

**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 VIII: BOQ  
(MARAM-PEREN SECTION IN THE STATE OF MANIPUR)  
▪ PKG-III: KM 75+000 TO KM 109+494**



**National Highways & Infrastructure  
Development Corporation Ltd.  
PTI Building, 3rd Floor, 4, Parliament Street,  
New Delhi-110001**



**C. E. Testing Company Pvt. Ltd.  
124-A, NSC Bose Road, Kolkata -700092**

**Road name- Maram to Peren road section on NH-129A in the State of Manipur  
(Package - III)  
(75 km to 109+494 km)**

**GENERAL ABSTRACT OF COST**

Length of Road (KM)

:

34.494

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	1.20	0.03	0.37%
2	Earth work ,Subgrade and Erosion control	115.48	3.35	35.32%
3	Sub-Base & Base	41.93	1.22	12.82%
4	Bituminous Courses	19.69	0.57	6.02%
5	Junction Improvement (Major & Minor)	0.07	0.00	0.02%
6	Traffic signs, Road marking & other road appurtenances	2.97	0.09	0.91%
	<b>Drainage and Protective Works</b>			
7	Longitudinal Drains	7.68	0.22	2.35%
8	Retaining wall	68.52	1.99	20.95%
9	Breast wall	28.86	0.84	8.83%
10	Protection Work	13.57	0.39	4.15%
<b>B.</b>	<b>BRIDGES &amp; CULVERTS</b>			
11	Culvert	26.33	0.76	8.05%
<b>C.</b>	<b>Utility Shifting</b>			
	Utility Shifting(Electrical+PHED)	0.69	0.02	0.21%
<b>D.</b>	<b>COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)</b>	<b>326.99</b>	<b>9.48</b>	
<b>E.</b>	Escalation @ 3% WPI (3% of A+B Only)	9.79		
<b>F.</b>	<b>Total Civil Cost including Escalation@3% (D+E=F)</b>	<b>336.78</b>	<b>9.76</b>	
<b>G.</b>	Maintenance for 5 years, i.e 2.5% on civil cost (F-C)	8.40		
<b>H.</b>	GST @ 12% of (F-C)	40.33		
<b>I.</b>	Contingencies @ 2.8% over Civil Cost (F-C)	9.41		
<b>J.</b>	Supervision Charges @ 3% of (F-C)	10.08		
<b>K.</b>	Agency Charges @3% of (F-C)	10.08		
<b>L.</b>	Escalation Cost @ 2.5% during Construction Period(For 1.5 Yrs of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)	8.40		
<b>M</b>	<b>TOTAL CONSTRUCTION COST * (F+G+H+I+J+K+L)=M</b>	<b>423.48</b>	<b>12.28</b>	
<b>N</b>	<b>DEPARTMENTAL COST</b>			
<b>a.</b>	LA & Structure Cost(Tentative)	25.75		
<b>b.</b>	Forest Clearance & Environment Cost (Forest+Environmental Budget+Muck Disposal)	15.61		
	<b>Sub Total (N)</b>	<b>41.36</b>		
<b>O</b>	<b>TOTAL CAPITAL COST (M+N)=O</b>	<b>464.84</b>	<b>13.48</b>	



*[Handwritten Signature]*

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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 -III (Km 75+000 to Km 109+494) 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 conform to SPCB (State Pollution Control Board) norms. Blasting as per Indian Explosive Act will be adopted. People living such blasting site should have prior information of operation hours. Workers at blasting site will be provided with ear plugs. Vehicle transporting earth materials will be covered. Water shall be spread to control the dust.

Degraded materials and waste water shall be disposed into the Septic Tank and soak pits etc. The contractor will make arrangement to clean up the spoil as soon as the work finishes in a stretch. If such sites are located outside the ROW, restoration of the site to a level acceptable to the land owner will be done within 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 conform 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)**

- i.) Adequate standby equipment including spare parts shall be available.
- ii.) 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 1<sup>st</sup> sentence of Clause 111.5 and substitute the following:**

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

### **Sub-Clause 111.8.2 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, SO<sub>2</sub>, NO<sub>X</sub>, HC and CO. operational areas include work sites, haulage roads, hot mix plants, quarries, crushing plants, stockpiles, borrow sites and spoil disposal sites.

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

#### ***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	<ul style="list-style-type: none"> <li>• Earthwork</li> <li>• 200 mm granular sub base (Grading-I of Table 400-1)</li> <li>• 225 mm W.B.M.</li> <li>• Prime coat &amp; Tack Coat</li> <li>• Mix seal surfacing Type B.</li> </ul>

Drainage should be provided as directed by the Engineer.

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

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

**Add the following Para in the end of Clause 112.4**

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

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

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

- The barricading shall be erected on the side of the carriageway portion/ portion of the carriageway where any construction activity is taken up on or alongside of the existing carriageway.



- Flagmen in adequate numbers shall be provided to marshal the traffic on diversion wherever diversion of traffic is resorted to.
- Proper traffic signage in required numbers shall be provided for the information of road users.
- A safety officer shall be nominated to prepare safety programmed and oversee the safety arrangements at site.

**Sub-Clause 112.6 Measurements for payment and rate**

***Replace this clause by following:***

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

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

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

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

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

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

A detailed resource based construction programme including resources planning



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

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

The Contractor shall prepare detailed construction drawings for each culvert on the basis of the drawings given in Bid Documents and get them approved by the Engineer. The drawings shall be submitted to the Engineer at least 8 weeks before commencement of construction of culverts.

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

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

The first issue of the detailed construction programme including the detailed description of the system and the procedures shall be submitted to the Engineer for acceptance not later than 28 days after the date of receipt of the letter of acceptance.

The contractor shall submit to the Engineer for approval & consent, the updated & revised programme at every three months interval or as such as directed by the Engineer. The updated & revised programme shall be submitted showing the actual progress achieved (physical & financial) and the effects of the progress achieved on the timing of the remaining work including any change to the sequence of the activities.

**Sub-Clause 114.4 Add the following as Clause 114.4**

If any 'work' executed by the Contractor does not meet the specifications, it shall be deemed as rejected. The Engineer, in his sole discretion, may consider a proposal by the Contractor to retain, the element or part of the 'work'. The Contractor's proposal shall be supported by calculations, drawings and other data to prove the soundness of the proposal and shall clearly describe the additional measures required to ensure the intended performance of the 'work'.

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



**CLAUSE 120 FIELD LABORATORY**

**Sub-Clause 120.1 Scope**

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

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

**Sub-Clause 120.2 Description**

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

Add the following at the end of this Clause:

“There shall also be provided a concrete paved area, for storing samples adjacent to the laboratory, of about 300 sqm and another 200 sqm shall be suitably roofed with open sides giving protection against sun and rain.

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

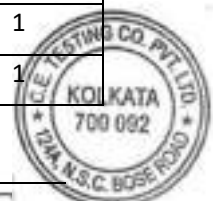
The field laboratory to be provided under the Contract shall be handed over to the Engineer in finished and fully equipped condition not later than 2 months after the receipt of Notice to Commence Work, and the field laboratory with all equipment/instrument shall be to the entire satisfaction of the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

**Sub-Clause 120.3 This clause stands deleted.**

**Sub-Clause 120.4 This clause stands deleted.**

**Table 100-2 Laboratory Equipment**

S. No.	Sub No.	Item, Specifications	Nos. required
<b>A: General</b>			
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>B: For Soils and Aggregates</b>			
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>B: For Soils and Aggregates</b>			
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**

<b>C: For Bitumen and Bituminous Mixes</b>			
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



<b>C: For Bitumen and Bituminous Mixes</b>		
iii)	Solvent extraction or centrifuge type apparatus complete (AASHTO, T-164) with extraction thimbles with stocks of solvent and filter paper	1
iv)	Laboratory mixer including required accessories about .02 cum capacity electrically operated fitted with heating jacket	1
v)	Marshall compaction apparatus automatically operated as per ASTM 1559-62 T and complete with electrically operated loading unit, compaction pedestal heating head assembly, dial micrometer and bracket for flow measurement, load transfer bar, specimen mould 100 mm dia. (4 in) with base plate, collars, specimen extractor, compaction hammer 4.53 kg (10 lb.) x457 mm (18 in) fall	1 set
vi)	Distant Reading Digital Thermometer for Measuring Temperatures in Asphaltic Mixes	As required
vii)	Riffle Box	1
viii)	Automatic Asphalt Content Gauge [Nuclear or equivalent]	1
ix)	Thin film Oven test apparatus to the requirement of AASHTO T 179, including accessories	1
x)	Ring Ball Apparatus as per IS 1205- 1978	1
xi)	Asphalt Institute Vacuum Viscometer as per IS 1206(part II) – 1978	1
xii)	BS U- Tube Modified Reverse Floro Viscometer IS 1206(Part III) – 1978	1
xiii)	Apparatus for Determination of Ductility Test as per IS 1208 – 1978	1
xiv)	Pen Sky – Martars closed Tester for testing flash and fire point as per IS 1209 – 1978.	1
xv)	Apparatus for Float Test – IS – 1210 – 1978	1
xvi)	Apparatus for Determination of water content (Dean and Shark Method) IS – 1211 – 1978	1
xvii)	Apparatus for Determination of Loss on Heating IS – 1212-1978.	1
xviii)	Apparatus of Determination of specified Gravity IS-1202-1978	1
xix)	Core cutting machine with 100mm dia. Diamond cutting Edge	1
xx)	Apparatus for Elastic Recovery test for Modified Bitumen	1
xxi)	Apparatus for Storage Stability test for Modified Bitumen	1
xxii)	Apparatus for Separation test for modified bitumen	1

**Sub-Clause 121.3.4 for Cement, Cement Concrete and Materials**

<b>D: For Cement, Cement Concrete and Materials</b>		
i)	Water still	1



<b>D: For Cement, Cement Concrete and Materials</b>			
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 hamper 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**

<b>E: For Control of Profile and Surface Evenness</b>		
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 2<sup>nd</sup> 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 1<sup>st</sup> 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 1<sup>st</sup> 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	Surface Course has been designed for 10 MSA and Base -Subbase has been designed for 20 MSA as per relevant IRC Manual	

**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 1<sup>st</sup> 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 1<sup>st</sup> line of 1<sup>st</sup> 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:***

<b>Grading</b>	<b>1</b>	<b>2</b>
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 1<sup>st</sup> 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, 5<sup>th</sup> kilometer stone and marker posts fixed at site.

**Sub-Clause 804.5 Rate**

The words '/marker posts' shall be inserted after the words '5<sup>th</sup> 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 <sup>2</sup> area subject to the condition that 10% of density tests shall be done on the edges.

**Note:**

Add the following note at the end

2. 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.
3. 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 300m<sup>3</sup>. For daily productions over 300m<sup>3</sup>, two additional beams and two additional cubes shall be cast of each 100m<sup>3</sup>, (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 1<sup>st</sup> 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 ± 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 m<sup>3</sup>. Two additional beams and two additional cubes for each 100 m<sup>3</sup> (or part thereof) in excess of 300m<sup>3</sup>.”

**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 2<sup>nd</sup> line the word "crushed gravel" and from the 3<sup>th</sup> 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 substrata".

**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:

<b>Structural depth d (mm)</b>	<b>Tolerance (mm)</b>
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 1:***



Water sprinklers or perforated pipes shall be used for curing of concrete for all major bridges, ROB's and grade separators. Such arrangement must be in place & tested before concreting for its proper functioning and shall be maintained for a minimum period of 14 days after concreting.

Approved concrete curing compounds should be preferred where water curing cannot be done reliably.

**CLAUSE 1716 TOLERANCES**

**Add the following at the end of Clause:**

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

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

**CLAUSE 1718 MEASUREMENT FOR PAYMENT**

**The clause may be read as under :**

Structural concrete shall be measured in cubic metres. In reinforced or prestressed concrete, the volume occupied by reinforcement or prestressing cables and sheathing shall not be deducted. The slab shall be measured as running continuously through and the beam as the portion below the slab. In the case of RCC/PSC voided slab the deduction shall be made for the volume of void.

**SECTION 1800 PRE-STRESSING**

**CLAUSE 1801 GENERAL**

**Add the following as the last paragraph of this clause:**

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

**CLAUSE 1802 MATERIALS**

**Sub-Clause 1802.2 Sheathing**

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

"The joint between the end of coupler and the duct shall be sealed with heat shrink tape to prevent penetration of slurry during concreting. The couplers of adjacent



ducts should be staggered at least 300mm apart.”

**Add the following at the end of Para 6:**

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

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

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

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

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

**Add the following as additional Sub-clause**

**Sub-Clause 1802.2.4 Corrugated HDPE sheathing ducts**

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

Specific Density	:	0.954 g/cm <sup>3</sup> at 23 °C
Yield Stress	:	18.0 N/mm <sup>2</sup>
Tensile Strength	:	21.0 N/mm <sup>2</sup>
Shore Hardness D-3 sec. Value	:	60
-15 sec. Value	:	58
Notch impact strength at 23 °C	:	10 KJ/m <sup>2</sup>
- 40 °C	:	4 KJ/m <sup>2</sup>
Coefficient of Thermal Expansion for		
20 °C - 80 °C	:	1.50 x 10 <sup>-4</sup> KJ/m <sup>2</sup>

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  $\epsilon_u$  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 5<sup>th</sup> and 6<sup>th</sup> 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 1<sup>st</sup> 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 30<sup>th</sup> Nov, 2000 and corrigendum of same circular dated 15<sup>th</sup> 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 of Adoption Joint	for	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 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 shall consist of steel armoured nosing at two edges of the joint gap suitably anchored to the deck concrete and a performed chlorprene elastomer or closed cell foam joint sealer compressed and fixed in to the joint gap with special adhesive binder.**

**Clause 2609.2**

**Material**

(a) Steel nosing

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

(b) Anchorage

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

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

(c) Corrosion Protection

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

(d) Joint Seal

i) The sealing element shall be a performed continuous chlorprene or closed cell foam seal with high tear strength, insensitive to soil, gasoline and ozone. It shall have high resistance to aging and ensure water tightness. The seal should be vulcanised in a single operation for the full length of the joint required for carriageway, kerbs and footpaths, if any. The seal shall cater for a horizontal movement upto 40 mm and vertical movement of 3 mm.



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

**Chloroprene Seal**

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

**Closed Cell Foam Seal**

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

**Table – 1**

	<b>Property</b>	<b>Specified Value</b>
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  $\pm 30$  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  $\pm 30$  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, spalled concrete (area of damage less than 0.5 m<sup>2</sup>) 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  $36 \pm 1$  percent. The particles shall be of nearly spherical shape with a diameter of  $0.35 \pm 0.05$  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 Cl 3.2.1 & Cl 3.6 respectively of IS: 383, confirmatory test shall be conducted by the contractor and sample kept for comparison by the Engineer.

### **Curing**

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

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

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

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

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

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

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

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

### **Mixing PMC**

#### **Methods of Mortar mixing**



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

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

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

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

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

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

In case the slurry sets before application of mortar, a fresh coat of slurry shall be applied. Under no circumstances, water shall be added in PMC repairs mortar mix. Unused mortar or mortar which has partially set shall not be re-mixed & used.

#### **Mechanical Strength of Mortar**

Anti-corrosive polymer modified mortar shall have the following:

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

#### **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/MM<sup>2</sup>
- DRY - 7-8 N/MM<sup>2</sup>

**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 loses soil and benched. The width of the benches shall be at list 300mm and they shall extend continuously for a sufficient length the height of the benches shall be in the range of 150-300mm.

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

**Clause 3002.4 Measurement of Payment**

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

**Clause 3003 MAINTENANCE OF EARTHEN SHOULDER**

**Clause 3003.1 Scope**

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

**Clause 3003.2 Material**

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

**Clause 3003.4 Measurement of Payment**

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

**Clause 3004.2 Filling Pot-holes and Patch Repairs**

**Clause 3004.2.1 Scope**

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



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

**Clause 3004.2.5 Measurement of Pavement**

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

**ADDITIONAL TECHNICAL SPECIFICATION**

***Appendix A-1 :: SPECIFICATION FOR PASSENGER SHELTER***

**1. Scope**

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

**2. Description**

**2.1 Passenger Shelter**

It will be a permanent structure supported on R.C. columns at the corners and having sloped reinforced concrete slab with protrusions on all sides. Panel walls on three sides shall be built with brick jail of 125mm thick set in cement mortar 1:4 (1 part cement : 4 parts sand). It shall



have seating arrangement with 100mm thick R.C. slab with raised back with atleast 1.5% reinforcement. The mix of concrete for seating slab and back shall be nominal one with 1:2:4 (1 part cement : 2 parts sand : 4 parts stone chips) and it will be finished with neat cement punning not less than 3mm thickness. The flooring shall be with 75mm thick B.F.S. flooring (1:2:4) over 100mm thick M-10 grade concrete. All walls, ceiling and roof top shall be finished with cement mortar (1:3). The exposed surfaces of the structure shall be painted with two coats of cement based paint of make and brand approved by the Engineer.

### **3.0 Measurement for Payment**

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

### **4.0 Rate**

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



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

**1. Painting with Synthetic Enamel Paint**

**Materials**

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

**Painting on New Surface**

**Preparation of surface.:**

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

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

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

**Lettering and Numbering on New Surface:**

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

**Measurement for payment:**

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

**Rate:**

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



## **2. Water Proof Cement Painting**

### **Material:**

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

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

### **Preparation of Surface:**

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

### **Preparation of mix:**

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

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

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

### **Application :**

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



specification. The completed surface shall be watered after the day's work.

The second coat shall be applied after the first coat has been set for at least 24 hours. Before application of the second or subsequent coats, the surface of the previous coat shall not be wetted.

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

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

**Precaution:**

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

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

**Measurement for Payment:**

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

**Rate:**

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



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

**1. Scope**

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

**2. Materials**

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

**3.0 Measurement for Payment**

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

**4.0 Rate**

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

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



**VOLUME - VI**  
**RATE ANALYSIS**



# SCHEDULE OF RATE



<b>Summary of Rate Analysis</b>			
<b>Code No</b>	<b>Descriptions</b>	<b>Unit</b>	<b>Rate</b>
<b>CHAPTER-2 (Road Works)</b>			
<b>SITE CLEARANCE AND DISMANTLING</b>			
<b>2.1</b>	<b>Cutting of Trees, including cutting of trunks</b> , 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
<b>2.3</b>	<b>Clearing and grubbing road land including uprooting rank vegetation</b> , 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
<b>2.4</b>	<b>Dismantling upto 1.5m in foundation and/or 1.5m above ground level</b> 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)	<b>a) Lime concrete, cement concrete M10 grade &amp; below.</b>	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)	<b>Dismantling Brick / Tile work</b>		
	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)	<b>Dismantling stone masonry</b>		
	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)	<b>Removing hume pipes class NP-3</b>		
	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)	<b>Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m</b>		
	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	<b>Dismantling Guard Rails</b> 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	<b>Removal of Telephone / Electric Poles</b> 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
<b>CHAPTER-3</b>			
<b>EARTH WORK</b>			
<b>B.</b>	<b>ROAD CONSTRUCTION</b>		
3.12	<b>Construction of Embankment with Material Obtained from Borrow Pits</b> 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	<b>Construction of Embankment with Material Deposited from Roadway Cutting</b> 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	<b>Construction of Subgrade and Earthen Shoulders</b> 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	<b>Compacting Original Ground</b>		
	<b>Compacting original ground supporting subgrade</b> 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	<b>Compacting original ground supporting embankment</b> 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	<b>Stripping and Storing Top Soil</b> 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	<b>Turfing with Sods</b> 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
<b>EARTH WORK ON HILL ROAD</b>			
3.31	<b>Excavation in Hill Area in Soil by Mechanical Means</b> 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	<b>Excavation in Hilly Area in Ordinary Rock by Mechanical Means not Requiring Blasting.</b> 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	<b>Excavation in Hilly Areas in Hard Rock Requiring Blasting</b> 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
<b>C.</b>	<b>EXCAVATION FOR STRUCTURE</b>		
<b>3.1</b>	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom, backfilling the excavation earth to the extent required and utilising the remaining earth locally for road work.		
<b>(i)</b>	<b>Ordinary soil</b>		
	a) Manual Means (Depth upto 3m)	Cum	408.50
	b) Mechanical Means (Depth upto 3m)	Cum	105.88
<b>(ii)</b>	<b>Ordinary Rock (not requiring blasting )</b>		
	a) Manual Means (Depth upto 3m)	Cum	510.60
	b) Mechanical Means	Cum	142.33
<b>(iii)</b>	<b>Hard Rock (requiring blasting )</b>		
	a) Manual Means	Cum	982.17
	b) Hard Rock ( blasting prohibited) Mechanical Means	Cum	1900.61
<b>(iv)</b>	<b>Marshy soil</b>		
	a) Manual Means	Cum	773.37
	b) Mechanical Means	Cum	269.34
<b>3.2</b>	Earth work in excavation of foundation trenches etc. in drains and channels etc. not exceeding 2.00 metres depth including dressing of bottom and sides of trenches, stacking the excavated soil clear from the edge of excavation including disposal of surplus soil as directed within a lead of 30.00 metres.		
<b>(i)</b>	<b>Ordinary Soil (Manual means)</b>	Cum	326.80
	<b>Mechanical Means</b>	Cum	84.70
<b>(ii)</b>	<b>Blasting work</b>		
	a) Soft rock	Cum	785.74
	b) Hard rock	Cum	1520.49
<b>(iii)</b>	<b>Chiselling/wedging out of rock (where blasting is prohibited).</b>		
	a) Soft rock	Cum	1765.25
	b) Hard rock	Cum	2647.87
<b>3.3</b>	Filling in foundation trenches as per drawing and Technical specification		
	a) Sandy Soil	Cum	326.10
	b) Sand Gravel	Cum	692.96
<b>3.4</b>	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		
<b>(i)</b>	<b>Ordinary Soil</b>	cum	217.49



Code No	Descriptions	Unit	Rate
<b>CHAPTER-4</b>			
<b>SUB-BASES</b>			
4.1	<b>Sub-base with Close Graded Material (Table:- 400-1)</b>		
	<b>Plant Mix Method</b> 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		
	<b>For Grading- II Material</b>	Cum	2949.87
	<b>For Grading-III Material</b>	Cum	2893.00
4.2	<b>By Mix in Place Method</b> 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		
	<b>For Grading- II Material</b>	Cum	2413.12
	<b>For Grading-III Material</b>	Cum	2356.25
4.3	<b>Granular Sub-Base with Coarse Graded Material ( Table:- 400- 2)</b> 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		
	<b>For Grading- II Material</b>	Cum	2285.30
	<b>For Grading-III Material</b>	Cum	2230.59
4.4	<b>Granular Sub-Base with Naturally Occuring Sand Gravel Material</b> 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 deletereous 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	<b>Lime Stabilisation for Improving Subgrade</b> (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	<b>By Mechanical Means</b>	cum	1652.44
B	<b>By Manual Means</b>	cum	1662.67



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Code No	Descriptions	Unit	Rate
<b>CHAPTER-5</b>			
<b>BASES</b>			
5.2	<b>Wet Mix Macadam</b> (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
<b>CHAPTER-6</b>			
<b>BITUMINOUS CONSTRUCTION</b>			
6.1	<b>Prime coat</b> (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.)		
	<b>A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm</b>	sqm	57.54
	<b>B) Stabilised Soil Based / Crusher run macadam 0.9 - 1.2kg /sqm</b>	sqm	97.04
6.2	<b>Tack coat</b>		
	Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom.		
	<b>i) On bituminous Surface @ 0.20 - 0.30 kg/sqm</b>	sqm	15.63
	<b>iii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm</b>	sqm	17.16
	<b>iv) On cement concrete pavement @ 0.300 - 0.35 kg/sqm</b>	sqm	22.22



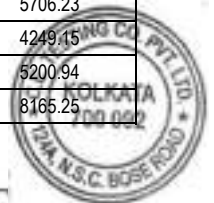
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Code No	Descriptions	Unit	Rate
6.6	<b>Dense Graded Bituminous Macadam</b> (Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, 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)	<b>for Grading I ( 40 mm nominal size )</b>		
	Using bitumen 60/70	cum	10661.33
(ii)	<b>for GradingII(19 mm nominal size)</b>		
	Using bitumen 60/70	cum	10707.15
6.8	<b>Bituminous Concrete</b> (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)	<b>for Grading-I ( 19 mm nominal size )</b>		
	<b>A) Using Bitumen 60/70</b>	cum	12064.76
	<b>B) Using Bitumen CRMB Gr-55</b>	cum	12622.49
	<b>C) Using Bitumen PMB 70</b>	cum	15913.73
(ii)	<b>for Grading-II(13 mm nominal size)</b>		
	<b>A) Using Bitumen 60/70</b>	cum	11950.36
	<b>B) Using Bitumen CRMB Gr-55</b>	cum	15599.71
	<b>C) Using Bitumen PMB 70</b>	cum	15898.91
6.15	<b>Mastic Asphalt</b> (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	<b>Precast Cement concrete M20 Kerb including fixing at site</b>	Rm	622.79
8.2	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc.		
	<b>a) 5th KM stone</b>	each	4556.84
	<b>b) Ordinary kilometer stone</b>	each	2676.24
8.6	<b>Painting on Steel Surfaces</b> 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	<b>Retro- reflectorised Traffic signs</b> 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 )	<b>90 cm equilateral triangle</b>	each	4931.35
( ii )	<b>60 cm equilateral triangle</b>	each	3621.96
( iii )	<b>60 cm circular</b>	each	4440.80
( iv )	<b>80 mm x 60 mm rectangular</b>	each	5706.23
( v )	<b>60 cm x 45 cm rectangular</b>	each	4249.15
(vi)	<b>60 cm x 60 cm square</b>	each	5200.94
( vii )	<b>90 cm high octagon</b>	each	8165.25



Code No	Descriptions	Unit	Rate
8.12	<b>Direction and Place Identification signs upto 0.9 sqm size board.</b> (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	<b>Direction and Place Identification signs with size more than 0.9 sqm size board.</b> (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	12831.40
8.14	<b>Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface</b> (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	<b>Road Delineators</b> (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	<b>RCC Crash Barrier</b> (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	<b>Metal Beam Crash Barrier</b>		
A	<b>Type - A, "W" : Metal Beam Crash Barrier</b> (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	<b>Road Markers/Road stud with lense reflector</b> 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	<b>Lighting on Bridges</b> 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
<b>CHAPTER-10</b>			
<b>CULVERTS</b>			
10.6	Steel reinforcement for RCC works including bending, binding and placing in position		
	HYSD bars	MT	72983.59
<b>CD Works</b>			



Code No	Descriptions	Unit	Rate
<b>CHAPTER-13</b>			
<b>EARTHWORK</b>			
13.1	Earth work in excavation of foundation for structures as per drawing and technical specification		
(a)	<b>Ordinary soil</b>		
(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)	<b>Ordinary rock</b>		
(i)	if blasting is resorted to	cum	312.75
(ii)	if blasting is not resorted to	cum	209.22
(c)	<b>Hard rock ( requiring blasting )</b>	cum	765.10
(d)	<b>Hard rock ( blasting prohibited )</b>	cum	670.52
(e)	<b>Marshy soil (upto 3 m depth)</b>	cum	947.09
13.2	<b>Filling in Foundation Trenches as per drawing &amp; technical specification using</b>		
(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
<b>CHAPTER-14</b>			
<b>FOUNDATION</b>			
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)	<b>Coursed rubble masonry( first sort )</b>	cum	6418.90
(b)	<b>Random Rubble Masonry (coursed/uncoursed )</b>	cum	6306.36
14.3	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications		
A	<b>PCC M15 Grade</b>	cum	8348.21
B	<b>PCC M20 Grade</b>	cum	9333.75
C	<b>RCC M20 Grade</b>		
Case I	Using Concrete Mixture	cum	9458.76
Case II	With batching plant, transit mixture & concrete pump	cum	8327.62
D	<b>PCC M25 Grade</b>		
Case I	Using Concrete Mixture	cum	10071.78
Case II	With batching plant, transit mixture & concrete pump	cum	8949.09
E	<b>RCC M25Grade</b>		
Case I	Using Concrete Mixture	cum	10230.25
Case II	With batching plant, transit mixture & concrete pump	cum	9077.25
F	<b>PCC M30 Grade</b>		
Case I	Using Concrete Mixture	cum	11992.49
Case II	With batching plant, transit mixture & concrete pump	cum	10864.5
G	<b>RCC M30 Grade</b>		
Case I	Using Concrete Mixture	cum	12089.498
Case II	With batching plant, transit mixture & concrete pump	cum	10966.06
H	<b>RCC M35 Grade</b>		
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 Mixure	cum	14349.42
Case II	With batching plant, transit mixture & concrete pump	cum	11182.62
(b)	M-30 Grade		
Case I	Using Concrete Mixure	cum	14140.28
Case II	With batching plant, transit mixture & concrete pump	cum	10973.48
(c)	M-25 Grade		
Case I	Using Concrete Mixure	cum	12187.1
Case II	With batching plant, transit mixture & concrete pump	cum	9020.31



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Code No	Descriptions	Unit	Rate
<b>CHAPTER-15</b>			
<b>SUB-STRUCTURE</b>			
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)	<b>Coursed rubble masonry( first sort )</b>	cum	6382.65
(b)	<b>Random Rubble Masonry (coursed/uncoursed )</b>	cum	6787.85
15.3	<b>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</b>		
(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
<b>15.5</b>	<b>HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification</b>	MT	77427.65
<b>15.6</b>	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
<b>15.7</b>	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
<b>15.8</b>	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
<b>15.9</b>	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
<b>15.10</b>	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
<b>15.11</b>	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
<b>15.12</b>	<b>Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications</b>	<b>Rm</b>	445.75



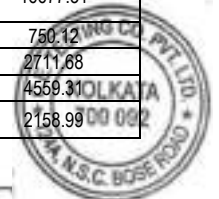
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Code No	Descriptions	Unit	Rate
<b>CHAPTER-16</b>			
<b>SUPER-STRUCTURE</b>			
<b>16.1</b>	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification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



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Code No	Descriptions	Unit	Rate
<b>Case-I</b>	<b>Using concrete mixture</b>		
(i)	Height up to 5m	cum	16451.92
(ii)	Height 5m to 10m	cum	17644.09
(iii)	Height above 10m	cum	18836.26
<b>Case-II</b>	<b>Using batching plant, transit mixer &amp; concrete pump</b>		
(i)	Height up to 5m	cum	14908.26
(ii)	Height 5m to 10m	cum	15988.57
(iii)	Height above 10m	cum	17068.87
(d)	<b>PSC Grade M40</b>		
(i)	<b>For solid slab super-structure</b>		
<b>Case-I</b>	<b>Using concrete mixture</b>		
(i)	Height up to 5m	cum	15122.49
(ii)	Height 5m to 10m	cum	15763.28
(iii)	Height above 10m	cum	16404.06
<b>Case-II</b>	<b>Using batching plant, transit mixer &amp; concrete pump</b>		
(i)	Height up to 5m	cum	13811.60
(ii)	Height 5m to 10m	cum	14396.84
(iii)	Height above 10m	cum	14982.08
(ii)	<b>For T-beam &amp; slab</b>		
<b>Case-I</b>	<b>Using concrete mixture</b>		
(i)	Height up to 5m	cum	15763.28
(ii)	Height 5m to 10m	cum	16404.06
(iii)	Height above 10m	cum	16446.38
<b>Case-II</b>	<b>Using batching plant, transit mixer &amp; concrete pump</b>		
(i)	Height up to 5m	cum	14396.84
(ii)	Height 5m to 10m	cum	14982.08
(iii)	Height above 10m	cum	15020.73
(iii)	<b>For box girder abnd balance cantilever</b>		
<b>Case-II</b>	<b>Using batching plant, transit mixer &amp; concrete pump</b>		
(i)	Height up to 5m	cum	16152.55
(ii)	Height 5m to 10m	cum	17323.02
(iii)	Height above 10m	cum	18493.50
(e)	<b>PSC Grade M45</b>		
	<b>Using batching plant, transit mixer &amp; concrete pump</b>		
(i)	<b>For solid slab super-structure</b>		
(i)	Height up to 5m	cum	14189.73
(ii)	Height 5m to 10m	cum	14801.35
(iii)	Height above 10m	cum	15412.98
(ii)	<b>For I-Beam &amp; slab including launching of pre-cast girders by launching truss up to 40m span.</b>		
(i)	Height up to 5m	cum	14801.35
(ii)	Height 5m to 10m	cum	15412.98
(iii)	Height above 10m	cum	15475.62
(iii)	<b>For cast in situ box girder, segmental construction and balanced cantilever</b>		
(i)	Height up to 5m	cum	16636.23
(ii)	Height 5m to 10m	cum	17859.48
(iii)	Height above 10m	cum	19082.74
(f)	<b>PSC M50 grade</b>		
	<b>Using batching plant, transit mixer &amp; concrete pump</b>		
(i)	<b>For cast in situ box girder, segmental construction and balanced cantilever</b>		
(i)	Height up to 5m	cum	17022.83
(ii)	Height 5m to 10m	cum	18283.78
(iii)	Height above 10m	cum	19544.73
<b>16.3</b>	<b>HYSD bar reinforcement in super-structure complete as per drawing and technical specifications</b>	MT	85183.86
<b>16.4</b>	High tensile steel wires/strands including all accessories for stressing, stressing operations and grouting complete as per drawing and Technical Specifications	MT	193515.71
<b>16.5</b>	Cement concrete wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications	cum	18782.51
<b>16.6</b>	Asphaltic concrete wearing coat of 25mm compacted thickness complete as per drawing and Technical Specifications	cum	16677.31
<b>16.7</b>	Bituminous Mastic wearing coat excluding tack coat complete as per drawing and Technical Specification	sqm	750.12
<b>16.8</b>	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	2711.68
<b>16.9</b>	Mild steel railing complete as per drawing and Technical Specifications	Rm	4559.31
<b>16.11</b>	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 ancourage 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)	<b>Boulder in wire crates.</b>	cum	2169.83
(c)	<b>Cement concrete block (M-15grade)</b>	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)	<b>Stone</b>	cum	1655.65
(b)	<b>Cement concrete block (M-15grade)</b>	cum	8515.17
10.2	<b>Plain cement concrete M-15</b> 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	<b>Cement plaster- 12mm. Thick in concrete mortar 1:3</b>	Sqm	223.49
10.19	Dry Boulder Pitching flooring	cum	1701.75
10.23	Reinforced cement concrete M-30 mix with stone aggrrt. 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 Coller 300mm	Each	216.00



# LEAD CHART



### 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	2	17.50	19.5
2	Filling Material	Local	-	-	10
3	Stone Metal	Local	2	-	10
4	Stone Boulder	Local	2	-	10
5	Stone Chips, Aggregate	Local	2	-	10
6	Coarse Sand	Barak Near Zuku	2	17.50	19.5
7	Cement	Imphal	160	17.5	177.5
8	Steel	Imphal	160	17.5	177.5
9	Bitumen	Imphal	160	17.5	177.5
10	Bitumen Emulsion	Imphal	160	17.5	177.5
11	Structural Steel	Imphal	160	17.5	177.5



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# CARRIAGE COST



**Carriage Cost of Material (Including loading & unloading )**

**Rubbish**

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

Sl.No.	Lead (km)	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
1	10.00	Upto 1	per m <sup>3</sup>		163.65	
		Upto 2	per m <sup>3</sup>		190.55	
		Upto 3	per m <sup>3</sup>		216.97	
		Upto 4	per m <sup>3</sup>		242.32	
		Upto 5	per m <sup>3</sup>	5	266.68	266.68
		for Every km beyond 5 km up to 10 km	per m <sup>3</sup>	5	26.51	132.55
					<b>Total</b>	<b>399.23</b>

**Stone aggregate below 40mm nominal size**

Name of Quarries Local  
Lead Upto Site (Km)= 10.00

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
2	10.00	Upto 1	per m <sup>3</sup>		156.35	
		Upto 2	per m <sup>3</sup>		182.05	
		Upto 3	per m <sup>3</sup>		207.29	
		Upto 4	per m <sup>3</sup>		231.51	
		Upto 5	per m <sup>3</sup>	5	254.79	254.79
		for Every km beyond 5 km up to 10 km	per m <sup>3</sup>	5	25.33	126.65
		for Every km beyond 10 km up to 20 km	per m <sup>3</sup>		20.42	0.00
		for Every km beyond 20 km	per m <sup>3</sup>		16.51	0.00
					<b>Total</b>	<b>381.44</b>

**Sand**

Name of Quarries Barak Near Zuku  
Lead Upto Site (Km)= 19.50

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
3	19.50	Upto 1	per m <sup>3</sup>		156.35	
		Upto 2	per m <sup>3</sup>		182.05	
		Upto 3	per m <sup>3</sup>		207.29	
		Upto 4	per m <sup>3</sup>		231.51	
		Upto 5	per m <sup>3</sup>	5	254.79	254.79
		for Every km beyond 5 km up to 10 km	per m <sup>3</sup>	5	25.33	126.65
		for Every km beyond 10 km up to 20 km	per m <sup>3</sup>	9.5	20.42	193.99
		for Every km beyond 20 km	per m <sup>3</sup>	0.00	16.51	0.00
					<b>Total</b>	<b>575.43</b>



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**Boulder**

Name of Quarries Local  
Lead Upto Site (Km)= 10.00

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
4	10.00	Upto 1	per m <sup>3</sup>		173.23	
		Upto 2	per m <sup>3</sup>		201.95	
		Upto 3	per m <sup>3</sup>		229.94	
		Upto 4	per m <sup>3</sup>		256.81	
		Upto 5	per m <sup>3</sup>	5	282.63	282.63
		for Every km beyond 5 km up to 10 km	per m <sup>3</sup>	5.00	28.10	140.50
		for Every km beyond 10 km up to 20 km	per m <sup>3</sup>		22.65	0.00
		for Every km beyond 20 km	per m <sup>3</sup>		18.31	0.00
<b>Total</b>						<b>423.13</b>

**Cement, Steel**

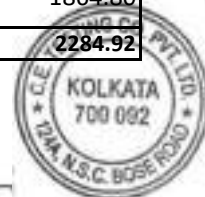
Name of Quarries Imphal  
Lead Upto Site (Km)= 177.50

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
5	177.50	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 beyond 10 km up to 20 km	per Tone	10	14.65	146.50
		for Every km beyond 20 km	per Tone	157.50	11.84	1864.80
<b>Total</b>						<b>2284.92</b>

**Bitumen**

Name of Quarries Imphal  
Lead Upto Site (Km)= 177.50

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
6	177.50	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 beyond 10 km up to 20 km	per Tone	10	14.65	146.50
		for Every km beyond 20 km	per Tone	157.50	11.84	1864.80
<b>Total</b>						<b>2284.92</b>



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# FINISHED RATE



**FINISHER RATE**  
**Road Works**

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

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

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



## FINISHER RATE

### Road Works

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

\*\*Note: Finished Rate inclusive of 1% Labour ces

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



## FINISHER RATE

### Road Works

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

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

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



## FINISHER RATE

### Road Works

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

\*\*Note: Finished Rate inclusive of 1% Labour ces

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**FINISHER RATE**

**Road Works**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
20	03.32	Excavation in Hilly Area in Ordinary Rock by Mechanical Means not Requiring Blasting. Excavation in hilly area in ordinary rock not requiring ballasting by mechanical means including cutting and trimming of slopes and disposal of cut material with all lift and lead upto 1000 metres	cum	304.56					0.00	307.61
21	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	2,997.00					558.15	3,590.70
					Course Sand	0.380	cum	575.43		
					Stone	0.250	cum	381.44		
					Chips/Aggregate					
					Stone Metal Cat1	0.640	cum	381.44		
22	04.06/NSC1	Cement Treated Crushed Rock or combination as per clause 403.2 and table 400.4in Sub base/ Base (Providing, laying and spreading Material on a prepared sub grade, adding the designed quantity of cement to the spread Material, mixing in place with rotavator, grading with the motor grader and compacting with the road roller at OMC to achieve the desired unconfined compressive strength and to form a layer of sub-base/base.) For Sub-Base course	Cum	3,114.00					641.72	3,793.28

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
					Cement	0.040	Ton	2,284.92		
					Sand	0.320	cum	575.43		
					Stone Chips/Aggregate	0.960	cum	381.44		
23	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401	Cum	2,063.00					0.00	2,083.63
24	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					580.32	3,581.12
					Course Sand	0.396	cum	575.43		
					Stone Metal Cat1	0.924	cum	381.44		
25	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	57.54					1.60	59.73
					Bitumen Emulsion	0.001	Ton	2,284.92		

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

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



## FINISHER RATE

### Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
26	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	15.63	Bitumen Emulsion	0.000	Ton	2,284.92	0.46	16.25
27	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	17.16	Bitumen Emulsion	0.000	Ton	2,284.92	0.57	17.91
28	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	11,264.00	Aggregate Bitumen 30/40 Filler	1.440 0.104 0.040	cum Ton Ton	381.44 2,284.92 399.23	802.87	12,187.54

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

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



## FINISHER RATE

### Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
29	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II ( 13 mm nominal size ) iii)Using bitumen 30/40	cum	12,371.00					864.39	13,367.74
					Aggregate	1.456	cum	381.44		
					Bitumen 30/40	0.130	Ton	2,284.92		
					Filler	0.030	Ton	399.23		
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					491.84	5,099.17
					Cement	0.108	Ton	2,284.92		
					Sand	0.176	cum	575.43		
					Steel	0.004	Ton	2,284.92		
					Stone	0.353	cum	381.44		
					Chips/Aggregate					
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					335.36	3,041.72
					Cement	0.074	Ton	2,284.92		

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
					Sand	0.121	cum	575.43		
					Steel	0.002	Ton	2,284.92		
					Stone Chips/Aggregate	0.242	cum	381.44		
32	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	843.03					947.14	1,808.07
					Sand	0.566	cum	575.43		
					Steel	0.080	Ton	2,284.92		
					Stone Chips/Aggregate	1.150	cum	381.44		
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	94.34
34	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade	sqm	85.06					0.00	85.91

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
35	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					470.74	5,456.11
					Cement	0.033	Ton	2,284.92		
					Sand	0.540	cum	575.43		
					Steel	0.019	Ton	2,284.92		
					Stone	0.108	cum	381.44		
					Chips/Aggregate					
36	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					470.74	4,960.66
					Cement	0.033	Ton	2,284.92		
					Sand	0.540	cum	575.43		
					Steel	0.019	Ton	2,284.92		

\*\*Note: Finished Rate inclusive of 1% Labour ces

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	381.44		
37	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					470.74	6,238.74
					Cement	0.033	Ton	2,284.92		
					Sand	0.540	cum	575.43		
					Steel	0.019	Ton	2,284.92		
					Stone Chips	0.108	cum	381.44		
38	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					470.74	4,767.09
					Cement	0.033	Ton	2,284.92		
					Sand	0.540	cum	575.43		

\*\*Note: Finished Rate inclusive of 1% Labour ces

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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	2,284.92		
					Stone Chips	0.108	cum	381.44		
39	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon	each	8,165.25					470.74	8,722.35
					Cement	0.033	Ton	2,284.92		
					Sand	0.540	cum	575.43		
					Steel	0.019	Ton	2,284.92		
					Stone Chips/Aggregate	0.108	cum	381.44		
40	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,223.04					212.82	12,560.22
					Cement	0.037	Ton	2,284.92		

\*\*Note: Finished Rate inclusive of 1% Labour ces

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	575.43		
					Steel	0.021	Ton	2,284.92		
					Stone Chips/Aggregate	0.120	cum	381.44		
41	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign as per IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,831.40					283.72	13,246.27
					Cement	0.044	Ton	2,284.92		
					Sand	0.072	cum	575.43		
					Steel	0.038	Ton	2,284.92		
					Stone Chips/Aggregate	0.144	cum	381.44		
42	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	1,012.16

\*\*Note: Finished Rate inclusive of 1% Labour ces

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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
43	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming to IRC-79 and the drawings.) 120x120 -Road Delineator	each	1,063.19					0.00	1,073.82
44	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m	Rm	3,334.08					0.00	3,367.42

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
45	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	383.64					0.00	387.48
46	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp	nos	21,165.02					0.00	21,376.67
47	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.	Ton	183,662.00	Steel	1.050	Ton	2,284.92	2,399.17	187,921.78

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

## FINISHER RATE

### Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
48	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign	sqm	695.00					0.00	701.95
49	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.	sqm	1,224.98					0.00	1,237.23
50	09.01/nsc1	Laying Reinforced Cement Concrete Pipe NP4 / Prestressed Concrete Pipe on First Class Bedding in Single Row . B)1200 mm dia	Rm	11,638.00					169.51	11,925.59
					Aggregate	0.400	cum	381.44		
					Cement	0.006	Ton	2,284.92		
					Course Sand	0.007	cum	575.43		

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

## FINISHER RATE

### Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
51	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					1,337.19	8,921.88
					Aggregate	0.850	cum	381.44		
					Cement	0.330	Ton	2,284.92		
					Sand	0.450	cum	575.43		
52	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					2,399.17	76,136.59
					Steel	1.050	Ton	2,284.92		
53	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					2,399.17	76,136.59
					Steel	1.050	Ton	2,284.92		
54	10.16	Cement Plaster 12mm Thick in Cement Mortar 1:3	sqm	223.49					0.00	225.72
55	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					457.73	1,648.36
					Stone Chips/Aggregate	1.200	cum	381.44		

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

## FINISHER RATE

### Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
56	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	381.44	457.73	1,631.16
57	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork.	cum	7,496.35	Aggregate Cement Sand	0.850 0.330 0.450	cum Ton cum	381.44 2,284.92 575.43	1,337.19	8,921.88
58	24/i/b	Galvanised Mild steel J /L hook	kg	120.00					0.00	121.20
59	40	Gextextile material (fine net)	sqm	25.50					0.00	25.76

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

**FINISHER RATE**

**Major Bridge**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
1	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	445.75					3.09	453.33
					Cement	0.001	Ton	2,284.92		
					Sand	0.002	cum	575.43		

\*\*Note: Finished Rate inclusive of 1% Labour ces

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	221.12
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	221.12
3	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to	cum	209.22					0.00	211.31
4	13.02/i	Filling in Foundation Trenches as per drawing & technical specification using Coarse sand	cum	2,528.78					0.00	2,554.07
5	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	1,007.86					457.73	1,480.25

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
					Stone Chips/Aggregate	1.200	cum	381.44		
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					690.52	1,320.62
					Sand	1.200	cum	575.43		
7	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	1,274.65					457.73	1,749.70
					Stone Chips/Aggregate	1.200	cum	381.44		
8	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					1,003.54	7,383.00
					Cement	0.170	Ton	2,284.92		
					Sand	0.300	cum	575.43		
					Stone Metal Cat1	1.160	cum	381.44		
9	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					1,337.19	9,782.25
					Aggregate	0.850	cum	381.44		
					Cement	0.330	Ton	2,284.92		
					Sand	0.450	cum	575.43		
10	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	9,333.75					1,470.51	10,912.30

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
					Aggregate	0.900	cum	381.44		
					Cement	0.380	Ton	2,284.92		
					Sand	0.450	cum	575.43		
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					1,539.06	10,722.47
					Aggregate	0.900	cum	381.44		
					Cement	0.410	Ton	2,284.92		
					Sand	0.450	cum	575.43		
12	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	77,427.65					2,399.17	80,625.09
					Steel	1.050	Ton	2,284.92		
13	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					1,003.54	7,869.30
					Cement	0.170	Ton	2,284.92		
					Sand	0.300	cum	575.43		
					Stone Metal Cat1	1.160	cum	381.44		
14	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					1,388.25	10,560.14

\*\*Note: Finished Rate inclusive of 1% Labour ces

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	0.344	Ton	2,284.92		
					Sand	0.450	cum	575.43		
					Stone Chips/Aggregate	0.900	cum	381.44		
15	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					1,523.06	11,575.92
					Cement	0.403	Ton	2,284.92		
					Sand	0.450	cum	575.43		
					Stone Chips/Aggregate	0.900	cum	381.44		
16	15.05	HYSB bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	77,427.65					2,399.17	80,625.09
					Steel	1.050	Ton	2,284.92		

\*\*Note: Finished Rate inclusive of 1% Labour ces

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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
17	15.12/Nsc	Supply and Installation of Mechanically woven double twisted hexagonal shaped steel wire mesh gabion boxes with Zinc + PVC coating having mesh size of 100 mm x 120 mm by using mesh wire 2.7 mm (Inner dia) and 3.7 (outer dia) with sledged wire 3.4 mm(inner dia) and 4.4 mm (outer dia) and lacing with 2.2mm inner dia and 3.3 mm outer dia.placing at indicated places in dry condition at easily accessible location as per direction of Engineer including tools, plant, labour etc. complete in all respect, carrying the material from nearest approach with all leads & lifts, manpower & machinery, materials, labor etc. complete as per detailed technical specifications and as directed by Engineer-In-Charge.	cum	1,706.90					0.00	1,723.97
18	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	445.75					3.09	453.33
					Cement	0.001	Ton	2,284.92		
					Sand	0.002	cum	575.43		

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
19	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complete as per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	10,446.36					1,517.36	12,083.36
					Cement	0.400	Ton	2,284.92		
					Course Sand	0.452	cum	575.43		
					Stone Chips/Aggregate	0.900	cum	381.44		
20	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	2,711.68					172.11	2,912.63
					Cement	0.035	Ton	2,284.92		
					Sand	0.039	cum	575.43		
					Steel	0.018	Ton	2,284.92		
					Stone Chips/Aggregate	0.077	cum	381.44		
21	16.11	Drainage Spouts complete as per drawing and Technical specification	each	2,158.99					9.42	2,190.09
					Structural Steel	0.004	Ton	2,355.04		

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
22	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					13.54	551.56
					Bitumen	0.003	Ton	2,284.92		
					Lime	0.005	Ton	399.23		
					Stone	0.014	cum	381.44		
					Chips/Aggregate					
23	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					1,388.25	10,560.14
					Cement	0.344	Ton	2,284.92		
					Sand	0.450	cum	575.43		
					Stone	0.900	cum	381.44		
					Chips/Aggregate					

\*\*Note: Finished Rate inclusive of 1% Labour ces

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
24	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	1,655.65	Stone Bolder	1.200	cum	423.13	507.76	2,185.04

\*\*Note: Finished Rate inclusive of 1% Labour ces

Item Rate Analysis has been done considering

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# NON SCHEDULE ITEM



**Analysis of Non-Schedule Rate**

**SUB-BASES, BASES ( NON- BITUMINOUS) AND SHOULDERS**

Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs
4.1	401		<b>Granular Sub-Base with Close Graded Material (Table:- 400-1) (Material Reuse)</b>				
		<b>A</b>	<b>Plant Mix Method</b>				
			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				
			<b>Unit = cum</b>				
			<b>Taking output = 225 cum (450 tonne)</b>				
			<b>a) Labour</b>				
			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>b) Machinery</b>				
			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
			<b>c) Material</b>				
			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)	<b>Rate per cum for grading-II Material</b>				
			<b>d) Overhead charges @ input on (a+b+c)</b>				31479.90
			<b>e) Contractor's profit @ input on (a+b+c+d)</b>				42497.87
			Cost for 225 cum = a+b+c+d+e				464101.53
			<b>Rate per cum = (a+b+c+d+e)/225</b>				2062.67
						<b>say</b>	<b>2063.00</b>
			Labour Cess@1%				20.63
			Rate per cum =				<b>2083.63</b>



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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	<b>Construction of Embankment with Material obtained from Borrowpits</b>				
		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	<b>Construction of Embankment with Material Deposited from Roadway Cutting</b>				
		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
		<b>So, Cost of Material obtained from Borrow Pit is Rs. =</b>			66.06	----- (iii=i-ii)
3.14	305	<b>Construction of Subgrade and Earthen Shoulders</b>				
		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
		<b>So,</b>				
		<b>Construction of Subgrade and Earthen Shoulders</b>				
		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	<b>Overhead Signs</b>					
		Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans					
		<b>A Truss and Vertical Support</b>					
		<i>Unit = tonne</i>					
		<i>Taking output = 1 tonne</i>					
		<b>a) Labour</b>					
		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>b) Material</b>					
		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	
		<b>c) Machinery</b>					
		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
		<b>d) Overhead charges @ 8% on (a+b+c)</b>				12367.81	
		<b>e) Contractor's profit @ 10% on (a+b+c+d)</b>				16696.54	
		<b>Rate per tonne = (a+b+c+d+e)</b>				183661.97	
					<i>say</i>	<b>183662.00</b>	
8.7		<b>B Aluminium Alloy Plate for Over Head Sign</b>					
		<i>Unit = sqm</i>					
		Taking output = 1 sqm					
		<b>a) Labour</b>					
		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>b) Material</b>					
		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
		<b>Miscellaneous</b>					
		Add 1 per cent of cost of labour for lifting arrangement, like ladders, pulleys, ropes etc				1.34	
		<b>c) Overhead charges @ 8% on (a+b)</b>				46.79	
		<b>d) Contractor's profit @ 10% on (a+b+c)</b>				63.16	
		<b>Rate per sqm = (a+b+c+d)</b>				694.78	
					<i>say</i>	<b>695.00</b>	
		<b>Note</b>					
		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.					



Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
8.22	809	<b>Reinforced Cement Concrete Crash Barrier</b>					
		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					
		<b>Unit = Linear metre</b>					
		Taking output = 10 m					
		(i) <b>a) M 40 grade concrete</b>					
		<b>M 40 grade concrete</b>	cum	3.000	11992.30	35976.90	0.00
		<b>b) Labour</b>					
		Mate	day	0.040	550.00	22.00	0.00
		Mazdoor	day	1.000	450.00	450.00	0.00
		<b>c) Material</b>					
		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
		<b>d) Overhead charges @ on (b+c)</b>				4678.06	
		<b>e) Contractor's profit @ on (b+c+d)</b>				6315.39	
		Cost for 10 metre = a+b+c+d+e				69469.24	
		<b>Rate per metre = (a+b+c+d+e)/10</b>				6946.92	
					<b>say</b>	<b>6947.00</b>	



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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	<u>2102.00</u>	
						<u>2102.00</u>	
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	<u>712.00</u>	
						<u>712.00</u>	
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	<u>228.00</u>	
						<u>228.00</u>	



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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					
			<i>Unit = Running meter</i>					
			<i>Taking output = 12 m</i>					
			12m long x 100 mm wide x 10mm deep recess					
			<b>a) Labour</b>					
			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>b) Material</b>					
			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					
			<b>c) Overhead charges @ 0.25 on (a+b)</b>				79.43	
			<b>d) Contractor's profit @ 0.1 on (a+b+c)</b>				39.71	
			Cost for 12 m = (a+b+c+d)				436.84	
			<b>Rate per m = (a+b+c+d)/12</b>				36.40	
						<b>say</b>	<b>36.40</b>	
							<b>36.00</b>	
		<b>Note</b>	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)	<b>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.</b>				
	Unit =1MT				
	Taking output = 1MT				
	<b>a) Material</b>				
	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>b) Labour</b>				
	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
	<b>c) Machinery</b>				
	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
	<b>d)Overheads @ 22.5% on (a+b+c)</b>				<b>20164.38</b>
<b>e)Contractor's profit @ 10% on (a+b+c+d)</b>				<b>10978.39</b>	
<b>Rate for per MT (a+b+c+d+e)</b>				<b>120762.24</b>	
			<b>say</b>	<b>120762.00</b>	



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**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>					
		<b>a) Material</b>					
		Stone	cum	1.00	575.00	575.00	M-003
		Stone Spalls	cum	0.20	66.00	13.20	M-008
		<b>b) Labour</b>					
		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	
		<b>c) Overhead charges @ 8% on (a+b)</b>				91.76	
		<b>d) Contractor's profit @ 10% on (a+b+c)</b>				123.88	
		<b>Rate per cum = (a+b+c+d)</b>				1362.70	
					<i>say</i>	<b>1363.00</b>	



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**Approach Slab**

Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks / Input ref.
14.11	1500,1600,1700 & 2704	Reinforced cement concrete approach slab including reinforcement and formwork complete as per drawing and Technical specification					
		<i>Unit = 1 cum</i>					
		<i>Taking output = 1 cum</i>					
		<b>a) Material</b>					
		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>b) Overhead charges @ 22.5% on (a)</b>				2558.97	
		<b>c) Contractor's profit @ 10% on (a+b)</b>				1393.22	
		<b>Rate per cum (a+b+c)</b>				15325.42	
					<i>say</i>	<b>15325.00</b>	
						<b>15325.00</b>	



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**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	<b>Dense Graded Bituminous Macadam</b>					
		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					
		<b>Unit = cum</b>					
		<b>Taking output = 195 cum (450 tonnes)</b>					
		<b>a) Labour</b>					
		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>b) Machinery</b>					
		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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		<b>c) Materials</b>					
		<b>Bitumen @ 4.25 per cent of weight of mix</b>	tonne	19.130	42361.44	810374.35	M-074
		<b>Aggregate</b>					
		Total weight of mix = 450 tonnes					
		Weight of bitumen = 19.13 tonnes					
		Weight of aggregate = 450 - 19.13 = 430.87 tonnes					
		<b>Taking density of aggregate = 1.5 ton/cum</b>					
		Volume of aggregate = 287.25 cum					
		<b>Grading - I (40 mm Nominal Size)</b>					
		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
		<b>or</b>					
		<b>Grading - II (19 mm Nominal Size)</b>					
		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					
		<b>(i) For Grading I (40 mm nominal size)</b>					
		<b>d) Overhead charges @ 0.08 on (a+b+c)</b>				147312.87	
		<b>e) Contractor's profit @ 0.1 on (a+b+c+d)</b>				198872.37	
		Cost for 205 cum = a+b+c+d+e				2187596.12	
		<b>Rate per cum = (a+b+c+d+e)/195 (For Grading I)</b>				11218.44	
						<b>say</b>	<b>11218.00</b>
		<b>(ii) For Grading II (19 mm nominal size)</b>					
		<b>d) Overhead charges @ 0.08 on (a+b+c)</b>				147905.04	
		<b>e) Contractor's profit @ 0.1 on (a+b+c+d)</b>				199671.80	
		Cost for 205 cum = a+b+c+d+e				2196389.78	
		<b>Rate per cum = (a+b+c+d+e)/195 (For Grading-II)</b>				11263.54	
						<b>say</b>	<b>11264.00</b>

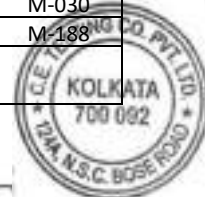


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		<b>Note</b>	*1. Although the roller are required only for 3 hours as per norms of output, but the same have to be available at site for six hours as the hot mix plant and paver will take six hours for mixing and paving the output of 450 tonnes considered in this analysis. To cater for the idle period of these rollers, their usage rates have been multiplied by a factor of 0.55.					
			2.Quantity of Bitumen has been taken for analysis purpose. The actual quantity will depend upon job mix formula.					
			3. Labour for traffic control, watch and ward and other miscellaneous duties at site including sundries have been included in administrative overheads of the contractor.					
			4. In case DBM is laid over freshly laid tack coat, provision of mechanical broom and 2 mazdoors shall be deleted as the same has been included in the cost of tack coat.					
			5. The individual density for each size of aggregates to be used for construction i.e. 37.5-25 mm, 25-10 mm etc. should be found in the laboratory and accordingly the quantities should be ammended for use in field. The average density of 1.5 tonne/cum is only a reference density in this Data Book.					
			6. The individual percentage of aggregates should be calculated from the total weight of dry aggregates i.e.. excluding the weight of bitumen. The weight of filler will also be 2 per cent by weight of dry aggregates.					




5.8	509	<b>Bituminous Concrete</b>					
		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					
		<b>Unit = cum</b>					
		<b>Taking output = 191 cum (450 tonnes)</b>					
		<b>a) Labour</b>					
		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>b) Machinery</b>					
		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
		<b>c) Material</b>					
		<b>i) Bitumen@ 5 per cent of weight of mix</b>	tonne	22.500	42361.44	953132.40	M-074
		<b>ii) Aggregate</b>					
		Total weight of mix = 450 tonnes					
		Weight of bitumen = 22.5 tonnes					
		Weight of aggregate = 450 -22.50 = 427.50 tonnes					
		<b>Taking density of aggregate = 1.5 ton/cum</b>					
		Volume of aggregate = 285 cum					
		<b>Grading - I (19 mm Nominal Size)</b>					
		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
		<b>or</b>					
		<b>Grading - II (13 mm Nominal Size)</b>					
		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
		<b>*Any one of the alternative may be adopted as per approved design</b>					



*Signature*

	(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	<b>12411.00</b>	
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	<b>12371.00</b>	
	Note	<p>*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.</p> <p>2.Quantity of Bitumen has been taken for analysis purpose. The actual quantity will depend upon job mix formula.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>				



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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 .				
		<i>Unit = metre</i>				
		<i>Taking output = 12.5 metres ( 5 pipes of 2.5 m length each )</i>				
9.2	B	1200 mm dia				
		<b>a) Labour</b>				
		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>b) Material</b>				
		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
		<b>c) Overhead charges @ on (a+b)</b>				9766.66
		<b>d) Contractor's profit @ on (a+b+c)</b>				13184.99
		Cost for 12.5 metres = a+b+c+d				145034.87
		<b>Rate per metre= (a+b+c+d)/12.5</b>				11602.79
					<b>say</b>	<b>11603.00</b>
	<b>Note</b>	1. In case of cement cradle 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	<b>Granular Sub-Base with Close Graded Material (Table:- 400-1)</b>				
	A	<b>Plant Mix Method</b>				
		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				
		<b>Unit = cum</b>				
		<b>Taking output = 225 cum (450 tonne)</b>				
		<b>a) Labour</b>				
		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>b) Machinery</b>				
		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
		<b>c) Material</b>				
		Close graded Granular sub-base Material as per table 400-1				
		<b>For Grading-V Material</b>				
		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)	<b>Rate per cum for grading-V Material</b>				
		<b>d) Overhead charges @ on (a+b+c)</b>				45408.94
		<b>e) Contractor's profit @ on (a+b+c+d)</b>				61302.07
		Cost for 225 cum = a+b+c+d+e				674322.79
		<b>Rate per cum = (a+b+c+d+e)/225</b>				2996.99
					<b>say</b>	<b>2997.00</b>
	<b>Note</b>	Any one of the grading for material may be adopted as per design				



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




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		<b>Reinforced Earth Structures</b>					
			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.					
			<b>Each component is analysed separately as under:</b>					
			considering Average height of wall = 8 m.					
7.5(i)		B	<b>With reinforcing elements of synthetic geogrids</b>					
			<b>Unit = sqm</b>					
			<b>Taking output = 300 sqm</b>					
			<b>a) Labour</b>					
			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>b) Material</b>					
			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	
			<b>c) Overhead charges @ 0.08 on (a+b)</b>				10347.84	
			<b>d) Contractor's profit @ 0.1 on (a+b+c)</b>				13969.58	
			Cost of 300 sqm of Synthetic geogrids = a+b+c+d				153665.42	
			<b>Rate per sqm = (a+b+c+d)/ 300</b>				512.22	
						<b>say</b>	<b>512.00</b>	
7.5	3104	(ii)	<b>Facing elements of RCC</b>					
			<b>Unit = sqm</b>					
			<b>Taking output = 75 sqm</b>					
			<b>a) Labour</b>					
			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>b) Machinery</b>					
			Light crane with lifting capacity upto 3 tonne	hour	6.000	1144.38	6866.25	P&M-013
			<b>c) Material</b>					
			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	
			<b>d) Overhead charges @ 0.08 on (a+b)</b>				707.22	
			<b>e) Contractor's profit @ 0.1 on (a+b+d)</b>				954.75	
			Cost for 75 sqm = a+b+c+d+e				229511.11	
			<b>Rate per sqm = (a+b+c+d+e)/ 75</b>				3060.15	
						<b>say</b>	<b>3060.00</b>	



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.					

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**CTB & CTSB**

4.6	403		<b>Cement Treated Crushed Rock or combination as per clause 403.2 and table 400.4 in Sub base/ Base</b>					
			Providing, laying and spreading Material on a prepared sub grade, adding the designed quantity of cement to the spread Material, mixing in place with rotavator, grading with the motor grader and compacting with the road roller at OMC to achieve the desired unconfined compressive strength and to form a layer of sub-base/base.					
			<b>Unit = cum</b>					
			<b>Taking output = 300 cum (600 tonnes)</b>					
			<b>Quantity of cement assumed as 4 per cent of quantity of crushed rock by weight.</b>					
			<b>a) Labour</b>					
			Mate	day	0.480	450.00	216.00	L-12
			Mazdoor skilled	day	2.000	450.00	900.00	L-15
			Mazdoor	day	10.000	400.00	4000.00	L-13
			<b>b) Machinery</b>					
			Motor Grader 110 HP @ 50 cum per hour	hour	6.000	3786.88	22721.25	P&M-032
			Vibratory roller 8 - 10 tonne	hour	6.000	1743.33	10460.00	P&M-059
			Tractor with Rotavator and blade @ 25 cum per hour	hour	12.000	561.57	6738.86	P&M-054
			Water tanker 6 KL capacity	hour	10.000	744.25	7442.50	P&M-060
			<b>c) Material</b>					
			Cement at site @ 4 per cent by weight of crushed aggregate (600 tonne)	tonne	24.000	9830.60	235934.40	M-086
			<b>Grading of material for sub-base course</b>					
			37.5 mm to 9.5 mm @ 55 per cent	cum	211.200	1325.49	279943.07	M-014
			9.5 mm to 4.75 mm @ 20 per cent	cum	76.800	1274.00	97843.20	M-025
			4.75 mm to 75 micron @ 25 per cent	cum	96.000	1174.00	112704.00	M-019
			Cost of water	KL	60.000	125.00	7500.00	M-195
			<b>or</b>					
			<b>Grading of material for Base course</b>					
			37.5 mm to 9.5 mm @ 32.5 per cent	cum	124.800	1325.49	165420.90	M-028
			9.5 mm to 4.75 mm @ 5 per cent	cum	19.200	1274.00	24460.80	M-025
			4.75 mm to 75 micron @ 62.5 per cent	cum	240.000	1174.00	281760.00	M-023
			Cost of water	KL	60.000	125.00	7500.00	M-195
4.6		(i)	<b>For Sub-Base course</b>					
			<b>d) Overhead charges @ 8% on (a+b+c)</b>				62912.26	
			<b>e) Contractor's profit @ 10% on (a+b+c+d)</b>				84931.55	
			Cost for 300 cum = a+b+c+d+e				934247.09	
			Rate per cum = (a+b+c+d+e)/300				3114.16	
						<b>say</b>	<b>3114.00</b>	
			<b>Add extra cost of VAT on Materials</b>				<b>3114.00</b>	
4.6		(ii)	<b>For Base course</b>					
			<b>d) Overhead charges @ 8% on (a+b+c)</b>				61404.38	
			<b>e) Contractor's profit @ 10% on (a+b+c+d)</b>				82895.91	
			Cost for 300 cum = a+b+c+d+e				911855.00	
			Rate per cum = (a+b+c+d+e)/300				3039.52	
						<b>say</b>	<b>3040.00</b>	
							<b>3040.00</b>	



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**VOLUME VII**  
**COST ESTIMATE**



# ABSTRACT OF COST



**Road name- Maram to Peren road section on NH-129A in the State of Manipur  
(Package - III)  
(75 km to 109+494 km)**

**GENERAL ABSTRACT OF COST**

Length of Road (KM)

:

34.494

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	1.20	0.03	0.37%
2	Earth work ,Subgrade and Erosion control	115.48	3.35	35.32%
3	Sub-Base & Base	41.93	1.22	12.82%
4	Bituminous Courses	19.69	0.57	6.02%
5	Junction Improvement (Major & Minor)	0.07	0.00	0.02%
6	Traffic signs, Road marking & other road appurtenances	2.97	0.09	0.91%
	<b>Drainage and Protective Works</b>			
7	Longitudinal Drains	7.68	0.22	2.35%
8	Retaining wall	68.52	1.99	20.95%
9	Breast wall	28.86	0.84	8.83%
10	Protection Work	13.57	0.39	4.15%
<b>B.</b>	<b>BRIDGES &amp; CULVERTS</b>			
11	Culvert	26.33	0.76	8.05%
<b>C.</b>	<b>Utility Shifting</b>			
	Utility Shifting(Electrical+PHED)	0.69	0.02	0.21%
<b>D.</b>	<b>COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)</b>	<b>326.99</b>	<b>9.48</b>	
<b>E.</b>	Escalation @ 3% WPI (3% of A+B Only)	9.79		
<b>F.</b>	<b>Total Civil Cost including Escalation@3% (D+E=F)</b>	<b>336.78</b>	<b>9.76</b>	
<b>G.</b>	Maintenance for 5 years, i.e 2.5% on civil cost (F-C)	8.40		
<b>H.</b>	GST @ 12% of (F-C)	40.33		
<b>I.</b>	Contingencies @ 2.8% over Civil Cost (F-C)	9.41		
<b>J.</b>	Supervision Charges @ 3% of (F-C)	10.08		
<b>K.</b>	Agency Charges @3% of (F-C)	10.08		
<b>L.</b>	Escalation Cost @ 2.5% during Construction Period(For 1.5 Yrs of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)	8.40		
<b>M</b>	<b>TOTAL CONSTRUCTION COST * (F+G+H+I+J+K+L)=M</b>	<b>423.48</b>	<b>12.28</b>	
<b>N</b>	<b>DEPARTMENTAL COST</b>			
<b>a.</b>	LA & Structure Cost(Tentative)	25.75		
<b>b.</b>	Forest Clearance & Environment Cost (Forest+Environmental Budget+Muck Disposal)	15.61		
	<b>Sub Total (N)</b>	<b>41.36</b>		
<b>O</b>	<b>TOTAL CAPITAL COST (M+N)=O</b>	<b>464.84</b>	<b>13.48</b>	



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**BILL**  
**(ROAD PART)**



### Summary of Bill of Quantity

**Bill No : 01. Site Clearance and Dismantling**

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	02.01/i	Cutting of Girth 300-600mm	Each	13.00	392.30	5,100
2	02.01/ii	Cutting of Girth 600-900mm	Each	25.00	723.48	18,087
3	02.01/iii	Cutting of Girth 900-1800mm	Each	86.00	1,373.64	118,133
4	02.01/iv	Cutting of Girth 1800-2700mm	Each	15.00	2,576.19	38,643
5	02.01/v	Cutting of Girth 2700mm more	Each	5.00	4,330.68	21,653
6	02.03/b	Clearing & grubbing( Mechanical - Light Jungle)	Ha	19.00	59,912.85	1,138,344
7	02.04/i/c	Dismantling Structure RCC	cum	128.00	1,756.40	224,819
8	02.04/iii/b	Dismantling Structure Rubble Stone Masonry Cement	Cum	2,402.00	494.21	1,187,092
9	02.04/vii/a	Morter Dismantle HP (300-600)	rm	20.00	267.64	5,353
10	02.04/vii/b	Dismantle HP (upto 600 - 900 mm dia)	rm	1,500.00	362.36	543,540
11	02.04/vii/c	Dismantle HP (above 900 mm dia)	rm	550.00	620.22	341,121
12	02.04/viii/e	Dismantle Flexible Pavement Granular	sqm	186,660.00	34.33	6,408,038
13	02.04/viii/f/ii	Dismantle Flexible Pavement Bituminous(Roller & Scarifier)	sqm	34,328.00	57.65	1,979,009
<b>Total of Bill</b>						<b>12,028,933</b>

**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	135,525.00	318.15	43,117,279
2	03.13	Embankment fill from Roadway Cutting	cum	171,494.00	161.80	27,747,729
3	03.14/Nsc	Subgrade and Earthen Shoulder Fill From Roadway	cum	26,304.98	248.74	6,543,100
4	03.15	Cutting Compacting original ground supporting sub-grade	cum	106,980.05	87.52	9,362,894
5	03.19	Turfing	sqm	111,311.00	62.49	6,955,824
6	03.31	Excavation in Hill in Soil For Roadway	cum	3,653,691.20	213.50	780,063,071
7	03.32	Excavation for Roadway Ordinary Rock Mechanical (Without Blasting)	cum	913,422.80	307.61	280,977,988
<b>Total of Bill</b>						<b>1,154,767,885</b>

**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	9,440.09	3,590.70	33,896,524
2	04.06/NSC1	CT Subbase	Cum	55,242.64	3,793.28	209,550,801



### Summary of Bill of Quantity

**Bill No : 03. Sub-Base & Base Courses**

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
3	04/nsc1	GSB Reuse	Cum	19,606.33	2,083.63	40,852,344
4	05.02	WMM	Cum	37,703.97	3,581.12	135,022,423
<b>Total of Bill</b>						<b>419,322,092</b>

**Bill No : 04. Bituminous Courses**

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	06.01/a	Prime Coat	sqm	252,812.70	59.73	15,100,503
2	06.02/ii	Tack Coat(Granular Layer)	sqm	252,812.70	17.91	4,527,875
3	06/Nsc1	DBM GR II	cum	4,266.00	12,187.54	51,992,046
4	06/Nsc2	BC GR II	cum	9,373.31	13,367.74	125,299,944
<b>Total of Bill</b>						<b>196,920,368</b>

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	05.02	WMM	Cum	86.10	3,581.12	308,334
2	06.01/a	Prime Coat	sqm	574.00	59.73	34,285
3	06.02/i	Tack Coat(Bituminous Layer)	sqm	574.00	16.25	9,328
4	06/Nsc2	BC GR II	cum	22.96	13,367.74	306,923
<b>Total of Bill</b>						<b>658,870</b>

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	08.02/a	5 th km Stone	each	7.00	5,099.17	35,694
2	08.02/b	Ordinary km Stone	each	28.00	3,041.72	85,168
3	08.04	Boundary Stone	each	347.00	1,808.07	627,400
4	08.06	Paint on Steel Surface	sqm	36.00	85.91	3,093
5	08.11/i	90 cm equilateral triangle	each	427.00	5,456.11	2,329,759
6	08.11/iii	60 cm circular	each	42.00	4,960.66	208,348
7	08.11/iv	80 cm x 60 cm rectangular	each	2.00	6,238.74	12,477
8	08.11/v	60 cm x 45 cm rectangular	each	120.00	4,767.09	572,051
9	08.11/vii	90 cm high octagon	each	6.00	8,722.35	52,334
10	08.12	Direction Sign(<.0.9 sqm)	sqm	2.00	12,560.22	25,120



### 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
11	08.13	Direction Sign(>.0.9 sqm)	sqm	16.00	13,246.27	211,940
12	08.14	Paint on Bituminous Surface	sqm	9,377.44	1,012.16	9,491,473
13	08.15/c/v	Road Delineators(100 cm long above Road)	each	1,398.00	1,073.82	1,501,200
14	08.18/A/b	Type-A, "W" Metal Beam Crash Barrier	Rm	3,335.00	3,367.42	11,230,346
15	08.20/ii	Road Stud/Road Markers	nos	6,302.00	387.48	2,441,899
16	08.22	Lighting on Bridges	nos	22.00	21,376.67	470,287
17	08/nsc/4/a	Overhead Signs-Truss and Vertical Support	Ton	1.04	187,921.78	196,190
18	08/nsc/4/b	Overhead Signs-Aluminium Alloy Plate for Over Head Sign	sqm	36.00	701.95	25,270
19	08/nsc/6	Rumble Strip	sqm	14.00	1,237.23	17,321
20	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	26.24	221.12	5,803
21	14.03/a	Foundation PCC M15	cum	0.97	9,782.25	9,469
22	14.03/e/II	Foundation RCC M25	cum	5.70	10,722.47	61,161
23	14.08	Foundation Steel (HYSD)	MT	0.86	80,625.09	69,015
24	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	2.00	11,575.92	23,152
25	15.05	Sub Structure Steel (HYSD)	MT	0.30	80,625.09	24,188
<b>Total of Bill</b>						<b>29,730,159</b>

**Bill No : 07. Longitudinal Drains**

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	10.16	Sub Structure Plaster with 1:3 Cement Morter	sqm	41,402.07	225.72	9,345,275
2	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	6,806.23	221.12	1,504,993
3	13.02/i	Filling in Foundation by Coarse Sand	cum	1,035.05	2,554.07	2,643,595
4	14.03/a	Foundation PCC M15	cum	2,146.90	9,782.25	21,001,552
5	14.03/b	Foundation PCC M20	cum	122.98	10,912.30	1,341,995
6	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	4,140.21	7,869.30	32,580,531
7	15.03/b/i	Sub Structure PCC M20	cum	285.09	10,560.14	3,010,590
8	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	332.80	11,575.92	3,852,466
9	15.05	Sub Structure Steel (HYSD)	MT	16.64	80,625.09	1,341,601
10	15.12	Sub Structure Weepholes per Meter	Rm	321.00	453.33	145,519
11	24/i/b	MS Hook(300gm each)	kg	51.20	121.20	6,205
12	40	Geotextile filter(75mm sqm)	sqm	57.60	25.76	1,484
<b>Total of Bill</b>						<b>76,775,807</b>

Item Rate Analysis has been done considering

### Summary of Bill of Quantity

**Bill No : 08. Retaining wall**

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	27,887.10	221.12	6,166,394
2	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	6,103.31	211.31	1,289,689
3	13.04	Sub Structure Filter Media	cum	28,389.00	1,749.70	49,672,228
4	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed ) Cement Morter(1:3)	cum	19,215.89	7,383.00	141,870,945
5	14.03/a	Foundation PCC M15	cum	7,227.52	9,782.25	70,701,388
6	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	49,167.92	7,869.30	386,917,074
7	15.12	Sub Structure Weepholes per Meter	Rm	8,036.00	453.33	3,642,960
8	15.12	Sub Structure Weepholes per Meter	Rm	54,924.00	453.33	24,898,697
<b>Total of Bill</b>						<b>685,159,376</b>

**Bill No : 09. Breast wall**

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	25,250.23	221.12	5,583,330
2	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	6,312.56	211.31	1,333,906
3	13.03/a	Sub Structure Backfill Granular Material	cum	3,585.38	1,480.25	5,307,251
4	13.03/b	Sub Structure Backfill Sandy Material	cum	1,142.78	1,320.62	1,509,172
5	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed ) Cement Morter(1:3)	cum	12,097.15	7,383.00	89,313,222
6	14.03/a	Foundation PCC M15	cum	5,623.66	9,782.25	55,012,009
7	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	16,197.68	7,869.30	127,464,364
8	15.12	Sub Structure Weepholes per Meter	Rm	6,875.80	453.33	3,117,007
<b>Total of Bill</b>						<b>288,640,261</b>

**Bill No : 10. Protection Work**

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	15.12/Nsc	Protection Work Gabian Structure for Retaining Earth	cum	78,720.00	1,723.97	135,710,918
<b>Total of Bill</b>						<b>135,710,918</b>

Item Rate Analysis has been done considering

**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	13.00	392.30	5,099.90
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	25.00	723.48	18,087.00
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	86.00	1,373.64	118,133.04
4	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm	Each	15.00	2,576.19	38,642.85
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	5.00	4,330.68	21,653.40
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	19.00	59,912.85	1,138,344.15



**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	128.00	1,756.40	224,819.20
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	2,402.00	494.21	1,187,092.42
9	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	20.00	267.64	5,352.80
10	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	1,500.00	362.36	543,540.00
11	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	550.00	620.22	341,121.00
12	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier	sqm	186,660.00	34.33	6,408,037.80
13	02.04/viii/f/ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier	sqm	34,328.00	57.65	1,979,009.20
<b>Total of Bill 01. Site Clearance and Dismantling</b>						<b>12,028,932.76</b>

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	135,525.00	318.15	43,117,278.75
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	171,494.00	161.80	27,747,729.20
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	26,304.98	248.74	6,543,099.73
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	106,980.05	87.52	9,362,893.98
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	111,311.00	62.49	6,955,824.39
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	3,653,691.20	213.50	780,063,071.20

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	913,422.80	307.61	280,977,987.51
<b>Total of Bill 02. Earth work,Subgrade and Erosion control</b>						<b>1,154,767,884.75</b>



## Bill No : 03. Sub-Base &amp; 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	9,440.09	3,590.70	33,896,523.98
2	04.06/NS C1	Cement Treated Crushed Rock or combination as per clause 403.2 and table 400.4 in Sub base/ Base (Providing, laying and spreading Material on a prepared sub grade, adding the designed quantity of cement to the spread Material, mixing in place with rotavator, grading with the motor grader and compacting with the road roller at OMC to achieve the desired unconfined compressive strength and to form a layer of sub-base/base.) For Sub-Base course	Cum	55,242.64	3,793.28	209,550,801.46
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	19,606.33	2,083.63	40,852,343.63
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	37,703.97	3,581.12	135,022,423.14

Item Rate Analysis has been done considering

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



		<b>Total of Bill 03. Sub-Base &amp; Base Courses</b>	<b>419,322,092.21</b>
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## 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	252,812.70	59.73	15,100,502.57
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	252,812.70	17.91	4,527,875.46
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	4,266.00	12,187.54	51,992,045.64



## 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	9,373.31	13,367.74	125,299,944.28
<b>Total of Bill 04. Bituminous Courses</b>						<b>196,920,367.95</b>



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	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	86.10	3,581.12	308,334.43
2	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	574.00	59.73	34,285.02
3	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	574.00	16.25	9,327.50
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	22.96	13,367.74	306,923.31
<b>Total of Bill 05. Junction Improvement (Major &amp; Minor)</b>						<b>658,870.26</b>



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone	each	7.00	5,099.17	35,694.19
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone	each	28.00	3,041.72	85,168.16
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	347.00	1,808.07	627,400.29
4	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade	sqm	36.00	85.91	3,092.76
5	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle	each	427.00	5,456.11	2,329,758.97



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
6	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular	each	42.00	4,960.66	208,347.72
7	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	2.00	6,238.74	12,477.48
8	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	120.00	4,767.09	572,050.80



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	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	6.00	8,722.35	52,334.10
10	08.12	Direction and Place Identification signs upto 0.9sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign asper IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	2.00	12,560.22	25,120.44
11	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 asper IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	16.00	13,246.27	211,940.32



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
12	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectoring Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectoring 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	9,377.44	1,012.16	9,491,472.71
13	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	1,398.00	1,073.82	1,501,200.36
14	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	3,335.00	3,367.42	11,230,345.70
15	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 &amp; other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			nos	6,302.00	387.48	2,441,898.96
16	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	22.00	21,376.67	470,286.74
17	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.	Ton	1.04	187,921.78	196,190.34
18	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign	sqm	36.00	701.95	25,270.20
19	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.	sqm	14.00	1,237.23	17,321.22

Item Rate Analysis has been done considering

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
20	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	26.24	221.12	5,803.07
21	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	0.97	9,782.25	9,469.22
22	14.03/e/l	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.70	10,722.47	61,160.97
23	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.86	80,625.09	69,015.08
24	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	2.00	11,575.92	23,151.84
25	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	0.30	80,625.09	24,187.53
<b>Total of Bill 06. Traffic signs, Road marking &amp; other road appurtenances</b>						<b>29,730,159.16</b>



## Bill No : 07. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3	sqm	41,402.07	225.72	9,345,275.24
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	6,806.23	221.12	1,504,993.14
3	13.02/i	Filling in Foundation Trenches as per drawing & technical specification using Coarse sand	cum	1,035.05	2,554.07	2,643,595.26
4	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	2,146.90	9,782.25	21,001,551.65
5	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	122.98	10,912.30	1,341,994.65
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	4,140.21	7,869.30	32,580,530.95
7	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	285.09	10,560.14	3,010,590.31
8	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				



Item Rate Analysis has been done considering

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

**Bill No : 07. Longitudinal Drains**

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	332.80	11,575.92	3,852,466.18
9	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	16.64	80,625.09	1,341,601.50
10	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	321.00	453.33	145,518.93
11	24/i/b	Galvanised Mild steel J /L hook	kg	51.20	121.20	6,205.44
12	40	Gextextile material (fine net)	sqm	57.60	25.76	1,483.78
<b>Total of Bill 07. Longitudinal Drains</b>						<b>76,775,807.02</b>

Item Rate Analysis has been done considering



## Bill No : 08. 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	27,887.10	221.12	6,166,394.45
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	6,103.31	211.31	1,289,689.38
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	28,389.00	1,749.70	49,672,228.05
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	19,215.89	7,383.00	141,870,945.40
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	7,227.52	9,782.25	70,701,387.96
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	49,167.92	7,869.30	386,917,073.51
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	8,036.00	453.33	3,642,959.88
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	54,924.00	453.33	24,898,696.92

Item Rate Analysis has been done considering

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



		<b>Total of Bill</b>	<b>08. Retaining wall</b>	<b>685,159,375.54</b>
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## Bill No : 09. 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	25,250.23	221.12	5,583,330.42
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	6,312.56	211.31	1,333,906.42
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	3,585.38	1,480.25	5,307,251.34
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	1,142.78	1,320.62	1,509,171.52
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	12,097.15	7,383.00	89,313,221.54
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	5,623.66	9,782.25	55,012,008.91
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	16,197.68	7,869.30	127,464,363.88
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	6,875.80	453.33	3,117,007.32

Item Rate Analysis has been done considering

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



		<b>Total of Bill    09. Breast wall</b>	<b>288,640,261.34</b>
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## Bill No : 10. Protection Work

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	15.12/Ns c	Supply and Installation of Mechanically woven double twisted hexagonal shaped steel wire mesh gabion boxes with Zinc + PVC coating having mesh size of 100 mm x 120 mm by using mesh wire 2.7 mm (Inner dia) and 3.7 (outer dia) with slevded wire 3.4 mm(inner dia) and 4.4 mm (outer dia) and lacing with 2.2mm inner dia and 3.3 mm outer dia.placing at indicated places in dry condition at easily accessible location as per direction of Engineer including tools, plant, labour etc. complete in all respect, carrying the material from nearest approach with all leads & lifts, manpower & machinery, materials, labor etc. complete as per detailed technical specifications and as directed by Engineer-In-Charge.	cum	78,720.00	1,723.97	135,710,918.40
<b>Total of Bill 10. Protection Work</b>						<b>135,710,918.40</b>

Item Rate Analysis has been done considering



**BILL**  
**(STRUCTURE PART)**



## Summary of Bill of Quantity

**Bill No : 11. Culvert**

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
<b>Foundation</b>						
1	10.20	Foundation Culvert PCC M15	cum	1,241.00	8,921.88	11,072,053
2	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	17,854.00	221.12	3,947,876
<b>End of Sub Total Foundation</b>						<b>15,019,930</b>
<b>Sub Structure</b>						
3	10.06/a	Steel culvert for Sub-Structure	Ton	532.00	76,136.59	40,504,666
4	10.20/b	Culvert Backfilling culvert by Gravelly materials	cum	1,865.00	1,648.36	3,074,191
5	10.20/c	Filter Media culvert behind abutment, wing and return wall	cum	6,107.00	1,631.16	9,961,494
6	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	7,595.00	11,575.92	87,919,112
7	15.12	Sub Structure Weepholes per Meter	Rm	4,116.00	453.33	1,865,906
<b>End of Sub Total Sub Structure</b>						<b>143,325,370</b>
<b>Super Structure</b>						
8	06.02/i	Tack Coat(Bituminous Layer)	sqm	2,795.00	16.25	45,419
9	06/Nsc2	BC GR II	cum	112.00	13,367.74	1,497,187
10	10.06/b	Steel culvert for Super-Structure	Ton	178.00	76,136.59	13,552,313
11	16.01/a/i	Super Structure RCC M25 - Solid Slab Super Structure(Upto 5m)	cum	2,380.00	12,083.36	28,758,397
12	16.08	Protection Work RCC Railing M30 ( Precast 12mm Aggregate)	Rm	559.00	2,912.63	1,628,160
13	16.11	Super Structure Drainage Spout	each	200.00	2,190.09	438,018
14	16.17	Super Structure Mastic Asphalt	sqm	2,795.00	551.56	1,541,610
<b>End of Sub Total Super Structure</b>						<b>47,461,104</b>
<b>Protection Work</b>						
15	10.02/Nsc	Protection Work Culvert M15	cum	1,943.00	8,921.88	17,335,213
16	13.01/a/i/Nsc	Excavation For Protection work	cum	14,873.00	221.12	3,288,718
17	16/nsc	Protection Work Curtain Wall- PCC (M-15)	cum	2,943.00	10,560.14	31,078,492
18	17.03/a	Protection Work Pitching on slopes laid over prepared filter media(Stone)	cum	2,252.00	2,185.04	4,920,710
<b>End of Sub Total Protection Work</b>						<b>56,623,133</b>
<b>Miscellaneous Work</b>						
19	08.05	Paint on Concrete Surface(2 Coat)	sqm	1,430.00	94.34	134,906
20	09.01/nsc1	Hume Pipe(NP4 1200 dia Single ROW)	Rm	60.00	11,925.59	715,535
<b>End of Sub Total Miscellaneous Work</b>						<b>850,442</b>
<b>Total</b>						<b>263,279,978</b>

Item Rate Analysis has been done considering



## Bill No : 11. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
<b>Foundation</b>						
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	1,241.00	8,921.88	11,072,053.08
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	17,854.00	221.12	3,947,876.48
<b>Sub Total of Foundation</b>						<b>15,019,929.56</b>
<b>Sub Structure</b>						
3	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure	Ton	532.00	76,136.59	40,504,665.88
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	1,865.00	1,648.36	3,074,191.40
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	6,107.00	1,631.16	9,961,494.12
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	7,595.00	11,575.92	87,919,112.40

Item Rate Analysis has been done considering

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



## Bill No : 11. 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	4,116.00	453.33	1,865,906.28
<b>Sub Total of Sub Structure</b>						<b>143,325,370.08</b>
<b>Super Structure</b>						
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	2,795.00	16.25	45,418.75
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	112.00	13,367.74	1,497,186.88
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	178.00	76,136.59	13,552,313.02
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	2,380.00	12,083.36	28,758,396.80



## Bill No : 11. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
12	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	559.00	2,912.63	1,628,160.17
13	16.11	Drainage Spouts complete as per drawing and Technical specification	each	200.00	2,190.09	438,018.00
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 10sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	2,795.00	551.56	1,541,610.20
<b>Sub Total of</b>			<b>Super Structure</b>			<b>47,461,103.82</b>
<b>Protection Work</b>						
15	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork. At Protection	cum	1,943.00	8,921.88	17,335,212.84
16	13.01/a/i/Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	14,873.00	221.12	3,288,717.76
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

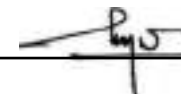
Manipur Schedule of Rates For National Highways - Works 2018(PWD, Manipur)



## Bill No : 11. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	2,943.00	10,560.14	31,078,492.02
18	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	2,252.00	2,185.04	4,920,710.08
<b>Sub Total of Protection Work</b>						<b>56,623,132.70</b>
<b>Miscellaneous Work</b>						
19	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	1,430.00	94.34	134,906.20
20	09.01/ns c1	Laying Reinforced Cement Concrete Pipe NP4 / Prestressed Concrete Pipe on First Class Bedding in Single Row . B)1200 mm dia	Rm	60.00	11,925.59	715,535.40
<b>Sub Total of Miscellaneous Work</b>						<b>850,441.60</b>
<b>Total of Bill 11. Culvert</b>						<b>263,279,977.76</b>

Item Rate Analysis has been done considering




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



TCS TYPE	DESCRIPTION
TCS-1A	Typical Cross Section of Two lane Carriageway in Built up area with both side footpath cum RCC Rectangular Drain (Reconstruction of Existing)
TCS-2	Typical Cross Section of Two Lane Carriageway in Rural Area with RR Masonry Trapezoidal Drain on Hill Side and Earthen Shoulder on valley side
TCS-2A	Typical Cross Section of Two Lane Carriageway in Rural Area with RR Masonry Trapezoidal Drain on Hill Side and Earthen Shoulder on valley side
TCS-3	Typical Cross Section of Two lane Carriageway in Rural area with breast wall on hill side and earthen shoulder on valley side (Overlay Portion)
TCS-3A	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)
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
TCS-4A	Typical Cross Section of Two lane Carriageway at reconstruction stretch in rural area with one side retaining wall and other side RR masonry
TCS-5	Typical Cross Section of Two lane Carriageway in Rural area with one side retaining wall and other side breast wall (Overlay Portion)
TCS-5A	Typical Cross Section of Two lane Carriageway in Rural area with one side retaining wall and other side breast wall (Reconstruction of Existing)
TCS-6A	Typical Cross Section of Two lane Carriageway in Rural area with both side RR Masonry Trapezoidal Drain (Reconstruction of Existing Pavement)
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
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
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)
TCS-11A	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)
TCS-12B	Typical Cross Section of Two lane Carriageway in rural area with both side breast wall (New construction)
TCS-14	Typical Cross Section of Two lane Carriageway in rural area with both side retaining wall (New Construction)
TCS-14A	Typical Cross Section of Two lane Carriageway in rural area with both side retaining wall (Reconstruction of Existing Pavement)
TCS-17	Typical Cross Section of Two lane Carriageway in rural area with breast wall on hill side and earthen shoulder on valley side (New Construction)
TCS-18	Typical Cross Section of Two lane Carriageway in rural area with one side retaining wall and other side breast wall (New Construction)
TCS-19	Typical Cross Section of Two lane Carriageway in rural area with one side breast wall and other side RR masonry trapezoidal drain (New Construction)
TCS-19A	Typical Cross Section of Two lane Carriageway in rural area with one side breast wall and other side gabion wall in Landslide and Sinking zone
Total length =	

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List of TCS				
Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
75000	75320		320	TCS-1A
75320	75430	2.7	107.3	TCS-9
75430	75515	3.96	81.04	TCS-4A
75515	75575		60	TCS-9
75575	75640		65	TCS-14
75640	75700	3.96	56.04	TCS-9
75700	75735		35	TCS-14
75735	75775		40	TCS-14A
75775	75825		50	TCS-9
75825	75875	6.14	43.86	TCS-14
75875	75985		110	TCS-7
75985	76010	16.6	8.4	TCS-2A
76010	76125		115	TCS-7
76125	76200		75	TCS-14
76200	76325		125	TCS-17
76325	76400		75	TCS-9
76400	76490	2.7	87.3	TCS-17
76490	76600	2.7	107.3	TCS-4
76600	76975	3.96	371.04	TCS-2A
76975	77025		50	TCS-2A
77025	77130		105	TCS-2A
77130	77180	2.7	47.3	TCS-4A
77180	77280		100	TCS-7
77280	77310	3.96	26.04	TCS-4
77310	77380		70	TCS-7
77380	77420		40	TCS-2
77420	77470		50	TCS-17
77470	77650	5.2	174.8	TCS-3
77650	77700		50	TCS-4
77700	77950	2.6	247.4	TCS-2
77950	78000		50	TCS-4
78000	78050	2.6	47.4	TCS-2
78050	78100		50	TCS-7
78100	78170		70	TCS-9
78170	78400	5.3	224.7	TCS-2
78400	78450	2.6	47.4	TCS-4
78450	78500		50	TCS-2
78500	78550		50	TCS-3
78550	78920	2.6	367.4	TCS-2
78920	79030	2.7	107.3	TCS-7
79030	79080		50	TCS-12B
79080	79110		30	TCS-7
79110	79280	2.6	167.4	TCS-2
79280	79480		200	TCS-19
79480	79550		70	TCS-11A
79550	79725		175	TCS-8
79725	79800		75	TCS-12B
79800	79990		190	TCS-8



*[Handwritten signature]*

Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
79990	80080		90	TCS-2A
80080	80150		70	TCS-14
80150	80320		170	TCS-14A
80320	80500	2.6	177.4	TCS-14
80500	80560		60	TCS-2A
80560	80650		90	TCS-7
80650	80700	2.7	47.3	TCS-17
80700	80760		60	TCS-7
80760	81000	2.6	237.4	TCS-2
81000	81080		80	TCS-2A
81080	81150	2.6	67.4	TCS-17
81150	81380	5.3	224.7	TCS-2A
81380	81470		90	TCS-7
81470	81910	6.66	433.34	TCS-2
81910	81940		30	TCS-7
81940	82110	5.3	164.7	TCS-2
82110	82220	5.2	104.8	TCS-18
82220	82575	5.2	349.8	TCS-2
82575	82650		75	TCS-2A
82650	82960	5.3	304.7	TCS-2
82960	83100	2.7	137.3	TCS-7
83100	83570	5.4	464.6	TCS-2
83570	83625		55	TCS-19
83625	83660		35	TCS-7
83660	83775	2.7	112.3	TCS-2
83775	83825		50	TCS-7
83825	84040	2.6	212.4	TCS-2
84040	84100		60	TCS-7
84100	84175		75	TCS-2
84175	84500	2.6	322.4	TCS-3A
84500	84550		50	TCS-5A
84550	84700	2.7	147.3	TCS-2A
84700	84820		120	TCS-17
84820	85300	5.2	474.8	TCS-4A
85300	85370		70	TCS-18
85370	85600	2.7	227.3	TCS-5A
85600	85900	2.6	297.4	TCS-2A
85900	85920		20	TCS-3
85920	86130	5.3	204.7	TCS-2A
86130	86230		100	TCS-18
86230	86950	8	712	TCS-2
86950	87000		50	TCS-3
87000	87520	5.3	514.7	TCS-2
87520	87600		80	TCS-5
87600	87750	2.7	147.3	TCS-2
87750	88400	7.9	642.1	TCS-7
88400	88830	9.26	420.74	TCS-2
88830	89130		300	TCS-17
89130	89350	2.7	217.3	TCS-2
89350	89400		50	TCS-7
89400	89590	2.6	187.4	TCS-2
89590	89650	2.6	57.4	TCS-3
89650	89700		50	TCS-2
89700	89800	3.96	96.04	TCS-7
89800	89950	2.7	147.3	TCS-2
89950	90000	2.6	47.4	TCS-19
90000	90300	5.3	294.7	TCS-7
90300	90450	2.6	147.4	TCS-2



