24
		cum	1	5.77	0.55	0.10	0.32
		cum	1	7.15	0.55	0.10	0.39
	On trades						
		cum	1	3.491	0.85	0.10	0.30
		cum	1	4.876	0.85	0.10	0.41
		cum	1	6.262	0.85	0.10	0.53
		cum	1	7.734	1.00	0.10	0.77
						Total	13.92
16	Eatrh work for excavation						
	Curtain Wall	cum	1	9.91	2.85	2.65	74.86
		cum	1	4.43		1.100	4.87
	stone Pitching	cum	1	6.09		1.700	10.36
		cum	1	7.76		1.700	13.19
		cum	1	7.73		0.500	3.87
						Total	107.15
17	Curtain Wall & guide wall- PCC (M-20)						
	Curtain Wall	cum	1	8.912	1.898		16.910
	Guide wall	cum	2	4.22		0.300	2.533
						Total	19.443
18	300 MM thk stone pitching						
	Below trades						
		cum	1	3.491	0.85	0.30	0.89
		cum	1	4.876	0.85	0.30	1.24
		cum	1	6.262	0.85	0.30	1.60
		cum	1	7.734	1.00	0.30	2.32
						Total	6.05





Summary sheet of Small Culvert (Quantities & amount)

		Span (m) x Height (m) =	TYPE 1_2.0 X 2.0 M_1 CELL_BOX C_Flex Ap_TW- 12M	TYPE 2_2.0 X 2.0 M_1 CELL_BOX C_STEPPED Ap_NC_TW-11M	TYPE 4_2.0 X 3.0 M_1 CELL_BOX C_Flex Ap_TW- 12M	TYPE 5_2.0 X 3.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M	TYPE 6_2.0 X 3.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	TYPE 8_3.0 X 4.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	TYPE 11_5.0 X 4.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	TYPE 12_2.0 X 3.0 M_1 CELL_BOX C_Flex Ap_TW- 12M with EC	TYPE 13_2.0 X 3.0 M_1 CELL_BOX C_Flex Ap_TW- 11M with EC	Total Quantity
	No. of Culverts =		1	22	3	12	7	2	1	1	1	
ITEM NO.	Description	Unit										
	A. Foundation											
Item no 1(a)	Excavation (upto 3 m depth)	cum	62.61	98.00	87.76	135.73	122.42	165.43	204.66	87.76	82.28	5673
Item no 3	P.C.C (M-15)	cum	7.05	6.51	10.30	9.51	8.88	11.70	13.41	10.30	9.51	414
	B. SubStructure											
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	36.22	34.10	63.14	58.80	52.84	89.59	116.37	63.14	58.80	2469
Item no 3	Steel (Substructure)	ton	2.54	2.39	4.42	4.12	3.70	6.27	8.15	4.42	4.12	173
Item no 4	Weep Holes	metre	22.20	20.40	31.60	28.80	33.60	43.20	51.00	31.60	31.60	1347
Item no 5	Backfilling - Granular Material	cum	9.26	11.22	11.82	14.00	12.02	16.30	20.54	11.82	11.40	620
Item no 7	Filter Media	cum	32.71	27.78	46.10	47.95	50.85	63.55	62.50	46.10	42.06	1991
	C. Super Structure											
Item no 1(b)	R.C.C M30 (Superstructure) upto 5m	cum	13.34	12.05	14.49	13.09	20.39	29.05	54.56	22.77	22.44	779
Item no 2	Steel (Superstructure)	ton	1.00	0.90	1.09	0.98	1.53	2.18	4.09	1.71	1.68	58
Item no 3(a)	Bituminous Concrete Wearing Coat(40mm)	cum	1.14	1.04	1.19	1.08	0.00	0.00	0.00	0.00	0.00	41
Item no 3(b)	Mastic Asphalt (12mm)	sqm	28.60	26.00	29.70	27.00	0.00	0.00	0.00	0.00	0.00	1014
Item no 3(c)	Tack Coat	sqm	28.60	26.00	29.70	27.00	0.00	0.00	0.00	0.00	0.00	1014
Item no 5	Crash Barrier (RCC railing)	metre	5.20	5.20	5.40	5.40	0.00	0.00	0.00	0.00	0.00	201
Item no 6	Drainage Spout	each	2.00	2.00	2.00	2.00	0.00	0.00	0.00	0.00	0.00	76
	D. Protection Work											
Item no 1	Eatrth work for excavation	cum	305.24	100.49	362.68	100.49	100.49	115.95	146.85	362.68	362.68	6618
Item no 2	Catch Pit PCC M15 slab	cum		1.08		1.44	1.44	2.04	3.24			58
Item no 3	Catch Pit Stone Masonry	cum		1.94		1.94	1.94	2.30	3.02			87
Item no 4	300 mm thick Rubble stone flooring laid over 100mm thick cement concrete bedding	cum		13.10		13.10	13.10	16.05	21.96			591
Item no 5	750 mm thick Flexible apron	cum	64.8675		86.1975					86.1975	86.1975	496
Item no 6	Curtain Wall & Guide Wall- PCC (M-20)	cum	64.38	20.09	75.09	20.09	20.09	21.99	25.78	75.09	75.09	1333
Item no 7	PCC M15	cum	9.51	11.65	11.10	11.65	11.65	13.92	18.45	11.10	11.10	589
	D. Miscellaneous											
Item no 1	Painting	cum	13.30	13.30	13.81	13.81	0.00	0.00	0.00	0.00	0.00	513