*[Handwritten signature]*

Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
90450	90500		50	TCS-5
90500	90570	3.96	66.04	TCS-2
90570	90660		90	TCS-7
90660	90750		90	TCS-2
90750	90800	2.6	47.4	TCS-5
90800	90850		50	TCS-2
90850	91100	2.6	247.4	TCS-3
91100	91120		20	TCS-2
91120	91180		60	TCS-7
91180	91240	2.7	57.3	TCS-2
91240	91320		80	TCS-7
91320	91410	2.7	87.3	TCS-2
91410	91470		60	TCS-7
91470	91540		70	TCS-2
91540	91625		85	TCS-19
91625	91700	2.7	72.3	TCS-7
91700	91900	2.7	197.3	TCS-2
91900	91975		75	TCS-8
91975	92375	7.92	392.08	TCS-7
92375	92425		50	TCS-8
92425	92720	2.7	292.3	TCS-7
92720	92770	2.7	47.3	TCS-2
92770	92850		80	TCS-7
92850	93440	10.5	579.5	TCS-2
93440	93580		140	TCS-7
93580	93660	2.7	77.3	TCS-2
93660	94020	5.3	354.7	TCS-7
94020	94290	5.4	264.6	TCS-2
94290	94380	2.6	87.4	TCS-7
94380	94480		100	TCS-4
94480	94800	8	312	TCS-7
94800	94930	2.7	127.3	TCS-2
94930	95060		130	TCS-7
95060	95140	3.96	76.04	TCS-3
95140	95250	6.14	103.86	TCS-2
95250	95350		100	TCS-7
95350	95830	13.2	466.8	TCS-2
95830	95960	3.96	126.04	TCS-7
95960	96750	9.16	780.84	TCS-2
96750	97000		250	TCS-5A
97000	97050		50	TCS-18
97050	97550		500	TCS-5A
97550	97650		100	TCS-18
97650	98160		510	TCS-5A
98160	98230		70	TCS-8
98230	98400		170	TCS-6A
98400	98460		60	TCS-8
98460	99070	10.1	599.9	TCS-14A
99070	99310	10.66	229.34	TCS-14
99310	99470	2.7	157.3	TCS-5A
99470	99530		60	TCS-14
99530	99680	5.3	144.7	TCS-14A
99680	99740		60	TCS-7
99740	99760		20	TCS-2A
99760	100230	8.1	461.9	TCS-7
100230	100340	5.3	104.7	TCS-2A
100340	100400		60	TCS-8
100400	100975	5.3	569.7	TCS-6A



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Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
100975	101425	5.3	444.7	TCS-2A
101425	101525		100	TCS-6A
101525	101730		205	TCS-14A
101730	101870	2.7	137.3	TCS-14
101870	101940	2.6	67.4	TCS-14A
101940	102020		80	TCS-7
102020	102070		50	TCS-9
102070	102200	2.7	127.3	TCS-7
102200	102500		300	TCS-8
102500	102675	2.7	172.3	TCS-19
102675	103075	5.4	394.6	TCS-18
103075	103250		175	TCS-7
103250	103600	2.7	347.3	TCS-19
103600	103650		50	TCS-6A
103650	103800		150	TCS-2A
103800	103860		60	TCS-2A
103860	103925		65	TCS-7
103925	104000		75	TCS-19
104000	104050		50	TCS-7
104050	104250	2.6	197.4	TCS-2
104250	104400	2.7	147.3	TCS-7
104400	104510	2.6	107.4	TCS-19
104510	104670	2.7	157.3	TCS-2A
104670	104740		70	TCS-7
104740	104820		80	TCS-2A
104820	105260	3.96	436.04	TCS-7
105260	105325		65	TCS-2A
105325	105860	8	527	TCS-5A
105860	107910	7.9	2042.1	TCS-19A
107910	107975		65	TCS-7
107975	109175	8	1192	TCS-9
109175	109275		100	TCS-8
109275	109325	2.7	47.3	TCS-7
109325	109494	66.5	102.5	TCS-9
<b>Total Length</b>		<b>497.88</b>	<b>33996</b>	



*[Handwritten signature]*

Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			

Summary of TCS Length

TCS No.	Net Length (m)	CD Length (m)	Total Length (m)
TCS-1	0	0	0
TCS-1A	320	0	320
TCS-2	9326	154.48	9480
TCS-2A	2795	49.76	2845
TCS-3	676	14.36	690
TCS-3A	322	2.6	325
TCS-4	381	9.26	390
TCS-4A	603	11.86	615
TCS-5	177	2.6	180
TCS-5A	2222	13.4	2235
TCS-6A	890	5.3	895
TCS-7	6379	75.9	6455
TCS-8	1080	0	1080
TCS-9	1763	81.16	1844
TCS-11A	70	0	70
TCS-12B	125	0	125
TCS-14	893	22.1	915
TCS-14A	1227	18	1245
TCS-17	797	8	805
TCS-18	819	10.6	830
TCS-19	1089	10.6	1100
TCS-19A	2042	7.9	2050
<b>Total=</b>	<b>33996</b>	<b>498</b>	<b>34494</b>

CD Length (m)	Total Length (m)
497.88	34494



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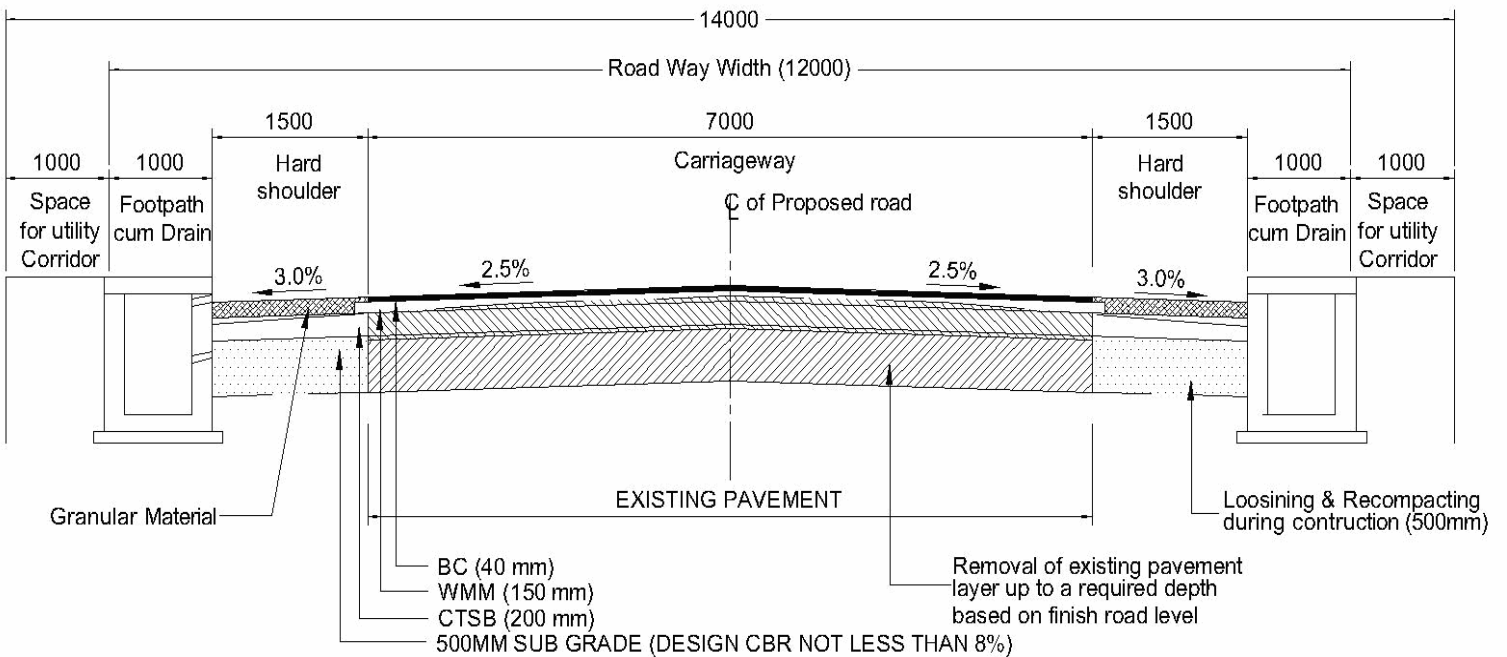
## Variable Declaration

## TCS-01A

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	320.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Paved Shoulder	ps	0.000	
17	Gap between road marking	g	6.000	m
18	CT	ctb	0.000	
19	CTSubbase	cts	0.200	
20	RAP	rap	0.000	



**Variable Declaration**



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



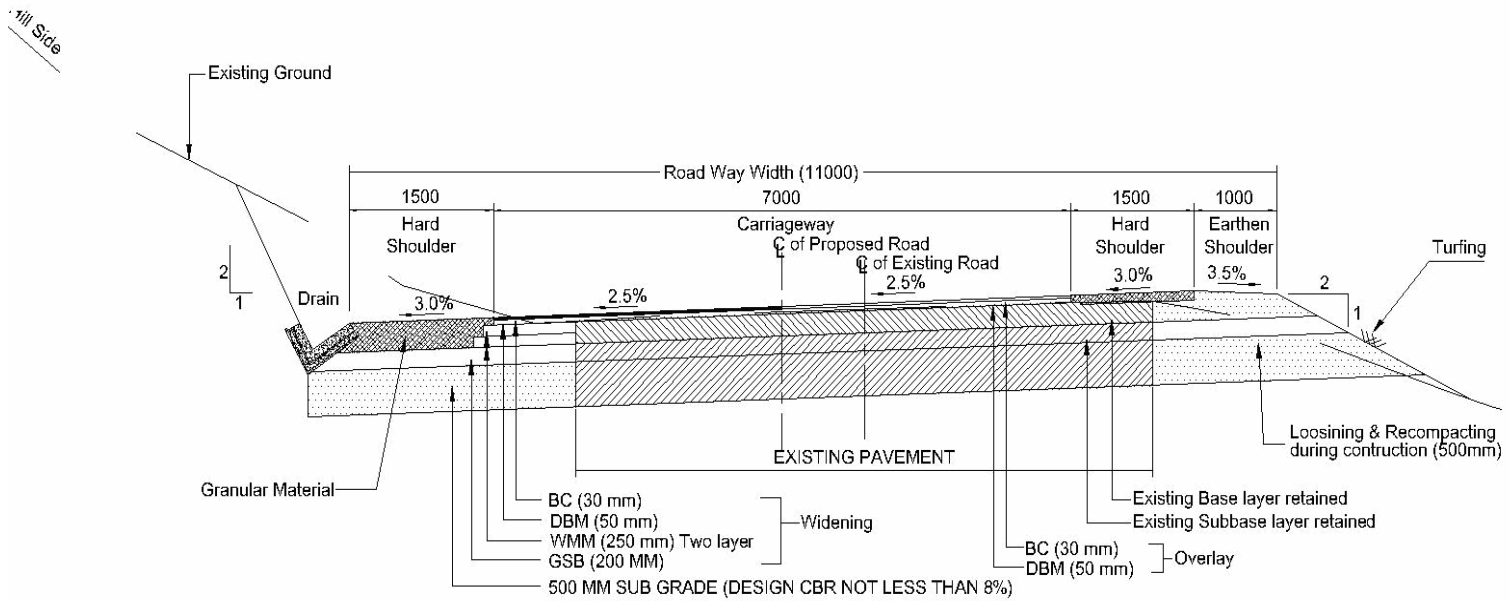
## Variable Declaration

## TCS-02

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.030	m
4	DBM Thickness	dbm	0.050	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	9326.000	m
9	Existing Pavement Width	ext_pav	6.000	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	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area Gsb Below Earthen Shoulder	ar_gsb	0.520	sqm
19	Area Earthen Shoulder	ar_es	0.453	sqm
20	RAP	rap	0.000	
21	CT Subbase	cts	0.200	
22	hard shoulder area(0.528+0.201)	hs_area	0.729	sqm



**Variable Declaration**



**TCS-2 : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY  
IN RURAL AREA WITH TRIANGULAR DRAIN HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE  
(OVERLAY OF EXISTING PAVEMENT)**



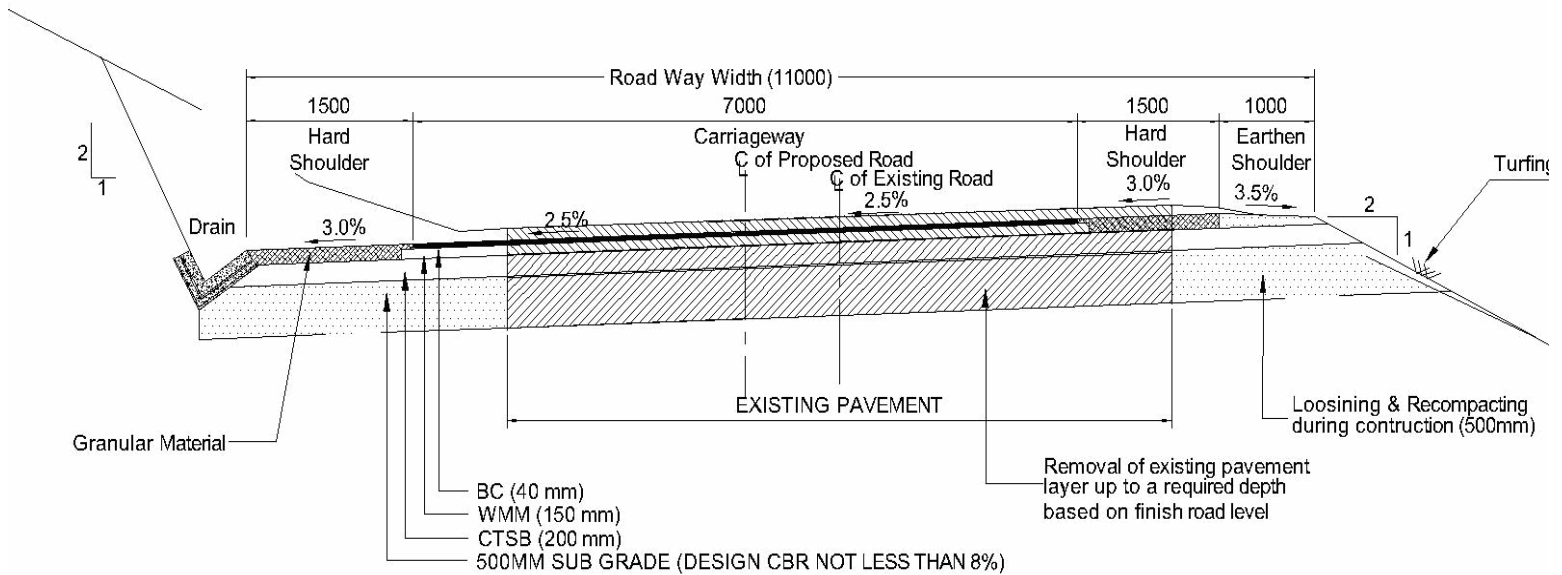
## Variable Declaration

## TCS-02A

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	2795.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area Gsb Below Earthen Shoulder	ar_gsb	0.520	sqm
19	Area Earthen Shoulder	ar_es	0.110	sqm
20	RAP	rap	0.000	
21	CT Subbase	cts	0.200	



**Variable Declaration**



**TCS-2A : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY  
IN RURAL AREA WITH TRIANGULAR DRAIN HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE  
(RECONSTRUCTION OF EXISTING PAVEMENT)**



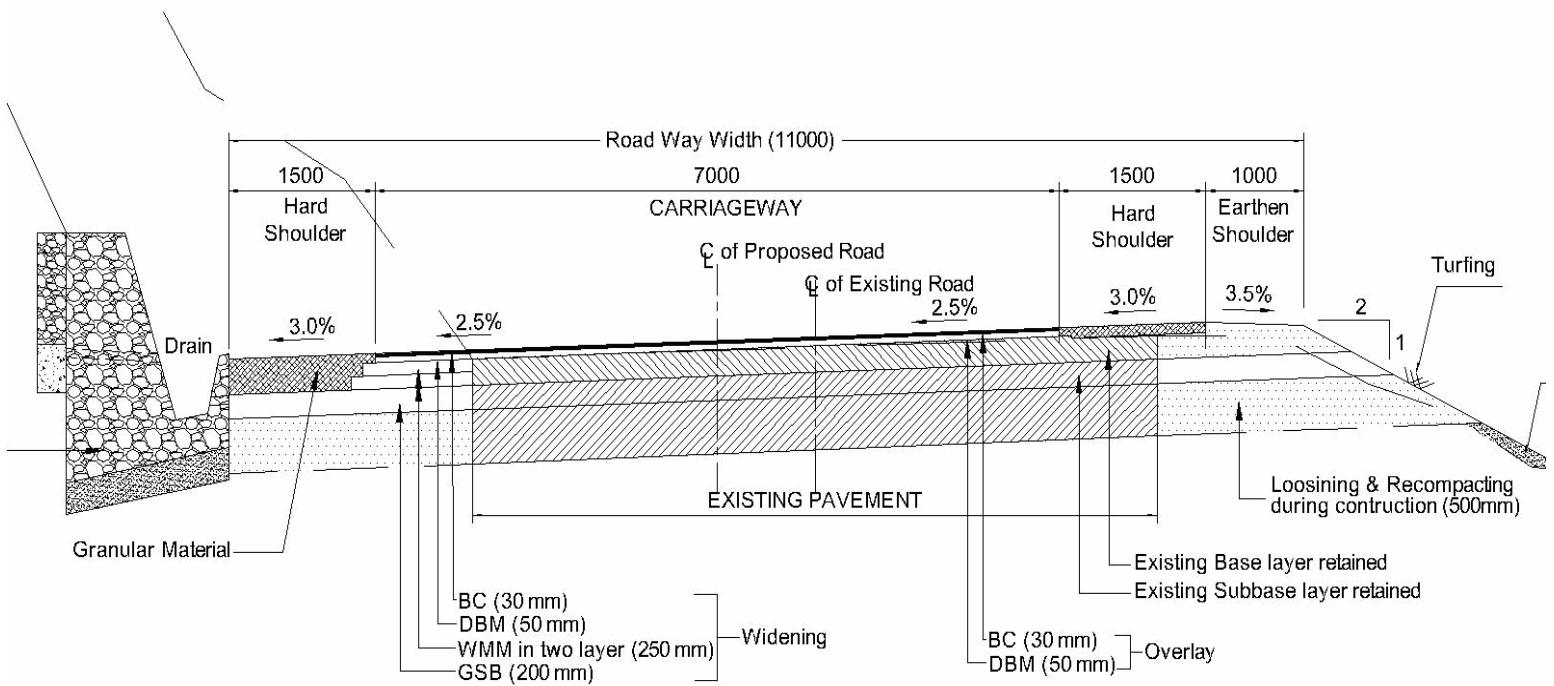
## Variable Declaration

## TCS-03

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.030	m
4	DBM Thickness	dbm	0.050	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	676.000	m
9	Existing Pavement Width	ext_pav	6.000	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	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area Gsb Below Earthen Shoulder	ar_gsb	0.520	sqm
19	Area Earthen Shoulder	ar_es	0.440	sqm
20	RAP	rap	0.000	
21	CT Subbase	cts	0.200	
22	hard shoulder area(0.528+0.201)	hs_area	0.729	



**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  
(OVERLAY OF EXISTING PAVEMENT)**



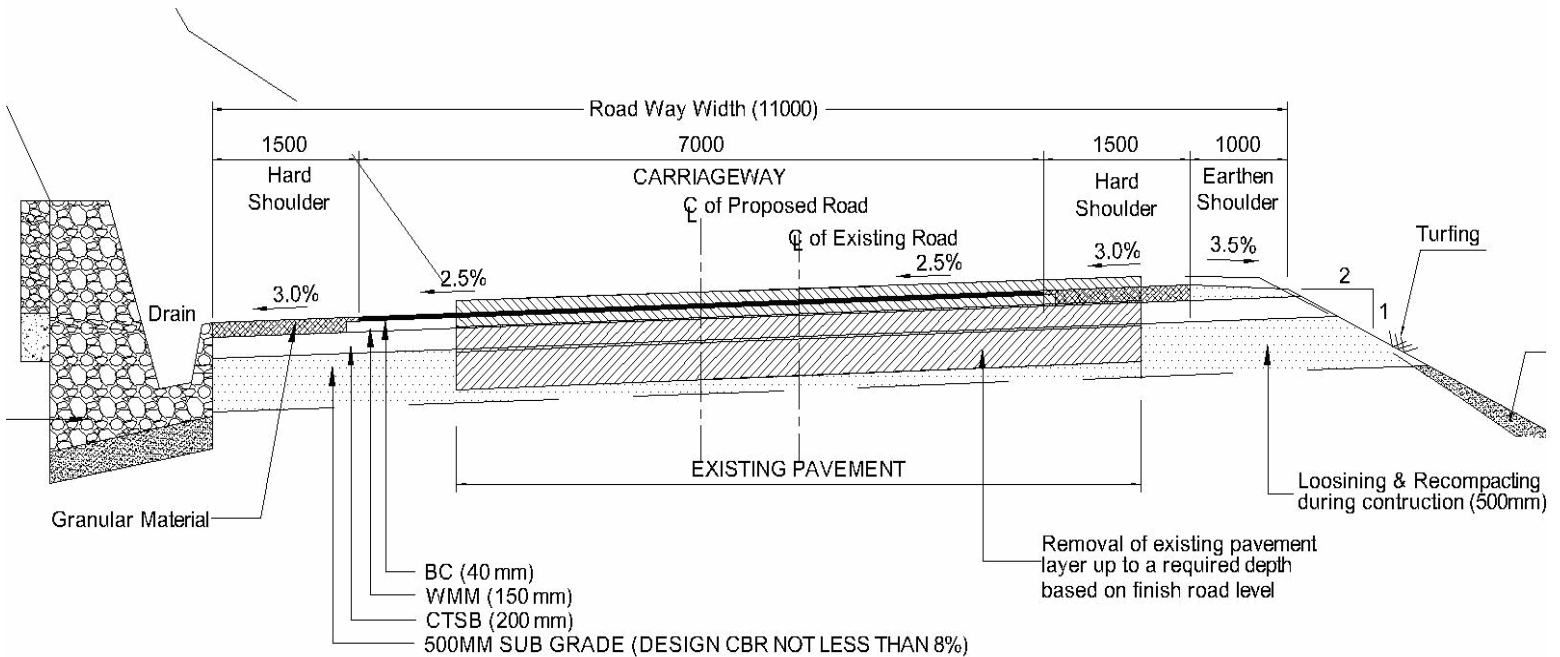
## Variable Declaration

## TCS-03A

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	322.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area Gsb Below Earthen Shoulder	ar_gsb	0.520	sqm
19	Area Earthen Shoulder	ar_es	0.440	sqm
20	RAP	rap	0.000	
21	CT Subbase	cts	0.200	



**Variable Declaration**



**TCS-3A :- 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)**



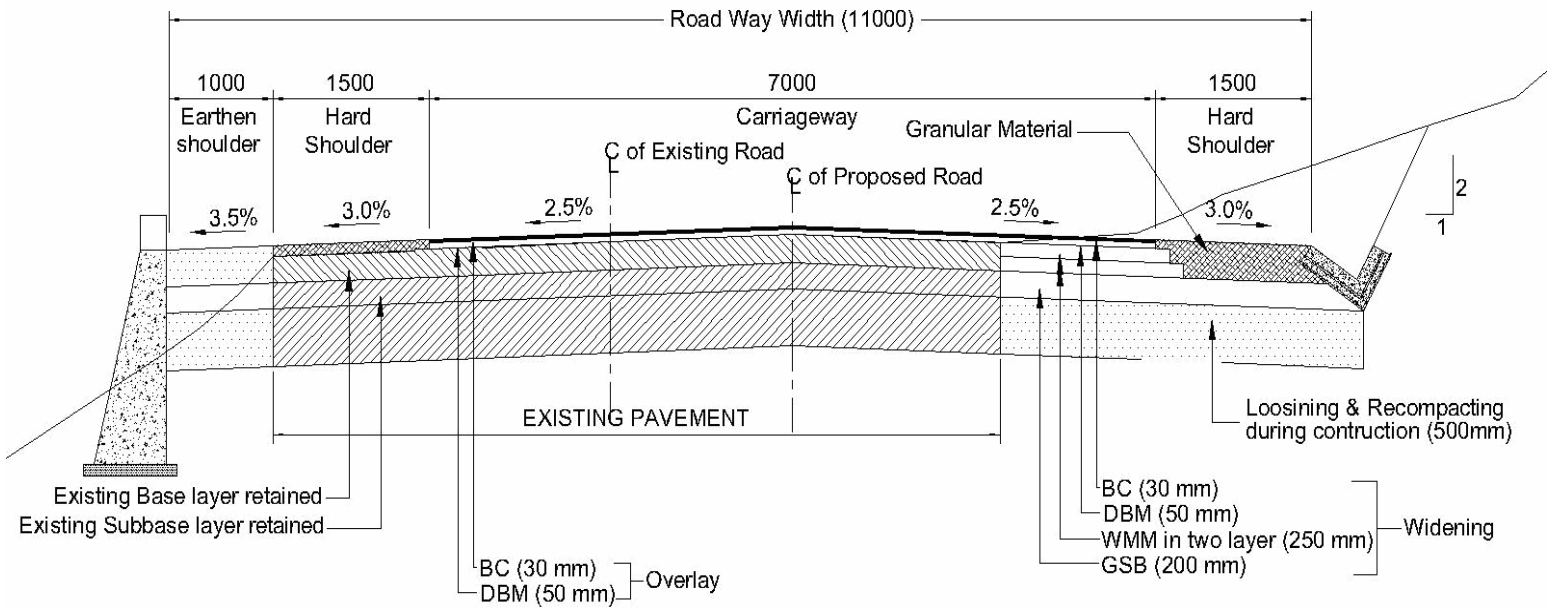
## Variable Declaration

## 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	0.030	m
4	DBM Thickness	dbm	0.050	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	381.000	m
9	Existing Pavement Width	ext_pav	6.000	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	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area Gsb Below Earthen Shoulder	ar_gsb	0.520	sqm
19	Area Earthen Shoulder	ar_es	0.440	sqm
20	RAP	rap	0.000	
21	CT Subbase	cts	0.200	
22	hard shoulder area(0.528+0.201)	hs_area	0.729	



**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 TRIANGULAR DRAIN (OVERLAY OF EXISTING PAVEMENT)**

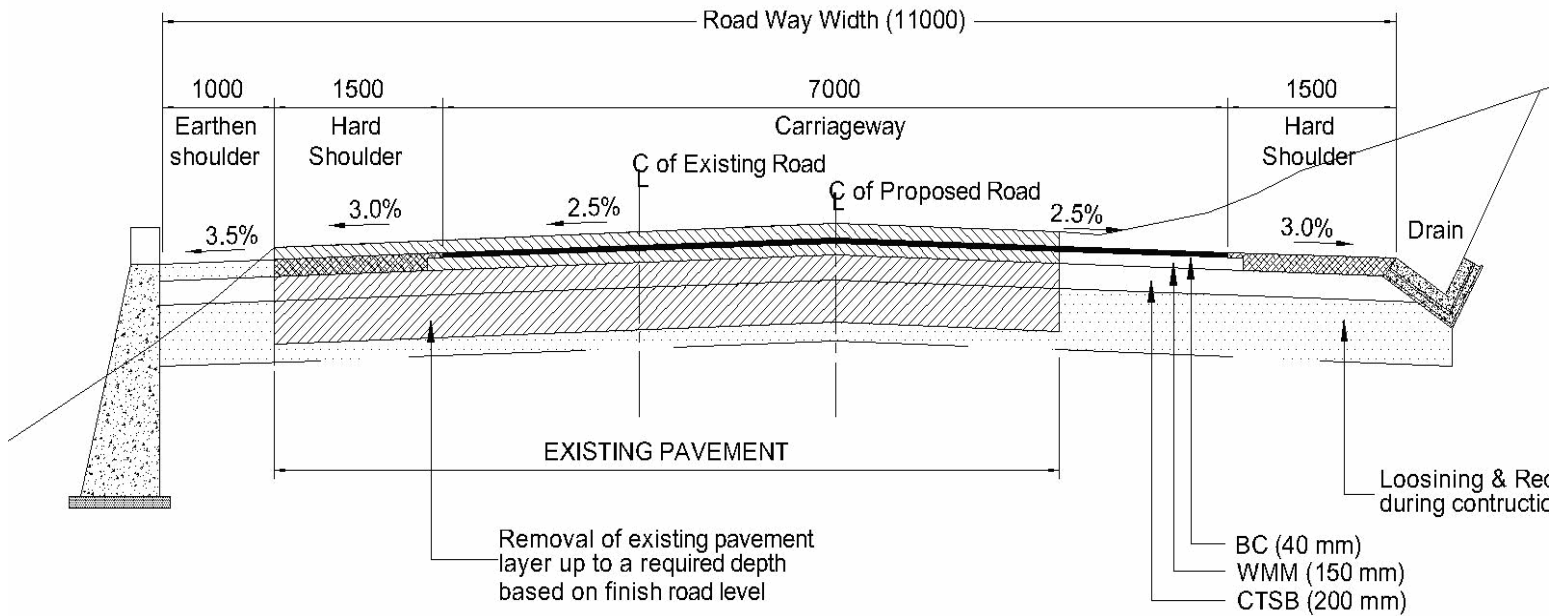
## Variable Declaration

## TCS-04A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	603.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area Gsb Below Earthen Shoulder	ar_gsb	0.520	sqm
19	Area Earthen Shoulder	ar_es	0.440	sqm
20	RAP	rap	0.000	
21	CT Subbase	cts	0.200	



**Variable Declaration**



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

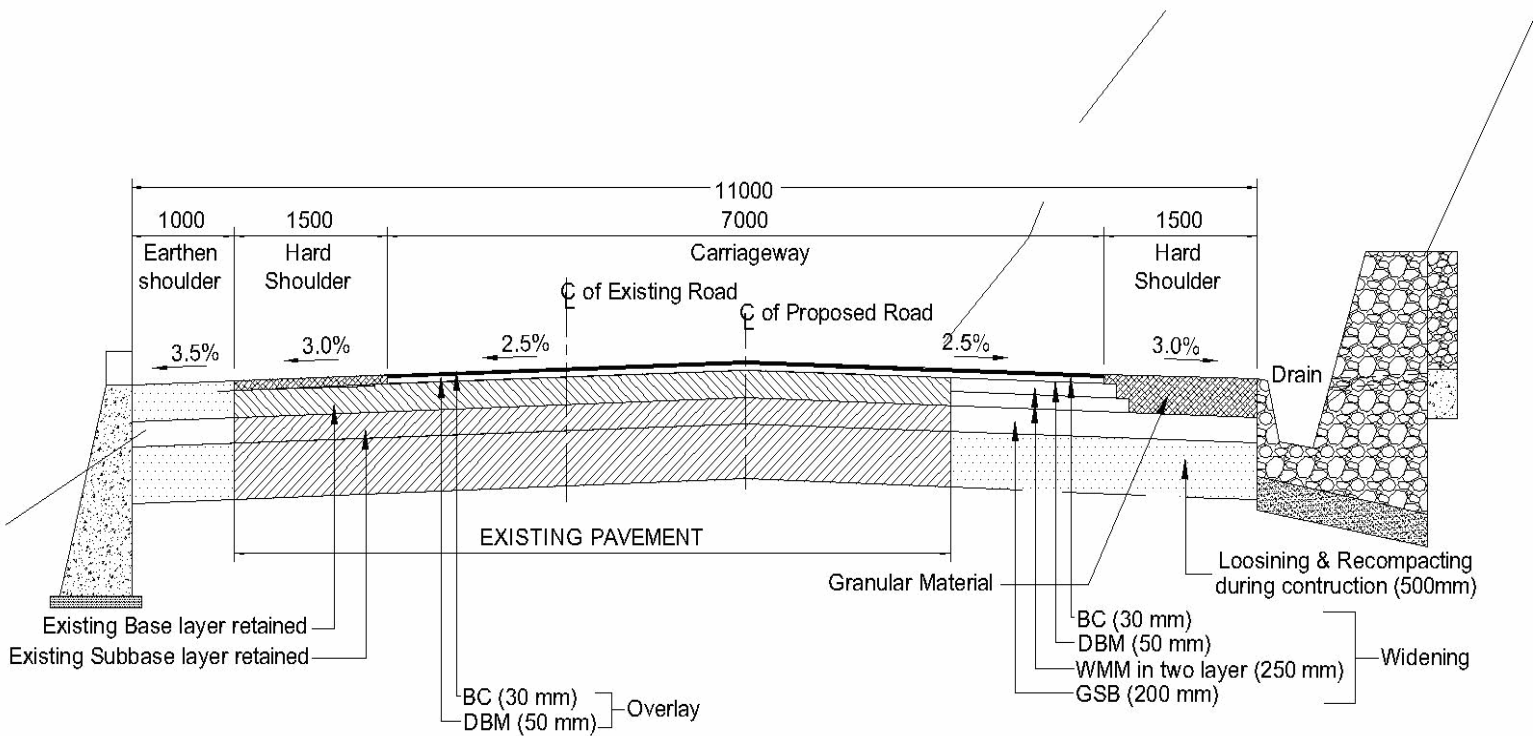
## Variable Declaration

## TCS-05

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.030	m
4	DBM Thickness	dbm	0.050	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	177.000	m
9	Existing Pavement Width	ext_pav	6.000	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	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area Gsb Below Earthen Shoulder	ar_gsb	0.520	sqm
19	Area Earthen Shoulder	ar_es	0.440	sqm
20	RAP	rap	0.000	
21	CT Subbase	cts	0.200	
22	hard shoulder area(0.528+0.201)	hs_area	0.729	



**Variable Declaration**



**TCS-5 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY  
IN RURAL AREA WITH ONE SIDE RETAINING WALL AND OTHER SIDE BREAST WALL  
(OVERLAY OF EXISTING PAVEMENT)**



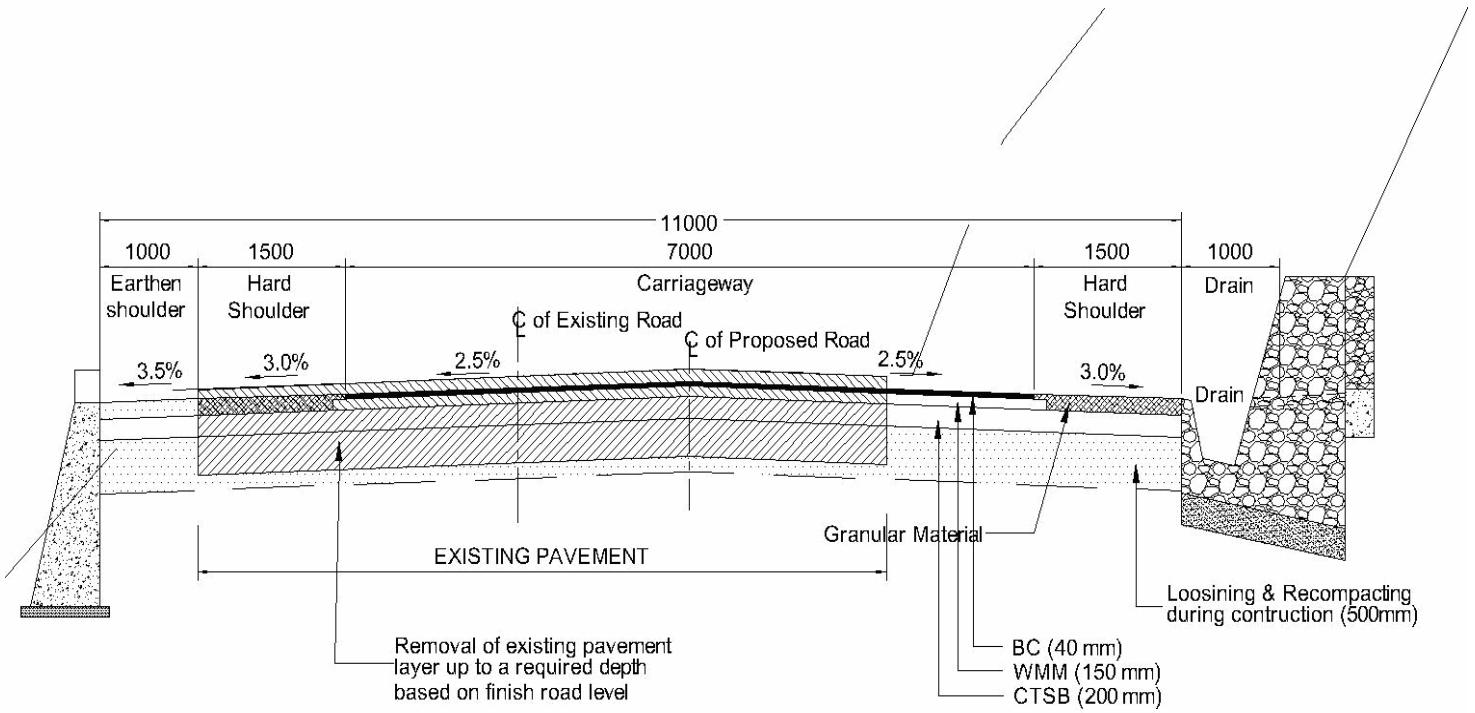
## Variable Declaration

## TCS-05A

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	2222.000	m
9	Existing Pavement Width	ext_pav	6.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area Gsb Below Earthen Shoulder	ar_gsb	0.520	sqm
19	Area Earthen Shoulder	ar_es	0.440	sqm
20	RAP	rap	0.000	
21	CT Subbase	cts	0.200	



**Variable Declaration**



**TCS-5A :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY  
IN RURAL AREA WITH ONE SIDE RETAINING WALL AND OTHER SIDE BREAST WALL  
(RECONSTRUCTION OF EXISTING PAVEMENT)**



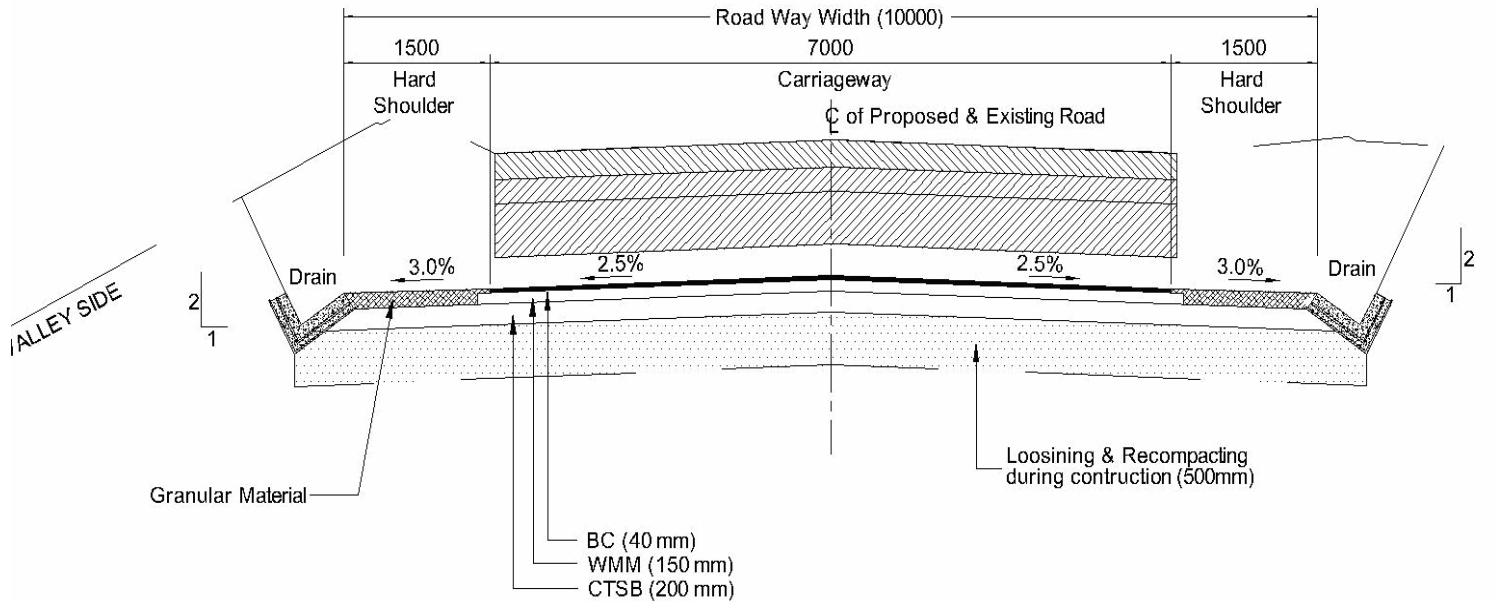
## Variable Declaration

## TCS-06A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	890.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	RAP	rap	0.000	
18	CT Subbase	cts	0.200	
19	hard shoulder area(0.528+0.201)	hs_area	0.729	



Variable Declaration



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

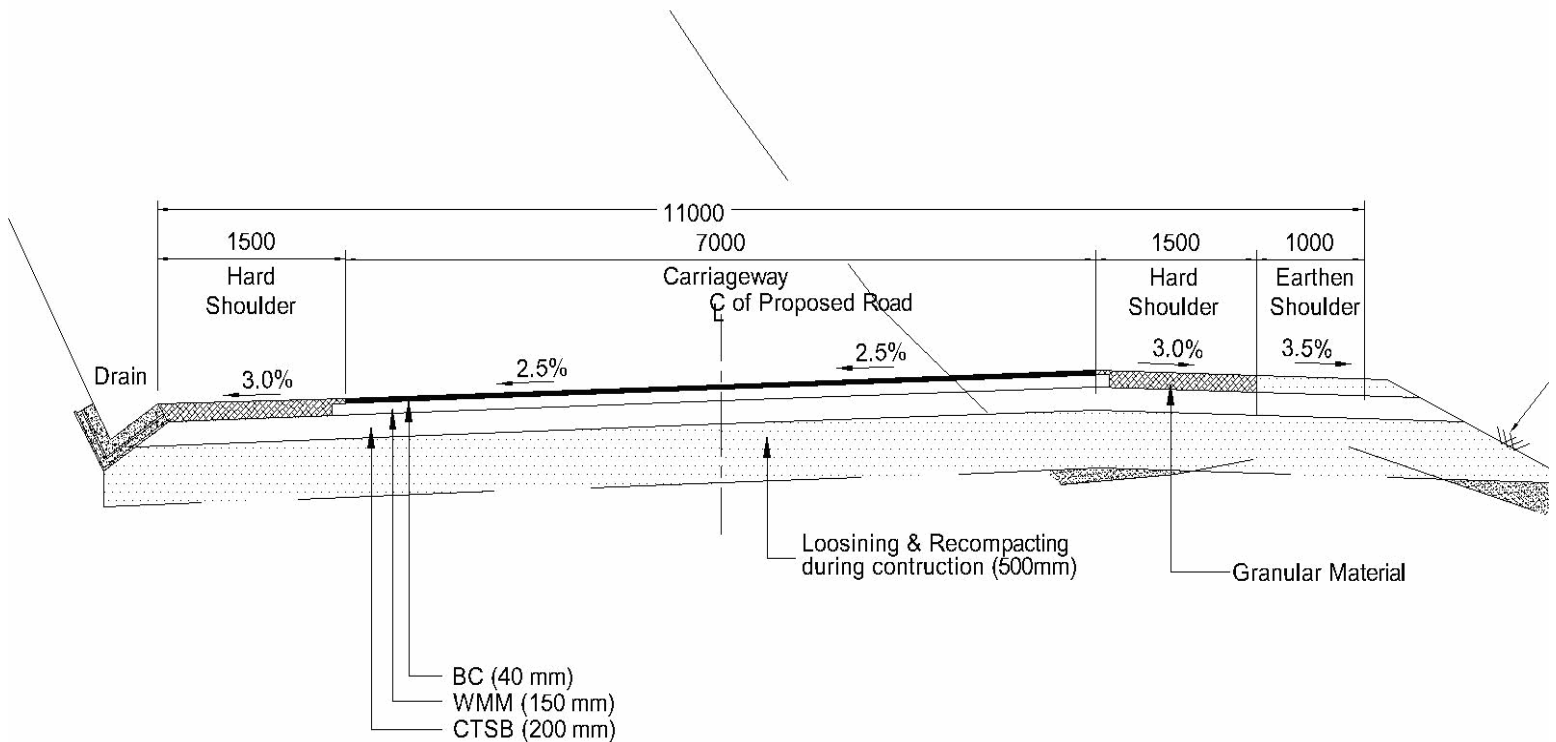
## Variable Declaration

## TCS-07

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	6379.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area of earthen Shoulder	ar_es	0.264	sqm
19	RAP	rap	0.000	
20	CT Subbase	cts	0.200	



Variable Declaration



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



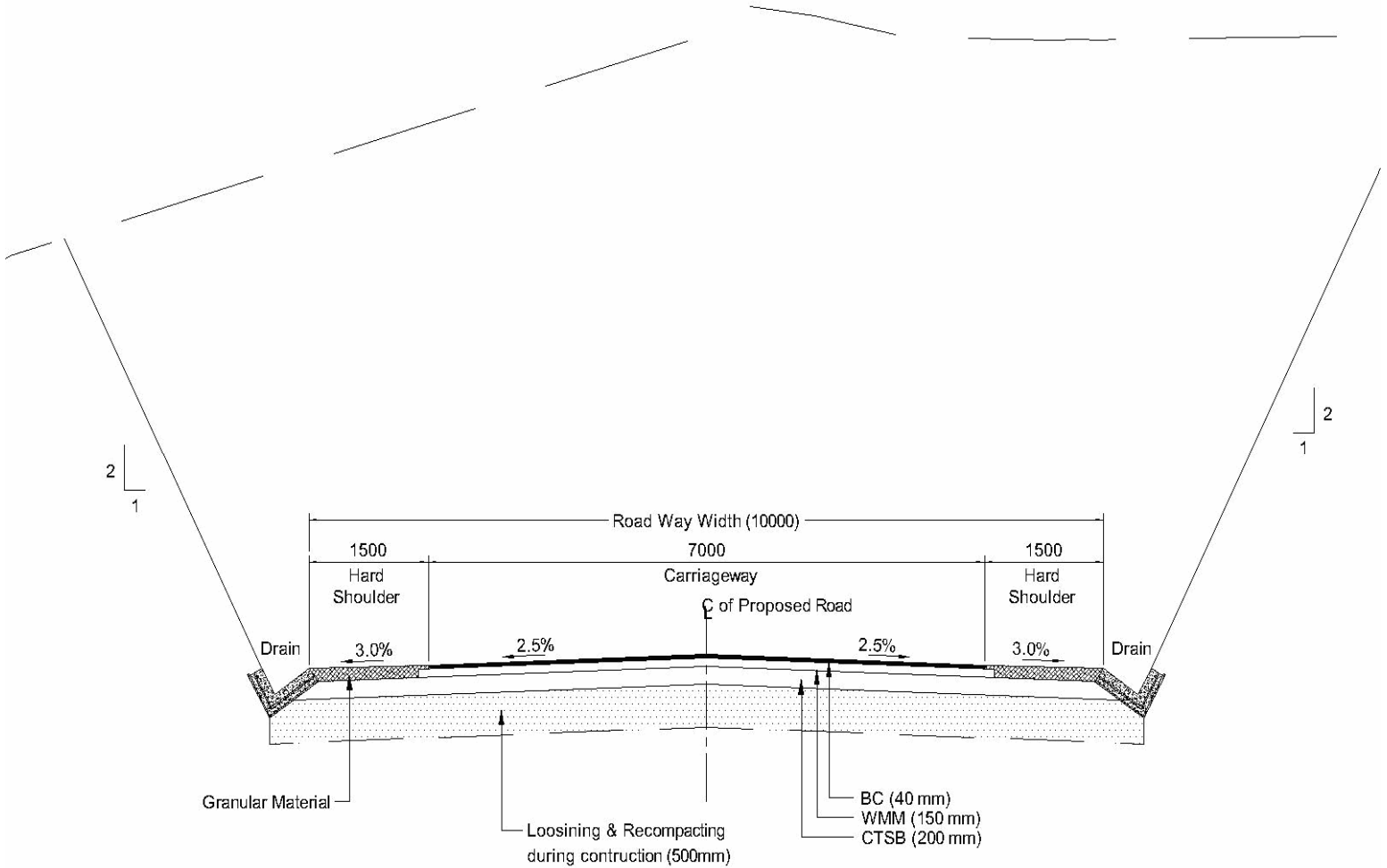
## Variable Declaration

## 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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	1080.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	RAP	rap	0.000	
18	CT Subbase	cts	0.200	



**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 TRIANGULAR DRAIN (NEW CONSTRUCTION)**

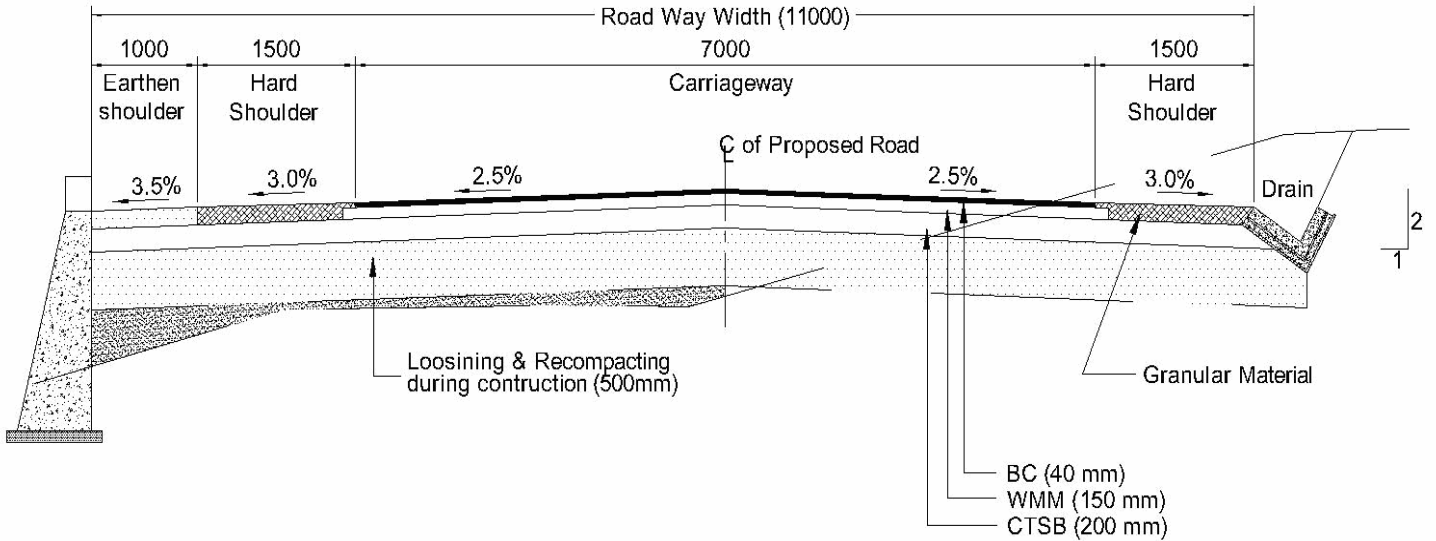
## Variable Declaration

## 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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	1763.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area of earthen Shoulder	ar_es	0.400	sqm
19	RAP	rap	0.000	
20	CT Subbase	cts	0.200	



**Variable Declaration**



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

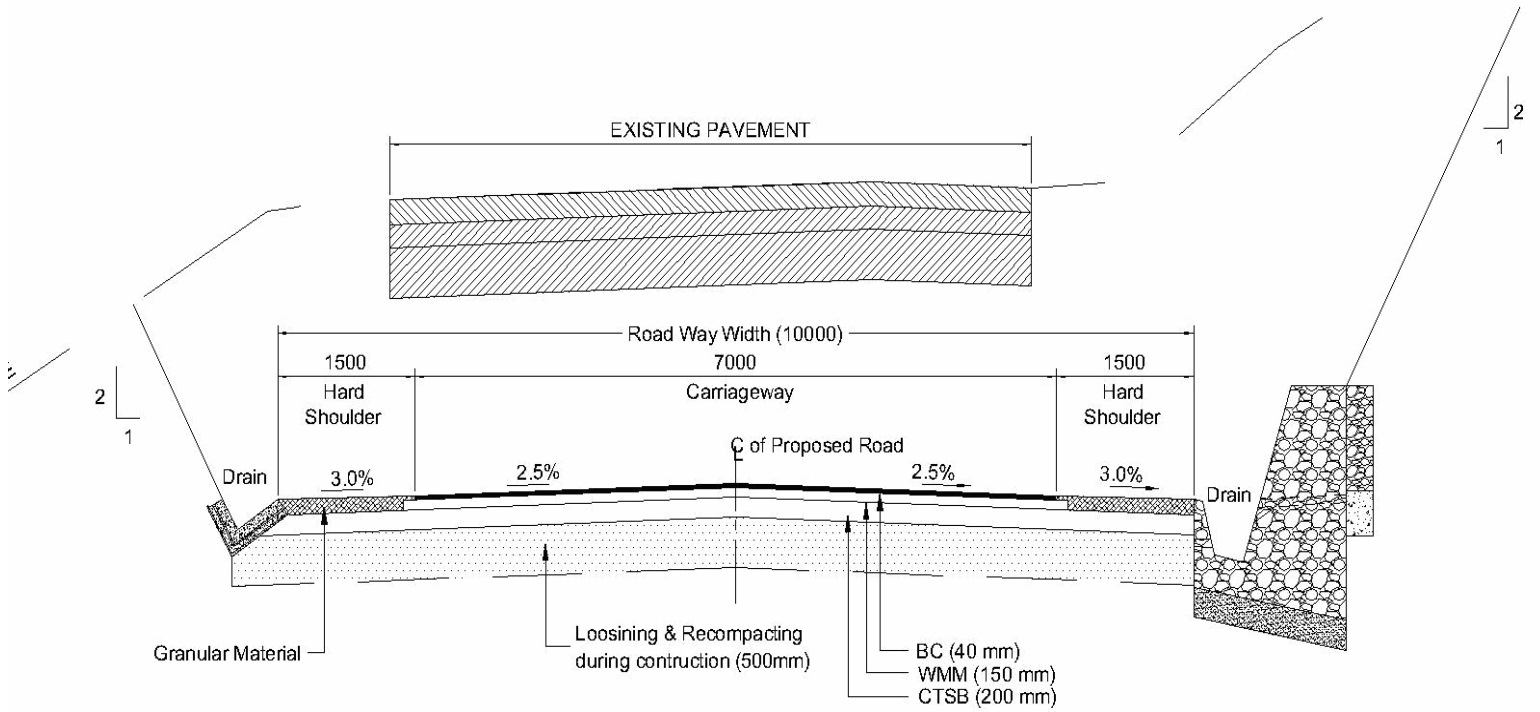
## Variable Declaration

## TCS-11A

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	70.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	RAP	rap	0.000	
18	CT Subbase	cts	0.200	



Variable Declaration



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

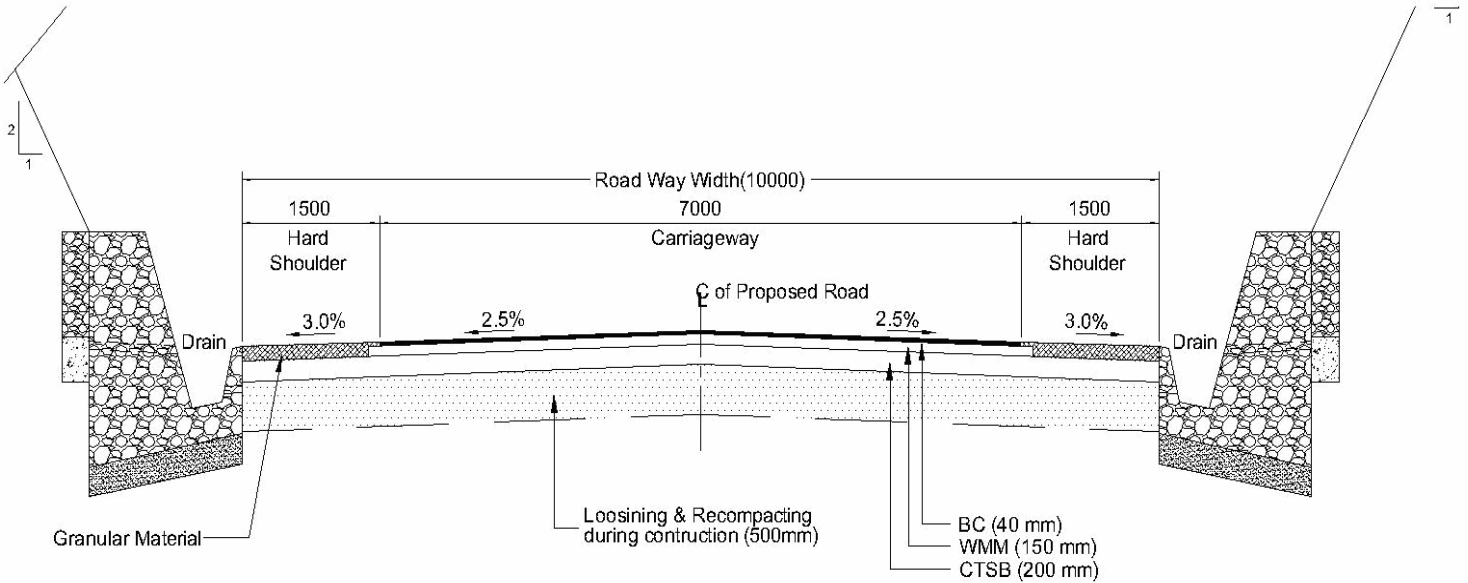
## Variable Declaration

## TCS-12B

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	125.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	RAP	rap	0.000	
18	CT Subbase	cts	0.200	



Variable Declaration



**TCS-12B :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY  
IN RURAL AREA WITH BOTH SIDE BREAST WALL  
(NEW CONSTRUCTION)**

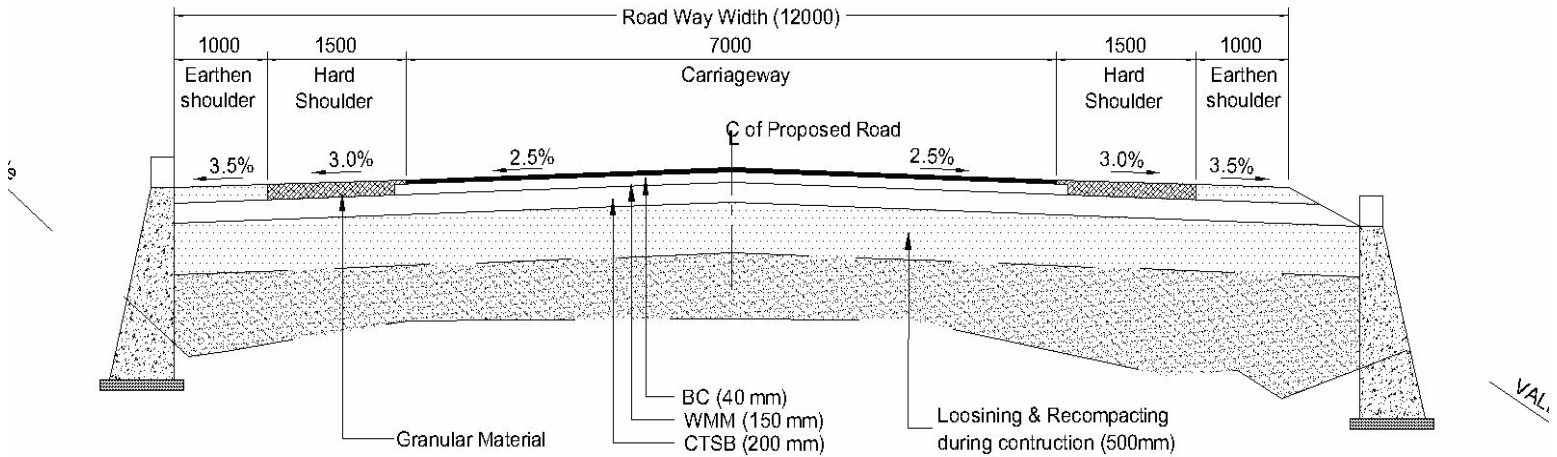
## Variable Declaration

## TCS-14

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	893.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area of earthen Shoulder	ar_es	0.400	sqm
19	RAP	rap	0.000	
20	CT Subbase	cts	0.200	



**Variable Declaration**



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



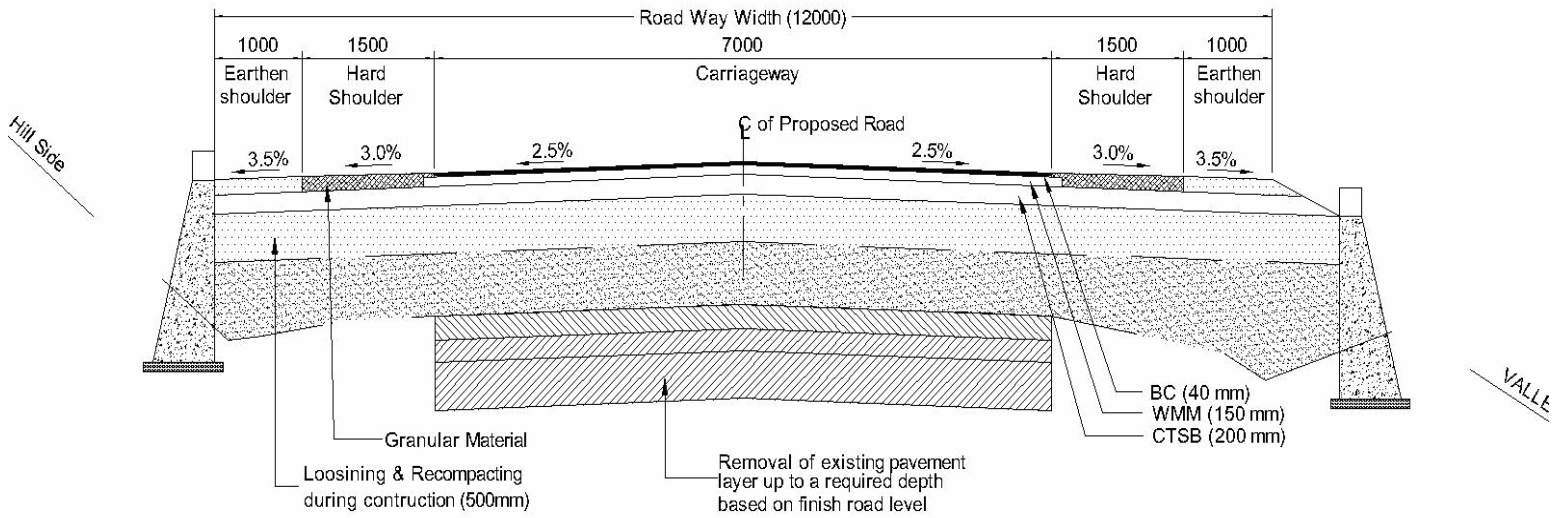
## Variable Declaration

## TCS-14A

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	1227.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area of earthen Shoulder	ar_es	0.400	sqm
19	RAP	rap	0.000	
20	CT Subbase	cts	0.200	



**Variable Declaration**



**TCS-14A :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY IN RURAL AREA  
WITH BOTH SIDE RETAINING WALL  
(RECONSTRUCTION OF EXISTING PAVEMENT)**



*[Handwritten signature]*

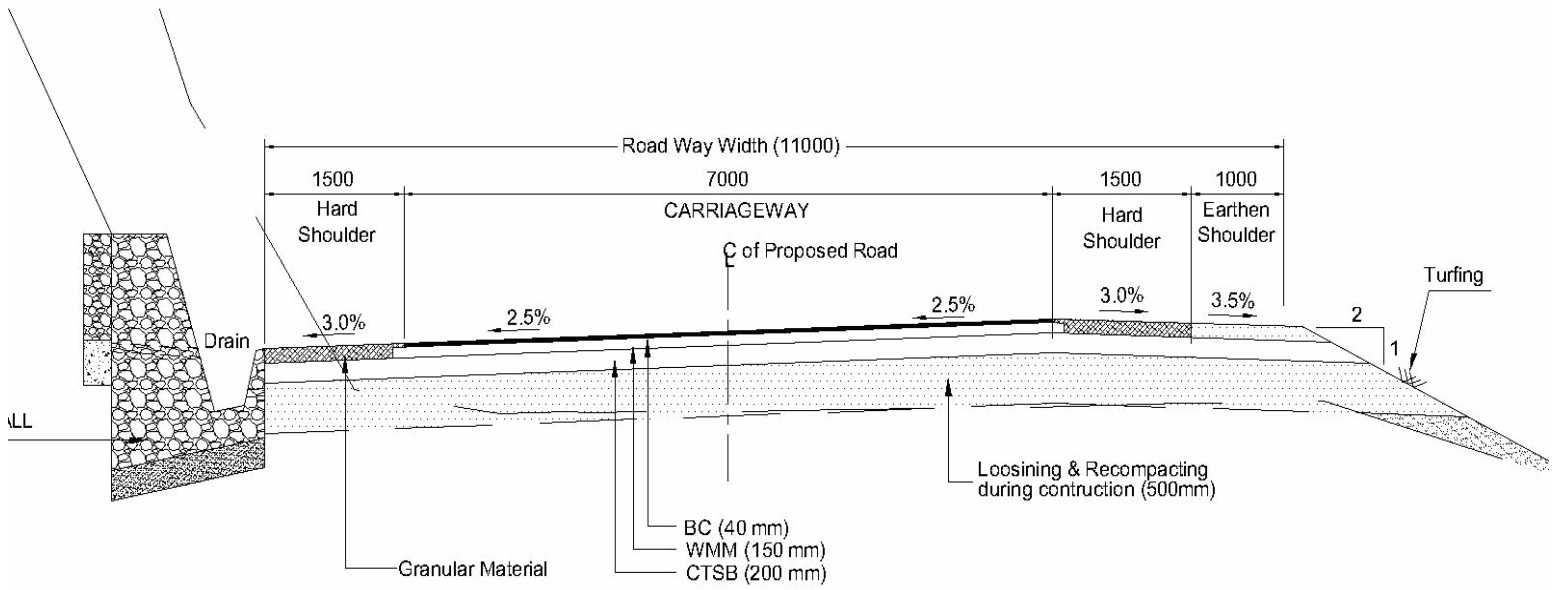
## Variable Declaration

## TCS-17

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	797.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area of earthen Shoulder	ar_es	0.264	sqm
19	RAP	rap	0.000	
20	CT Subbase	cts	0.200	



**Variable Declaration**



**TCS-17 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY  
IN RURAL AREA WITH BREAST WALL ON HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE  
(NEW CONSTRUCTION)**



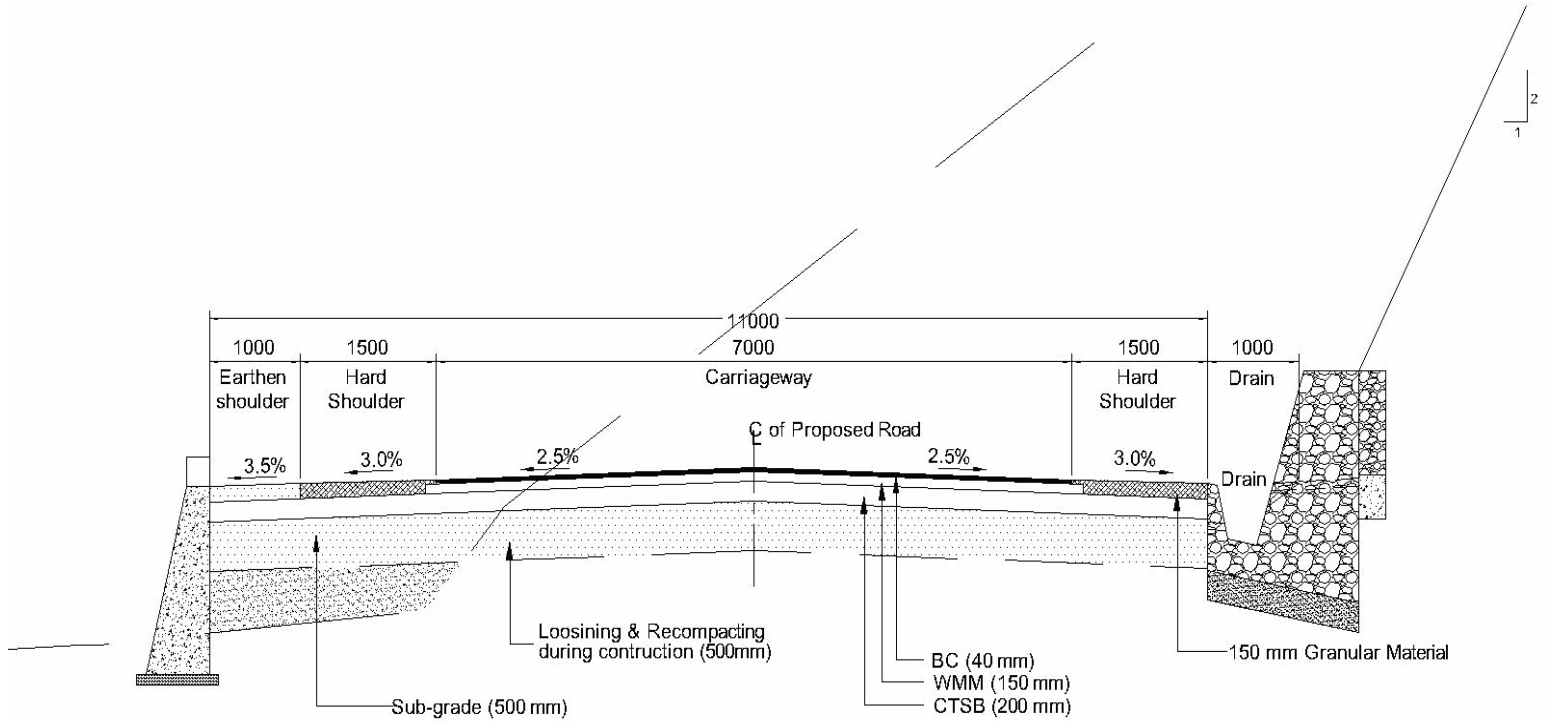
## Variable Declaration

## TCS-18

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	819.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area of earthen Shoulder	ar_es	0.400	sqm
19	RAP	rap	0.000	
20	CT Subbase	cts	0.200	



**Variable Declaration**



**TCS-18 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY  
IN RURAL AREA WITH ONE SIDE RETAINING WALL AND OTHER SIDE BREAST WALL  
(NEW CONSTRUCTION)**

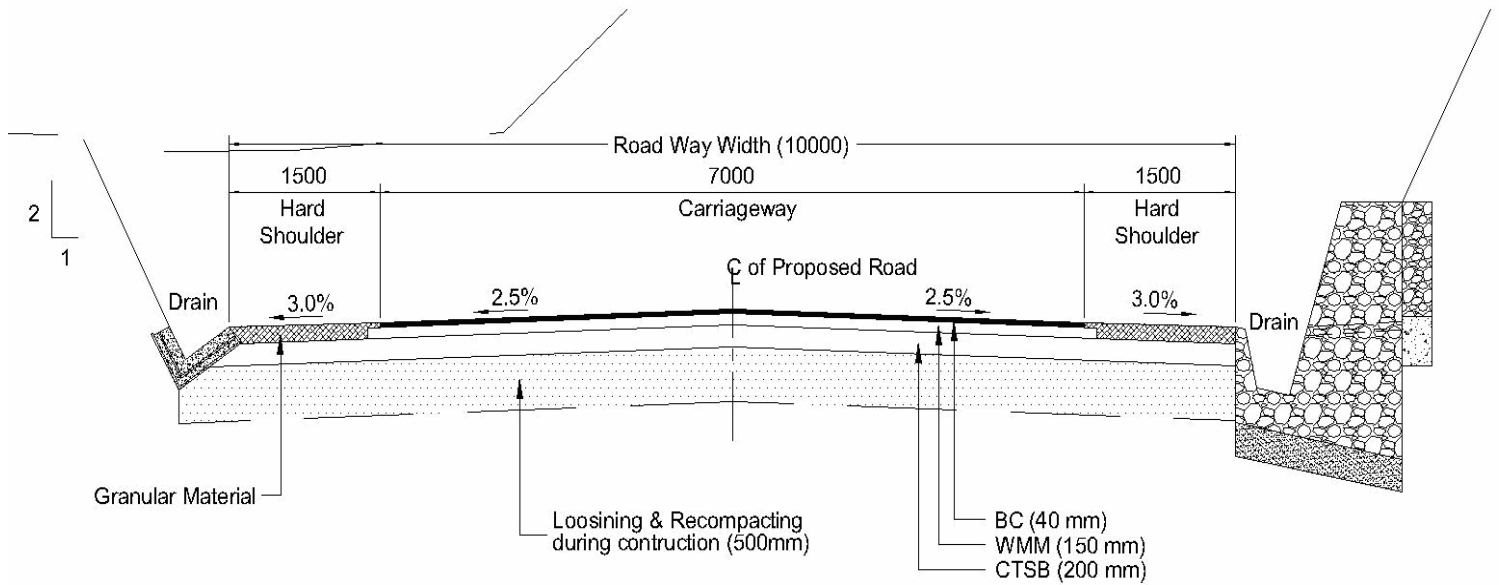
## Variable Declaration

## TCS-19

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	1089.000	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	RAP	rap	0.000	
18	CT Subbase	cts	0.200	



**Variable Declaration**



TCS-19 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY  
IN RURAL AREA WITH ONE SIDE BREAST WALL AND OTHER SIDE TRIANGULAR DRAIN  
(NEW CONSTRUCTION )



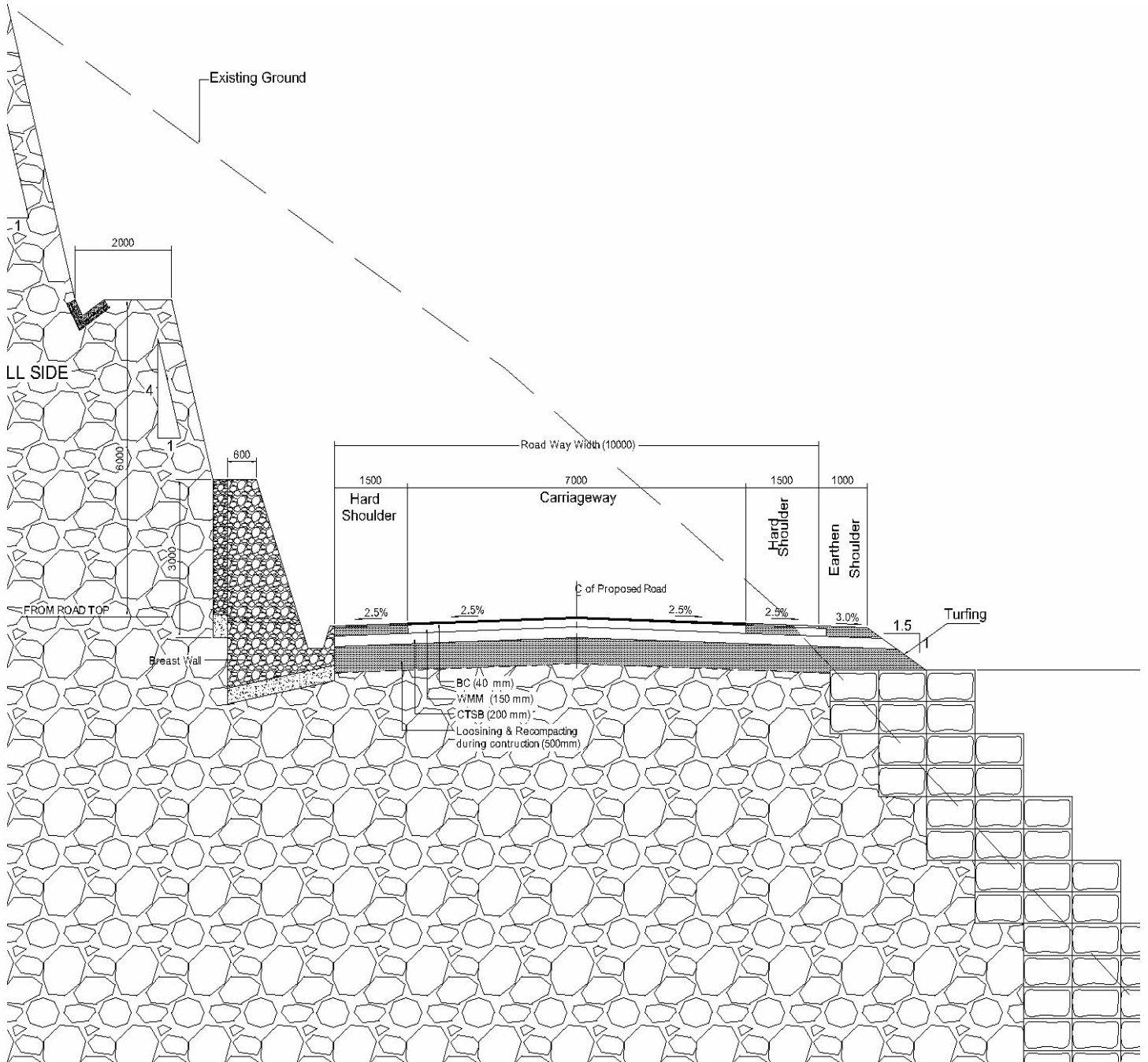
## Variable Declaration

## TCS-19A

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	0.000	m
5	WMM Layer-I Thickness	wmm1	0.150	m
6	GSB Thickness	gsb	0.000	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	2042.100	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	0.000	m
15	GSB Reuse	gsb_per	67.500	
16	Gap between road marking	g	6.000	m
17	Earthen shoulder	es	1.000	m
18	Area of earthen Shoulder	ar_es	0.264	sqm
19	RAP	rap	0.000	
20	CT Subbase	cts	0.200	



**Variable Declaration**



## Site Clearance and Dismantling

### A.Tree Cutting

SI No	Girth Details	No.	Unit
1	Girth from 300 mm to 600 mm	13	Each
2	Girth from 600 mm to 900 mm	25	Each
3	Girth from 900 mm to 1800 mm	86	Each
4	Girth from 1800 mm to 2700 mm	15	Each
5	Above 2700 mm	5	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- 5

### B.Clearing and grubbing

Clearing and Grubbing Area                      19 Ha

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

### C. Dismantling

#### SI No    A.Rubble stone masonry in cement mortar

1	Culvert =	2402	Cum
	Total=	2402	cum

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

#### SI No    B.Total Dismantling of Reinforced cement concrete

1	Culvert =	128	Cum
	Total=	128	cum

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

#### SI No    C.Total Dismantling Hume Pipe Culvert

1	up to 600 mm dia=	20	m
2	600-900 mm dia=	1500	m
3	above 900 mm dia=	550	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 =	34328	sqm
	Total=	34328	sqm

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

#### SI No    E.Total Dismantling of Granular Layer

1	Road =	186660	sqm
	Total=	186660	sqm

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



*[Handwritten Signature]*

## Site Clearance and Dismantling (Tree Cutting List)

SI No	CHAINAGE(KM)	EASTING(M)	NORTHING(M)	GIRTH (M)	SIDE
1	75+226	587848.702	2822159.246	0.5	RHS
2	75+284	587876.812	2822222.958	0.9	RHS
3	75+290	587876.776	2822229.073	0.7	RHS
4	75+352	587876.888	2822291.662	1	RHS
5	75+420	587901.549	2822345.006	1	RHS
6	75+696	587987.304	2822583.751	0.7	LHS
7	75+976	587993.446	2822781.791	0.5	RHS
8	77+210	587641.575	2823676.165	1.7	LHS
9	77+988	587123.79	2824192.712	2	RHS
10	78+536	586815.801	2824566.973	2	RHS
11	79+122	586280.421	2824559.632	0.4	RHS
12	80+290	585751.549	2823907.875	1.4	LHS
13	80+344	585689.764	2823932.904	0.8	RHS
14	82+054	585144.953	2822907.598	1.5	RHS
15	83+094	584789.684	2822249.643	0.8	RHS
16	83+170	584729.156	2822233.074	1	LHS
17	83+366	584677.365	2822062.712	3.5	LHS
18	83+934	584520.949	2821628.023	0.5	LHS
19	84+120	584496.899	2821440.348	0.4	LHS
20	84+124	584494.568	2821438.183	0.5	LHS
21	84+134	584486.103	2821430.912	0.4	LHS
22	84+144	584476.379	2821423.035	0.6	LHS
23	84+770	584335.454	2821088.758	1	LHS
24	85+350	584076.92	2820574.544	0.9	RHS
25	85+360	584076.729	2820563.907	0.4	RHS
26	85+916	584137.296	2820125.732	0.7	RHS
27	86+352	583790.577	2820007.183	0.4	RHS
28	86+478	583693.162	2819924.887	1	LHS
29	86+552	583622.337	2819898.229	0.4	RHS
30	86+564	583612.105	2819890.211	0.6	RHS
31	86+578	583601.878	2819880.415	2.5	RHS
32	87+516	583062.526	2819139.379	0.7	LHS
33	87+808	583063.089	2819412.22	1.2	RHS
34	88+182	583104.978	2819751.122	1.6	LHS
35	88+220	583146.607	2819766.558	4.4	RHS
36	89+534	583160.018	2820888.993	1.2	RHS
37	90+264	583523.304	2821440.194	1.3	RHS
38	90+316	583503.783	2821499.014	1.1	RHS
39	90+376	583495.523	2821535.437	1.5	RHS
40	90+540	583493.998	2821683.542	1.1	RHS
41	91+368	583708.845	2822401.432	1	RHS
42	91+370	583708.99	2822401.845	0.8	RHS
43	91+390	583707.93	2822421.114	0.5	RHS
44	91+748	583615.019	2822745.006	1.3	LHS
45	92+068	583476.064	2822993.101	1.6	RHS
46	92+320	583253.232	2823103.14	1.6	RHS
47	92+320	583259.173	2823093.532	1.2	RHS
48	92+632	582969.011	2823050.306	1.2	LHS
49	92+868	582750.29	2823017.757	1.9	RHS
50	93+306	582404.908	2823048.482	0.7	RHS
51	93+734	582216.845	2823254.659	1.8	RHS
52	93+752	582196.598	2823265.43	2.1	RHS



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53	93+918	582059.438	2823185.954	0.5	RHS
54	94+402	581656.95	2823190.939	0.9	RHS
55	95+186	580986.16	2823024.294	1.5	RHS
56	95+216	580962.661	2823003.054	1.3	RHS
57	95+226	580962.363	2822991.04	1.5	RHS
58	95+326	580904.608	2822908.01	1.6	RHS
59	95+366	580884.838	2822893.135	1.4	RHS
60	95+488	580758.483	2822864.356	1.1	RHS
61	96+384	580374.518	2822284.02	0.7	RHS
62	96+432	580354.884	2822238.955	0.6	RHS
63	96+448	580349.363	2822221.267	0.6	RHS
64	96+822	580184.407	2822070.39	1.3	RHS
65	97+018	580178.922	2822250.558	1.5	RHS
66	97+508	580014.799	2822685.787	1.2	LHS
67	97+664	580034.662	2822838.745	1	RHS
68	97+670	580029.784	2822844.784	1.5	RHS
69	97+780	579960.626	2822934.347	1	RHS
70	97+794	579947.42	2822935.152	2	RHS
71	97+830	579924.501	2822962.751	1	RHS
72	97+836	579918.89	2822967.029	3.5	RHS
73	98+054	579732.864	2822928.803	1.5	RHS
74	98+268	579563.325	2822780.923	1.3	LHS
75	98+388	579462.199	2822714.158	1.9	RHS
76	98+540	579355.632	2822653.902	1.6	RHS
77	98+682	579264.635	2822545.639	0.8	LHS
78	98+740	579223.114	2822501.608	1.2	RHS
79	98+834	579154.533	2822478.67	1.2	RHS
80	98+840	579146.763	2822480.777	1.5	RHS
81	98+850	579143.151	2822484.485	1.5	RHS
82	98+920	579078.93	2822513.111	1.2	RHS
83	98+940	579054.406	2822508.228	1	RHS
84	98+946	579048.409	2822507.702	1.2	RHS
85	99+004	578992.469	2822480.909	1.5	RHS
86	99+016	578981.178	2822476.247	1.2	RHS
87	99+042	578959.426	2822462.71	1	RHS
88	99+066	578935.14	2822455.561	1.4	RHS
89	99+848	578374.084	2821965.212	1.6	RHS
90	101+548	577274.069	2821322.231	0.5	LHS
91	101+562	577289.273	2821317.736	1.2	LHS
92	101+576	577304.094	2821311.518	1.9	LHS
93	101+578	577305.73	2821310.521	1.2	LHS
94	101+588	577315.819	2821308.882	0.9	LHS
95	101+600	577326.907	2821312.89	1	LHS
96	101+616	577339.898	2821320.639	2.1	LHS
97	101+620	577345.012	2821315.477	0.9	LHS
98	101+636	577355.897	2821323.319	0.6	LHS
99	101+636	577358.872	2821316.734	0.6	LHS
100	101+650	577372.307	2821315.383	0.9	LHS
101	101+656	577377.849	2821318.589	1.1	LHS
102	101+678	577394.985	2821334.05	1.4	LHS
103	101+680	577399.328	2821329.187	1.1	LHS
104	101+680	577398.153	2821330.72	0.9	LHS
105	101+682	577401.208	2821329.738	0.7	LHS
106	101+684	577403.288	2821332.628	0.9	LHS
107	101+696	577417.376	2821333.776	0.9	LHS
108	101+696	577420.715	2821312.46	1.2	RHS



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109	101+738	577462.159	2821318.908	0.7	LHS
110	101+798	577515.262	2821319.445	1	LHS
111	101+804	577518.769	2821319.356	1	LHS
112	101+824	577544.43	2821314.593	1.8	RHS
113	101+880	577580.623	2821354.855	0.7	RHS
114	101+882	577582.651	2821355.095	1	RHS
115	101+894	577586.633	2821377.817	1.2	LHS
116	102+040	577644.506	2821329.102	0.8	RHS
117	102+056	577631.111	2821323.921	0.9	RHS
118	102+062	577624.924	2821322.709	1	RHS
119	102+078	577609.786	2821319.291	1.8	RHS
120	102+104	577582.173	2821291.942	0.9	RHS
121	102+104	577582.534	2821291.751	0.9	RHS
122	102+104	577585.156	2821292.975	0.7	RHS
123	102+192	577635.104	2821213.486	1	LHS
124	102+212	577637.402	2821195.506	0.8	LHS
125	102+234	577627.812	2821168.917	1.1	RHS
126	102+234	577628.392	2821168.964	1.2	RHS
127	102+236	577626.875	2821165.389	0.8	RHS
128	102+280	577627.742	2821136.692	1.1	RHS
129	102+384	577564.962	2821062.866	1.2	RHS
130	102+544	577415.087	2821054.48	2.2	RHS
131	102+724	577277.179	2820923.991	1.8	RHS
132	102+808	577234.273	2820867.842	1.2	RHS
133	102+822	577240.216	2820845.082	0.9	LHS
134	102+830	577237.857	2820840.936	1.2	LHS
135	102+852	577236.14	2820820.097	3.3	LHS
136	103+228	576986.883	2820559.502	1.8	RHS
137	103+272	576968.999	2820517.957	3.5	LHS
138	103+296	576934.465	2820518.545	1.1	RHS
139	103+338	576912.542	2820477.435	1	RHS
140	103+340	576915.581	2820474.377	0.9	RHS
141	103+914	576960.352	2820451.513	0.6	LHS
142	104+794	576559.386	2820154.659	0.7	RHS
143	104+854	576529.742	2820206.814	0.9	RHS
144	104+890	576512.773	2820240.564	1.7	RHS

**Summary Girth**

Girth from 300 mm to 600 mm	13	Nos
Girth from 600 mm to 900 mm	25	Nos
Girth from 900 mm to 1800 mm	86	Nos
Girth from 1800 mm to 2700 mm	15	Nos
Above 2700 mm	5	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



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**Site Clearance and Dismantling  
Clearing and Grubbing Road Land :**

TCS Type	Net Length(m)	Existing Road Width (m)	Width of TCS (m)	Area to be cleared and grubbed (Ha)
TCS-1	0	6.5	12	0.0
TCS-1A	320	6.5	12	0.2
TCS-2	9483	6.5	12	5.2
TCS-2A	4159	6.5	12	2.3
TCS-3	472	6.5	12	0.3
TCS-3A	322	6.5	12	0.2
TCS-4	381	6.5	12	0.2
TCS-4A	238	6.5	12	0.1
TCS-5	431	6.5	12	0.2
TCS-5A	577	6.5	12	0.3
TCS-6A	2265	6.5	12	1.2
TCS-7	6821	6.5	12	3.8
TCS-8	1180	6.5	12	0.6
TCS-9	1818	6.5	12	1.0
TCS-11A	320	6.5	12	0.2
TCS-12B	125	6.5	12	0.1
TCS-14	219	6.5	12	0.1
TCS-14A	40	6.5	12	0.0
TCS-17	877	6.5	12	0.5
TCS-18	817	6.5	12	0.4
TCS-19	1089	6.5	12	0.6
TCS-19A	2042	6.5	12	1.1
Total=				19

**Total= 19**

**Total area of clearing & grubbing=**

**19 Ha**

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



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**Site Clearance and Dismantling  
Calculation of Quantities for Dismantling  
Ch 75+000 to 87.350 Km**

Sl. No.	Brief Description	Unit	Design ch.	No.	L	B / H	T	Quantity	Total Quantity
			75.555	2	9.7	3	0.5	29.10	
			75.653	2	10	3	0.5	30.00	
			76.16	2	10.1	3	0.5	30.30	
			76.842	2	9.6	3	0.5	28.80	
			77.3	2	10.2	3	0.5	30.60	
			77.428	2	9.5	3	0.5	28.50	
			77.803	2	10.2	3	0.5	30.60	
			78.392	2	10.1	3	0.5	30.30	
			78.602	2	10.2	3	0.5	30.60	
			78.874	2	10	3	0.5	30.00	
			79.176	2	10	3	0.5	30.00	
			79.365	2	10.2	3	0.5	30.60	
			79.559	2	10.2	3	0.5	30.60	
			79.744	2	10.2	3	0.5	30.60	
			79.948	2	10.1	3	0.5	30.30	
			80.283	2	10.2	3	0.5	30.60	
			80.711	2	10	3	0.5	30.00	
			80.983	2	9.8	3	0.5	29.40	
			81.439	2	10.3	3	0.5	30.90	
			81.665	2	10.1	3	0.5	30.30	
			81.665	2	10.1	3	0.5	30.30	
			82.176	2	10.3	3	0.5	30.90	
			82.28	2	12.8	3	0.5	38.40	
			82.375	2	10.2	3	0.5	30.60	
			82.906	2	10.1	3	0.5	30.30	
			83.064	2	9.9	3	0.5	29.70	
			83.243	2	10	3	0.5	30.00	
			83.427	2	10	3	0.5	30.00	
			83.539	2	10.2	3	0.5	30.60	
			83.882	2	10.1	3	0.5	30.30	
			84.047	2	10	3	0.5	30.00	
			84.355	2	10	3	0.5	30.00	
			84.547	2	10	3	0.5	30.00	
			84.681	2	9.8	3	0.5	29.40	
			84.833	2	9.8	3	0.5	29.40	
			85.04	2	8.8	3	0.5	26.40	
			85.865	2	8.8	3	0.5	26.40	
			86.207	2	9.8	3	0.5	29.40	
			86.662	2	9.8	3	0.5	29.40	
			86.883	2	10.1	3	0.5	30.30	
A) Stone Masonry	Head wall for existing pipe culvert H=h, Length=L, and thickness=t	Cum							



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| | | | 87.171 2 10.1 3 0.5 30.3



A) Stone Masonry	Abutments for existing slab culvert H=h, Length=L, and thickness=t.	Cum	75.939	2	10.2	3	0.5	30.60	
			76.688	2	10.1	3	0.5	30.30	
			77.106	2	9.9	3	0.5	29.70	
						TOTAL =			1324.8
C) RCC	For Slab culvert	Cum	75.939	1	10.2	4.0	0.3	12.24	
			76.688	1	10.1	1.2	0.3	3.64	
			77.106	1	9.9	1.2	0.3	3.56	
						TOTAL =			19.44
D) Hume Pipe	Hume Pipe								
	Dia upto 600 mm =	m	1	10.00					10
	Dia from 600-900 mm =	m	75	10.00					750
	Dia above 900mm =	m	28	10.00					275

Quantity Summary of Dismantling of Existing Culvert::

Total Dismantling of Rubble stone masonry in cement mortar=	1325 cum	..... Bill No- 01, Sl. No- 8
Total Dismantling of Reinforced cement concrete=	19 cum	..... Bill No- 01, Sl. No- 7
Total Dismantling of up to 600 mm dia Hume Pipe=	10 m	..... Bill No- 01, Sl. No- 9
Total Dismantling of above 600 mm to 900 mm dia Hume Pipe=	750 m	..... Bill No- 01, Sl. No- 10
Total Dismantling of above 900 mm dia Hume Pipe=	275 m	..... Bill No- 01, Sl. No- 11



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**Site Clearance and Dismantling**  
**Calculation of Quantities for Dismantling**  
**Ch 87.350 to 109.494 Km**

Sl. No.	Brief Description	Unit	Design ch. No.	L	B / H	T	Quantity	Total Quantity
			87.575	2	9.5	3	0.5	28.5
			87.994	2	9	3	0.5	27
			88.185	2	9	3	0.5	27
			88.496	2	10	3	0.5	30
			88.695	2	10.2	3	0.5	30.6
			88.922	2	10.5	3	0.5	31.5
			89.227	2	9.6	3	0.5	28.8
			89.661	2	9.7	3	0.5	29.1
			90.283	2	10	3	0.5	30
			90.531	2	10	3	0.5	30
			90.727	2	10	3	0.5	30
			91.037	2	10	3	0.5	30
			91.302	2	8.9	3	0.5	26.7
			91.549	2	10	3	0.5	30
			91.913	2	9.8	3	0.5	29.4
A) Stone Masonry	Head wall for existing pipe culv	Cum	92.058	2	9.6	3	0.5	28.8
			91.235	2	10.6	3	0.5	31.8
			91.727	2	9.6	3	0.5	28.8
			92.202	2	7	3	0.5	21
			93.129	2	7	3	0.5	21
			93.28	2	7	3	0.5	21
			95.573	2	7.2	3	0.5	21.6
			96.075	2	7.2	3	0.5	21.6
			97.204	2	7	3	0.5	21
			97.883	2	7.1	3	0.5	21.3
			98.16	2	9.6	3	0.5	28.8
			98.322	2	8.2	3	0.5	24.6
			98.434	2	8.6	3	0.5	25.8
A) Stone Masonry	Abutments for existing slab culvert H=h, Length=L, and thickness=t.		99.741	2	7.6	3	0.5	22.8
			99.957	2	7.6	3	0.5	22.8
			100.68	2	7.6	3	0.5	22.8
			101.034	2	7.6	3	0.5	22.8
			100.676	2	8.7	3	0.5	26.1
			101.035	2	7.1	3	0.5	21.3
			101.289	2	7.2	3	0.5	21.6
			100.595	2	7	3	0.5	21
			103.822	2	7	3	0.5	21
			104.47	2	7.2	3	0.5	21.6
			104.7	2	7.6	3	0.5	22.8
			105.089	2	6.9	3	0.5	20.7
			105.343	2	7	3	0.5	21
		Cum	106.542	2	10.9	3	0.5	32.7
						TOTAL =		1076.7



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C) RCC	For Slab culvert		91.235	1	10.6	1.0	0.3	3.18	
		91.727	1	9.6	1.0	0.3	2.88		
		92.202	1	7	1.5	0.3	3.15		
		93.129	1	7	1.5	0.3	3.15		
		93.28	1	7	1.5	0.3	3.15		
		95.573	1	7.2	1.5	0.3	3.24		
		96.075	1	7.2	1.5	0.3	3.24		
		97.204	1	7	1.5	0.3	3.15		
		97.883	1	7.1	2.0	0.3	4.26		
		98.16	1	9.6	1.5	0.3	4.32		
		98.322	1	8.2	1.5	0.3	3.69		
		98.434	1	8.6	2.0	0.3	5.16		
		99.741	1	7.6	1.5	0.3	3.42		
		99.957	1	7.6	1.5	0.3	3.42		
		100.68	1	7.6	1.5	0.3	3.42		
		101.034	1	7.6	1.5	0.3	3.42		
		100.676	1	8.7	1.5	0.3	3.915		
		101.035	1	7.1	1.5	0.3	3.195		
		101.289	1	7.2	1.5	0.3	3.24		
		100.595	1	7	1.5	0.3	3.15		
		103.822	1	7	3.0	0.3	6.3		
		104.47	1	7.2	3.0	0.3	6.48		
		104.7	1	7.6	1.5	0.3	3.42		
		105.089	1	6.9	1.5	0.3	3.105		
		105.343	1	7	3.0	0.3	6.3		
		Cum		106.542	1	10.9	4	0.3	13.08
		TOTAL =							108
		D) Hume Pipe	Hume Pipe						
			Dia upto 600 mm =	m	1	10			10
			Dia from 600-900 mm =	m	75	10			750
Dia above 900mm =	m		27.5	10			275		

Quantity Summary of Dismantling of Existing Culvert::

Total Dismantling of Rubble stone masonry in cement mortar=	1077 cum	.....	Bill No- 01, Sl. No- 8
Total Dismantling of Reinforced cement concrete=	108 cum	.....	Bill No- 01, Sl. No- 7
Total Dismantling of up to 600 mm dia Hume Pipe=	10 m	.....	Bill No- 01, Sl. No- 9
Total Dismantling of above 600 mm to 900 mm dia Hume Pipe=	750 m	.....	Bill No- 01, Sl. No- 10
Total Dismantling of above 900 mm dia Hume Pipe=	275 m	.....	Bill No- 01, Sl. No- 11



**Site Clearance and Dismantling  
Dismantling of Flexible Pavement**

Proposed Ch. (m)		Length (m)	Existing Alignment Followed	
From	To		Horizontal	Vertical
75000	75320	320	Y	N
75320	75430	110	N	NA
75430	75515	85	Y	N
75515	75735	220	N	NA
75735	75760	25	Y	N
75760	75985	225	N	NA
75985	76010	25	Y	N
76010	76490	480	N	NA
76490	77180	690	Y	Y
77180	77280	100	N	NA
77280	77310	30	Y	Y
77310	77380	70	N	NA
77380	77420	40	Y	Y
77420	77470	50	N	NA
77470	78050	580	Y	Y
78050	78170	120	N	NA
78170	78920	750	Y	Y
78920	79110	190	N	NA
79110	79280	170	Y	Y
79280	79480	200	N	NA
79480	79550	70	Y	N
79550	79990	440	N	NA
79990	80080	90	Y	N
80080	80150	70	N	NA
80150	80320	170	Y	N
80320	80500	180	N	NA
80500	80560	60	Y	N
80560	80760	200	N	NA
80760	81080	320	Y	Y
81080	81150	70	N	NA
81150	81380	230	Y	N
81380	81470	90	N	NA
81470	81910	440	Y	Y
81910	81940	30	N	NA
81940	82110	170	Y	Y
82110	82220	110	N	NA
82220	82960	740	Y	Y
82960	83100	140	N	NA
83100	83570	470	Y	Y
83570	83660	90	N	NA
83660	84040	380	Y	Y
84040	84100	60	N	NA
84100	84700	600	Y	N
84700	84820	120	N	NA
84820	85300	480	Y	N
85300	85370	70	N	NA
85370	86130	760	Y	N
86130	86230	100	N	NA
86230	87750	1520	Y	Y
87750	88400	650	N	NA
88400	88830	430	Y	Y
88830	89130	300	N	NA
89130	89350	220	Y	Y
89350	89400	50	N	NA
89400	89700	300	Y	Y
89700	89800	100	N	NA
89800	89950	150	Y	Y
89950	90300	350	N	NA
90300	90570	270	Y	Y




90570	90660	90	N	NA
90660	91120	460	Y	Y
91120	91180	60	N	NA
91180	91240	60	Y	Y
91240	91320	80	N	NA
91320	91410	90	Y	Y
91410	91470	60	N	NA
91470	91540	70	Y	Y
91540	91700	160	N	NA
91700	91900	200	Y	Y
91900	92720	820	N	NA
92720	93440	720	Y	Y
93440	93580	140	N	NA
93580	93660	80	Y	Y
93660	94020	360	N	NA
94020	94290	270	Y	Y
94290	94380	90	N	NA
94380	94480	100	Y	Y
94480	94800	320	N	NA
94800	94930	130	Y	Y
94930	95060	130	N	NA
95060	95250	190	Y	Y
95250	95350	100	N	NA
95350	95830	480	Y	Y
95830	95960	130	N	NA
95960	96365	405	Y	Y
96365	97000	635	Y	N
97000	97050	50	N	NA
97050	97550	500	Y	N
97550	97650	100	N	NA
97650	98160	510	Y	N
98160	98230	70	N	NA
98230	98400	170	Y	N
98400	98460	60	N	NA
98460	99070	610	Y	N
99070	99310	240	N	NA
99310	99470	160	Y	Y
99470	99530	60	N	NA
99530	99680	150	Y	N
99680	99740	60	N	NA
99740	99760	20	Y	N
99760	100230	470	N	NA
100230	100340	110	Y	N
100340	100400	60	N	NA
100400	101730	1330	Y	N
101730	101870	140	N	NA
101870	101940	70	Y	N
101940	103600	1660	N	NA
103600	103860	260	Y	N
103860	104050	190	N	NA
104050	104250	200	Y	N
104250	104510	260	N	NA
104510	104670	160	Y	N
104670	104740	70	N	NA
104740	104820	80	Y	N
104820	105260	440	N	NA
105260	105860	600	Y	N
105860	107910	2050	Y	N
107910	109494	1584	N	NA

**Total Length 34494**

A) Proposed Alignment follows Existing Horizontal = 21.455 Km		
B) Proposed Alignment follows Existing both Horizontal & Vertical	11.085 km	
C) Reconstructon Of Pavement Length=	10.37 km	
Dismantel of Bituminous layer=	2574.6 cum	
Quantity of Dismantelled Bituminous Material(sqm) (Assume avg thickness 75mm)	34328 sqm	
Dismantel of granular layer=	27999 cum	
use 70% as dismanteling=	19599.3 cum	
Quantity of Dismantelled Granular Material(sqm) (Assum	186660 sqm	



*[Handwritten signature]*

**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)
75+000.000	7.4205	0	0	0
75+025.000	1.326	2.384	109.65	30.4
75+050.000	0.7565	1.168	26.35	44.8
75+075.000	5.729	0	80.75	14.4
75+100.000	8.313	0	175.1	0
75+125.000	15.7335	0	300.9	0
75+150.000	31.3225	0	588.2	0
75+175.000	44.1065	0	942.65	0
75+200.000	20.8165	0	811.75	0
75+225.000	22.95	0	547.4	0
75+250.000	24.9135	0	598.4	0
75+275.000	16.5155	0	517.65	0
75+300.000	9.214	0	321.3	0
75+325.000	7.2845	0	206.55	0
75+350.000	11.3475	0	232.9	0
75+375.000	12.733	13.248	300.9	164.8
75+400.000	0	74.56	158.95	1097.6
75+425.000	0	51.312	0	1572.8
75+450.000	0	38.576	0	1123.2
75+475.000	0.0085	26.672	0	816
75+500.000	0	38.032	0	809.6
75+525.000	10.3785	22.528	130.05	756.8
75+550.000	47.1665	0	719.1	281.6
75+575.000	23.5705	19.936	884	249.6
75+600.000	0	121.792	294.95	1771.2
75+625.000	24.7095	32.176	308.55	1924.8
75+650.000	175.8905	0	2507.5	401.6
75+675.000	91.6895	0	3344.75	0
75+700.000	34.6545	0	1579.3	0
75+725.000	0.629	45.472	441.15	568
75+750.000	0	43.712	7.65	1115.2
75+775.000	12.733	8.608	158.95	654.4
75+800.000	50.2265	0	787.1	107.2
75+825.000	47.311	0	1218.9	0
75+850.000	11.5005	0	735.25	0
75+875.000	6.3495	0.496	222.7	6.4
75+900.000	141.984	0	1853.85	6.4
75+925.000	200.3875	0	4279.75	0
75+950.000	97.4865	0	3723	0
75+975.000	114.784	0	2653.7	0
76+000.000	27.0385	0	1773.1	0
76+025.000	133.943	0	2011.95	0
76+050.000	245.361	0	4741.3	0
76+075.000	208.8705	0	5678	0
76+100.000	195.2705	0	5051.55	0
76+125.000	160.242	0	4443.8	0
76+150.000	38.607	0	2485.4	0
76+175.000	1.3515	49.616	499.8	620.8
76+200.000	2.1165	79.952	43.35	1619.2
76+225.000	20.9355	0	288.15	1000
76+250.000	92.0805	0	1412.7	0



*[Handwritten Signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
76+275.000	89.0715	0	2264.4	0
76+300.000	129.5825	0	2733.6	0
76+325.000	155.0145	0	3557.25	0
76+350.000	3.8675	119.68	1985.6	1496
76+375.000	101.745	0	1320.05	1496
76+400.000	18.479	0.032	1502.8	0
76+425.000	193.018	0	2643.5	0
76+450.000	271.269	0	5803.8	0
76+475.000	160.3525	0	5394.95	0
76+500.000	95.812	0	3201.95	0
76+525.000	83.096	0.16	2236.35	1.6
76+550.000	128.843	0	2649.45	1.6
76+575.000	181.5005	0	3879.4	0
76+600.000	131.852	0	3916.8	0
76+625.000	107.627	0	2993.7	0
76+650.000	234.94	0	4282.3	0
76+675.000	202.4785	0	5468.05	0
76+700.000	188.581	6.624	4888.35	83.2
76+725.000	221.833	53.984	5129.75	758.4
76+750.000	216.937	0	5484.2	675.2
76+775.000	118.7195	0.032	4195.6	0
76+800.000	3.1365	6.016	1523.2	75.2
76+825.000	33.898	0	463.25	75.2
76+850.000	42.976	0	960.5	0
76+875.000	9.1375	0	651.1	0
76+900.000	28.6535	0	472.6	0
76+925.000	31.841	0.528	756.5	6.4
76+950.000	60.945	2.016	1159.4	32
76+975.000	45.6535	0.8	1332.8	35.2
77+000.000	127.2365	0	2161.55	9.6
77+025.000	28.56	0	1947.35	0
77+050.000	82.1695	0	1383.8	0
77+075.000	45.4665	1.008	1595.45	12.8
77+100.000	47.8975	0	1167.05	12.8
77+125.000	61.353	0	1365.95	0
77+150.000	67.9745	25.648	1616.7	320
77+175.000	9.4265	0	967.3	320
77+200.000	116.79	0	1577.6	0
77+225.000	359.1845	0	5950	0
77+250.000	354.824	0	8925	0
77+275.000	134.3595	0	6114.9	0
77+300.000	6.749	0	1763.75	0
77+325.000	336.634	0	4292.5	0
77+350.000	418.7525	0	9442.65	0
77+375.000	94.5455	0	6415.8	0
77+400.000	157.6835	0	3152.65	0
77+425.000	516.698	0	8429.45	0
77+450.000	415.752	0	11655.2	0
77+475.000	79.7385	0	6193.95	0
77+500.000	29.3505	0	1363.4	0
77+525.000	85.068	0	1430.55	0
77+550.000	299.2595	2.496	4804.2	30.4
77+575.000	294.695	0	7424.75	30.4
77+600.000	135.218	0	5373.7	0
77+625.000	74.5875	0	2622.25	0



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
77+650.000	96.0415	2.784	2132.65	35.2
77+675.000	23.7575	10.768	1497.7	169.6
77+700.000	58.8795	0	1032.75	134.4
77+725.000	61.1405	0	1500.25	0
77+750.000	114.6395	2.528	2197.25	32
77+775.000	106.4455	0	2763.35	32
77+800.000	103.615	0	2625.65	0
77+825.000	94.7325	0.048	2479.45	0
77+850.000	38.165	0	1660.9	0
77+875.000	56.032	0	1177.25	0
77+900.000	32.3935	2.384	1105	30.4
77+925.000	35.1305	0	844.05	30.4
77+950.000	13.7275	0	611.15	0
77+975.000	35.394	0	613.7	0
78+000.000	115.6595	29.344	1887.85	366.4
78+025.000	188.377	0	3800.35	366.4
78+050.000	136.493	0	4061.3	0
78+075.000	212.84	0	4366.45	0
78+100.000	89.6665	0	3781.65	0
78+125.000	35.9635	0	1570.8	0
78+150.000	38.2755	0	928.2	0
78+175.000	47.9485	3.072	1077.8	38.4
78+200.000	64.073	23.312	1399.95	329.6
78+225.000	31.1525	0	1190	291.2
78+250.000	11.5005	2.304	532.95	28.8
78+275.000	85.1105	0	1207.85	28.8
78+300.000	89.0205	0.96	2176.85	11.2
78+325.000	77.741	3.632	2084.2	57.6
78+350.000	109.1485	0	2335.8	44.8
78+375.000	94.469	0	2544.9	0
78+400.000	61.1405	0	1944.8	0
78+425.000	107.4315	9.376	2107.15	116.8
78+450.000	18.2155	43.36	1570.8	659.2
78+475.000	81.396	0	1245.25	542.4
78+500.000	111.7835	0	2414.85	0
78+525.000	143.5225	0	3191.75	0
78+550.000	173.111	0	3957.6	0
78+575.000	316.761	1.472	6123.4	19.2
78+600.000	216.495	3.232	6665.7	59.2
78+625.000	249.2285	26.736	5821.65	374.4
78+650.000	71.1705	0	4005.2	334.4
78+675.000	13.345	0	1056.55	0
78+700.000	9.605	19.248	286.45	240
78+725.000	18.156	1.296	346.8	257.6
78+750.000	8.942	36.8	339.15	476.8
78+775.000	17.6205	0	332.35	460.8
78+800.000	85.935	0	1294.55	0
78+825.000	55.9215	5.36	1773.1	67.2
78+850.000	7.14	6.928	787.95	153.6
78+875.000	7.4375	0	181.9	86.4
78+900.000	43.3925	1.904	635.8	24
78+925.000	105.0515	2.752	1855.55	57.6
78+950.000	172.4735	0	3468.85	35.2
78+975.000	154.87	0	4091.9	0
79+000.000	9.4775	6.096	2054.45	76.8



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
79+025.000	207.604	0	2713.2	76.8
79+050.000	479.247	0	8585.85	0
79+075.000	469.693	0	11861.75	0
79+100.000	70.5585	0	6753.14375	0
79+125.000	61.506	0	1650.7	0
79+150.000	123.267	0	2309.45	0
79+175.000	2.567	13.424	1573.35	168
79+200.000	29.8265	50.112	404.6	793.6
79+225.000	33.8045	4.448	795.6	681.6
79+250.000	42.7125	0	956.25	56
79+275.000	101.9235	0	1807.95	0
79+300.000	164.288	0	3327.75	0
79+325.000	79.866	0	3052.35	0
79+350.000	26.469	0	1329.4	0
79+375.000	101.524	0	1599.7	0
79+400.000	140.369	0	3023.45	0
79+425.000	240.5755	0	4761.7	0
79+450.000	381.004	0	7769.85	0
79+475.000	202.8015	0	7297.25	0
79+500.000	131.1295	0	4174.35	0
79+525.000	127.2195	0	3229.15	0
79+550.000	228.055	0	4441.25	0
79+575.000	428.077	0	8201.65	0
79+600.000	550.698	0	12234.9	0
79+625.000	332.741	0	11043.2	0
79+650.000	504.3985	0	10464.35	0
79+675.000	626.093	0	14131.25	0
79+700.000	502.044	0	14101.5	0
79+725.000	313.5565	0	10194.9	0
79+750.000	717.7485	0	12891.1	0
79+775.000	971.9495	0	21121.65	0
79+800.000	808.622	0	22257.25	0
79+825.000	496.757	0	16317.45	0
79+850.000	230.8345	0	9095	0
79+875.000	269.688	0	6256.85	0
79+900.000	272.4165	0	6776.2	0
79+925.000	364.4205	0	7960.25	0
79+950.000	385.407	0	9372.95	0
79+975.000	172.516	0	6974.25	0
80+000.000	80.9285	0	3167.95	0
80+025.000	19.6775	0	1257.15	0
80+050.000	34.697	12.96	680	161.6
80+075.000	56.78	0	1143.25	161.6
80+100.000	94.928	0	1896.35	0
80+125.000	136.884	0	2897.65	0
80+150.000	94.2395	0	2889.15	0
80+175.000	42.7465	0	1712.75	0
80+200.000	38.6495	0	1017.45	0
80+225.000	76.6615	0	1441.6	0
80+250.000	49.436	0	1575.9	0
80+275.000	196.0525	0	3068.5	0
80+300.000	50.83	0	3086.35	0
80+325.000	38.5305	0	1116.9	0
80+350.000	220.303	0	3235.1	0
80+375.000	318.104	0	6730.3	0



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
80+400.000	51.102	0	4614.65	0
80+425.000	20.468	0	894.2	0
80+450.000	35.4025	44.096	698.7	550.4
80+475.000	256.7085	21.888	3651.6	824
80+500.000	44.217	40.784	3761.25	784
80+525.000	79.73	34.256	1549.55	937.6
80+550.000	46.8095	13.296	1581.85	595.2
80+575.000	127.466	0	2178.55	166.4
80+600.000	66.5295	0.96	2425.05	11.2
80+625.000	13.617	4.08	1002.15	62.4
80+650.000	254.847	0.608	3355.8	59.2
80+675.000	120.071	4.864	4686.9	68.8
80+700.000	34.731	41.184	1935.45	576
80+725.000	116.4585	0	1889.55	515.2
80+750.000	119.1785	0	2945.25	0
80+775.000	7.2505	0	1580.15	0
80+800.000	21.6155	0.16	361.25	1.6
80+825.000	66.487	0.448	1101.6	8
80+850.000	96.288	0	2034.9	4.8
80+875.000	89.5985	0.048	2323.9	0
80+900.000	77.4775	0	2088.45	0
80+925.000	30.09	0.032	1344.7	0
80+950.000	17.918	2.928	600.1	36.8
80+975.000	25.3215	3.264	540.6	76.8
81+000.000	13.328	0	482.8	40
81+025.000	12.189	0	318.75	0
81+050.000	5.4995	1.552	221	19.2
81+075.000	54.009	0	743.75	19.2
81+100.000	164.985	0	2737.85	0
81+125.000	183.634	0	4357.95	0
81+150.000	135.711	0	3991.6	0
81+175.000	73.4995	0	2615.45	0
81+200.000	49.0535	1.296	1531.7	16
81+225.000	137.649	0.848	2334.1	27.2
81+250.000	159.9785	3.104	3720.45	49.6
81+275.000	104.006	0	3299.7	38.4
81+300.000	34.4845	0	1731.45	0
81+325.000	9.3415	50.784	548.25	635.2
81+350.000	30.6255	0	499.8	635.2
81+375.000	17.85	16.128	606.05	201.6
81+400.000	86.496	0.608	1303.9	209.6
81+425.000	177.242	0	3296.3	8
81+450.000	58.2845	0	2944.4	0
81+475.000	14.79	0	913.75	0
81+500.000	6.6895	2.96	268.6	36.8
81+525.000	15.793	3.344	281.35	78.4
81+550.000	40.0775	0	698.7	41.6
81+575.000	71.995	0.8	1400.8	9.6
81+600.000	15.1215	0	1088.85	9.6
81+625.000	27.387	0.032	531.25	0
81+650.000	46.8435	0.064	928.2	1.6
81+675.000	38.947	0	1072.7	0
81+700.000	18.326	1.696	715.7	20.8
81+725.000	5.746	0	300.9	20.8
81+750.000	7.5905	0	166.6	0



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
81+775.000	1.3515	1.136	111.35	14.4
81+800.000	6.9275	0	103.7	14.4
81+825.000	5.1085	1.2	150.45	14.4
81+850.000	20.927	0	325.55	14.4
81+875.000	30.872	0.16	647.7	1.6
81+900.000	23.3495	0	677.45	1.6
81+925.000	93.1345	0	1456.05	0
81+950.000	5.542	0	1233.35	0
81+975.000	9.673	2.72	190.4	33.6
82+000.000	34.714	0	555.05	33.6
82+025.000	8.3385	2.112	538.05	27.2
82+050.000	4.539	7.92	160.65	124.8
82+075.000	23.8255	0	354.45	99.2
82+100.000	81.277	0	1314.1	0
82+125.000	194.174	0	3443.35	0
82+150.000	263.721	0	5723.9	0
82+175.000	303.11	0	7085.6	0
82+200.000	1.7595	105.248	3810.55	1315.2
82+225.000	115.6595	0	1467.95	1315.2
82+250.000	192.117	0	3847.1	0
82+275.000	76.4065	0	3356.65	0
82+300.000	60.7835	0	1715.3	0
82+325.000	36.2015	3.104	1212.1	38.4
82+350.000	96.135	0	1654.1	38.4
82+375.000	31.195	3.728	1592.05	46.4
82+400.000	11.6195	2.288	535.5	75.2
82+425.000	12.342	0	299.2	28.8
82+450.000	48.0335	0	754.8	0
82+475.000	21.6155	0	870.4	0
82+500.000	38.2585	4.544	748	57.6
82+525.000	60.8005	0.4	1238.45	62.4
82+550.000	142.0775	0	2535.55	4.8
82+575.000	110.8315	0	3161.15	0
82+600.000	86.122	0	2461.6	0
82+625.000	56.865	0	1787.55	0
82+650.000	60.367	0.48	1465.4	6.4
82+675.000	46.563	8.432	1336.2	112
82+700.000	32.011	0	982.6	105.6
82+725.000	18.513	3.024	631.55	38.4
82+750.000	11.4495	0	374.85	38.4
82+775.000	10.0555	0	268.6	0
82+800.000	12.478	0	281.35	0
82+825.000	12.002	0.432	306	4.8
82+850.000	51.5015	0	793.9	4.8
82+875.000	10.336	5.392	772.65	67.2
82+900.000	2.924	3.12	165.75	105.6
82+925.000	103.1475	0	1326	38.4
82+950.000	31.9345	0	1688.95	0
82+975.000	3.6805	21.36	445.4	267.2
83+000.000	48.3225	0	650.25	267.2
83+025.000	63.155	0.064	1393.15	1.6
83+050.000	181.73	0.016	3060.85	1.6
83+075.000	5.508	13.648	2340.9	171.2
83+100.000	40.511	4.368	575.45	225.6
83+125.000	51.6545	0.448	1151.75	60.8



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
83+150.000	38.6495	0	1128.8	4.8
83+175.000	6.256	0	561	0
83+200.000	124.5505	0	1635.4	0
83+225.000	110.5425	0	2938.45	0
83+250.000	42.364	3.664	1911.65	46.4
83+275.000	89.0545	0	1643.05	46.4
83+300.000	7.055	0	1201.05	0
83+325.000	2.329	6.528	117.3	81.6
83+350.000	36.737	0.016	487.9	81.6
83+375.000	34.476	0	889.95	0
83+400.000	4.7855	1.344	490.45	16
83+425.000	7.1655	0	149.6	16
83+450.000	9.9705	0	214.2	0
83+475.000	24.3015	0	428.4	0
83+500.000	17.9775	0	528.7	0
83+525.000	6.3325	10.08	304.3	126.4
83+550.000	11.305	0	220.15	126.4
83+575.000	77.197	0	1105.85	0
83+600.000	219.215	0	3705.15	0
83+625.000	170.289	0	4868.8	0
83+650.000	46.903	0	2714.9	0
83+675.000	16.9405	0	798.15	0
83+700.000	64.7615	0	1021.7	0
83+725.000	18.87	0	1045.5	0
83+750.000	17	0	448.8	0
83+775.000	16.5665	0	419.9	0
83+800.000	56.8735	0	918	0
83+825.000	8.602	0	818.55	0
83+850.000	80.189	0	1110.1	0
83+875.000	167.4415	0	3095.7	0
83+900.000	151.5975	0	3988.2	0
83+925.000	142.9105	0.576	3681.35	6.4
83+950.000	65.552	0	2606.1	6.4
83+975.000	41.0805	8.816	1332.8	110.4
84+000.000	37.706	0	985.15	110.4
84+025.000	17.2465	9.472	686.8	118.4
84+050.000	63.9285	0	1014.9	118.4
84+075.000	85.476	0	1867.45	0
84+100.000	51.782	0	1715.3	0
84+125.000	10.6335	0	780.3	0
84+150.000	30.94	0	519.35	0
84+175.000	117.827	0	1859.8	0
84+200.000	34.6375	0	1905.7	0
84+225.000	57.443	0	1150.9	0
84+250.000	126.2845	0	2296.7	0
84+275.000	132.991	0	3241.05	0
84+300.000	158.9415	0	3649.05	0
84+325.000	135.9745	0	3686.45	0
84+350.000	80.512	0	2706.4	0
84+375.000	187.255	0	3347.3	0
84+400.000	215.6025	0	5035.4	0
84+425.000	77.4265	0	3662.65	0
84+450.000	199.886	0	3466.3	0
84+475.000	313.2335	0	6414.1	0
84+500.000	156.502	0	5871.8	0



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
84+525.000	71.009	0	2844.1	0
84+550.000	9.911	0	1011.5	0
84+575.000	39.9585	0	623.05	0
84+600.000	58.888	0	1235.9	0
84+625.000	33.966	0	1161.1	0
84+650.000	39.3295	0	916.3	0
84+675.000	129.2935	0.32	2108	4.8
84+700.000	211.072	0	4254.25	4.8
84+725.000	250.954	0	5774.9	0
84+750.000	375.343	0	7828.5	0
84+775.000	349.435	0	9059.3	0
84+800.000	215.3475	0	7060.1	0
84+825.000	106.114	0	4017.95	0
84+850.000	80.6565	0	2334.95	0
84+875.000	120.887	0	2519.4	0
84+900.000	82.331	0	2540.65	0
84+925.000	3.043	1.024	1066.75	12.8
84+950.000	57.9105	5.088	761.6	76.8
84+975.000	65.0845	11.712	1537.65	209.6
85+000.000	51.8075	9.84	1461.15	268.8
85+025.000	115.8805	0	2096.1	123.2
85+050.000	146.8885	27.616	3284.4	345.6
85+075.000	225.148	0	4650.35	345.6
85+100.000	31.96	0	3213.85	0
85+125.000	21.4795	0	668.1	0
85+150.000	15.8015	30.688	465.8	384
85+175.000	15.9035	29.008	396.1	745.6
85+200.000	24.565	0	505.75	363.2
85+225.000	11.73	45.664	453.9	571.2
85+250.000	57.936	0	870.4	571.2
85+275.000	42.908	0	1260.55	0
85+300.000	23.698	1.488	832.15	19.2
85+325.000	128.367	0	1900.6	19.2
85+350.000	246.755	0	4689.45	0
85+375.000	112.931	0	4495.65	0
85+400.000	42.398	0	1941.4	0
85+425.000	74.103	0	1456.05	0
85+450.000	35.3005	0.16	1367.65	1.6
85+475.000	196.418	0	2896.8	1.6
85+500.000	208.913	0	5066.85	0
85+525.000	250.6055	0	5744.3	0
85+550.000	172.21	0	5285.3	0
85+575.000	21.114	0	2416.55	0
85+600.000	52.445	7.232	919.7	89.6
85+625.000	98.8805	0.112	1891.25	91.2
85+650.000	113.696	10.512	2657.1	132.8
85+675.000	6.477	30.656	1501.95	515.2
85+700.000	75.48	20.208	1024.25	635.2
85+725.000	71.5785	0	1838.55	252.8
85+750.000	8.4745	21.728	1000.45	272
85+775.000	43.265	6.72	646.85	355.2
85+800.000	89.5305	1.2	1660.05	99.2
85+825.000	56.5505	8.592	1825.8	123.2
85+850.000	83.453	0	1750.15	107.2
85+875.000	71.434	0	1936.3	0



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
85+900.000	134.8525	0.368	2578.9	4.8
85+925.000	52.53	0	2342.6	4.8
85+950.000	35.071	0	1094.8	0
85+975.000	132.753	0	2097.8	0
86+000.000	21.2925	4.096	1925.25	51.2
86+025.000	101.167	2.912	1530.85	88
86+050.000	37.944	3.072	1739.1	75.2
86+075.000	56.4315	0	1179.8	38.4
86+100.000	75.395	0	1648.15	0
86+125.000	147.3135	0	2783.75	0
86+150.000	192.015	0	4241.5	0
86+175.000	232.8915	0	5311.65	0
86+200.000	215.067	0.56	5599.8	6.4
86+225.000	36.5585	0.224	3145	9.6
86+250.000	46.801	0.176	1042.1	4.8
86+275.000	24.871	0	895.9	1.6
86+300.000	77.809	0.432	1283.5	4.8
86+325.000	27.6845	0	1318.35	4.8



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
86+350.000	122.995	0	1883.6	0
86+375.000	44.54	0	2094.4	0
86+400.000	23.8595	0	855.1	0
86+425.000	15.453	0	491.3	0
86+450.000	5.6865	7.84	264.35	97.6
86+475.000	13.0645	0.368	234.6	102.4
86+500.000	21.3435	0	430.1	4.8
86+525.000	46.988	0	854.25	0
86+550.000	49.8525	0	1210.4	0
86+575.000	141.933	0	2397	0
86+600.000	32.215	0	2176.85	0
86+625.000	48.263	0	1006.4	0
86+650.000	56.9245	0	1314.95	0
86+675.000	46.682	0	1295.4	0
86+700.000	57.1965	1.456	1298.8	17.6
86+725.000	42.16	0	1241.85	17.6
86+750.000	56.1765	0	1229.1	0
86+775.000	52.3175	0	1356.6	0
86+800.000	62.696	0	1437.35	0
86+825.000	41.4375	4.064	1301.35	51.2
86+850.000	62.118	1.056	1294.55	64
86+875.000	4.5135	0	833	12.8
86+900.000	120.139	0	1558.05	0
86+925.000	123.913	1.248	3050.65	16
86+950.000	47.4215	12.368	2142	169.6
86+975.000	7.1315	5.008	681.7	217.6
87+000.000	20.757	0	348.5	62.4
87+025.000	24.191	0	561.85	0
87+050.000	68.3145	1.328	1156	16
87+075.000	37.315	2.752	1320.05	51.2
87+100.000	126.344	1.312	2045.95	51.2
87+125.000	142.5025	0	3360.9	16
87+150.000	102.0085	0	3056.6	0
87+175.000	166.0985	0	3351.55	0
87+200.000	117.419	0	3543.65	0
87+225.000	52.8615	0.064	2128.4	1.6
87+250.000	70.839	0	1546.15	1.6
87+275.000	18.3005	1.344	1114.35	17.6
87+300.000	16.354	0	433.5	17.6
87+325.000	7.633	0	300.05	0
87+350.000	10.166	0	222.7	0
87+375.000	6.1285	0	204	0
87+400.000	38.3265	0	555.9	0
87+425.000	63.1975	0	1269.05	0
87+450.000	97.495	0	2008.55	0
87+475.000	118.4645	0	2699.6	0
87+500.000	171.972	0	3630.35	0
87+525.000	153.8585	0	4073.2	0
87+550.000	42.1345	0	2449.7	0
87+575.000	107.236	0	1867.45	0
87+600.000	109.9475	0.4	2714.9	4.8
87+625.000	65.1865	1.008	2189.6	17.6
87+650.000	94.197	0.352	1992.4	17.6
87+675.000	74.4515	2.72	2108	38.4
87+700.000	107.355	0	2272.9	33.6



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
87+725.000	22.61	1.904	1624.35	24
87+750.000	25.143	0.352	596.7	28.8
87+775.000	83.198	0	1354.05	4.8
87+800.000	57.732	0.016	1761.2	0
87+825.000	57.783	0	1444.15	0
87+850.000	160.4205	0	2727.65	0
87+875.000	125.63	0	3575.95	0
87+900.000	51.7225	0	2216.8	0
87+925.000	5.287	6.128	712.3	76.8
87+950.000	94.3245	0	1245.25	76.8
87+975.000	43.3075	0	1720.4	0
88+000.000	98.464	0	1772.25	0
88+025.000	74.5705	0	2163.25	0
88+050.000	52.6405	3.2	1590.35	40
88+075.000	112.166	0.56	2060.4	46.4
88+100.000	134.8355	0	3087.2	6.4
88+125.000	53.8135	13.792	2357.9	172.8
88+150.000	58.82	15.808	1407.6	369.6
88+175.000	226.763	5.744	3570	268.8
88+200.000	108.834	0	4194.75	72
88+225.000	107.9755	0	2709.8	0
88+250.000	136.6885	0	3058.3	0
88+275.000	136.476	0	3414.45	0
88+300.000	143.7265	0	3502.85	0
88+325.000	192.865	0	4207.5	0
88+350.000	180.2765	0	4663.95	0
88+375.000	84.6515	0	3311.6	0
88+400.000	166.243	10.096	3136.5	126.4
88+425.000	85.697	0	3149.25	126.4
88+450.000	42.568	0.128	1603.1	1.6
88+475.000	92.9815	0	1694.05	1.6
88+500.000	55.4625	0	1855.55	0
88+525.000	354.6795	0	5126.35	0
88+550.000	186.371	0	6763.45	0
88+575.000	221.8585	0	5102.55	0
88+600.000	108.171	9.824	4125.05	123.2
88+625.000	137.275	0	3067.65	123.2
88+650.000	54.6805	0	2399.55	0
88+675.000	103.734	0.384	1980.5	4.8
88+700.000	89.6325	0	2417.4	4.8
88+725.000	144.6785	0	2929.1	0
88+750.000	109.5565	4.368	3178.15	54.4
88+775.000	197.795	0	3842	54.4
88+800.000	182.7245	0	4756.6	0
88+825.000	301.3505	0	6051.15	0
88+850.000	297.6955	0	7488.5	0
88+875.000	439.4075	0	9214	0
88+900.000	245.225	0	8557.8	0
88+925.000	360.043	0	7565.85	0
88+950.000	258.468	0	7731.6	0
88+975.000	230.9705	0	6118.3	0
89+000.000	322.065	0	6913.05	0
89+025.000	346.12	0.48	8352.1	6.4
89+050.000	260.032	0.352	7576.9	11.2
89+075.000	79.5345	5.84	4244.9	76.8



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
89+100.000	66.3425	0	1823.25	73.6
89+125.000	137.853	0.016	2552.55	0
89+150.000	156.961	0	3684.75	0
89+175.000	99.0505	4.416	3200.25	54.4
89+200.000	76.6785	0	2196.4	54.4
89+225.000	28.169	0	1310.7	0
89+250.000	26.197	0	680	0
89+275.000	8.568	0	434.35	0
89+300.000	133.365	0	1773.95	0
89+325.000	76.415	0	2622.25	0
89+350.000	72.5305	0	1861.5	0
89+375.000	214.6675	0	3590.4	0
89+400.000	87.7115	0	3779.95	0
89+425.000	7.276	1.648	1187.45	20.8
89+450.000	35.7595	0	538.05	20.8
89+475.000	60.7835	0	1207	0
89+500.000	68.1275	1.04	1611.6	12.8
89+525.000	57.7575	0.928	1573.35	24
89+550.000	40.715	0	1230.8	11.2
89+575.000	47.005	0	1096.5	0
89+600.000	29.0275	0	950.3	0
89+625.000	25.398	0	680	0
89+650.000	5.423	0.016	385.05	0
89+675.000	11.2285	0	208.25	0
89+700.000	120.173	0	1642.2	0
89+725.000	100.9715	0	2764.2	0
89+750.000	121.1675	0	2776.95	0
89+775.000	122.2555	0	3043	0
89+800.000	5.933	2.192	1602.25	27.2
89+825.000	78.5825	0	1056.55	27.2
89+850.000	106.2755	0	2311.15	0
89+875.000	183.3365	0	3620.15	0
89+900.000	77.3415	0	3258.05	0
89+925.000	92.871	1.344	2127.55	17.6
89+950.000	107.8395	0	2509.2	17.6
89+975.000	218.5095	0	4079.15	0
90+000.000	187.391	0	5073.65	0
90+025.000	6.1455	0.064	2419.1	0
90+050.000	24.973	0	389.3	0
90+075.000	99.6455	0	1558.05	0
90+100.000	11.5685	0	1389.75	0
90+125.000	128.9875	0	1756.95	0
90+150.000	110.789	0	2997.1	0
90+175.000	66.8865	1.216	2221.05	14.4
90+200.000	139.196	0	2576.35	14.4
90+225.000	7.1485	10.56	1829.2	132.8
90+250.000	178.0155	0	2314.55	132.8
90+275.000	111.469	0	3618.45	0
90+300.000	48.331	0	1997.5	0
90+325.000	45.9765	0	1178.95	0
90+350.000	21.3095	0	841.5	0
90+375.000	111.0355	0	1654.1	0
90+400.000	176.103	5.104	3589.55	64
90+425.000	196.3925	1.2	4656.3	78.4
90+450.000	67.2605	3.28	3295.45	56



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
90+475.000	14.5435	0	1022.55	41.6
90+500.000	32.385	0	586.5	0
90+525.000	16.762	6.288	614.55	78.4
90+550.000	26.86	0.016	545.7	78.4
90+575.000	43.7495	0	882.3	0
90+600.000	97.1805	0	1762.05	0
90+625.000	129.9905	0	2839.85	0
90+650.000	77.197	0	2589.95	0
90+675.000	5.1765	1.296	1029.35	16
90+700.000	6.8595	3.168	150.45	56
90+725.000	20.434	0	340.85	40
90+750.000	57.2985	0	971.55	0
90+775.000	28.2625	0	1069.3	0
90+800.000	5.7545	0	425	0
90+825.000	9.265	0	187.85	0
90+850.000	6.052	0.304	191.25	3.2
90+875.000	8.721	1.152	184.45	17.6
90+900.000	14.1525	0	285.6	14.4
90+925.000	21.743	0.256	448.8	3.2
90+950.000	27.7695	0	618.8	3.2
90+975.000	35.904	0	795.6	0
91+000.000	9.4775	0	566.95	0
91+025.000	19.9495	1.024	368.05	12.8
91+050.000	36.567	0	706.35	12.8
91+075.000	19.8985	3.568	705.5	44.8
91+100.000	41.4375	0	766.7	44.8
91+125.000	39.729	0	1014.9	0
91+150.000	82.8155	0	1531.7	0
91+175.000	21.1735	0.448	1299.65	4.8
91+200.000	7.4715	0.944	357.85	17.6
91+225.000	16.0055	0	293.25	11.2
91+250.000	77.6135	0	1170.45	0
91+275.000	177.9135	0	3194.3	0
91+300.000	107.7715	0	3570.85	0
91+325.000	3.4595	7.36	1390.6	92.8
91+350.000	41.8455	0	566.1	92.8
91+375.000	24.1995	0	825.35	0
91+400.000	53.4395	4.064	970.7	51.2
91+425.000	106.93	0	2004.3	51.2
91+450.000	124.202	0	2889.15	0
91+475.000	92.174	0.096	2704.7	1.6
91+500.000	98.0305	0	2377.45	1.6
91+525.000	33.966	0.864	1649.85	11.2
91+550.000	13.294	0.576	590.75	17.6
91+575.000	169.0735	0	2279.7	8
91+600.000	231.591	0	5008.2	0
91+625.000	152.796	0	4805.05	0
91+650.000	26.4265	0	2240.6	0
91+675.000	3.5955	25.232	375.7	315.2
91+700.000	40.4515	0	550.8	315.2
91+725.000	45.2285	0	1071	0
91+750.000	33.915	0	989.4	0
91+775.000	13.073	0	587.35	0
91+800.000	7.497	0	256.7	0
91+825.000	11.866	0.832	242.25	9.6



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
91+850.000	57.7235	0	869.55	9.6
91+875.000	25.1345	0	1036.15	0
91+900.000	86.666	0	1397.4	0
91+925.000	192.9585	0	3495.2	0
91+950.000	168.64	0	4520.3	0
91+975.000	130.6705	0	3741.7	0
92+000.000	8.721	0.224	1742.5	3.2
92+025.000	10.387	11.376	238.85	145.6
92+050.000	74.698	0	1063.35	142.4
92+075.000	188.1985	0	3286.1	0
92+100.000	142.2815	0	4131	0
92+125.000	78.5145	0	2759.95	0
92+150.000	6.46	2.416	1062.5	30.4
92+175.000	28.424	0	436.05	30.4
92+200.000	134.2235	0	2033.2	0
92+225.000	92.582	0	2834.75	0
92+250.000	26.86	0	1492.6	0
92+275.000	9.9875	0	460.7	0
92+300.000	6.7915	0	209.95	0
92+325.000	8.4405	0	190.4	0
92+350.000	4.964	0	167.45	0
92+375.000	4.5985	0	119.85	0
92+400.000	141.6015	0	1827.5	0
92+425.000	93.4235	0	2937.6	0
92+450.000	12.9625	0	1330.25	0
92+475.000	20.9525	0.448	424.15	6.4
92+500.000	12.6905	1.024	420.75	19.2
92+525.000	30.651	0	541.45	12.8
92+550.000	38.93	0	869.55	0
92+575.000	87.1505	0	1575.9	0
92+600.000	12.0615	0	1240.15	0
92+625.000	7.9645	0	250.75	0
92+650.000	11.186	0	239.7	0
92+675.000	69.479	0	1008.1	0
92+700.000	124.2955	0	2422.5	0
92+725.000	65.331	0	2370.65	0
92+750.000	31.7645	0	1213.8	0
92+775.000	113.22	1.728	1812.2	22.4
92+800.000	116.0505	0	2866.2	22.4
92+825.000	239.581	0	4445.5	0
92+850.000	87.397	0.512	4086.8	6.4
92+875.000	2.907	20.288	1128.8	260.8
92+900.000	44.285	0	589.9	254.4
92+925.000	42.262	0	1082.05	0
92+950.000	12.1125	0	680	0
92+975.000	42.959	0	688.5	0
93+000.000	73.236	0	1452.65	0
93+025.000	65.5945	0.112	1735.7	1.6
93+050.000	66.6655	1.984	1653.25	25.6
93+075.000	83.3425	11.984	1875.1	174.4
93+100.000	68.8245	0.608	1902.3	156.8
93+125.000	123.284	30.352	2401.25	387.2
93+150.000	101.5155	0	2810.1	379.2
93+175.000	45.526	0	1837.7	0
93+200.000	6.7065	1.888	652.8	24



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
93+225.000	95.948	0	1283.5	24
93+250.000	98.413	0	2429.3	0
93+275.000	117.0365	0	2692.8	0
93+300.000	83.3935	0	2505.8	0
93+325.000	118.2945	0	2521.1	0
93+350.000	105.8505	0	2801.6	0
93+375.000	75.344	0	2265.25	0
93+400.000	32.1895	0	1343.85	0
93+425.000	1.53	10.592	421.6	132.8
93+450.000	10.0555	0	144.5	132.8
93+475.000	38.2755	0	604.35	0
93+500.000	7.0805	1.264	566.95	16
93+525.000	43.809	0	635.8	16
93+550.000	81.294	0	1564	0
93+575.000	22.066	0	1292	0
93+600.000	19.0315	6.816	513.4	84.8
93+625.000	8.381	0.016	342.55	84.8
93+650.000	90.9075	0	1241	0
93+675.000	182.2145	0	3414.45	0
93+700.000	42.5255	0	2809.25	0
93+725.000	7.1995	0.032	621.35	0
93+750.000	76.211	0	1042.95	0
93+775.000	73.678	0	1873.4	0
93+800.000	16.5665	3.088	1127.95	38.4
93+825.000	69.037	0.016	1070.15	38.4
93+850.000	240.125	0	3864.1	0
93+875.000	26.112	0	3327.75	0
93+900.000	50.745	0	960.5	0
93+925.000	8.8315	0.544	744.6	6.4
93+950.000	36.6605	0	568.65	6.4
93+975.000	45.3815	0	1025.1	0
94+000.000	82.756	0	1601.4	0
94+025.000	8.2875	11.312	1138.15	140.8
94+050.000	65.399	0	921.4	140.8
94+075.000	10.472	0.576	948.6	6.4
94+100.000	33.0565	0	544	6.4
94+125.000	81.379	0	1430.55	0
94+150.000	298.0695	0	4743	0
94+175.000	230.979	0	6613	0
94+200.000	102.2465	0	4165	0
94+225.000	62.696	1.136	2062.1	14.4
94+250.000	29.6905	0.528	1155.15	20.8
94+275.000	33.694	0	792.2	6.4
94+300.000	56.1255	0	1122.85	0
94+325.000	211.174	0	3341.35	0
94+350.000	145.571	0	4459.1	0
94+375.000	4.3775	3.536	1874.25	44.8
94+400.000	27.183	0	394.4	44.8
94+425.000	48.1355	0	941.8	0
94+450.000	51.833	27.104	1249.5	339.2
94+475.000	100.8865	8.048	1909.1	440
94+500.000	181.186	0	3525.8	100.8
94+525.000	96.747	2.128	3473.95	27.2
94+550.000	155.601	0	3154.35	27.2
94+575.000	6.9955	10.56	2032.35	132.8



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
94+600.000	12.9115	0	249.05	132.8
94+625.000	145.8345	4.496	1983.9	56
94+650.000	141.4145	0	3590.4	56
94+675.000	10.88	0	1904	0
94+700.000	22.8905	0	422.45	0
94+725.000	194.5225	0	2717.45	0
94+750.000	33.235	0	2846.65	0
94+775.000	3.383	18.704	457.3	233.6
94+800.000	73.525	0	961.35	233.6
94+825.000	83.232	0	1959.25	0
94+850.000	46.6225	0	1623.5	0
94+875.000	75.9305	0	1531.7	0
94+900.000	44.7865	0.32	1508.75	3.2
94+925.000	4.7855	4.448	619.65	59.2
94+950.000	71.893	0	958.8	56
94+975.000	89.3435	0	2015.35	0
95+000.000	106.2925	0	2445.45	0
95+025.000	1.377	7.056	1345.55	88
95+050.000	7.3185	23.264	108.8	379.2
95+075.000	4.624	21.728	149.6	561.6
95+100.000	145.9365	0	1881.9	272
95+125.000	113.1095	3.744	3238.5	46.4
95+150.000	66.0705	0	2239.75	46.4
95+175.000	121.3715	0	2342.6	0
95+200.000	50.15	0	2143.7	0
95+225.000	11.441	8.352	770.1	104
95+250.000	33.9575	2.048	567.8	129.6
95+275.000	131.7245	0	2071.45	25.6
95+300.000	128.6985	0	3255.5	0
95+325.000	138.5755	0	3341.35	0
95+350.000	29.2995	0.144	2098.65	1.6
95+375.000	29.4695	2.768	734.4	36.8
95+400.000	19.635	0	613.7	35.2
95+425.000	17.1955	0.048	460.7	0
95+450.000	5.066	1.152	277.95	14.4
95+475.000	4.998	0	125.8	14.4
95+500.000	7.6415	1.728	158.1	22.4
95+525.000	27.557	0	440.3	22.4
95+550.000	33.8895	0	768.4	0
95+575.000	30.7105	0	807.5	0
95+600.000	19.8305	0	631.55	0
95+625.000	29.257	0	613.7	0
95+650.000	26.1885	0.048	692.75	0
95+675.000	6.834	0	413.1	0
95+700.000	21.2245	0	351.05	0
95+725.000	8.823	0	375.7	0
95+750.000	6.1455	0	187	0
95+775.000	20.0515	0	327.25	0
95+800.000	34.578	0	682.55	0
95+825.000	35.6065	0	877.2	0
95+850.000	126.48	0	2026.4	0
95+875.000	8.9335	0	1692.35	0
95+900.000	6.919	0	198.05	0
95+925.000	110.9335	0	1473.05	0
95+950.000	43.5625	0	1931.2	0



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
95+975.000	21.624	0.048	815.15	0
96+000.000	55.0375	0	957.95	0
96+025.000	5.253	1.952	753.95	24
96+050.000	14.348	10	244.8	148.8
96+075.000	10.183	0	306.85	124.8
96+100.000	5.644	0	198.05	0
96+125.000	10.353	0	199.75	0
96+150.000	5.1595	0.064	193.8	0
96+175.000	9.673	2.144	185.3	27.2
96+200.000	17.8585	0	344.25	27.2
96+225.000	28.832	0	583.95	0
96+250.000	12.189	0	512.55	0
96+275.000	3.451	0.752	195.5	9.6
96+300.000	11.9085	0.304	192.1	12.8
96+325.000	16.337	0	352.75	3.2
96+350.000	9.0695	0	317.9	0
96+375.000	4.131	0	164.9	0
96+400.000	0.9775	3.664	63.75	46.4
96+425.000	0.8245	6.832	22.1	131.2
96+450.000	10.8375	10.096	145.35	211.2
96+475.000	25.8825	0.464	459	132.8
96+500.000	35.5045	5.248	767.55	72
96+525.000	44.5315	0.08	1000.45	67.2
96+550.000	111.2565	29.184	1947.35	366.4
96+575.000	136.459	0	3096.55	364.8
96+600.000	175.2615	0	3896.4	0
96+625.000	190.485	0	4572.15	0
96+650.000	165.5205	0	4449.75	0
96+675.000	187.3485	0	4410.65	0
96+700.000	389.062	0	7205.45	0
96+725.000	173.604	0	7032.9	0
96+750.000	117.7165	0	3641.4	0
96+775.000	253.3	0	4637.6	0
96+800.000	389.6485	0	8036.75	0
96+825.000	383.979	0	9670.45	0
96+850.000	300.135	0	8551.85	0
96+875.000	328.0405	0	7852.3	0
96+900.000	382.653	0	8883.35	0
96+925.000	409.071	0	9896.55	0
96+950.000	377.91	0	9837.05	0
96+975.000	292.842	0	8384.4	0
97+000.000	399.704	0	8656.4	0
97+025.000	518.721	0	11480.1	0
97+050.000	427.38	0	11826.05	0
97+075.000	502.894	0	11628	0
97+100.000	358.768	0	10771.2	0
97+125.000	403.869	0	9532.75	0
97+150.000	388.3225	0	9902.5	0
97+175.000	344.845	0	9164.7	0
97+200.000	313.123	0	8224.6	0
97+225.000	456.5435	0	9621.15	0
97+250.000	536.5115	0	12413.4	0
97+275.000	470.8915	0	12592.75	0
97+300.000	469.234	0	11751.25	0
97+325.000	483.1995	0	11905.1	0



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
97+350.000	446.5135	0	11621.2	0
97+375.000	409.462	0	10699.8	0
97+400.000	359.227	0	9608.4	0
97+425.000	263.262	0	7780.9	0
97+450.000	279.8625	0	6788.95	0
97+475.000	320.5775	0	7505.5	0
97+500.000	347.514	0	8351.25	0
97+525.000	297.1345	0	8058	0
97+550.000	367.761	0	8311.3	0
97+575.000	456.212	0	10299.45	0
97+600.000	490.9005	0	11838.8	0
97+625.000	489.277	0	12251.9	0
97+650.000	444.108	0	11667.1	0
97+675.000	556.24	0	12504.35	0
97+700.000	500.803	0	13213.25	0
97+725.000	654.126	0	14436.4	0
97+750.000	614.2185	0	15854.2	0
97+775.000	637.84	0	15651.05	0
97+800.000	614.703	0	15657	0
97+825.000	591.668	0	15079.85	0
97+850.000	577.2945	0	14612.35	0
97+875.000	636.9305	0	15177.6	0
97+900.000	656.1405	0	16163.6	0
97+925.000	617.7035	0	15923.05	0
97+950.000	589.73	0	15092.6	0
97+975.000	433.891	0	12795.05	0
98+000.000	359.159	0	9913.55	0
98+025.000	414.868	0	9675.55	0
98+050.000	456.909	0	10897	0
98+075.000	413.066	0	10874.9	0
98+100.000	322.6855	0	9197	0
98+125.000	454.4185	0	9713.8	0
98+150.000	400.452	0	10686.2	0
98+175.000	440.045	0	10506	0
98+200.000	452.557	0	11157.95	0
98+225.000	308.7115	0	9515.75	0
98+250.000	368.883	0	8470.25	0
98+275.000	456.518	0	10317.3	0
98+300.000	517.3355	0	12172.85	0
98+325.000	416.9845	0	11679	0
98+350.000	396.508	0	10168.55	0
98+375.000	354.8835	0	9392.5	0
98+400.000	315.8345	0	8384.4	0
98+425.000	431.8255	0	9345.75	0
98+450.000	413.3635	0	10564.65	0
98+475.000	262.48	0	8448.15	0
98+500.000	240.9155	0	6292.55	0
98+525.000	197.438	0	5479.1	0
98+550.000	293.335	0	6134.45	0
98+575.000	296.276	0	7370.35	0
98+600.000	258.944	0	6940.25	0
98+625.000	216.07	0	5938.1	0
98+650.000	328.202	0	6803.4	0
98+675.000	275.7995	0	7549.7	0
98+700.000	280.5085	0	6953.85	0



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
98+725.000	306.8245	0	7341.45	0
98+750.000	231.1065	0	6724.35	0
98+775.000	234.2685	0	5817.4	0
98+800.000	281.656	0	6448.95	0
98+825.000	150.3735	0	5400.05	0
98+850.000	90.2785	0	3008.15	0
98+875.000	137.1645	0	2843.25	0
98+900.000	96.815	0	2924.85	0
98+925.000	40.341	0.208	1714.45	3.2
98+950.000	43.741	0	1051.45	3.2
98+975.000	34.2125	2.192	974.1	27.2
99+000.000	33.286	8.928	844.05	139.2
99+025.000	6.6895	25.488	499.8	430.4
99+050.000	0	38.416	83.3	798.4
99+075.000	0	74.928	0	1417.6
99+100.000	42.84	0	535.5	936
99+125.000	27.387	12.864	878.05	161.6
99+150.000	102.4845	0	1623.5	161.6
99+175.000	36.4905	3.856	1737.4	48
99+200.000	17.3825	0	673.2	48
99+225.000	26.6475	0	550.8	0
99+250.000	149.0135	0	2195.55	0
99+275.000	25.585	0	2182.8	0
99+300.000	28.9595	0.64	681.7	8
99+325.000	33.405	0	779.45	8
99+350.000	45.798	0	990.25	0
99+375.000	50.099	0	1198.5	0
99+400.000	23.358	0	918	0
99+425.000	29.4355	0.16	659.6	1.6
99+450.000	26.5625	0.192	700.4	4.8
99+475.000	8.7975	12.16	442	153.6
99+500.000	6.7235	35.568	193.8	596.8
99+525.000	27.6675	0	430.1	444.8
99+550.000	19.193	0	585.65	0
99+575.000	37.315	2.336	706.35	28.8
99+600.000	23.4855	0	759.9	28.8
99+625.000	24.2845	0	596.7	0
99+650.000	14.4585	0	484.5	0
99+675.000	56.2105	0	883.15	0
99+700.000	76.483	0	1658.35	0
99+725.000	58.429	0	1686.4	0
99+750.000	40.001	0	1229.95	0
99+775.000	16.184	1.504	702.1	19.2
99+800.000	118.541	0	1683.85	19.2
99+825.000	64.583	0	2289.05	0
99+850.000	9.0015	0	919.7	0
99+875.000	0.0935	34.144	113.9	427.2
99+900.000	18.6235	2.656	233.75	459.2
99+925.000	33.864	0	656.2	33.6
99+950.000	5.1255	0	487.05	0
99+975.000	1.785	3.968	86.7	49.6
100+000.00	42.075	0.032	548.25	49.6
100+025.00	50.745	0	1160.25	0
100+050.00	81.7785	0	1656.65	0
100+075.00	54.2895	0	1700.85	0



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
100+100.00	27.064	0	1016.6	0
100+125.00	39.508	0	832.15	0
100+150.00	187.51	0	2837.3	0
100+175.00	289.7905	0	5966.15	0
100+200.00	205.1985	0	6187.15	0
100+225.00	130.4155	0	4194.75	0
100+250.00	75.463	0	2573.8	0
100+275.00	35.394	0	1385.5	0
100+300.00	23.851	0	740.35	0
100+325.00	72.7685	0	1207.85	0
100+350.00	106.0885	0	2235.5	0
100+375.00	139.7315	0	3072.75	0
100+400.00	87.465	0	2839.85	0
100+425.00	93.6445	0	2263.55	0
100+450.00	88.6635	0	2278.85	0
100+475.00	74.069	0	2034.05	0
100+500.00	117.4275	0	2393.6	0
100+525.00	171.0965	0	3606.55	0
100+550.00	133.45	0	3807.15	0
100+575.00	147.22	0	3507.95	0
100+600.00	146.4805	0	3671.15	0
100+625.00	151.2575	0	3721.3	0
100+650.00	161.211	0	3905.75	0
100+675.00	122.043	0	3541.1	0
100+700.00	131.223	0	3166.25	0
100+725.00	143.9985	0	3439.95	0
100+750.00	140.131	0	3551.3	0
100+775.00	135.2605	0	3442.5	0
100+800.00	155.6945	0	3637.15	0
100+825.00	139.723	0	3692.4	0
100+850.00	121.244	0	3262.3	0
100+875.00	130.628	0	3148.4	0
100+900.00	124.508	0	3189.2	0
100+925.00	117.419	4.496	3024.3	56
100+950.00	65.1015	0	2281.4	56
100+975.00	79.2285	0.16	1803.7	1.6
101+000.00	41.6755	0	1511.3	1.6
101+025.00	14.96	6.128	708.05	76.8
101+050.00	8.007	0.112	287.3	78.4
101+075.00	8.925	1.792	211.65	24
101+100.00	19.397	0	354.45	22.4
101+125.00	30.141	0	618.8	0
101+150.00	34.187	0	804.1	0
101+175.00	41.871	1.904	950.3	24
101+200.00	0.017	21.968	523.6	297.6
101+225.00	0	51.632	0	920
101+250.00	0.4165	29.328	5.1	1011.2
101+275.00	7.055	0	93.5	366.4
101+300.00	0.0255	4.832	88.4	60.8
101+325.00	2.6605	0.016	33.15	60.8
101+350.00	13.4555	0.032	201.45	0
101+375.00	3.2725	0	209.1	0
101+400.00	7.837	0	138.55	0
101+425.00	22.44	0	378.25	0
101+450.00	31.807	0	678.3	0



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
101+475.00	40.7405	0	906.95	0
101+500.00	169.3285	0	2625.65	0
101+525.00	35.3855	0	2559.35	0
101+550.00	39.661	0	938.4	0
101+575.00	41.616	0	1015.75	0
101+600.00	4.5305	0.448	577.15	4.8
101+625.00	8.6275	0	164.9	4.8
101+650.00	4.4965	0.256	164.05	3.2
101+675.00	12.1465	0	208.25	3.2
101+700.00	17.51	0	370.6	0
101+725.00	9.4945	0	337.45	0
101+750.00	7.582	0.176	213.35	1.6
101+775.00	12.3335	1.44	249.05	20.8
101+800.00	11.6365	7.024	299.2	105.6
101+825.00	8.5935	0	253.3	88
101+850.00	0	17.904	107.1	224
101+875.00	4.743	0	59.5	224
101+900.00	2.4565	2.512	90.1	32
101+925.00	0.595	12.608	38.25	188.8
101+950.00	4.2925	16.464	61.2	363.2
101+975.00	8.007	18.4	153.85	435.2
102+000.00	24.0635	8.832	401.2	340.8
102+025.00	16.439	28.944	506.6	472
102+050.00	19.1675	14.928	445.4	548.8
102+075.00	72.0375	3.2	1139.85	227.2
102+100.00	35.2495	0	1341.3	40
102+125.00	56.746	0	1150.05	0
102+150.00	71.9525	0	1609.05	0
102+175.00	115.413	0	2341.75	0
102+200.00	64.362	0	2247.4	0
102+225.00	24.004	0	1104.15	0
102+250.00	34.408	13.472	730.15	168
102+275.00	39.831	17.344	928.2	385.6
102+300.00	54.587	0.064	1180.65	217.6
102+325.00	41.667	0	1203.6	0
102+350.00	110.0325	0	1896.35	0
102+375.00	175.559	0	3570	0
102+400.00	142.46	0	3975.45	0
102+425.00	129.3275	0	3397.45	0
102+450.00	175.1425	0	3806.3	0
102+475.00	273.6405	0	5610	0
102+500.00	242.199	0	6448.1	0
102+525.00	213.1205	0	5691.6	0
102+550.00	342.5925	0	6946.2	0
102+575.00	349.554	0.032	8652.15	0
102+600.00	342.5245	0.112	8651.3	1.6
102+625.00	396.066	0	9232.7	1.6
102+650.00	409.0965	0	10064.85	0
102+675.00	366.197	0	9690.85	0
102+700.00	138.907	0	6313.8	0
102+725.00	152.15	0	3638	0
102+750.00	126.7775	20.64	3486.7	257.6
102+775.00	126.327	28.496	3163.7	614.4
102+800.00	187.9945	0.032	3928.7	356.8
102+825.00	208.5645	34.656	4957.2	433.6



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
102+850.00	150.1525	10.912	4483.75	569.6
102+875.00	22.083	23.232	2153.05	427.2
102+900.00	103.785	0	1573.35	291.2
102+925.00	47.7615	30.896	1894.65	385.6
102+950.00	8.109	47.12	698.7	976
102+975.00	28.203	93.792	453.9	1761.6
103+000.00	36.4055	65.248	807.5	1988.8
103+025.00	22.4315	63.152	735.25	1604.8
103+050.00	87.652	6.608	1376.15	872
103+075.00	75.599	17.184	2040.85	297.6
103+100.00	100.4275	0	2200.65	214.4
103+125.00	122.9865	0	2792.25	0
103+150.00	153.2295	0	3452.7	0
103+175.00	107.8225	0.144	3263.15	1.6
103+200.00	80.4355	0	2352.8	1.6
103+225.00	275.57	18.528	4449.75	232
103+250.00	374.0595	18.608	8120.05	464
103+275.00	240.7285	63.024	7684.85	1020.8
103+300.00	195.653	0	5454.45	787.2
103+325.00	211.99	0	5095.75	0
103+350.00	136.68	0	4357.95	0
103+375.00	119.2975	0	3199.4	0
103+400.00	135.235	0	3181.55	0
103+425.00	234.3195	0	4619.75	0
103+450.00	243.508	6.4	5972.95	80
103+475.00	458.0055	0	8768.6	80
103+500.00	495.5075	0	11918.7	0
103+525.00	526.83	28.208	12778.9	352
103+550.00	385.7895	30.464	11407.85	732.8
103+575.00	222.1475	3.536	7599	425.6
103+600.00	38.42	0	3257.2	44.8
103+625.00	51.1445	10.08	1119.45	126.4
103+650.00	62.3475	24.368	1418.65	430.4
103+675.00	82.5435	28.368	1811.35	659.2
103+700.00	84.796	33.088	2091.85	768
103+725.00	13.43	0	1228.25	414.4
103+750.00	0	23.744	168.3	296
103+775.00	0	50.416	0	926.4
103+800.00	0	55.568	0	1324.8
103+825.00	0	60.736	0	1454.4
103+850.00	0.663	67.36	8.5	1601.6
103+875.00	48.926	21.536	619.65	1112
103+900.00	105.298	6.592	1927.8	352
103+925.00	234.056	0	4242.35	81.6
103+950.00	517.1995	0	9390.8	0
103+975.00	639.761	0	14461.9	0
104+000.00	313.1655	0	11911.9	0
104+025.00	27.5995	0	4259.35	0
104+050.00	9.69	34.288	465.8	428.8
104+075.00	6.7065	8.192	204.85	531.2
104+100.00	11.067	0	221.85	102.4
104+125.00	21.5645	13.936	408	174.4
104+150.00	19.703	16.288	515.95	377.6
104+175.00	4.199	37.76	298.35	675.2
104+200.00	6.9445	0.416	139.4	476.8



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
104+225.00	3.4425	2.512	130.05	36.8
104+250.00	35.8105	0.08	490.45	32
104+275.00	13.447	0	615.4	1.6
104+300.00	21.199	0	432.65	0
104+325.00	11.2625	0	405.45	0
104+350.00	59.279	0	881.45	0
104+375.00	17.1785	2.464	955.4	30.4
104+400.00	16.2945	26.896	418.2	366.4
104+425.00	102.5185	0	1484.95	336
104+450.00	380.851	0	6041.8	0
104+475.00	444.7795	0	10320.7	0
104+500.00	132.7105	0	7218.2	0
104+525.00	45.0415	0	2221.9	0
104+550.00	26.2565	0.56	891.65	6.4
104+575.00	7.327	7.056	419.9	94.4
104+600.00	19.0825	0	329.8	88
104+625.00	6.732	25.36	323	316.8
104+650.00	11.866	32.832	232.9	728
104+675.00	24.9475	33.6	459.85	830.4
104+700.00	75.242	12.4	1252.05	574.4
104+725.00	138.295	8.992	2669	267.2
104+750.00	48.7475	0	2338.35	112
104+775.00	75.4885	0.272	1552.95	3.2
104+800.00	191.2585	0	3334.55	3.2
104+825.00	265.0045	0	5703.5	0
104+850.00	336.005	0	7512.3	0
104+875.00	296.157	0	7901.6	0
104+900.00	202.6825	0.704	6235.6	9.6
104+925.00	172.652	3.632	4692	54.4
104+950.00	436.7215	3.808	7616.85	92.8
104+975.00	365.823	1.504	10031.7	65.6
105+000.00	512.0315	0	10973.5	19.2
105+025.00	513.2725	0	12816.3	0
105+050.00	13.6935	1.072	6587.5	12.8
105+075.00	332.588	0	4328.2	12.8
105+100.00	446.301	0	9735.9	0
105+125.00	17.68	0	5799.55	0
105+150.00	113.1945	0	1636.25	0
105+175.00	108.8255	3.808	2775.25	48
105+200.00	158.015	0.192	3335.4	49.6
105+225.00	185.2405	0	4290.8	1.6
105+250.00	259.403	1.088	5558.15	14.4
105+275.00	231.9055	0.672	6141.25	22.4
105+300.00	44.71	1.04	3457.8	20.8
105+325.00	10.9905	0.08	696.15	14.4
105+350.00	6.1625	32.048	214.2	401.6
105+375.00	14.042	31.584	252.45	795.2
105+400.00	12.104	4.08	326.4	446.4
105+425.00	16.983	0	363.8	51.2
105+450.00	8.3725	6.816	317.05	84.8
105+475.00	107.2445	0.064	1445	86.4
105+500.00	183.702	44.288	3637.15	555.2
105+525.00	259.4625	0.64	5539.45	561.6
105+550.00	388.926	9.44	8104.75	126.4
105+575.00	582.4455	28.448	12142.25	473.6



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
105+600.00	389.827	0	12153.3	355.2
105+625.00	535.109	16.496	11561.7	206.4
105+650.00	394.009	0	11613.55	206.4
105+675.00	363.9955	0	9474.95	0
105+700.00	131.937	1.68	6199.05	20.8
105+725.00	183.4895	0.816	3943.15	30.4
105+750.00	236.368	8.048	5247.9	110.4
105+775.00	328.2445	22.496	7057.55	382.4
105+800.00	0.9605	26.032	4114.85	606.4
105+825.00	94.112	59.68	1188.3	1072
105+850.00	96.645	0	2384.25	745.6
105+875.00	200.5405	60.608	3714.5	756.8
105+900.00	358.343	0	6986.15	756.8
105+925.00	681.105	0	12993.1	0
105+950.00	976.0805	0	20714.5	0
105+975.00	1030.2595	88.992	25079.25	1112
106+000.00	930.733	34.608	24512.3	1545.6
106+025.00	664.598	11.808	19941.85	580.8
106+050.00	725.2285	2.72	17373.15	182.4
106+075.00	633.2585	0	16981.3	33.6
106+100.00	845.393	0	18483.25	0
106+125.00	1480.989	0	29079.35	0
106+150.00	826.3445	4.896	28841.35	60.8
106+175.00	402.1095	0	15356.1	60.8
106+200.00	256.071	0	8227.15	0
106+225.00	197.8375	0	5673.75	0
106+250.00	85.5865	0	3542.8	0
106+275.00	31.416	0	1462.85	0
106+300.00	28.9	0	753.95	0
106+325.00	14.3905	36.704	541.45	459.2
106+350.00	436.6705	5.84	5638.05	531.2
106+375.00	366.52	0	10040.2	73.6
106+400.00	408.969	0	9693.4	0
106+425.00	424.218	0	10415.05	0
106+450.00	414.579	0	10484.75	0
106+475.00	249.458	0	8300.25	0
106+500.00	126.5905	7.792	4700.5	97.6
106+525.00	94.911	0	2768.45	97.6
106+550.00	311.1425	0	5075.35	0
106+575.00	560.235	0	10891.9	0
106+600.00	148.546	0	8859.55	0
106+625.00	72.1055	0	2758.25	0
106+650.00	57.001	0	1614.15	0
106+675.00	84.9235	8.624	1773.95	107.2
106+700.00	104.397	0	2366.4	107.2
106+725.00	70.38	42.896	2184.5	536
106+750.00	104.652	27.824	2187.9	883.2
106+775.00	367.0895	0	5896.45	347.2
106+800.00	442.391	76.72	10118.4	958.4
106+825.00	626.8665	0	13365.4	958.4
106+850.00	351.543	12.992	12229.8	161.6
106+875.00	83.555	0	5438.3	161.6
106+900.00	47.5065	0	1637.95	0
106+925.00	33.932	0	1018.3	0
106+950.00	47.0815	0	1012.35	0



*[Handwritten signature]*

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
106+975.00	39.0745	0	1076.95	0
107+000.00	484.143	0	6539.9	0
107+025.00	540.3875	0	12806.95	0
107+050.00	472.464	0	12660.75	0
107+075.00	500.8455	0	12166.05	0
107+100.00	366.656	0	10843.45	0
107+125.00	203.6005	0.256	7128.1	3.2
107+150.00	309.434	4.88	6413.25	64
107+175.00	378.318	0	8596.9	60.8
107+200.00	219.3085	1.616	7470.65	20.8
107+225.00	496.2045	0	8943.7	20.8
107+250.00	478.2695	0	12180.5	0
107+275.00	374.442	0	10659	0
107+300.00	264.214	0	7983.2	0
107+325.00	263.6445	0	6598.55	0
107+350.00	385.798	0	8118.35	0
107+375.00	549.644	0	11693.45	0
107+400.00	439.8665	0	12369.2	0
107+425.00	197.9225	0	7972.15	0
107+450.00	76.092	0	3425.5	0
107+475.00	104.0995	0	2252.5	0
107+500.00	310.012	0	5176.5	0
107+525.00	604.724	0	11434.2	0
107+550.00	666.876	0	15895	0
107+575.00	638.571	0	16318.3	0
107+600.00	171.122	0	10120.95	0
107+625.00	464.2955	0	7942.4	0
107+650.00	709.886	0	14676.95	0
107+675.00	609.008	0	16486.6	0
107+700.00	787.542	0	17457.3	0
107+725.00	718.3265	4.592	18823.25	57.6
107+750.00	733.737	14.224	18150.9	235.2
107+775.00	846.906	60.8	19758.25	937.6
107+800.00	471.121	5.936	16475.55	833.6
107+825.00	144.5425	91.936	7695.9	1224
107+850.00	534.0805	0	8483	1148.8
107+875.00	683.349	0	15217.55	0
107+900.00	496.638	0	14750.05	0
107+925.00	364.956	68.096	10769.5	851.2
107+950.00	438.447	21.792	10042.75	1123.2
107+975.00	405.178	0	10545.1	272
108+000.00	35.2835	0	5505.45	0
108+025.00	38.2415	25.344	918.85	316.8
108+050.00	34.952	49.056	914.6	929.6
108+075.00	45.1605	43.376	1001.3	1155.2
108+100.00	56.3975	20.576	1269.9	800
108+125.00	67.5835	0	1549.55	257.6
108+150.00	60.4265	41.872	1599.7	523.2
108+175.00	118.915	0	2241.45	523.2
108+200.00	203.1925	0	4026.45	0
108+225.00	289.9095	10.736	6163.35	134.4
108+250.00	227.2475	0	6464.25	134.4
108+275.00	169.8895	0	4964	0
108+300.00	140.5305	4.16	3880.25	51.2
108+325.00	173.8505	16.656	3929.55	260.8



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Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
108+350.00	162.6645	0	4206.65	208
108+375.00	62.6365	57.904	2816.05	723.2
108+400.00	43.2055	158.416	1322.6	2704
108+425.00	79.22	0	1530	1980.8




Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
108+450.00	54.2215	44.032	1667.7	550.4
108+475.00	59.007	43.232	1415.25	1091.2
108+500.00	183.923	36.832	3036.2	1000
108+525.00	222.921	9.808	5085.55	582.4
108+550.00	356.898	0	7247.95	123.2
108+575.00	548.403	69.856	11316.05	873.6
108+600.00	459.068	90.048	12593.6	1998.4
108+625.00	396.7035	0	10697.25	1126.4
108+650.00	119.9775	37.76	6458.3	472
108+675.00	144.364	20.528	3303.95	728
108+700.00	89.0545	79.92	2918.05	1256
108+725.00	83.9035	0	2161.55	998.4
108+750.00	56.6865	12.928	1757.8	161.6
108+775.00	75.3695	0	1650.7	161.6
108+800.00	77.248	0	1907.4	0
108+825.00	67.371	0.032	1807.95	0
108+850.00	31.331	0	1233.35	0
108+875.00	41.718	0	912.9	0
108+900.00	70.448	0	1402.5	0
108+925.00	179.707	1.92	3127.15	24
108+950.00	114.087	1.056	3672	36.8
108+975.00	59.6275	12.416	2171.75	168
109+000.00	58.208	0	1473.05	155.2
109+025.00	44.404	29.328	1282.65	366.4
109+050.00	38.3095	47.504	1033.6	960
109+075.00	42.738	29.792	1013.2	966.4
109+100.00	28.6195	28.736	891.65	731.2
109+125.00	35.1305	6.736	796.45	443.2
109+150.00	57.0265	4.864	1151.75	145.6
109+175.00	113.322	43.568	2129.25	604.8
109+200.00	167.858	0	3514.75	544
109+225.00	226.644	0	4930.85	0
109+250.00	122.2045	0	4360.5	0
109+275.00	20.3575	0	1781.6	0
109+300.00	23.63	0	549.95	0
109+325.00	2.6605	85.856	328.95	1073.6
109+350.00	10.5145	9.072	164.9	1187.2
109+375.00	32.0875	0	532.95	113.6
109+400.00	21.692	0	672.35	0
109+425.00	9.7495	0	392.7	0
109+450.00	0.153	92.368	124.1	1155.2
109+475.00	0	204.864	1.7	3715.2
109+490.00	0	109.776	0	2360
<b>Total =</b>			<b>4,567,114</b>	<b>171,494</b>

Total Earthwork in cutting = 4567114.494 cum  
**Assume 20% total cutting Volume for Ordinary Rock Cutting=** 913422.8988 cum Bill No- 02, Sl. No- 7  
**Total earthwork in soil=** 3653691.595 cum Bill No- 02, Sl. No- 6  
**Total Earthwork in filling =** 171494.4 cum Bill No- 02, Sl. No- 2

Using 70% of cutting material for filling earthworks in embankment  
Earthwork used from Roadway Cutting Material= 2557584.12 cum  
So no Earthwork required for embankment const from borrowpit ::



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**Variable Declaration****Earthwork**

SI No	Variable Description	Variable	Dimension	Unit
1	Total Earthwork In Cutting	tot_cut	4567114.000	cum
2	Total Earthwork In Filling (Consider Only Embankment)	tot_fill	171494.000	cum
3	Percentage of Rock	per_rock	20.000	percent

### Extra Widening Summary

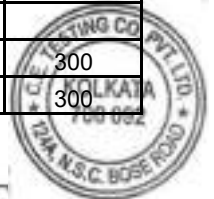
Total Length of 0.6m Extra Widening=	3670	m
Total Length of 0.9m Extra Widening=	3050	m
Total Length of 1.2m Extra Widening=	4682	m
Total Length of 1.5m Extra Widening=	2849	m
<b>Total Area of Extra Widening=</b>	<b>14840</b>	<b>Sqm</b>



## Calculation of Extra Widening on Flexible Pavement

Extra Widening  
For 0.6m EXTRA WIDENING  
Ch 75+000 to 87.350 Km

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	75501.459	75526.459	25	12.5	
691	Arc	75567.233	75625.796	58.563	58.563	300
	Transition	75685.041	75700.041	15	7.5	
692	Arc	75700.041	75750.142	50.101	50.101	125
	Transition	75750.142	75765.142	15	7.5	
	Transition	76196.168	76211.168	15	7.5	
696	Arc	76211.168	76240.286	29.118	29.118	200
	Transition	76240.286	76255.286	15	7.5	
	Transition	76682.256	76697.256	15	7.5	
699	Arc	76697.256	76738.096	40.84	40.84	200
	Transition	76738.096	76753.096	15	7.5	
	Transition	76956.507	76986.507	30	15	
701	Arc	76986.507	77006.787	20.28	20.28	150
	Transition	77006.787	77036.787	30	15	
	Transition	77065.718	77080.718	15	7.5	
702	Arc	77080.718	77093.013	12.294	12.294	200
	Transition	77093.013	77108.013	15	7.5	
	Transition	77259.271	77289.271	30	15	
704	Arc	77289.271	77309.424	20.152	20.152	150
	Transition	77309.424	77339.424	30	15	
	Transition	77449.94	77479.94	30	15	
705	Arc	77479.94	77503.6	23.66	23.66	150
	Transition	77503.6	77533.6	30	15	
	Transition	77871.745	77886.745	15	7.5	
709	Arc	77886.745	77923.277	36.532	36.532	300
	Transition	77923.277	77938.277	15	7.5	
	Transition	79189.708	79224.708	35	17.5	
719	Arc	79245.039	79278.571	33.532	33.532	300
	Transition	79316.694	79356.694	40	20	
	Transition	79991.52	80006.52	15	7.5	
724	Arc	80006.52	80016.299	9.779	9.779	150
	Transition	80016.299	80031.299	15	7.5	
	Transition	80759.825	80774.825	15	7.5	
731	Arc	80774.825	80795.298	20.474	20.474	150
	Transition	80795.298	80810.298	15	7.5	
732	Arc	80850.983	80879.384	28.401	28.401	300
	Transition	80969.489	81009.489	40	20	
	Transition	81050.086	81090.086	40	20	
734	Arc	81167.53	81240.079	72.549	72.549	300
735	Arc	81345.241	81359.26	14.02	14.02	300



*[Handwritten Signature]*

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	81529.77	81554.77	25	12.5	
	Transition	81657.168	81672.168	15	7.5	
737	Arc	81672.168	81765.355	93.187	93.187	125
	Transition	81765.355	81780.355	15	7.5	
	Transition	83807.335	83822.335	15	7.5	
755	Arc	83822.335	83839.624	17.289	17.289	150
	Transition	83839.624	83854.624	15	7.5	
	Transition	84252.392	84267.392	15	7.5	
758	Arc	84267.392	84347.944	80.552	80.552	125
	Transition	84347.944	84362.944	15	7.5	
	Transition	84640.95	84670.95	30	15	
761	Arc	84670.95	84700.544	29.593	29.593	300
	Transition	84700.544	84730.544	30	15	
	Transition	85206.545	85221.545	15	7.5	
763	Arc	85221.545	85231.117	9.572	9.572	125
	Transition	85231.117	85246.117	15	7.5	
	Transition	85255.214	85270.214	15	7.5	
764	Arc	85270.214	85308.038	37.824	37.824	150
	Transition	85308.038	85323.038	15	7.5	
	Transition	85456.554	85496.554	40	20	
766	Arc	85585.175	85634.779	49.605	49.605	300
	Transition	85651.153	85681.153	30	15	
	Transition	86219.374	86234.374	15	7.5	
772	Arc	86234.374	86249.645	15.271	15.271	150
	Transition	86249.645	86264.645	15	7.5	
773	Arc	86356.644	86382.817	26.173	26.173	300
	Transition	86469.598	86489.598	20	10	
	Transition	86736.258	86771.258	35	17.5	
777	Arc	86846.264	86882.848	36.584	36.584	300
778	Arc	87045.625	87109.019	63.394	63.394	300
	Transition	87257.86	87277.86	20	10	
<b>Total Length of 0.6m Extra Widening=</b>					<b>1419</b>	<b>m</b>



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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
<b>For 0.9m EXTRA WIDENING</b>						
	Transition	75023.786	75048.786	25	12.5	
	Transition	75222.727	75247.727	25	12.5	
687	Arc	75247.727	75277.054	29.327	29.327	80
	Transition	75277.054	75302.054	25	12.5	
	Transition	75463.701	75488.701	25	12.5	
690	Arc	75488.701	75501.459	12.758	12.758	100
	Transition	75501.459	75526.459	25	12.5	
	Transition	78000.441	78020.441	20	10	
710	Arc	78020.441	78081.214	60.774	60.774	100
	Transition	78081.214	78101.214	20	10	
	Transition	78391.61	78411.61	20	10	
713	Arc	78411.61	78422.056	10.446	10.446	100
	Transition	78422.056	78442.056	20	10	
	Transition	78667.321	78687.321	20	10	
715	Arc	78687.321	78718.049	30.728	30.728	100
	Transition	78718.049	78738.049	20	10	
	Transition	78959.887	78979.887	20	10	
717	Arc	78979.887	79060.81	80.924	80.924	100
	Transition	79060.81	79080.81	20	10	
	Transition	79686.548	79706.548	20	10	
722	Arc	79706.548	79733.367	26.819	26.819	100
	Transition	79733.367	79753.367	20	10	
	Transition	79821.977	79846.977	25	12.5	
723	Arc	79846.977	79857.428	10.451	10.451	80
	Transition	79857.428	79882.428	25	12.5	
	Transition	80069.579	80089.579	20	10	
725	Arc	80089.579	80103.228	13.648	13.648	100
	Transition	80103.228	80123.228	20	10	
	Transition	80278.585	80303.585	25	12.5	
727	Arc	80303.585	80312.475	8.89	8.89	80
	Transition	80312.475	80337.475	25	12.5	
	Transition	80500.302	80525.302	25	12.5	
729	Arc	80525.302	80540.618	15.316	15.316	80
	Transition	80540.618	80565.618	25	12.5	
	Transition	82102.759	82122.759	20	10	
741	Arc	82122.759	82141.043	18.284	18.284	100
	Transition	82141.043	82161.043	20	10	
	Transition	82189.52	82209.52	20	10	
742	Arc	82209.52	82244.453	34.933	34.933	100
	Transition	82244.453	82264.453	20	10	
	Transition	82351.017	82371.017	20	10	
743	Arc	82371.017	82396.73	25.713	25.713	100



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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	82396.73	82416.73	20	10	
	Transition	82451.439	82471.439	20	10	
744	Arc	82471.439	82482.932	11.494	11.494	100
	Transition	82482.932	82502.932	20	10	
	Transition	82623.474	82643.474	20	10	
745	Arc	82643.474	82648.606	5.132	5.132	100
	Transition	82648.606	82668.606	20	10	
	Transition	82881.634	82901.634	20	10	
748	Arc	82993.386	83016.617	23.23	23.23	100
	Transition	83047.66	83067.66	20	10	
	Transition	83259.313	83284.313	25	12.5	
751	Arc	83284.313	83298.059	13.746	13.746	80
	Transition	83298.059	83323.059	25	12.5	
	Transition	84387.138	84412.138	25	12.5	
759	Arc	84412.138	84426.839	14.7	14.7	80
	Transition	84426.839	84451.839	25	12.5	
	Transition	85943.465	85963.465	20	10	
770	Arc	85963.465	86012.899	49.434	49.434	100
	Transition	86012.899	86032.899	20	10	
	Transition	86105.664	86125.664	20	10	
771	Arc	86125.664	86149.358	23.695	23.695	100
	Transition	86149.358	86169.358	20	10	
	Transition	86469.598	86489.598	20	10	
774	Arc	86489.598	86517.377	27.779	27.779	100
	Transition	86517.377	86537.377	20	10	
	Transition	86627.029	86647.029	20	10	
775	Arc	86647.029	86662.011	14.982	14.982	100
	Transition	86662.011	86682.011	20	10	
	Transition	87257.86	87277.86	20	10	
779	Arc	87277.86	87281.712	3.852	3.852	100
	Transition	87281.712	87301.712	20	10	
<b>Total Length of 0.9m Extra Widening=</b>					<b>1095</b>	<b>m</b>



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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	75111.196	75151.196	40	20	
686	Arc	75151.196	75173.73	22.534	22.534	50
	Transition	75173.73	75213.73	40	20	
	Transition	75916.716	75951.716	35	17.5	
693	Arc	75951.716	75958.51	6.794	6.794	60
	Transition	75958.51	75993.51	35	17.5	
	Transition	76308.789	76338.789	30	15	
697	Arc	76338.789	76461.475	122.686	122.686	75
	Transition	76461.475	76491.475	30	15	
	Transition	76555.901	76595.901	40	20	
698	Arc	76595.901	76623.759	27.858	27.858	50
	Transition	76623.759	76663.759	40	20	
	Transition	76834.218	76874.218	40	20	
700	Arc	76874.218	76892.951	18.732	18.732	50
	Transition	76892.951	76932.951	40	20	
	Transition	77125.079	77160.079	35	17.5	
703	Arc	77160.079	77178.627	18.548	18.548	60
	Transition	77178.627	77213.627	35	17.5	
	Transition	77574.737	77614.737	40	20	
706	Arc	77614.737	77625.386	10.649	10.649	50
	Transition	77625.386	77665.386	40	20	
	Transition	77681.638	77716.638	35	17.5	
707	Arc	77716.638	77723.123	6.485	6.485	60
	Transition	77723.123	77758.123	35	17.5	
	Transition	77773.55	77803.55	30	15	
708	Arc	77803.55	77815.941	12.39	12.39	75
	Transition	77815.941	77845.941	30	15	
	Transition	78286.829	78306.829	20	10	
712	Arc	78306.829	78322.172	15.342	15.342	60
	Transition	78322.172	78342.172	20	10	
	Transition	78524.511	78564.511	40	20	
714	Arc	78564.511	78583.616	19.105	19.105	50
	Transition	78583.616	78623.616	40	20	
	Transition	78819.024	78859.024	40	20	
716	Arc	78859.024	78874.468	15.445	15.445	50
	Transition	78874.468	78914.468	40	20	
	Transition	79144.396	79179.396	35	17.5	
718	Arc	79179.396	79189.708	10.312	10.312	60
	Transition	79189.708	79224.708	35	17.5	
	Transition	79316.694	79356.694	40	20	
720	Arc	79356.694	79417.612	60.918	60.918	50
	Transition	79417.612	79457.612	40	20	
	Transition	79461.777	79501.777	40	20	



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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
721	Arc	79501.777	79587.849	86.072	86.072	50
	Transition	79587.849	79627.849	40	20	
	Transition	80645.176	80675.176	30	15	
730	Arc	80675.176	80700.455	25.279	25.279	75
	Transition	80700.455	80730.455	30	15	
	Transition	80969.489	81009.489	40	20	
733	Arc	81009.489	81050.086	40.597	40.597	50
	Transition	81050.086	81090.086	40	20	
	Transition	83156.221	83191.221	35	17.5	
750	Arc	83191.221	83204.295	13.074	13.074	60
	Transition	83204.295	83239.295	35	17.5	
	Transition	83351.349	83381.349	30	15	
752	Arc	83381.349	83428.045	46.696	46.696	70
	Transition	83428.045	83458.045	30	15	
	Transition	83539.681	83579.681	40	20	
753	Arc	83579.681	83588.037	8.356	8.356	50
	Transition	83588.037	83628.037	40	20	
	Transition	83635.128	83675.128	40	20	
754	Arc	83675.128	83689.879	14.752	14.752	50
	Transition	83689.879	83729.879	40	20	
	Transition	84119.215	84159.215	40	20	
757	Arc	84159.215	84205.579	46.364	46.364	50
	Transition	84205.579	84245.579	40	20	
	Transition	84488.422	84528.422	40	20	
760	Arc	84528.422	84540.545	12.124	12.124	50
	Transition	84540.545	84580.545	40	20	
	Transition	85409.009	85449.009	40	20	
765	Arc	85449.009	85456.554	7.545	7.545	50
	Transition	85456.554	85496.554	40	20	
	Transition	85856.993	85876.993	20	10	
769	Arc	85876.993	85907.309	30.317	30.317	60
	Transition	85907.309	85927.309	20	10	
	Transition	86695.069	86730.069	35	17.5	
776	Arc	86730.069	86736.258	6.188	6.188	60
	Transition	86736.258	86771.258	35	17.5	
Total Length of 1.2m Extra Widening=					<b>1635</b>	<b>m</b>



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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 1.5m EXTRA WIDENING

	Transition	75315.039	75345.039	30	15	
688	Arc	75345.039	75358.069	13.031	13.031	30
	Transition	75358.069	75388.069	30	15	
	Transition	75389.486	75419.486	30	15	
689	Arc	75419.486	75421.968	2.482	2.482	35
	Transition	75421.968	75451.968	30	15	
	Transition	75998.023	76028.023	30	15	
694	Arc	76028.023	76028.658	0.635	0.635	30
	Transition	76028.658	76058.658	30	15	
	Transition	76068.76	76103.76	35	17.5	
695	Arc	76103.76	76111.419	7.659	7.659	40
	Transition	76111.419	76146.419	35	17.5	
	Transition	78193.134	78223.134	30	15	
711	Arc	78223.134	78234.824	11.689	11.689	30
	Transition	78234.824	78264.824	30	15	
	Transition	80138.608	80168.608	30	15	
726	Arc	80168.608	80184.365	15.758	15.758	30
	Transition	80184.365	80214.365	30	15	
	Transition	80390.791	80420.791	30	15	
728	Arc	80420.791	80437.126	16.335	16.335	30
	Transition	80437.126	80467.126	30	15	
	Transition	81529.77	81554.77	25	12.5	
736	Arc	81554.77	81607.227	52.457	52.457	40
	Transition	81607.227	81632.227	25	12.5	
	Transition	81818.374	81843.374	25	12.5	
738	Arc	81843.374	81852.463	9.089	9.089	40
	Transition	81852.463	81877.463	25	12.5	
	Transition	81889.701	81909.701	20	10	
739	Arc	81909.701	81937.994	28.294	28.294	20
	Transition	81937.994	81957.994	20	10	
	Transition	81984.907	82004.907	20	10	
740	Arc	82004.907	82023.791	18.884	18.884	20
	Transition	82023.791	82043.791	20	10	
	Transition	82757.983	82777.983	20	10	
746	Arc	82777.983	82803.809	25.826	25.826	20
	Transition	82803.809	82823.809	20	10	
	Transition	82852.862	82872.862	20	10	
747	Arc	82872.862	82881.634	8.772	8.772	30
	Transition	82881.634	82901.634	20	10	
	Transition	83047.66	83067.66	20	10	
749	Arc	83067.66	83083.775	16.115	16.115	30
	Transition	83083.775	83103.775	20	10	
	Transition	83993.516	84018.516	25	12.5	



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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
756	Arc	84018.516	84048.522	30.006	30.006	25
	Transition	84048.522	84073.522	25	12.5	
	Transition	85651.153	85681.153	30	15	
767	Arc	85681.153	85697.161	16.008	16.008	30
	Transition	85697.161	85727.161	30	15	
	Transition	85749.827	85779.827	30	15	
768	Arc	85779.827	85790.302	10.475	10.475	30
	Transition	85790.302	85820.302	30	15	
	Transition	87313.696	87338.696	25	12.5	
780	Arc	87338.696	87371.169	32.473	32.473	25
<b>Total Length of 1.5m Extra Widening=</b>					<b>778</b>	<b>m</b>

Total Length of 0.6m Extra Widening= 1419 m  
 Total Length of 0.9m Extra Widening= 1095 m  
 Total Length of 1.2m Extra Widening= 1635 m  
 Total Length of 1.5m Extra Widening= 778 m  
**Total Area of Extra Widening= 4967 Sqm**



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Calculation of Extra Widening on Flexible Pavement

EXTRA WIDENING For 0.6m EXTRA WIDENING Ch 87.350 to 109.494 Km						
HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH	LENGTH OF EXTRA	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
773	Arc	86356.644	86382.817	26.173	26.173	300
	Transition	86469.598	86489.598	20	10	
	Transition	86736.258	86771.258	35	17.5	
777	Arc	86846.264	86882.848	36.584	36.584	300
778	Arc	87045.625	87109.019	63.394	63.394	300
	Transition	87257.86	87277.86	20	10	
	Transition	89581.623	89596.623	15	7.5	
795	Arc	89596.623	89689.049	92.426	92.426	200
	Transition	89689.049	89704.049	15	7.5	
	Transition	89774.748	89789.748	15	7.5	
796	Arc	89789.748	89840.957	51.209	51.209	150
	Transition	89840.957	89855.957	15	7.5	
	Transition	91016.212	91031.212	15	7.5	
804	Arc	91031.212	91053.029	21.818	21.818	200
	Transition	91053.029	91068.029	15	7.5	
	Transition	91226.408	91246.408	20	10	
805	Arc	91246.408	91310.082	63.674	63.674	200
	Transition	91310.082	91330.082	20	10	
	Transition	92135.785	92150.785	15	7.5	
810	Arc	92150.785	92164.194	13.409	13.409	125
	Transition	92164.194	92179.194	15	7.5	
	Transition	92289.357	92304.357	15	7.5	
812	Arc	92304.357	92338.81	34.453	34.453	150
	Transition	92338.81	92353.81	15	7.5	
	Transition	92473.978	92488.978	15	7.5	
813	Arc	92488.978	92501.788	12.81	12.81	150
	Transition	92501.788	92516.788	15	7.5	
	Transition	92581.01	92596.01	15	7.5	
814	Arc	92596.01	92612.65	16.64	16.64	150
	Transition	92612.65	92627.65	15	7.5	
	Transition	92733.337	92773.337	40	20	
816	Arc	92790.039	92808.522	18.483	18.483	300
	Transition	92842.047	92872.047	30	15	
	Transition	92902.049	92932.049	30	15	
818	Arc	92937.567	93014.517	76.949	76.949	170
	Transition	93047.05	93067.05	20	10	
	Transition	93149.969	93164.969	15	7.5	
820	Arc	93164.969	93297.046	132.077	132.077	200
	Transition	93297.046	93312.046	15	7.5	
	Transition	93321.865	93336.865	15	7.5	
821	Arc	93336.865	93358.62	21.755	21.755	125
	Transition	93358.62	93373.62	15	7.5	
	Transition	94186.979	94201.979	15	7.5	
830	Arc	94201.979	94219.077	17.098	17.098	150
	Transition	94219.077	94234.077	15	7.5	
	Transition	96503.08	96518.08	15	7.5	
849	Arc	96518.08	96533.942	15.863	15.863	125
	Transition	96533.942	96548.942	15	7.5	
	Transition	96598.305	96613.305	15	7.5	
850	Arc	96613.305	96625.473	12.168	12.168	200
	Transition	96625.473	96640.473	15	7.5	
	Transition	97124.592	97139.592	15	7.5	
855	Arc	97139.592	97148.351	8.759	8.759	125
	Transition	97148.351	97163.351	15	7.5	
	Transition	97359.414	97374.414	15	7.5	
858	Arc	97374.414	97385.91	11.496	11.496	125
	Transition	97385.91	97400.91	15	7.5	
	Transition	97674.522	97699.522	25	12.5	
862	Arc	97742.175	97776.846	34.671	34.671	300
	Transition	97898.415	97913.415	15	7.5	
863	Arc	97913.415	97956.355	42.94	42.94	150



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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH	LENGTH OF EXTRA	RADIUS (m)	
		CHAINAGE (m)	CHAINAGE (m)				
	Transition	97956.355	97971.355	15	7.5		
	Transition	98704.847	98724.847	20	10		
870	Arc	98909.451	98937.519	28.068	28.068	300	
	Transition	98978.057	99003.057	25	12.5		
	Transition	99446.045	99461.045	15	7.5		
875	Arc	99461.045	99483.017	21.972	21.972	150	
	Transition	99483.017	99498.017	15	7.5		
876	Arc	99532.479	99573.858	41.38	41.38	300	
	Transition	99677.372	99717.372	40	20		
	Transition	100203.125	100228.125	25	12.5		
880	Arc	100270.208	100342.733	72.525	72.525	300	
881	Arc	100452.764	100468.578	15.814	15.814	300	
882	Arc	100626.624	100692.525	65.902	65.902	300	
	Transition	100732.157	100747.157	15	7.5		
883	Arc	100747.157	100758.718	11.561	11.561	150	
	Transition	100758.718	100773.718	15	7.5		
884	Arc	100789.23	100873.041	83.812	83.812	300	
	Transition	100919.308	100939.308	20	10		
	Transition	104485.761	104500.761	15	7.5		
926	Arc	104500.761	104535.931	35.17	35.17	150	
	Transition	104535.931	104550.931	15	7.5		
	Transition	104815.816	104830.816	15	7.5		
928	Arc	104830.816	105007.523	176.707	176.707	225	
	Transition	105007.523	105022.523	15	7.5		
	Transition	105125.172	105160.172	35	17.5		
930	Arc	105229.589	105252.474	22.885	22.885	300	
	Transition	105373.552	105388.552	15	7.5		
931	Arc	105388.552	105493.522	104.97	104.97	125	
	Transition	105493.522	105508.522	15	7.5		
	Transition	105543.371	105558.371	15	7.5		
932	Arc	105558.371	105577.468	19.097	19.097	200	
	Transition	105577.468	105592.468	15	7.5		
	Transition	105825.3	105845.3	20	10		
935	Arc	105855.784	105880.56	24.776	24.776	170	
	Transition	105896.89	105911.89	15	7.5		
	Transition	106377.769	106397.769	20	10		
945	Arc	106430.101	106446.375	16.274	16.274	200	
	Transition	106479.033	106494.033	15	7.5		
	Transition	108670.402	108685.402	15	7.5		
989	Arc	108713.799	108729.505	15.706	15.706	200	
	Transition	108842.584	108862.584	20	10		
	Transition	109037.488	109052.488	15	7.5		
994	Arc	109071.979	109087.421	15.441	15.441	200	
	Transition	109102.503	109117.503	15	7.5		
	Transition	109191.764	109211.764	20	10		
997	Arc	109214.044	109245.682	31.638	31.638	170	
	Transition	109257.511	109277.511	20	10		
	Transition	109456.871	109471.871	15	7.5		
Total Length of 0.6m Extra Widening=						2251.047	m



*[Handwritten signature]*

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH	LENGTH OF EXTRA	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
For 0.9m EXTRA WIDENING						
	Transition	86469.598	86489.598	20	10	
774	Arc	86489.598	86517.377	27.779	27.779	100
	Transition	86517.377	86537.377	20	10	
	Transition	86627.029	86647.029	20	10	
775	Arc	86647.029	86662.011	14.982	14.982	100
	Transition	86662.011	86682.011	20	10	
	Transition	87257.86	87277.86	20	10	
779	Arc	87277.86	87281.712	3.852	3.852	100
	Transition	87281.712	87301.712	20	10	
	Transition	87646.457	87666.457	20	10	
782	Arc	87666.457	87691.569	25.111	25.111	100
	Transition	87691.569	87711.569	20	10	
	Transition	88052.403	88097.403	45	22.5	
784	Arc	88097.403	88102.469	5.066	5.066	100
	Transition	88102.469	88147.469	45	22.5	
	Transition	88316.411	88336.411	20	10	
786	Arc	88336.411	88349.49	13.079	13.079	100
	Transition	88349.49	88369.49	20	10	
	Transition	88726.087	88751.087	25	12.5	
789	Arc	88751.087	88793.575	42.488	42.488	90
	Transition	88793.575	88818.575	25	12.5	
	Transition	89079.583	89099.583	20	10	
791	Arc	89099.583	89131.069	31.486	31.486	100



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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH	LENGTH OF EXTRA	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	89131.069	89151.069	20	10	
	Transition	89933.816	89953.816	20	10	
797	Arc	89953.816	89979.142	25.327	25.327	100
	Transition	89979.142	89999.142	20	10	
	Transition	90497.716	90517.716	20	10	
802	Arc	90517.716	90550.17	32.454	32.454	100
	Transition	90550.17	90570.17	20	10	
	Transition	92188.455	92213.455	25	12.5	
811	Arc	92213.455	92226.244	12.789	12.789	80
	Transition	92226.244	92251.244	25	12.5	
	Transition	93585.014	93600.014	15	7.5	
824	Arc	93600.014	93631.22	31.206	10	100
	Transition	93631.22	93646.22	15	32.454	
	Transition	94474.271	94494.271	20	10	
832	Arc	94494.271	94520.476	26.205	12.5	100
	Transition	94520.476	94540.476	20	12.789	
	Transition	94555.285	94575.285	20	12.5	
833	Arc	94575.285	94598.357	23.073	7.5	100
	Transition	94598.357	94618.357	20	31.206	
	Transition	94677.579	94697.579	20	7.5	
834	Arc	94697.579	94779.331	81.752	10	100
	Transition	94779.331	94799.331	20	26.205	
	Transition	95954.524	95969.524	15	10	
843	Arc	95969.524	95980.811	11.286	10	90
	Transition	95980.811	95995.811	15	23.073	
	Transition	96019.738	96034.738	15	10	
844	Arc	96034.738	96040.309	5.571	10	80
	Transition	96040.309	96055.309	15	81.752	
	Transition	96825.408	96845.408	20	10	
852	Arc	96845.408	96895.971	50.563	7.5	100
	Transition	96895.971	96915.971	20	11.286	
	Transition	96973.407	96993.407	20	7.5	
853	Arc	96993.407	97000.951	7.544	7.5	100
	Transition	97000.951	97020.951	20	5.571	
	Transition	97031.437	97056.437	25	7.5	
854	Arc	97056.437	97063.482	7.045	10	80
	Transition	97063.482	97088.482	25	50.563	
	Transition	97177.681	97202.681	25	10	
856	Arc	97202.681	97206.607	3.926	10	80
	Transition	97206.607	97231.607	25	7.544	
	Transition	97541.831	97566.831	25	10	
860	Arc	97566.831	97593.067	26.236	12.5	80
	Transition	97593.067	97618.067	25	7.045	
	Transition	97624.781	97649.781	25	12.5	
861	Arc	97649.781	97674.522	24.741	12.5	80



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HIP/CURVE NO.	ELEMENT	START		END		RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)	CHORD LENGTH	LENGTH OF EXTRA	
	Transition	97674.522	97699.522	25	3.926	
	Transition	98203.135	98223.135	20	12.5	
866	Arc	98223.135	98242.465	19.331	12.5	100
	Transition	98242.465	98262.465	20	26.236	
	Transition	98662.138	98682.138	20	12.5	
869	Arc	98682.138	98704.847	22.709	12.5	100
	Transition	98704.847	98724.847	20	24.741	
	Transition	98978.057	99003.057	25	12.5	
871	Arc	99003.057	99012.273	9.216	10	80
	Transition	99012.273	99037.273	25	19.331	
	Transition	99118.414	99138.414	20	10	
872	Arc	99138.414	99155.54	17.126	10	100
	Transition	99155.54	99175.54	20	22.709	
	Transition	99236.6	99256.6	20	10	
873	Arc	99256.6	99312.544	55.943	12.5	100
	Transition	99312.544	99332.544	20	9.216	
	Transition	99350.555	99370.555	20	12.5	
874	Arc	99370.555	99376.962	6.406	10	100
	Transition	99376.962	99396.962	20	17.126	
	Transition	100153.02	100178.02	25	10	
879	Arc	100178.02	100203.125	25.105	10	80
	Transition	100203.125	100228.125	25	55.943	
	Transition	101666.375	101681.375	15	10	
893	Arc	101681.375	101691.724	10.348	10	80
	Transition	101691.724	101706.724	15	6.406	
900	Arc	102181.24	102195.658	14.418	10	80
	Transition	102275.136	102290.136	15	12.5	
902	Arc	102290.136	102296.094	5.958	25.105	100
	Transition	102296.094	102311.094	15	12.5	
	Transition	102433.439	102448.439	15	7.5	
904	Arc	102448.439	102455.772	7.333	10.348	80
	Transition	102455.772	102470.772	15	7.5	
	Transition	103235.334	103250.334	15	14.418	
914	Arc	103250.334	103252.048	1.713	7.5	100
	Transition	103252.048	103267.048	15	5.958	
	Transition	103272.624	103287.624	15	7.5	
915	Arc	103287.624	103296.799	9.174	7.5	80
	Transition	103296.799	103311.799	15	7.333	
	Transition	103731.192	103751.192	20	7.5	
920	Arc	103751.192	103757.516	6.324	7.5	100
	Transition	103757.516	103777.516	20	1.713	
	Transition	103858.867	103883.867	25	7.5	
922	Arc	103933.335	103960.052	26.717	7.5	100
	Transition	103971.928	103991.928	20	9.174	
	Transition	105984.144	105999.144	15	7.5	
938	Arc	105999.144	106003.574	4.43	10	100
	Transition	106003.574	106018.574	15	6.324	
	Transition	106629.628	106644.628	15	10	
949	Arc	106644.628	106654.684	10.056	12.5	100
	Transition	106654.684	106669.684	15	26.717	
953	Arc	106873.848	106897.425	23.577	10	80
958	Arc	107069.053	107080.664	11.611	7.5	80
959	Arc	107090.571	107121.633	31.062	4.43	80
960	Arc	107128.307	107149.766	21.459	7.5	80
963	Arc	107289.327	107316.742	27.415	7.5	80
964	Arc	107319.697	107351.191	31.494	10.056	80
	Transition	107916.571	107931.571	15	7.5	
975	Arc	107931.571	107937.598	6.027	23.577	80
	Transition	107937.598	107952.598	15	11.611	
977	Arc	108016.636	108035.111	18.475	31.062	80
981	Arc	108237.391	108253.894	16.503	21.459	80
983	Arc	108357.202	108365.952	8.75	27.415	100
984	Arc	108383.166	108410.607	27.441	31.494	80
	Transition	108522.687	108537.687	15	7.5	
986	Arc	108537.687	108543.364	5.677	6.027	80
	Transition	108543.364	108558.364	15	7.5	
	Transition	108902.029	108917.029	15	18.475	
991	Arc	108917.029	108924.356	7.327	16.503	80
	Transition	108924.356	108939.356	15	8.75	
	Transition	109102.503	109117.503	15	27.441	
995	Arc	109117.503	109125.458	7.956	7.5	80
	Transition	109125.458	109140.458	15	5.677	
	Transition	109431.945	109446.945	15	7.5	
1000	Arc	109446.945	109456.871	9.926	7.5	100
	Transition	109456.871	109471.871	15	7.327	

Total Length of 0.9m Extra Widening=

1955.429



HIP/CURVE NO.	ELEMENT	START	END			RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)	CHORD LENGTH	LENGTH OF EXTRA	
For 1.2m EXTRA WIDENING						
	Transition	86695.069	86730.069	35	17.5	
776	Arc	86730.069	86736.258	6.188	6.188	60
	Transition	86736.258	86771.258	35	17.5	
	Transition	87430.953	87465.953	35	17.5	
781	Arc	87465.953	87478.558	12.605	12.605	60
	Transition	87478.558	87513.558	35	17.5	
	Transition	87820.446	87855.446	35	17.5	
783	Arc	87855.446	87872.913	17.467	17.467	60
	Transition	87872.913	87907.913	35	17.5	
	Transition	88165.554	88195.554	30	15	
785	Arc	88195.554	88244.909	49.355	49.355	70
	Transition	88244.909	88274.909	30	15	
	Transition	88473.791	88503.791	30	15	
787	Arc	88503.791	88536.67	32.879	32.879	70
	Transition	88536.67	88566.67	30	15	
	Transition	88607.906	88647.906	40	20	
788	Arc	88647.906	88664.823	16.918	16.918	50
	Transition	88664.823	88704.823	40	20	
	Transition	88988.927	89023.927	35	17.5	
790	Arc	89023.927	89036.626	12.7	12.7	60
	Transition	89036.626	89071.626	35	17.5	
	Transition	89156.472	89176.472	20	10	
792	Arc	89176.472	89190.147	13.675	13.675	60
	Transition	89190.147	89210.147	20	10	
	Transition	89348.519	89383.519	35	17.5	
794	Arc	89383.519	89387.559	4.04	4.04	60
	Transition	89387.559	89422.559	35	17.5	
	Transition	91379.366	91419.366	40	20	
806	Arc	91419.366	91430.886	11.52	11.52	50
	Transition	91430.886	91470.886	40	20	
	Transition	91486.911	91521.911	35	17.5	
807	Arc	91521.911	91543.117	21.206	21.206	60
	Transition	91543.117	91578.117	35	17.5	
	Transition	91973.988	92003.988	30	15	
809	Arc	92003.988	92023.258	19.27	19.27	70
	Transition	92023.258	92053.258	30	15	
	Transition	92669.902	92709.902	40	20	
815	Arc	92709.902	92733.337	23.435	23.435	50
	Transition	92733.337	92773.337	40	20	
	Transition	93378.962	93398.962	20	10	
822	Arc	93398.962	93495.72	96.758	96.758	60
	Transition	93495.72	93515.72	20	10	
	Transition	93526.642	93546.642	20	10	
823	Arc	93546.642	93556.036	9.394	9.394	50
	Transition	93556.036	93576.036	20	10	
	Transition	93683.191	93703.191	20	10	
825	Arc	93703.191	93720.338	17.147	17.147	50
	Transition	93720.338	93740.338	20	10	
	Transition	94004.375	94024.375	20	10	
829	Arc	94024.375	94091.269	66.894	66.894	55
	Transition	94091.269	94111.269	20	10	
	Transition	94247.445	94282.445	35	17.5	
831	Arc	94282.445	94303.313	20.868	20.868	60
	Transition	94303.313	94338.313	35	17.5	
	Transition	94910.216	94940.216	30	15	
835	Arc	94940.216	94973.974	33.758	33.758	75
	Transition	94973.974	95003.974	30	15	
	Transition	95025.073	95055.073	30	15	
836	Arc	95055.073	95097.751	42.679	42.679	75
	Transition	95097.751	95127.751	30	15	
	Transition	95201.386	95231.386	30	15	
837	Arc	95231.386	95271.156	39.769	39.769	75
	Transition	95271.156	95301.156	30	15	
	Transition	95319.899	95359.899	40	20	
838	Arc	95359.899	95379.785	19.886	19.886	50
	Transition	95379.785	95419.785	40	20	
	Transition	95441.869	95481.869	40	20	
839	Arc	95481.869	95490.486	8.618	8.618	50
	Transition	95490.486	95530.486	40	20	
	Transition	95577.895	95607.895	30	15	
840	Arc	95607.895	95713.558	105.663	105.663	72
	Transition	95713.558	95743.558	30	15	
	Transition	95803.38	95823.38	20	10	
841	Arc	95823.38	95835.745	12.365	12.365	60
	Transition	95835.745	95855.745	20	10	
	Transition	96326.363	96361.363	35	17.5	
848	Arc	96361.363	96434.802	73.439	73.439	60



*Handwritten signature/initials*

HIP/CURVE NO.	ELEMENT	START		END		RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)	CHORD LENGTH	LENGTH OF EXTRA	
	Transition	96434.802	96469.802	35	17.5	
	Transition	96667.381	96707.381	40	20	
851	Arc	96707.381	96721.317	13.935	13.935	50
	Transition	96721.317	96761.317	40	20	
	Transition	97238.619	97278.619	40	20	
857	Arc	97278.619	97300.055	21.436	21.436	50
	Transition	97300.055	97340.055	40	20	
	Transition	97418.687	97458.687	40	20	
859	Arc	97458.687	97493.851	35.164	35.164	50
	Transition	97493.851	97533.851	40	20	
	Transition	98301.619	98341.619	40	20	
867	Arc	98341.619	98376.426	34.807	34.807	50
	Transition	98376.426	98416.426	40	20	
	Transition	98463.605	98503.605	40	20	
868	Arc	98503.605	98507	3.395	3.395	50
	Transition	98507	98547	40	20	
	Transition	99677.372	99717.372	40	20	
877	Arc	99717.372	99754.391	37.02	37.02	50
	Transition	99754.391	99794.391	40	20	
	Transition	99864.238	99894.238	30	15	
878	Arc	99894.238	99981.275	87.037	87.037	75
	Transition	99981.275	100011.275	30	15	
	Transition	101025.495	101045.495	20	10	
886	Arc	101045.495	101063.161	17.666	17.666	50
	Transition	101063.161	101083.161	20	10	
	Transition	101122.198	101137.198	15	7.5	
887	Arc	101137.198	101149.99	12.792	12.792	70
	Transition	101149.99	101164.99	15	7.5	
	Transition	101185.777	101215.777	30	15	
888	Arc	101215.777	101226.283	10.506	10.506	70
	Transition	101226.283	101256.283	30	15	
	Transition	101282.585	101302.585	20	10	
889	Arc	101302.585	101342.956	40.371	40.371	50
	Transition	101342.956	101362.956	20	10	
	Transition	101374.243	101399.243	25	12.5	
890	Arc	101399.243	101422.056	22.813	22.813	50
	Transition	101422.056	101447.056	25	12.5	
	Transition	102200.802	102220.802	20	10	
901	Arc	102220.802	102228.209	7.407	7.407	50
	Transition	102228.209	102248.209	20	10	
	Transition	103045.108	103060.108	15	7.5	
912	Arc	103060.108	103061.867	1.759	1.759	50
	Transition	103061.867	103076.867	15	7.5	
	Transition	103101.005	103121.005	20	10	
913	Arc	103121.005	103126.932	5.928	5.928	50
	Transition	103126.932	103146.932	20	10	
	Transition	103363.787	103383.787	20	10	
916	Arc	103383.787	103390.509	6.722	6.722	50
	Transition	103390.509	103410.509	20	10	
	Transition	103501.261	103516.261	15	7.5	
918	Arc	103516.261	103519.809	3.548	3.548	50
	Transition	103519.809	103534.809	15	7.5	
	Transition	103828.086	103853.086	25	12.5	
921	Arc	103853.086	103858.867	5.78	5.78	50
	Transition	103858.867	103883.867	25	12.5	
	Transition	104361.974	104401.974	40	20	
925	Arc	104401.974	104414.954	12.98	12.98	50
	Transition	104414.954	104454.954	40	20	
	Transition	104629.898	104664.898	35	17.5	
927	Arc	104664.898	104715.588	50.69	50.69	60
	Transition	104715.588	104750.588	35	17.5	
	Transition	105051.998	105086.998	35	17.5	
929	Arc	105086.998	105125.172	38.174	38.174	60
	Transition	105125.172	105160.172	35	17.5	
	Transition	105742.577	105762.577	20	10	
933	Arc	105762.577	105767.268	4.691	4.691	50
	Transition	105767.268	105787.268	20	10	
	Transition	105792.059	105812.059	20	10	
934	Arc	105812.059	105825.3	13.24	13.24	50
	Transition	105825.3	105845.3	20	10	
	Transition	105896.89	105911.89	15	7.5	
936	Arc	105911.89	105914.589	2.699	2.699	65
	Transition	105914.589	105929.589	15	7.5	
	Transition	105935.248	105950.248	15	7.5	
937	Arc	105950.248	105951.419	1.17	1.17	65
	Transition	105951.419	105966.419	15	7.5	
	Transition	106298.844	106318.844	20	10	
943	Arc	106318.844	106322.339	3.495	3.495	50



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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH	LENGTH OF EXTRA	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	106322.339	106342.339	20	10	
	Transition	106349.764	106369.764	20	10	
944	Arc	106369.764	106377.769	8.005	8.005	50
	Transition	106377.769	106397.769	20	10	
	Transition	106754.723	106774.723	20	10	
951	Arc	106774.723	106782.871	8.148	8.148	50
	Transition	106782.871	106802.871	20	10	
	Transition	107830.384	107845.384	15	7.5	
973	Arc	107845.384	107847.308	1.924	1.924	50
	Transition	107847.308	107862.308	15	7.5	
	Transition	107956.351	107976.351	20	10	
976	Arc	107976.351	107985.335	8.984	8.984	50
	Transition	107985.335	108005.335	20	10	
	Transition	108042.138	108057.138	15	7.5	
978	Arc	108057.138	108063.169	6.031	6.031	50
	Transition	108063.169	108078.169	15	7.5	
	Transition	108134.857	108149.857	15	7.5	
979	Arc	108149.857	108159.972	10.115	10.115	70
	Transition	108159.972	108174.972	15	7.5	
	Transition	108842.584	108862.584	20	10	
990	Arc	108862.584	108869.915	7.33	7.33	50
	Transition	108869.915	108889.915	20	10	
	Transition	109164.037	109184.037	20	10	
996	Arc	109184.037	109191.764	7.726	7.726	50
	Transition	109191.764	109211.764	20	10	
	Transition	109257.511	109277.511	20	10	
998	Arc	109277.511	109284.8	7.288	7.288	50
	Transition	109284.8	109304.8	20	10	
	Transition	109352.027	109367.027	15	7.5	
999	Arc	109367.027	109369.586	2.559	2.559	70
	Transition	109369.586	109384.586	15	7.5	
	Transition	109591.351	109611.351	20	10	

Total Length of 1.2m Extra Widening=

3046.831 m



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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH	LENGTH OF EXTRA	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
For 1.5m EXTRA WIDENING						
	Transition	87313.696	87338.696	25	12.5	
780	Arc	87338.696	87371.169	32.473	32.473	25
	Transition	87371.169	87396.169	25	12.5	
	Transition	89226.201	89251.201	25	12.5	
793	Arc	89251.201	89280.234	29.033	29.033	40
	Transition	89280.234	89305.234	25	12.5	
	Transition	90045.087	90070.087	25	12.5	
798	Arc	90070.087	90084.473	14.386	14.386	40
	Transition	90084.473	90109.473	25	12.5	
	Transition	90123.349	90143.349	20	10	
799	Arc	90143.349	90158.483	15.134	15.134	30
	Transition	90158.483	90178.483	20	10	
	Transition	90197.891	90227.891	30	15	
800	Arc	90227.891	90234.081	6.19	6.19	30
	Transition	90234.081	90264.081	30	15	
	Transition	90302.854	90332.854	30	15	
801	Arc	90332.854	90349.097	16.243	16.243	30
	Transition	90349.097	90379.097	30	15	
	Transition	92842.047	92872.047	30	15	
817	Arc	92872.047	92902.049	30.001	30.001	35
	Transition	92902.049	92932.049	30	15	
	Transition	93047.05	93067.05	20	10	
819	Arc	93067.05	93100.462	33.412	33.412	20
	Transition	93100.462	93120.462	20	10	
	Transition	93807.196	93832.196	25	12.5	
826	Arc	93832.196	93837.216	5.02	5.02	40
	Transition	93837.216	93862.216	25	12.5	
	Transition	93879.252	93904.252	25	12.5	
827	Arc	93904.252	93913.421	9.169	9.169	40
	Transition	93913.421	93938.421	25	12.5	
	Transition	93942.137	93972.137	30	15	
828	Arc	93972.137	93973.725	1.588	1.588	30
	Transition	93973.725	94003.725	30	15	
	Transition	95864.394	95889.394	25	12.5	
842	Arc	95889.394	95903.962	14.568	14.568	40
	Transition	95903.962	95928.962	25	12.5	
	Transition	96062.318	96082.318	20	10	
845	Arc	96082.318	96093.92	11.601	11.601	20
	Transition	96093.92	96113.92	20	10	
	Transition	96126.472	96146.472	20	10	
846	Arc	96146.472	96173.376	26.904	26.904	20
	Transition	96173.376	96193.376	20	10	
	Transition	96228.603	96248.603	20	10	
847	Arc	96248.603	96265.25	16.647	16.647	20
	Transition	96265.25	96285.25	20	10	
	Transition	98011.706	98041.706	30	15	
864	Arc	98041.706	98044.088	2.382	2.382	30
	Transition	98044.088	98074.088	30	15	
	Transition	98097.717	98122.717	25	12.5	
865	Arc	98122.717	98128.917	6.2	6.2	40
	Transition	98128.917	98153.917	25	12.5	
	Transition	100919.308	100939.308	20	10	
885	Arc	100939.308	100964.003	24.695	24.695	15



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HIP/CURVE NO.	ELEMENT	START		END		RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)	CHORD LENGTH	LENGTH OF EXTRA	
	Transition	100964.003	100984.003	20	10	
	Transition	101477.596	101497.596	20	10	
891	Arc	101497.596	101532.168	34.572	34.572	20
	Transition	101532.168	101552.168	20	10	
	Transition	101597.209	101617.209	20	10	
892	Arc	101617.209	101631.466	14.257	14.257	20
	Transition	101631.466	101651.466	20	10	
	Transition	101757.324	101772.324	15	7.5	
894	Arc	101772.324	101791.634	19.31	19.31	40
	Transition	101791.634	101806.634	15	7.5	
	Transition	101863.187	101878.187	15	7.5	
895	Arc	101878.187	101916.779	38.591	38.591	40
	Transition	101916.779	101931.779	15	7.5	
	Transition	101960.076	101975.076	15	7.5	
896	Arc	101975.076	101987.217	12.141	12.141	30
	Transition	101987.217	102002.217	15	7.5	
	Transition	102014.553	102029.553	15	7.5	
897	Arc	102029.553	102043.837	14.284	14.284	30
	Transition	102043.837	102058.837	15	7.5	
	Transition	102081.057	102096.057	15	7.5	
898	Arc	102096.057	102103.875	7.818	7.818	15
	Transition	102103.875	102118.875	15	7.5	
	Transition	102121.855	102136.855	15	7.5	
899	Arc	102136.855	102138.076	1.222	1.222	25
	Transition	102138.076	102153.076	15	7.5	
	Transition	102332.011	102357.011	25	12.5	
903	Arc	102357.011	102385.894	28.883	28.883	40
	Transition	102385.894	102410.894	25	12.5	
	Transition	102493.861	102508.861	15	7.5	
905	Arc	102508.861	102511.798	2.937	2.937	30
	Transition	102511.798	102526.798	15	7.5	
	Transition	102568.424	102583.424	15	7.5	
906	Arc	102583.424	102591.575	8.152	8.152	30
	Transition	102591.575	102606.575	15	7.5	
	Transition	102622.89	102637.89	15	7.5	
907	Arc	102637.89	102647.16	9.27	9.27	30
	Transition	102647.16	102662.16	15	7.5	
	Transition	102663.895	102678.895	15	7.5	
908	Arc	102678.895	102699.639	20.744	20.744	15
	Transition	102699.639	102714.639	15	7.5	
	Transition	102755.788	102770.788	15	7.5	
909	Arc	102770.788	102779.401	8.613	8.613	30
	Transition	102779.401	102794.401	15	7.5	
	Transition	102836.864	102854.864	18	9	
910	Arc	102854.864	102879.967	25.102	25.102	14
	Transition	102879.967	102897.967	18	9	
	Transition	102939.586	102954.586	15	7.5	
911	Arc	102954.586	102961.305	6.719	6.719	30
	Transition	102961.305	102976.305	15	7.5	
	Transition	103423.032	103448.032	25	12.5	
917	Arc	103448.032	103454.201	6.168	6.168	40
	Transition	103454.201	103479.201	25	12.5	



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HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH	LENGTH OF EXTRA	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	103573.608	103588.608	15	7.5	
919	Arc	103588.608	103625.855	37.246	37.246	17
	Transition	103625.855	103640.855	15	7.5	
	Transition	103971.928	103991.928	20	10	
923	Arc	103991.928	104033.26	41.331	41.331	20
	Transition	104033.26	104053.26	20	10	
	Transition	106072.591	106087.591	15	7.5	
939	Arc	106087.591	106089.846	2.256	2.256	25
	Transition	106089.846	106104.846	15	7.5	
	Transition	106109.49	106124.49	15	7.5	
940	Arc	106124.49	106128.341	3.852	3.852	25
	Transition	106128.341	106143.341	15	7.5	
	Transition	106147.414	106162.414	15	7.5	
941	Arc	106162.414	106164.434	2.02	2.02	40
	Transition	106164.434	106179.434	15	7.5	
	Transition	106256.38	106271.38	15	7.5	
942	Arc	106271.38	106275.899	4.519	4.519	30
	Transition	106275.899	106290.899	15	7.5	
	Transition	106479.033	106494.033	15	7.5	
946	Arc	106494.033	106499.701	5.668	5.668	40
	Transition	106499.701	106514.701	15	7.5	
	Transition	106515.47	106530.47	15	7.5	
947	Arc	106530.47	106532.175	1.705	1.705	40
	Transition	106532.175	106547.175	15	7.5	
	Transition	106547.799	106562.799	15	7.5	
948	Arc	106562.799	106562.893	0.094	0.094	20
	Transition	106562.893	106577.893	15	7.5	
	Transition	106698.234	106723.234	25	12.5	
950	Arc	106723.234	106724.316	1.082	1.082	40
	Transition	106724.316	106749.316	25	12.5	
	Transition	106831.718	106846.718	15	7.5	
952	Arc	106846.718	106847.766	1.048	1.048	30
	Transition	106847.766	106862.766	15	7.5	
	Transition	106910.304	106930.304	20	10	
954	Arc	106930.304	106931.858	1.554	1.554	20
	Transition	106931.858	106951.858	20	10	
	Transition	106955.669	106970.669	15	7.5	
955	Arc	106970.669	106972.173	1.504	1.504	30
	Transition	106972.173	106987.173	15	7.5	
	Transition	106988.308	107003.308	15	7.5	
956	Arc	107003.308	107005.79	2.482	2.482	20
	Transition	107005.79	107020.79	15	7.5	
	Transition	107029.911	107044.911	15	7.5	
957	Arc	107044.911	107047.225	2.314	2.314	25
	Transition	107047.225	107062.225	15	7.5	
	Transition	107169.977	107184.977	15	7.5	
961	Arc	107184.977	107191.479	6.501	6.501	40
	Transition	107191.479	107206.479	15	7.5	
	Transition	107213.857	107228.857	15	7.5	
962	Arc	107228.857	107238.243	9.386	9.386	30



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HIP/CURVE NO.	ELEMENT	START		END		RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)	CHORD LENGTH	LENGTH OF EXTRA	
	Transition	107238.243	107253.243	15	7.5	
	Transition	107376.439	107391.439	15	7.5	
965	Arc	107391.439	107393.253	1.814	1.814	15
	Transition	107393.253	107408.253	15	7.5	
	Transition	107413.94	107428.94	15	7.5	
966	Arc	107428.94	107430.138	1.198	1.198	25
	Transition	107430.138	107445.138	15	7.5	
	Transition	107522.314	107537.314	15	7.5	
967	Arc	107537.314	107552.65	15.336	15.336	15
	Transition	107552.65	107567.65	15	7.5	
	Transition	107573.424	107588.424	15	7.5	
968	Arc	107588.424	107601.752	13.328	13.328	15
	Transition	107601.752	107616.752	15	7.5	
	Transition	107619.095	107634.095	15	7.5	
969	Arc	107634.095	107637.303	3.209	3.209	18
	Transition	107637.303	107652.303	15	7.5	
	Transition	107661.025	107676.025	15	7.5	
970	Arc	107676.025	107676.678	0.653	0.653	30
	Transition	107676.678	107691.678	15	7.5	
	Transition	107708.573	107723.573	15	7.5	
971	Arc	107723.573	107733.392	9.819	9.819	14
	Transition	107733.392	107748.392	15	7.5	
	Transition	107761.439	107776.439	15	7.5	
972	Arc	107776.439	107802.112	25.673	25.673	15
	Transition	107802.112	107817.112	15	7.5	
	Transition	107864.858	107879.858	15	7.5	
974	Arc	107879.858	107893.246	13.388	13.388	14
	Transition	107893.246	107908.246	15	7.5	
	Transition	108198.486	108213.486	15	7.5	
980	Arc	108213.486	108217.116	3.629	3.629	40
	Transition	108217.116	108232.116	15	7.5	
	Transition	108296.487	108311.487	15	7.5	
982	Arc	108311.487	108322.789	11.303	11.303	30
	Transition	108322.789	108337.789	15	7.5	
	Transition	108434.469	108459.469	25	12.5	
985	Arc	108459.469	108460.84	1.371	1.371	40
	Transition	108460.84	108485.84	25	12.5	
	Transition	108609.914	108624.914	15	7.5	
987	Arc	108624.914	108629.429	4.515	4.515	40
	Transition	108629.429	108644.429	15	7.5	
	Transition	108649.394	108664.394	15	7.5	
988	Arc	108664.394	108670.402	6.007	6.007	40
	Transition	108670.402	108685.402	15	7.5	
	Transition	108963.66	108978.66	15	7.5	
992	Arc	108978.66	108988.656	9.996	9.996	30
	Transition	108988.656	109003.656	15	7.5	
	Transition	109017.222	109032.222	15	7.5	
993	Arc	109032.222	109037.488	5.266	5.266	40
	Transition	109037.488	109052.488	15	7.5	
	Transition	109692.889	109707.889	15	7.5	
<b>Total Length of 1.5m Extra Widening=</b>						2070.996 m

Total Length of 0.6m Extra Widening= 2251.047 m  
 Total Length of 0.9m Extra Widening= 1955.429 m  
 Total Length of 1.2m Extra Widening= 3046.831 m  
 Total Length of 1.5m Extra Widening= 2070.996 m  
 Total Area of Extra Widening= 9873.2055 Sqm



*Signature*

## Variable Declaration

## Extra Widening on Flexible Pavement

SI No	Variable Description	Variable	Dimension	Unit
1	Total Area of Extra Widening	ew_area	14840.000	Sqm
2	BC	bc	0.040	m
3	DBM	dbm	0.000	m
4	WMM-I	wmm1	0.150	m
5	WMM-II	wmm2	0.000	m
6	GSB	gsb	0.000	m
7	GSB percentage Re-use	gsb_per	67.500	percentage
8	CT subbase	cts	0.200	



## Triangular Drain

Chainage (m)		Length of CD (m)	Net Length(m)	TCS No.	Side
From	To				
75320	75430	2.7	107.3	TCS-9	Hill
75430	75515	3.96	81.04	TCS-4A	Hill
75515	75575	0	60	TCS-9	Hill
75640	75700	3.96	56.04	TCS-9	Hill
75775	75825	0	50	TCS-9	Hill
75875	75985	0	110	TCS-7	Hill
75985	76010	16.6	8.4	TCS-2A	Hill
76010	76125	0	115	TCS-7	Hill
76325	76400	0	75	TCS-9	Hill
76490	76600	2.7	107.3	TCS-4	Hill
76600	76975	3.96	371.04	TCS-2A	Hill
76975	77025	0	50	TCS-2A	Hill
77025	77130	0	105	TCS-2A	Hill
77130	77180	2.7	47.3	TCS-4A	Hill
77180	77280	0	100	TCS-7	Hill
77280	77310	3.96	26.04	TCS-4	Hill
77310	77380	0	70	TCS-7	Hill
77380	77420	0	40	TCS-2	Hill
77650	77700	0	50	TCS-4	Hill
77700	77950	2.6	247.4	TCS-2	Hill
77950	78000	0	50	TCS-4	Hill
78000	78050	2.6	47.4	TCS-2	Hill
78050	78100	0	50	TCS-7	Hill
78100	78170	0	70	TCS-9	Hill
78170	78400	5.3	224.7	TCS-2	Hill
78400	78450	2.6	47.4	TCS-4	Hill
78450	78500	0	50	TCS-2	Hill
78550	78920	2.6	367.4	TCS-2	Hill
78920	79030	2.7	107.3	TCS-7	Hill
79080	79110	0	30	TCS-7	Hill
79110	79280	2.6	167.4	TCS-2	Hill
79280	79480	0	200	TCS-19	Hill
79480	79550	0	70	TCS-11A	Hill
79550	79725	0	350	TCS-8	Both
79800	79990	0	380	TCS-8	Both
79990	80080	0	90	TCS-2A	Hill
80500	80560	0	60	TCS-2A	Hill
80560	80650	0	90	TCS-7	Hill
80700	80760	0	60	TCS-7	Hill
80760	81000	2.6	237.4	TCS-2	Hill
81000	81080	0	80	TCS-2A	Hill
81150	81380	5.3	224.7	TCS-2A	Hill
81380	81470	0	90	TCS-7	Hill
81470	81910	6.66	433.34	TCS-2	Hill
81910	81940	0	30	TCS-7	Hill
81940	82110	5.3	164.7	TCS-2	Hill
82220	82575	5.2	349.8	TCS-2	Hill
82575	82650	0	75	TCS-2A	Hill
82650	82960	5.3	304.7	TCS-2	Hill
82960	83100	2.7	137.3	TCS-7	Hill
83100	83570	5.4	464.6	TCS-2	Hill



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83570	83625	0	55	TCS-19	Hill
83625	83660	0	35	TCS-7	Hill
83660	83775	2.7	112.3	TCS-2	Hill
83775	83825	0	50	TCS-7	Hill
83825	84040	2.6	212.4	TCS-2	Hill
84040	84100	0	60	TCS-7	Hill
84100	84175	0	75	TCS-2	Hill
84550	84700	2.7	147.3	TCS-2A	Hill
84820	85300	5.2	474.8	TCS-4A	Hill
85600	85900	2.6	297.4	TCS-2A	Hill
85920	86130	5.3	204.7	TCS-2A	Hill
86230	86950	8	712	TCS-2	Hill
87000	87520	5.3	514.7	TCS-2	Hill
87600	87750	2.7	147.3	TCS-2	Hill
87750	88400	7.9	642.1	TCS-7	Hill
88400	88830	9.26	420.74	TCS-2	Hill
89130	89350	2.7	217.3	TCS-2	Hill
89350	89400	0	50	TCS-7	Hill
89400	89590	2.6	187.4	TCS-2	Hill
89650	89700	0	50	TCS-2	Hill
89700	89800	3.96	96.04	TCS-7	Hill
89800	89950	2.7	147.3	TCS-2	Hill
89950	90000	2.6	47.4	TCS-19	Hill
90000	90300	5.3	294.7	TCS-7	Hill
90300	90450	2.6	147.4	TCS-2	Hill
90500	90570	3.96	66.04	TCS-2	Hill
90570	90660	0	90	TCS-7	Hill
90660	90750	0	90	TCS-2	Hill
90800	90850	0	50	TCS-2	Hill
91100	91120	0	20	TCS-2	Hill
91120	91180	0	60	TCS-7	Hill
91180	91240	2.7	57.3	TCS-2	Hill
91240	91320	0	80	TCS-7	Hill
91320	91410	2.7	87.3	TCS-2	Hill
91410	91470	0	60	TCS-7	Hill
91470	91540	0	70	TCS-2	Hill
91540	91625	0	85	TCS-19	Hill
91625	91700	2.7	72.3	TCS-7	Hill
91700	91900	2.7	197.3	TCS-2	Hill
91900	91975	0	150	TCS-8	Both
91975	92375	7.92	392.08	TCS-7	Hill
92375	92425	0	100	TCS-8	Both
92425	92720	2.7	292.3	TCS-7	Hill
92720	92770	2.7	47.3	TCS-2	Hill
92770	92850	0	80	TCS-7	Hill
92850	93440	10.5	579.5	TCS-2	Hill
93440	93580	0	140	TCS-7	Hill
93580	93660	2.7	77.3	TCS-2	Hill
93660	94020	5.3	354.7	TCS-7	Hill
94020	94290	5.4	264.6	TCS-2	Hill
94290	94380	2.6	87.4	TCS-7	Hill
94380	94480	0	100	TCS-4	Hill
94480	94800	8	312	TCS-7	Hill
94800	94930	2.7	127.3	TCS-2	Hill
94930	95060	0	130	TCS-7	Hill



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95140	95250	6.14	103.86	TCS-2	Hill
95250	95350	0	100	TCS-7	Hill
95350	95830	13.2	466.8	TCS-2	Hill
95830	95960	3.96	126.04	TCS-7	Hill
95960	96750	9.16	780.84	TCS-2	Hill
98160	98230	0	140	TCS-8	Both
98230	98400	0	340	TCS-6A	Both
98400	98460	0	120	TCS-8	Both
99680	99740	0	60	TCS-7	Hill
99740	99760	0	20	TCS-2A	Hill
99760	100230	8.1	461.9	TCS-7	Hill
100230	100340	5.3	104.7	TCS-2A	Hill
100340	100400	0	120	TCS-8	Both
100400	100975	5.3	1139.4	TCS-6A	Both
100975	101425	5.3	444.7	TCS-2A	Hill
101425	101525	0	200	TCS-6A	Both
101940	102020	0	80	TCS-7	Hill
102020	102070	0	50	TCS-9	Hill
102070	102200	2.7	127.3	TCS-7	Hill
102200	102500	0	600	TCS-8	Both
102500	102675	2.7	172.3	TCS-19	Hill
103075	103250	0	175	TCS-7	Hill
103250	103600	2.7	347.3	TCS-19	Hill
103600	103650	0	100	TCS-6A	Both
103650	103800	0	150	TCS-2A	Hill
103800	103860	0	60	TCS-2A	Hill
103860	103925	0	65	TCS-7	Hill
103925	104000	0	75	TCS-19	Hill
104000	104050	0	50	TCS-7	Hill
104050	104250	2.6	197.4	TCS-2	Hill
104250	104400	2.7	147.3	TCS-7	Hill
104400	104510	2.6	107.4	TCS-19	Hill
104510	104670	2.7	157.3	TCS-2A	Hill
104670	104740	0	70	TCS-7	Hill
104740	104820	0	80	TCS-2A	Hill
104820	105260	3.96	436.04	TCS-7	Hill
105260	105325	0	65	TCS-2A	Hill
107910	107975	0	65	TCS-7	Hill
107975	109175	8	1192	TCS-9	Hill
109175	109275	0	200	TCS-8	Both
109275	109325	2.7	47.3	TCS-7	Hill
109325	109494	66.5	102.5	TCS-9	Hill

Total = 26345.38



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## Catchwater Drain

Chainage (m)		Length of CD	Net Length(m)
From	To		
76200	76325	0	125
76400	76490	2.7	87.3
77420	77470	0	50
77470	77650	5.2	174.8
78500	78550	0	50
79030	79080	0	50
79280	79480	0	200
79480	79550	0	70
79725	79800	0	75
80400	80500	2.6	97.4
80650	80700	2.7	47.3
81080	81150	2.6	67.4
82110	82220	5.2	104.8
83570	83625	0	55
84175	84500	2.6	322.4
84500	84550	0	50
84700	84820	0	120
85300	85370	0	70
85550	85600	2.7	47.3
85900	85920	0	20
86130	86230	0	100
86950	87000	0	50
87520	87600	0	80
88830	89130	0	300
89590	89650	2.6	57.4
89950	90000	2.6	47.4
90450	90500	0	50
90750	90800	2.6	47.4
90850	91100	2.6	247.4
91540	91625	0	85
95060	95140	3.96	76.04
96750	97000	0	250
97000	97050	0	50
102500	102675	2.7	172.3
102675	103075	5.4	394.6
103250	103600	2.7	347.3
103925	104000	0	75
104400	104510	2.6	107.4
105325	105860	8	527
105860	107910	7.9	2042.1
Total =			6990.04

Total Length of Triangular Drain = 33335 m

Chute Drain (of avg 8 m height @ 50m Interval) 1118 m



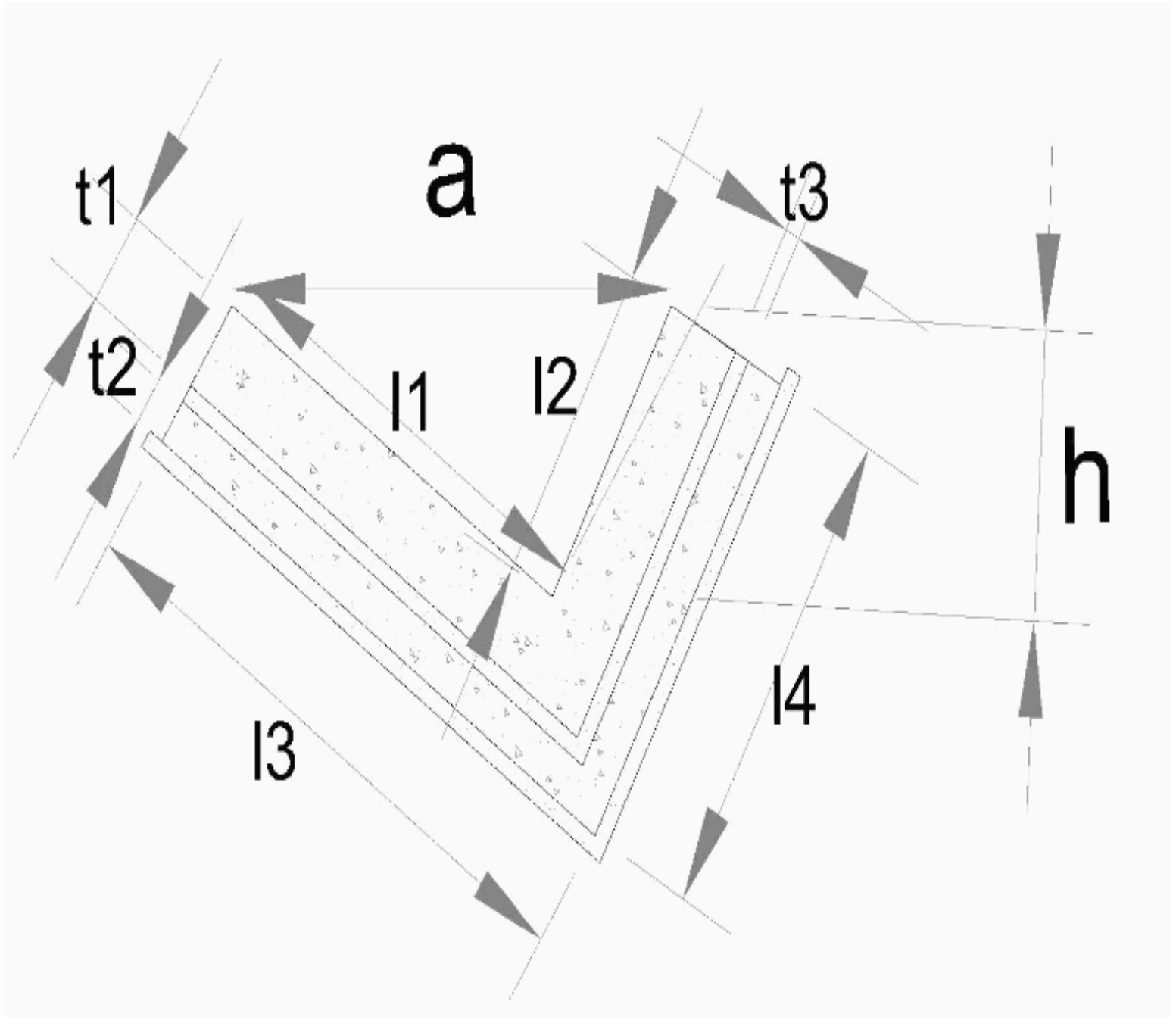
## Variable Declaration

## Traingular Shape Drain

SI No	Variable Description	Variable	Dimension	Unit
1	Ref Drawing	a	0.600	
2	Ref Drawing	h	0.300	
3	Ref Drawing	t1	0.100	
4	Ref Drawing	t2	0.050	
5	Ref Drawing	t3	0.025	
6	Ref Drawing	t4	0.025	
7	length	l	33335.000	
8	Ref Drawing	l1	0.530	
9	Ref Drawing	l2	0.342	
10	Ref Drawing	l3	0.712	
11	Ref Drawing	l4	0.530	



Variable Declaration



## Breast Wall

Chainage (m)		Length of CD(m)	Net Length(m)	TCS No.	Side	Avg. Height (m)
From	To					
76200	76325	0	125	TCS-17	Hill	1.5
76400	76490	2.7	87	TCS-17	Hill	1.5
77420	77470	0	50	TCS-17	Hill	1.5
77470	77650	5.2	175	TCS-3	Hill	1.5
78500	78550	0	50	TCS-3	Hill	1.5
79030	79080	0	100	TCS-12B	Both	1.5
79280	79480	0	200	TCS-19	Hill	1.5
79480	79550	0	70	TCS-11A	Hill	1.5
79725	79800	0	150	TCS-12B	Both	1.5
80650	80700	2.7	47	TCS-17	Hill	1.5
81080	81150	2.6	67	TCS-17	Hill	1.5
82110	82220	5.2	105	TCS-18	Hill	1.5
83570	83625	0	55	TCS-19	Hill	1.5
84175	84500	2.6	322	TCS-3A	Hill	1.5
84500	84550	0	50	TCS-5A	Hill	1.5
84700	84820	0	120	TCS-17	Hill	1.5
85300	85370	0	70	TCS-18	Hill	1.5
85370	85600	2.7	227	TCS-5A	Hill	1.5
85900	85920	0	20	TCS-3	Hill	1.5
86130	86230	0	100	TCS-18	Hill	1.5
86950	87000	0	50	TCS-3	Hill	1.5
87520	87600	0	80	TCS-5	Hill	1.5
88830	89130	0	300	TCS-17	Hill	1.5
89590	89650	2.6	57	TCS-3	Hill	1.5
89950	90000	2.6	47	TCS-19	Hill	1.5
90450	90500	0	50	TCS-5	Hill	1.5
90750	90800	2.6	47	TCS-5	Hill	1.5
90850	91100	2.6	247	TCS-3	Hill	1.5
91540	91625	0	85	TCS-19	Hill	1.5
95060	95140	3.96	76	TCS-3	Hill	1.5
96750	97000	0	250	TCS-5A	Hill	1.5
97000	97050	0	50	TCS-18	Hill	1.5
97050	97550	0	500	TCS-5A	Hill	1.5
97550	97650	0	100	TCS-18	Hill	1.5
97650	98160	0	510	TCS-5A	Hill	1.5
99310	99470	2.7	157	TCS-5A	Hill	1.5
102500	102675	2.7	172	TCS-19	Hill	1.5
102675	103075	5.4	395	TCS-18	Hill	1.5
103250	103600	2.7	347	TCS-19	Hill	1.5
103925	104000	0	75	TCS-19	Hill	1.5
104400	104510	2.6	107	TCS-19	Hill	1.5
105325	105860	8	527	TCS-5A	Hill	1.5
105860	107910	7.9	2042	TCS-19A	Hill	3

Total = 8465

1.5m Height Breast Wall= 6423 m  
 3.0m Height Breast Wall= 2042 m



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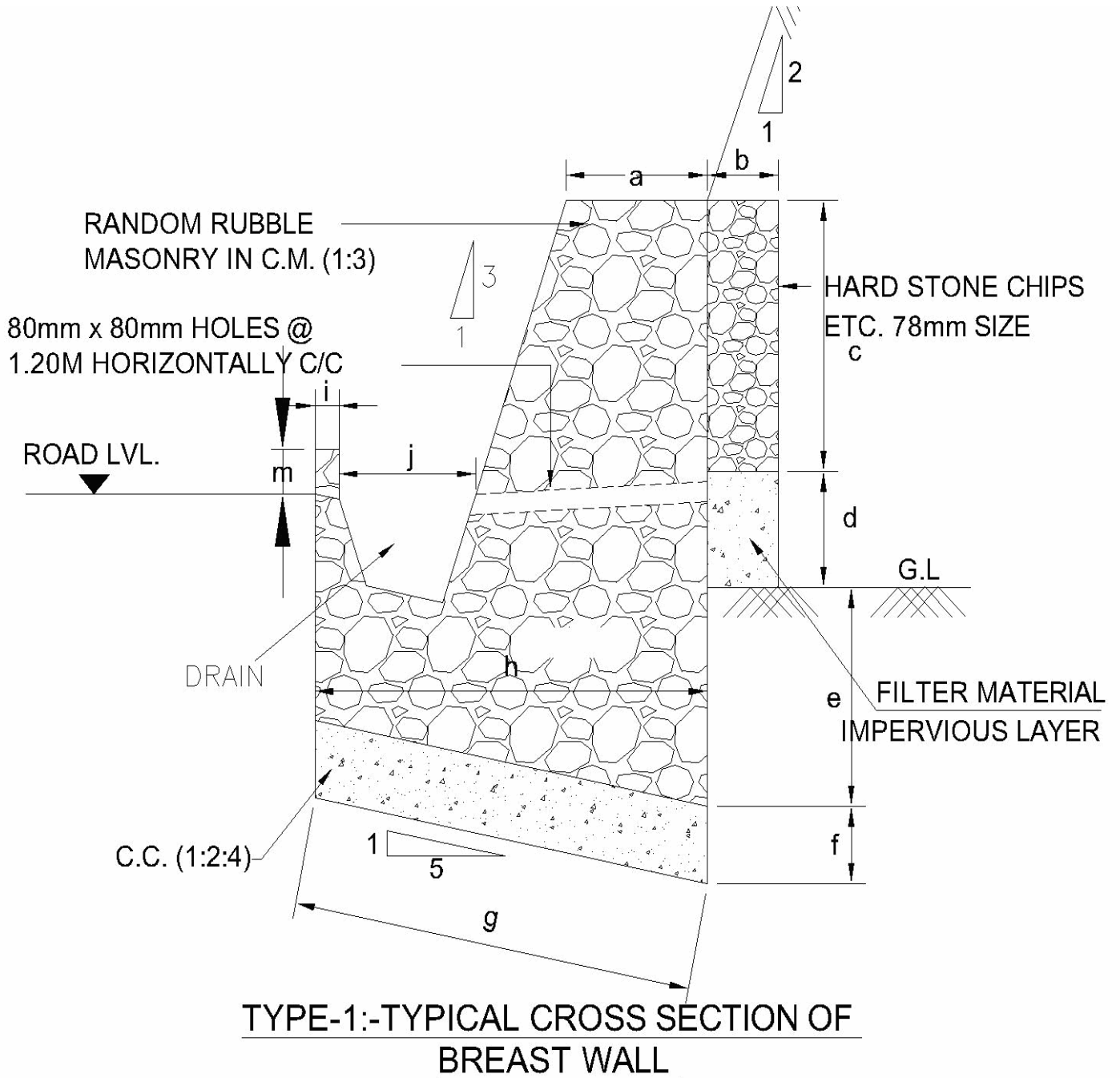
## Variable Declaration

## Breast Wall (3m)

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	2.550	m
4	From Diagram	d	0.450	m
5	From Diagram	e	0.950	m
6	From Diagram	f	0.300	m
7	PCC Width $g = \sqrt{h^2 + (h/5)^5}$	g	2.260	m
8	From Diagram	h	2.221	m
9	From Diagram	i	0.200	m
10	From Diagram	j	1.000	m
11	length	l	2042.000	m
12	Percentage of Earthwork in Ordinary Rock(20%)	p	0.200	
13	From Diagram	m	0.300	m



Variable Declaration



**TYPE-1:-TYPICAL CROSS SECTION OF BREAST WALL**

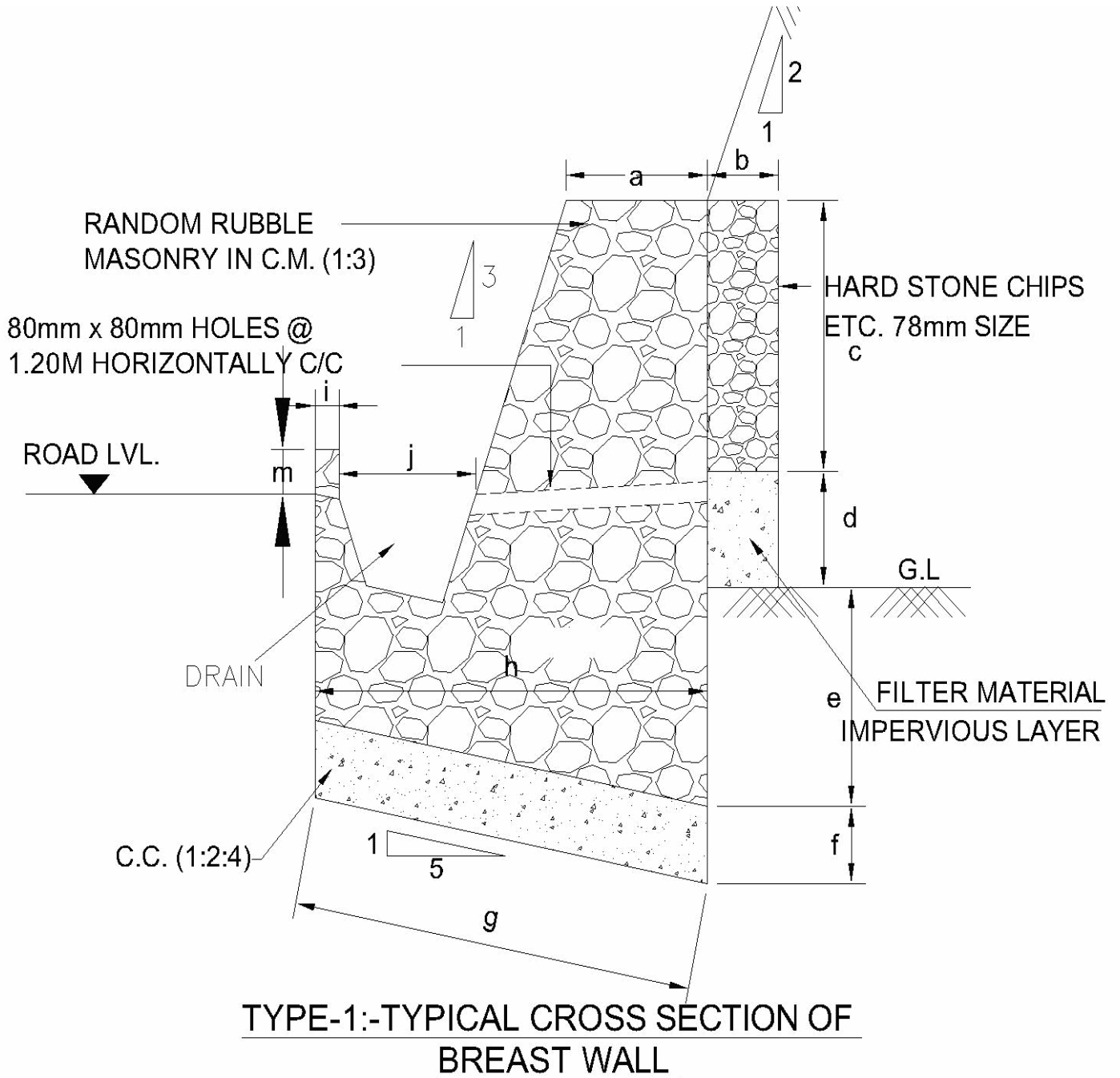
## Variable Declaration

## Breast Wall(1.5m)

SI No	Variable Description	Variable	Dimension	Unit
1	From Diagram	a	0.600	m
2	From Diagram	b	0.300	m
3	From Diagram	c	1.050	m
4	From Diagram	d	0.450	m
5	From Diagram	e	0.850	m
6	From Diagram	f	0.300	m
7	PCC Width $g = \sqrt{h^2 + (h/5)^5}$	g	2.200	m
8	From Diagram	h	2.160	m
9	From Diagram	i	0.200	m
10	From Diagram	j	1.000	m
11	length	l	6423.000	m
12	Percentage of Earthwork in Ordinary Rock(20%)	p	0.200	
13	From Diagram	m	0.300	m



Variable Declaration



## RR Masonry Retaining Wall

Chainage (m)		Length of CD(m)	Net Length(m)	TCS No.	Side	Avg. Height (m)
From	To					
75320	75430	2.7	107.3	TCS-9	Valley	6
75430	75515	3.96	81.04	TCS-4A	Valley	6
75515	75575	0	60	TCS-9	Valley	6
75575	75640	0	130	TCS-14	Both	6
75640	75700	3.96	56.04	TCS-9	Valley	6
75700	75735	0	70	TCS-14	Both	6
75735	75775	0	80	TCS-14A	Both	6
75775	75825	0	50	TCS-9	Valley	6
75825	75875	6.14	87.72	TCS-14	Both	6
76125	76200	0	150	TCS-14	Both	2
76325	76400	0	75	TCS-9	Valley	3
76490	76600	2.7	107.3	TCS-4	Valley	3
77130	77180	2.7	47.3	TCS-4A	Valley	3
77280	77310	3.96	26.04	TCS-4	Valley	2
77650	77700	0	50	TCS-4	Valley	3
77950	78000	0	50	TCS-4	Valley	3
78100	78170	0	70	TCS-9	Valley	2
78400	78450	2.6	47.4	TCS-4	Valley	2
80080	80150	0	140	TCS-14	Both	6
80150	80320	0	340	TCS-14A	Both	6
80320	80500	2.6	354.8	TCS-14	Both	6
82110	82220	5.2	104.8	TCS-18	Valley	2
84500	84550	0	50	TCS-5A	Valley	2
84820	85300	5.2	474.8	TCS-4A	Valley	6
85300	85370	0	70	TCS-18	Valley	6
85370	85600	2.7	227.3	TCS-5A	Valley	6
86130	86230	0	100	TCS-18	Valley	2
87520	87600	0	80	TCS-5	Valley	2
90450	90500	0	50	TCS-5	Valley	2
90750	90800	2.6	47.4	TCS-5	Valley	2
94380	94480	0	100	TCS-4	Valley	2
96750	97000	0	250	TCS-5A	Valley	4
97000	97050	0	50	TCS-18	Valley	4
97050	97550	0	500	TCS-5A	Valley	4
97550	97650	0	100	TCS-18	Valley	4
97650	98160	0	510	TCS-5A	Valley	6
98460	99070	10.1	1199.8	TCS-14A	Both	6
99070	99310	10.66	458.68	TCS-14	Both	6
99310	99470	2.7	157.3	TCS-5A	Valley	6
99470	99530	0	120	TCS-14	Both	6
99530	99680	5.3	289.4	TCS-14A	Both	4
101525	101730	0	410	TCS-14A	Both	4
101730	101870	2.7	274.6	TCS-14	Both	4
101870	101940	2.6	134.8	TCS-14A	Both	4
102020	102070	0	50	TCS-9	Valley	2
102675	103075	5.4	394.6	TCS-18	Valley	2
105325	105860	8	527	TCS-5A	Valley	2
107975	109175	8	1192	TCS-9	Valley	2
109325	109494	66.5	102.5	TCS-9	Valley	2

Total = 10205

Length of 2.0 m Retaining Wall = 3092 m  
 Length of 3.0 m Retaining Wall = 330 m  
 Length of 4.0 m Retaining Wall = 2009 m  
 Length of 6.0 m Retaining Wall = 4775 m



*[Handwritten Signature]*

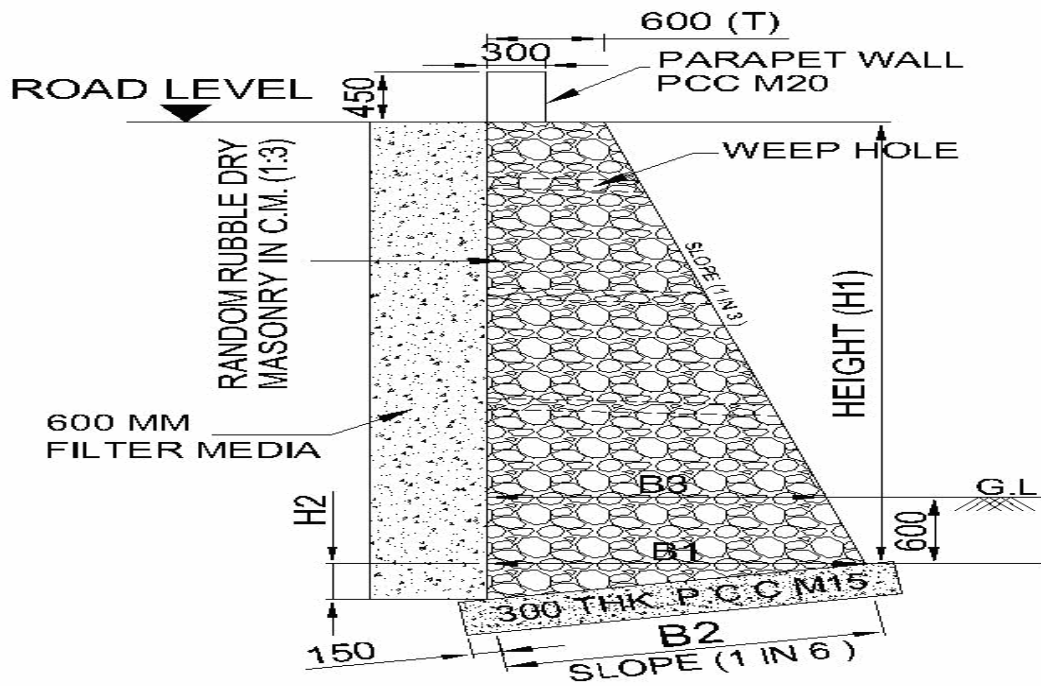
## Variable Declaration

## 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	$B2 = B1/\text{Cos}Z$	B2	1.284	m
6	$H2 = B1.\text{Tan}Z$	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	$B3 = T + (H1-d)\text{Tan}Y$	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	3092.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \text{COS}Y) / 1$	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 HIGHT)  
(SCALE 1:50)



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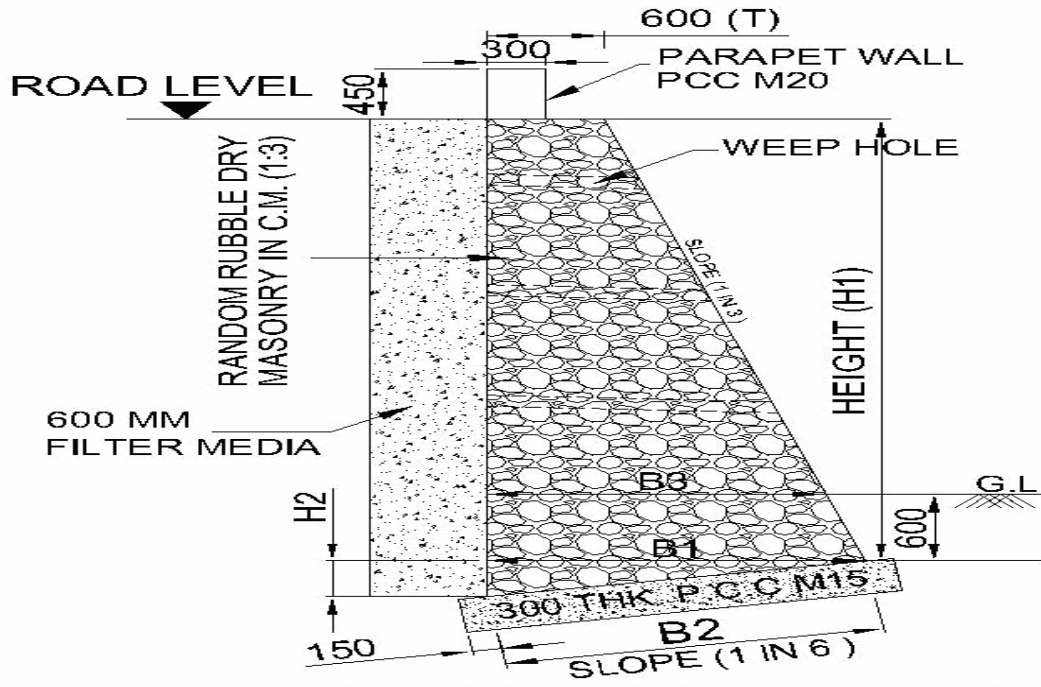
## Variable Declaration

## 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	$B2 = B1/\text{Cos}Z$	B2	1.622	m
6	$H2 = B1.\text{Tan}Z$	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	$B3 = T + (H1-d)\text{Tan}Y$	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	330.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \text{COS}Y) / 1$	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 HIGHT)  
(SCALE 1:50)



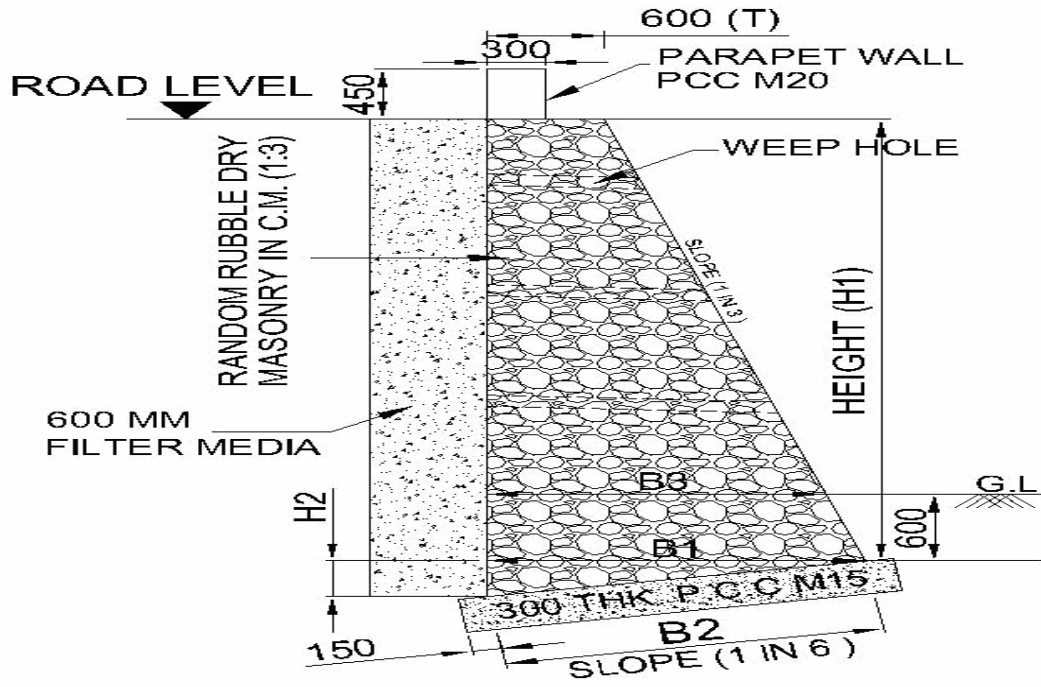
## Variable Declaration

## 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	$B2 = B1/\text{Cos}Z$	B2	1.960	m
6	$H2 = B1.\text{Tan}Z$	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	$B3 = T + (H1-d)\text{Tan}Y$	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	2009.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \text{COS}Y) / 1$	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)

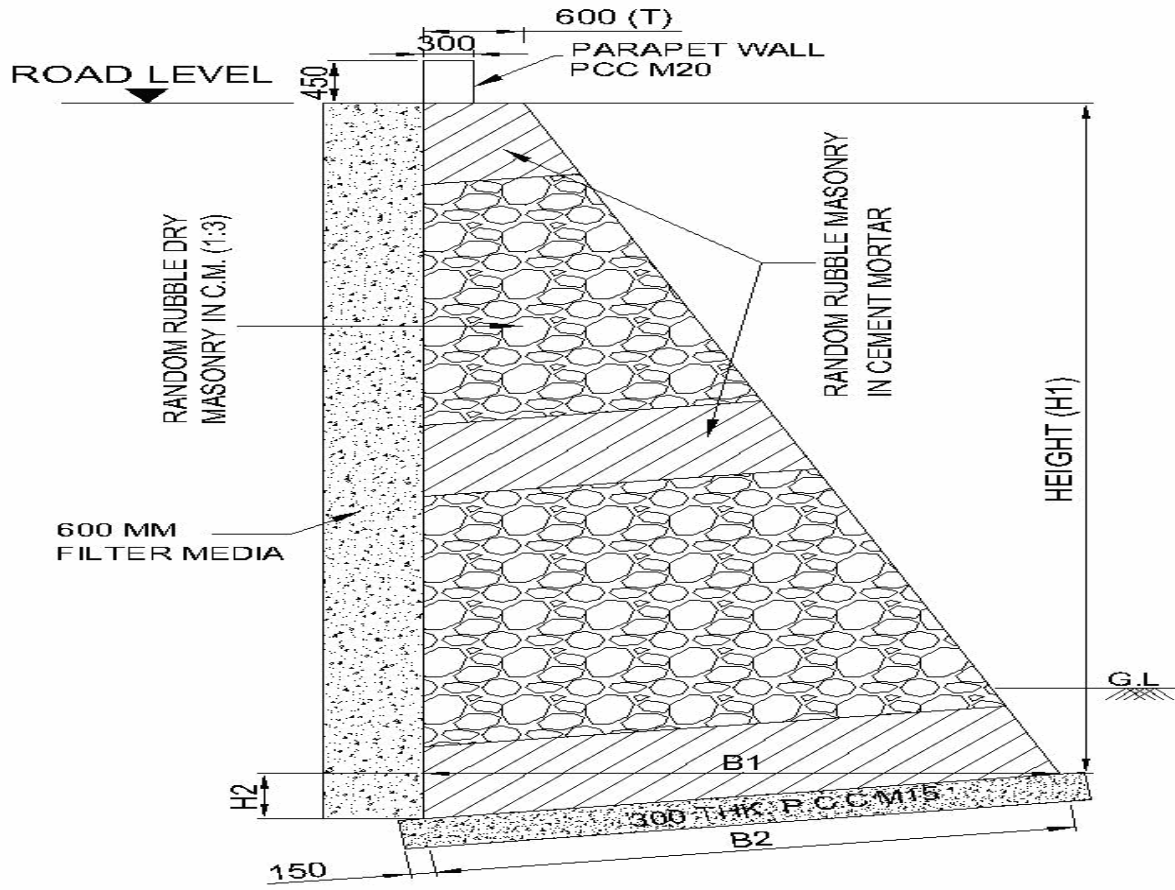
## Variable Declaration

## Retaining Wall 6.0m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height (H1)	H1	6.000	m
3	Slope at Base(1 In 6)	Z	9.462	degree
4	$B1 = (T+H1/3)$	B1	2.600	m
5	$B2 = B1/\text{Cos}Z$	B2	2.636	m
6	$H2 = B1.\text{Tan}Z$	H2	0.433	m
7	EGL to PCC top Height	d	0.900	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	$B3 = T + (H1-d)\text{Tan}Y$	B3	2.400	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	4775.000	m
14	No of weephole along slope of 1m gap $m = ((H1 - d) / \text{COS}Y) / 1$	n	10.000	nos
15	Avg Length of Weephole $q = (B3 + T) / 2$	weep_len	1.025	m
16	percentage of rock cutting	p_c	0.200	
17	Taking gap every 10m length	gap	0.300	m
18	Height of parapet wall	para_ht	0.450	m
19	width of parapet wall	para_w	0.300	m



Variable Declaration



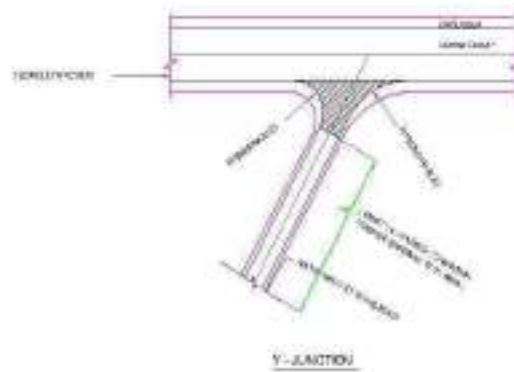
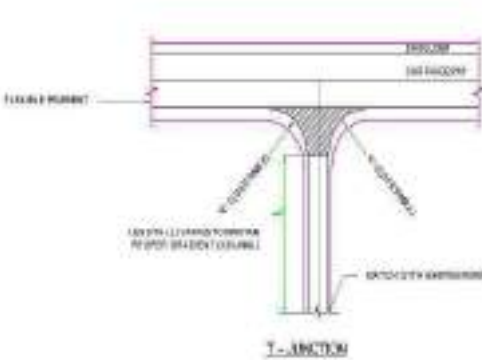
TYPICAL CROSS SECTION OF  
RETAINING WALL (5.0M TO 8.0M HIGHT)  
(SCALE 1:50)



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## Minor Junction

Minor Junction			
Sl No	Design Chainage (km)	Junction Type	Type
1	75.000	Y	3-legged
2	87.580	Y	3-legged
3	91.900	Y	3-legged
4	96.150	Y	3-legged
5	109.300	Y	3-legged
6	109.700	X	4-legged



### Junction Type-1

Hatch Area=  $(3.5 \times 5) + 2 \times (0.5 \times 5 \times 5) = 42.50 \text{ sqm}$   
 Existing Road Area=  $10 \times 3.75 = 37.5 \text{ sqm}$   
 Total Area=  $80.00 \text{ sqm}$   
 (Note: L=10m)

### 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=  $96 \text{ sqm}$   
 (Note: L=10m)

### Quantity Calculation for Minor Junction

Junction-Type	Total No.	Each Junction area (sqm)	Total area (sqm)
Y-Type	6	96	574
<b>Total</b>	<b>6</b>		<b>574</b>

No of HP Culvert at Minor Junction= 60 nos



*[Signature]*

## Variable Declaration

## Minor Junction

SI No	Variable Description	Variable	Dimension	Unit
1	Total_area	tot_area	574.000	area
2	BC	bc	0.040	m
3	DBM	dbm	0.000	m
4	WMM-I	wmm1	0.150	m
5	WMM-II	wmm2	0.000	m
6	GSB	gsb	0.000	m
7	GSB percentage Re-use	gsb_per	67.500	percentage
8	CT subbase	cts	0.200	



Traffic Signs and Other Appurtenance

Summary Of Traffic Signs

Total No of Street Light=	22	Nos	Bill No- 06, Sl. No- 15
Kilometer stones=	28	Nos	Bill No- 06, Sl. No- 4
5th Kilometer stones=	7	Nos	Bill No- 06, Sl. No- 3
Boundary Stones=	347	Nos	Bill No- 06, Sl. No- 5
Delineators (100 cm long and circular s	1398	Nos	Bill No- 06, Sl. No- 13
Road Stud=	5586	Nos	Bill No- 06, Sl. No- 14
900 mm Octagonal	6	Nos	Bill No- 06, Sl. No- 9
600 mm circular	42	Nos	Bill No- 06, Sl. No- 7
900 mm Tringular	427	Nos	Bill No- 06, Sl. No- 6
500x600 Rectangular (Chevron)	716	Nos	Bill No- 06, Sl. No- 14
450 mm x 600 mm rectangular	16	Nos	Bill No- 06, Sl. No- 8
Direction Sign < 0.9 sqm	2	sqm	Bill No- 06, Sl. No- 10
Direction Sign > 0.9 sqm	16	sqm	Bill No- 06, Sl. No- 11
Rumble Strip=	14	sqm	Bill No- 06, Sl. No- 17



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Traffic Signs and Other Appurtenance(Calculation)

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: 75.155, 75.253, 75.350, 75.493, 77.085, 80.856, 81.013, 81.350, 81.677, 82.375, 82.476, 82.997, 83.385, 83.586, 84.676, 85.227, 85.590, 85.686, 85.785, 86.130, 86.361, 86.735, 87.470, 87.859, 91.422, 92.218, 92.493, 92.715, 94.497, 96.367, 96.522, 96.618, 96.850, 97.060, 97.207, 97.379, 97.571, 97.746, 99.009, 99.142, 99.375, 99.537, 100.750, 101.687, 101.779, 102.225, 102.514, 102.587, 103.066, 103.255, 103.387, 104.408, 104.671, 104.835, 105.238, 105.394, 105.818, 105.955, 106.093, 106.166, 106.278, 106.375, 106.434, 106.536, 108.240, 108.387, 108.629, 108.667, 108.718, 108.867, 108.982, 109.075, 109.450, 109.494, 109.614, 109.867	152	@ 2per location



2	<b>Left Hand Side Curve</b>	fig 15.01	900 mm Tringular	Left Hand Side Curve : 75.420, 75.571, 77.165, 77.294, 79.852, 80.780, 81.172, 81.561, 82.214, 82.647, 83.073, 83.196, 83.288, 83.681, 84.918, 85.274, 85.453, 85.881, 85.967, 86.239, 86.497, 86.651, 86.850, 87.053,87.673,89.604, 89.795, 90.661, 91.037, 91.250, 91.525, 91.693, 92.009, 92.155, 92.307, 92.600, 92.797, 92.878, 92.942, 94.580, 96.039, 96.712, 96.998, 97.144, 97.283, 97.462, 97.656, 98.684, 98.915, 99.263, 99.465, 100.278, 100.459, 100.631, 100.793, 101.622, 102.294, 102.361, 102.452, 102.777, 103.128, 103.293, 103.450, 103.857, 104.148, 104.507, 105.095, 105.562, 105.769, 105.861, 105.918, 105.995, 106.128, 106.322, 106.499, 108.218, 108.317, 108.360, 108.464, 108.541, 108.926,	170	@ 2per location
3	<b>Built-up area</b>	fig 15.35	900 mm Tringular	2 ( 75.000, 75.380)	4	@ 2per location
7	<b>Side road</b>	fig 15.09 & 15.10	900 mm Tringular	75, 87.580, 91.900, 96.150, 109.30	10	@ 2per location
8	<b>Y Intersection</b>	fig 15.11 & 15.12	900 mm Tringular	75,87.580, 91.900, 96.15, 109.300	10	@ 2per location
8	<b>Pedestain Crossing</b>		900 mm Tringular	75,Bus bay- 96.780Side Road- 87.	12	@ 2per location
9	<b>Bus Stop</b>	fig 17.35	800x600 rectangul ar	96+780km	2	@ 2per location
11	<b>Direction Sign</b>	Fig 16.06	>0.9 sqm	Built up- 2 ( 75.000, 75.380),87.580, 91.900, 96.150, 109.300	12	@ 2per location

*[Handwritten signature]*



12	<b>Hazard Marker</b>	fig 15.76 & fig 15.77	900x300 mm rectangul ar	Culvert- 75.39, 75.507, 75.7, 75.86, 76.483, 76.565, 76.711, 77.165, 77.292, 77.502, 77.65, 77.82, 78.002, 78.23, 78.359, 78.434, 78.708, 79.005, 79.18, 80.435, 80.695, 80.812, 81.142, 81.255, 81.367, 81.592, 81.868, 81.952, 82.05, 82.127, 82.199, 82.482, 82.568, 82.725, 82.9, 83.075, 83.18, 83.525, 83.666, 83.975, 84.435, 84.64, 84.978, 85.217, 85.455, 85.785, 86.005, 86.076, Culvert- 87.517, 87.74, 87.927, 88.042, 88.24, 88.462, 88.61, 88.763, 89.194, 89.524, 89.65, 89.8, 89.92, 89.98, 90.032, 90.227, 90.45, 90.532, 90.793, 91.041, 91.22, 91.405, 91.67, 91.796, 92.015, 92.36, 92.54, 92.751, 92.875, 92.971, 93.29, 93.425, 93.585, 93.795, 93.93, 94.032, 94.281, 94.375, 94.59, 94.688, 94.77, 94.93, 95.07, 95.235, 95.367, 95.445, 95.503, 95.689, 95.77, 95.89, 96.03, 96.157, 96.431, 98.854, 99.031	560	@ 4 per structure
13	<b>Stop Sign</b>	fig 14.01	900 mm Octagona l	Side Road- 75.000,87.580, 91.900, 96.150, 109.300, Cross Road- 109.700	6	@ 1per location
14	<b>Speed limit</b>	fig 14.37	600mm Cicular	Built Up area- 2 ( 75.000, 75.380,) Min Design Speed- 81.910, 82.023, 82.777, 83.016, 93.067, 93.164, 96.082, 96.265, 101.050, 104.003, 105.950, 109.889	28	@ 2per location

*[Handwritten signature]*



16	<b>Rumble strip</b>	fig 15.50	900 Triangular	Built-up area- 2 ( 75.000, 75.380)	14	@ 1per location
17	<b>Right &amp; Left Hair Pin bend</b>	fig 15.03 & 15.04	900 mm Triangular	82.700, 82.900,87.450, 92.970, 93.200, 96.070, 96.250, 100.850, 101.060, 101.400, 101.600, 102.600, 102.760, 102.800, 102.950, 103.500, 103.750, 103.900, 104.100, 109.150, <del>100.400</del>	21	@ 1per location
18	<b>Right &amp; Left Reverse bend</b>	Fig 15.05 & Fig 15.06	900 mm Triangular	79.150, 79.750, 79.950, 80.750, 81.800, 82.150, 83.800, <del>84.650, 99.600, 100.200</del>	10	@ 1per location
19	<b>Seriese of bends</b>	Fig 15.07	900 mm Tri	75.700, 76.950, 77.450, 79.050,88.000, 89.450, 89.900, 90.500, 93.300, 94.350, 94.650, 96.000, 97.900, 98.600, 101.850, 101.100, 101.350, 102.200, <del>106.550, 108.200</del>	20	@ 1per location
20	<b>Convex Mirror for Blind Curve</b>			82.750, 82.830,87.300, 87.400, 93.040, 93.140, 96.125, 96.190, 100.920, 100.990, 101.470, 101.550, 102.650, 102.730, 102.830, 102.900, 103.570, 103.640, 103.970, 104.050, <del>100.250, 100.220</del>	44	@ 2per location
21	<b>Restriction Ends</b>	Fig 14.40	600 mm ci	Built Up area- 2 ( 75.000, 75.380,) Min Design Speed- 81.910, 82.023, 82.777, 83.016,93.067, 93.164, 96.082, 96.265, 101.050, 104.003, 105.950, 109.889	14	@ 1per location
22	<b>Place/ City identification</b>	Fig 16.06	Direction Sign > 0.9 sqm	Built up- 2 ( 75.000, 75.380)	4	@ 2per location
23	<b>National Highway route marker sign</b>	Fig 20.02	450x600 mm Rectangul ar plate	1. Junction ( one number per junction) So, 2 nos. 3. For Through Traffic (Considering one number per 5km)	16	@ 2per location



*[Handwritten signature]*

SUMMARY

90 cm equilateral triangle		427	nos
Stop Sign (90 cm high octagon)		6	nos
60 cm circular		42	nos
45 cm x 60 cm rectangular		16	nos
Direction Sign	<.0.9 sqm	1.8	nos
	>0.9 sqm	16	nos
Object Marker (one way)		0	nos
Hazard Marker		560	nos
Convex Mirror for Blind Curve		44	nos

Calculation of km Stone, Hectometer Stone and Boundary Stone

Item	Remarks	Nos
Kilometer stones	Total KM Stone- No. of 5th KM stone	28
	(km stone 5th, 10th, 15th, 20th etc)	7
Boundary stones	(Total Lengthx5x2) + 2x1	347



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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-1A	320	640.00
	<b>Total =</b>	<b>640</b>

**Total length = 640 m**

Assuming, street lights @= 50m interval

for 640 m 14 nos

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

Total nos of street light= **22 nos**

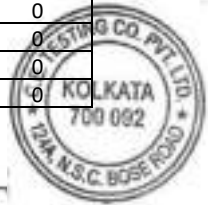
Bill No- 06, Sl. No- 15



CALCULATION FOR DELINEATOR

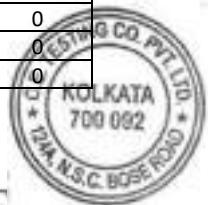
In Horizontal Curves (radius 300 m or less)

HIP / CURVE NO.	ELEMENT	START	END	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
		CHAINAGE (m)	CHAINAGE (m)											
254	Arc	75151.196	75173.73	50	8	22.534	3	1	1	1	1	0	1	0
255	Arc	75247.727	75277.054	80	8	29.327	4	2	1	1	1	0	0	0
256	Arc	75345.039	75358.069	30	6	13.03	2	1	1	1	1	1	0	0
257	Arc	75419.486	75421.968	35	6	2.482	1	0	1	1	1	1	0	0
258	Arc	75488.701	75501.459	100	12	12.758	1	1	1	1	1	0	0	0
259	Arc	75567.233	75625.796	300	25	58.563	2	1	0	0	1	0	0	0
260	Arc	75700.041	75750.142	125	12	50.101	4	2	1	1	1	1	0	0
261	Arc	75951.716	75958.51	60	8	6.794	1	0	1	1	1	0	1	0
262	Arc	76028.023	76028.658	30	6	0.635	1	0	1	1	1	1	0	0
263	Arc	76103.76	76111.419	40	6	7.659	1	1	1	1	1	1	0	0
264	Arc	76211.168	76240.286	200	20	29.118	1	1	1	1	1	0	0	0
265	Arc	76338.789	76461.475	75	8	122.686	15	8	1	1	1	1	0	0
266	Arc	76595.901	76623.759	50	8	27.858	3	2	1	1	1	0	0	0
267	Arc	76697.256	76738.096	200	20	40.84	2	1	1	1	1	0	0	0
268	Arc	76874.218	76892.951	50	8	18.733	2	1	1	1	1	1	0	0
269	Arc	76986.507	77006.787	150	12	20.28	2	1	1	1	1	0	0	0
270	Arc	77080.718	77093.013	200	20	12.295	1	0	1	0	1	0	0	0
271	Arc	77160.079	77178.627	60	8	18.548	2	1	1	1	1	1	0	0
272	Arc	77289.271	77309.424	150	12	20.153	2	1	1	1	1	1	0	0
273	Arc	77479.94	77503.6	150	12	23.66	2	1	1	1	1	0	0	0
274	Arc	77614.737	77625.386	50	8	10.649	1	1	1	1	1	1	0	0
275	Arc	77716.638	77723.123	60	8	6.485	1	0	1	1	1	1	0	0
276	Arc	77803.55	77815.941	75	8	12.391	2	1	1	1	1	0	0	0
277	Arc	77886.745	77923.277	300	25	36.532	1	1	0	1	1	0	0	0
278	Arc	78020.441	78081.214	100	12	60.773	5	3	1	1	1	1	0	0
279	Arc	78223.134	78234.824	30	6	11.69	2	1	1	1	1	1	1	0
280	Arc	78306.829	78322.172	60	8	15.343	2	1	1	1	1	1	0	0
281	Arc	78411.61	78422.056	100	12	10.446	1	0	1	1	1	1	0	0
282	Arc	78564.511	78583.616	50	8	19.105	2	1	1	1	1	1	0	0
283	Arc	78687.321	78718.049	100	12	30.728	3	1	1	1	1	1	0	0



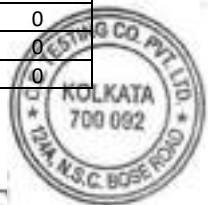
*Signature*

HIP / CURVE NO.	ELEMENT	START	END	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
		CHAINAGE (m)	CHAINAGE (m)											
284	Arc	78859.024	78874.468	50	8	15.444	2	1	1	1	1	1	0	0
285	Arc	78979.887	79060.81	100	12	80.923	7	3	1	1	1	1	0	0
1	Arc	79179.396	79189.708	60	8	10.312	1	1	1	1	1	0	0	0
2	Arc	79245.039	79278.571	300	25	33.532	1	1	0	0	1	0	0	0
3	Arc	79356.694	79417.612	50	8	60.918	8	4	1	1	1	1	0	0
4	Arc	79501.777	79587.849	50	8	86.072	11	5	1	1	1	1	0	0
5	Arc	79706.548	79733.367	100	12	26.819	2	1	1	1	1	0	0	0
6	Arc	79846.977	79857.428	80	8	10.451	1	1	1	1	1	1	0	0
7	Arc	80006.52	80016.299	150	12	9.779	1	0	1	1	1	0	0	0
8	Arc	80089.579	80103.228	100	12	13.649	1	1	1	1	1	0	0	0
9	Arc	80168.608	80184.365	30	6	15.757	3	1	1	1	1	1	0	0
10	Arc	80303.585	80312.475	80	8	8.89	1	1	1	1	1	1	0	0
11	Arc	80420.791	80437.126	30	6	16.335	3	1	1	1	1	1	0	0
12	Arc	80525.302	80540.618	80	8	15.316	2	1	1	1	1	1	0	0
13	Arc	80675.176	80700.455	75	8	25.279	3	2	1	1	1	0	0	0
14	Arc	80774.825	80795.298	150	12	20.473	2	1	1	1	1	0	0	0
15	Arc	80850.983	80879.384	300	25	28.401	1	1	0	1	1	0	0	0
16	Arc	81009.489	81050.086	50	8	40.597	5	3	1	1	1	1	0	0
17	Arc	81167.53	81240.079	300	25	72.549	3	1	1	1	1	0	0	0
18	Arc	81345.241	81359.26	300	25	14.019	1	0	1	1	1	0	0	0
19	Arc	81554.77	81607.227	40	6	52.457	9	4	1	1	1	1	1	0
20	Arc	81672.168	81765.355	125	12	93.187	8	4	1	1	1	0	0	0
21	Arc	81843.374	81852.463	40	6	9.089	2	1	1	1	1	0	0	0
22	Arc	81909.701	81937.994	20	6	28.293	5	2	1	1	1	1	0	0
23	Arc	82004.907	82023.791	20	6	18.884	3	2	1	1	1	1	0	0
24	Arc	82122.759	82141.043	100	12	18.284	2	1	1	1	1	0	0	0
25	Arc	82209.52	82244.453	100	12	34.933	3	1	1	1	1	1	0	0
26	Arc	82371.017	82396.73	100	12	25.713	2	1	1	1	1	0	0	0
27	Arc	82471.439	82482.932	100	12	11.493	1	0	1	1	1	1	0	0
28	Arc	82643.474	82648.606	100	12	5.132	1	0	1	1	1	1	0	0
29	Arc	82777.983	82803.809	20	6	25.826	4	2	1	1	1	1	0	0
30	Arc	82872.862	82881.634	30	6	8.772	1	1	1	1	1	1	0	0
31	Arc	82993.386	83016.617	100	12	23.231	2	1	1	1	1	0	0	0
32	Arc	83067.66	83083.775	30	6	16.115	3	1	1	1	1	1	0	0
33	Arc	83191.221	83204.295	60	8	13.074	2	1	1	1	1	1	0	0



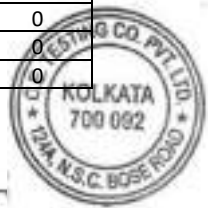
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HIP / CURVE NO.	ELEMENT	START	END	RADIUS (m)	Spacing on Curve (S)	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve
		CHAINAGE (m)	CHAINAGE (m)											
34	Arc	83284.313	83298.059	80	8	13.746	2	1	1	1	1	1	0	0
35	Arc	83381.349	83428.045	70	8	46.696	6	3	1	1	1	1	0	0
36	Arc	83579.681	83588.037	50	8	8.356	1	1	1	1	1	1	0	0
37	Arc	83675.128	83689.879	50	8	14.751	2	1	1	1	1	1	0	0
38	Arc	83822.335	83839.624	150	12	17.289	1	1	1	1	1	1	0	0
39	Arc	84018.516	84048.522	25	6	30.006	5	3	1	1	1	1	1	0
40	Arc	84159.215	84205.579	50	8	46.364	6	3	1	1	1	0	0	0
41	Arc	84267.392	84347.944	125	12	80.552	7	3	1	1	1	0	0	0
42	Arc	84412.138	84426.839	80	8	14.701	2	1	1	1	1	1	0	0
43	Arc	84528.422	84540.545	50	8	12.123	2	1	1	1	1	1	0	0
44	Arc	84670.95	84700.544	300	25	29.594	1	1	1	1	1	1	0	0
46	Arc	85221.545	85231.117	125	12	9.572	1	0	1	0	1	0	1	0
47	Arc	85270.214	85308.038	150	12	37.824	3	2	0	1	1	1	0	0
48	Arc	85449.009	85456.554	50	8	7.545	1	0	1	1	1	1	0	0
49	Arc	85585.175	85634.779	300	25	49.604	2	1	1	0	1	0	0	0
50	Arc	85681.153	85697.161	30	6	16.008	3	1	1	1	1	1	0	0
51	Arc	85779.827	85790.302	30	6	10.475	2	1	1	1	1	1	0	0
52	Arc	85876.993	85907.309	60	8	30.316	4	2	1	1	1	0	0	0
53	Arc	85963.465	86012.899	100	12	49.434	4	2	1	1	1	0	0	0
54	Arc	86125.664	86149.358	100	12	23.694	2	1	1	1	1	0	0	0
55	Arc	86234.374	86249.645	150	12	15.271	1	1	1	1	1	0	0	0
56	Arc	86356.644	86382.817	300	25	26.173	1	1	1	1	1	0	0	0
57	Arc	86489.598	86517.377	100	12	27.779	2	1	1	1	1	1	0	0
58	Arc	86647.029	86662.011	100	12	14.982	1	1	1	1	1	0	0	0
59	Arc	86730.069	86736.258	60	8	6.189	1	0	1	1	1	1	0	0
60	Arc	86846.264	86882.848	300	25	36.584	1	1	1	1	1	0	0	0
61	Arc	87045.625	87109.019	300	25	63.394	3	1	1	1	1	0	0	0
62	Arc	87277.86	87281.712	100	12	3.852	1	0	1	1	1	0	0	0
63	Arc	87338.696	87371.169	25	6	32.473	5	3	1	1	1	1	0	0
64	Arc	87465.953	87478.558	60	8	12.605	2	1	1	1	1	1	0	1
65	Arc	87666.457	87691.569	100	12	25.112	2	1	1	1	1	1	0	0
66	Arc	87855.446	87872.913	60	8	17.467	2	1	1	1	1	1	0	1
67	Arc	88097.403	88102.469	100	12	5.066	1	0	1	1	1	0	0	0
68	Arc	88195.554	88244.909	70	8	49.355	6	3	1	1	1	1	0	0
69	Arc	88336.411	88349.49	100	12	13.079	1	1	1	1	1	1	0	0



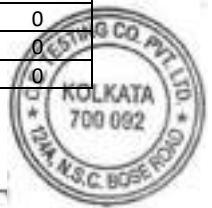
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HIP / CURVE NO.	ELEMENT	START	END	RADIUS (m)	Spacing on Curve (S)	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve
		CHAINAGE (m)	CHAINAGE (m)											
70	Arc	88503.791	88536.67	70	8	32.879	4	2	1	1	1	1	0	0
71	Arc	88647.906	88664.823	50	8	16.917	2	1	1	1	1	1	0	0
72	Arc	88751.087	88793.575	90	8	42.488	5	3	1	1	1	1	0	1
73	Arc	89023.927	89036.626	60	8	12.699	2	1	1	1	1	0	1	0
74	Arc	89099.583	89131.069	100	12	31.486	3	1	1	1	1	0	0	0
75	Arc	89176.472	89190.147	60	8	13.675	2	1	1	1	1	0	0	0
76	Arc	89251.201	89280.234	40	6	29.033	5	2	1	1	1	1	0	0
77	Arc	89383.519	89387.559	60	8	4.04	1	0	1	1	1	1	0	1
78	Arc	89596.623	89689.049	200	20	92.426	5	2	1	1	1	0	0	0
79	Arc	89789.748	89840.957	150	12	51.209	4	2	1	1	1	0	0	0
80	Arc	89953.816	89979.142	100	12	25.326	2	1	1	1	1	0	0	0
81	Arc	90070.087	90084.473	40	6	14.386	2	1	1	1	1	1	0	0
82	Arc	90143.349	90158.483	30	6	15.134	3	1	1	1	1	1	0	0
83	Arc	90227.891	90234.081	30	6	6.19	1	1	1	1	1	1	0	0
84	Arc	90332.854	90349.097	30	6	16.243	3	1	1	1	1	1	0	1
85	Arc	90517.716	90550.17	100	12	32.454	3	1	1	1	1	1	0	1
87	Arc	91031.212	91053.029	200	20	21.817	1	1	1	1	1	1	1	0
88	Arc	91246.408	91310.082	200	20	63.674	3	2	1	1	1	0	0	0
89	Arc	91419.366	91430.886	50	8	11.52	1	1	1	1	1	1	0	0
90	Arc	91521.911	91543.117	60	8	21.206	3	1	1	1	1	1	0	1
92	Arc	92003.988	92023.258	70	8	19.27	2	1	1	1	1	1	1	0
93	Arc	92150.785	92164.194	125	12	13.409	1	1	1	1	1	0	0	0
94	Arc	92213.455	92226.244	80	8	12.789	2	1	1	1	1	1	0	0
95	Arc	92304.357	92338.81	150	12	34.453	3	1	1	1	1	1	0	0
96	Arc	92488.978	92501.788	150	12	12.81	1	1	1	1	1	0	0	0
97	Arc	92596.01	92612.65	150	12	16.64	1	1	1	1	1	0	0	0
98	Arc	92709.902	92733.337	50	8	23.435	3	1	1	1	1	0	0	0
99	Arc	92790.039	92808.522	300	25	18.483	1	0	0	0	1	0	0	0
100	Arc	92872.047	92902.049	35	6	30.002	5	3	1	1	1	0	0	0
101	Arc	92937.567	93014.517	170	12	76.95	6	3	0	1	1	0	0	0
102	Arc	93067.05	93100.462	20	6	33.412	6	3	1	1	1	1	0	0
103	Arc	93164.969	93297.046	200	20	132.077	7	3	0	0	1	0	0	0
104	Arc	93336.865	93358.62	125	12	21.755	2	1	0	0	1	0	0	0
105	Arc	93398.962	93495.72	60	8	96.758	12	6	1	1	1	0	0	0
106	Arc	93546.642	93556.036	50	8	9.394	1	1	1	1	1	0	0	0

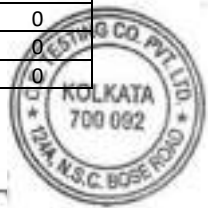


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HIP / CURVE NO.	ELEMENT	START	END	RADIUS (m)	Spacing on Curve (S)	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve
		CHAINAGE (m)	CHAINAGE (m)											
107	Arc	93600.014	93631.22	100	12	31.206	3	1	1	1	1	0	0	0
108	Arc	93703.191	93720.338	50	8	17.147	2	1	1	1	1	1	0	0
109	Arc	93832.196	93837.216	40	6	5.02	1	0	1	1	1	1	0	0
110	Arc	93904.252	93913.421	40	6	9.169	2	1	1	1	1	1	0	0
111	Arc	93972.137	93973.725	30	6	1.588	1	0	1	1	1	0	0	0
112	Arc	94024.375	94091.269	55	8	66.894	8	4	1	1	1	1	0	0
113	Arc	94201.979	94219.077	150	12	17.098	1	1	1	1	1	0	0	0
114	Arc	94282.445	94303.313	60	8	20.868	3	1	1	1	1	1	0	1
115	Arc	94494.271	94520.476	100	12	26.205	2	1	1	1	1	0	0	0
116	Arc	94575.285	94598.357	100	12	23.072	2	1	1	1	1	0	0	0
117	Arc	94697.579	94779.331	100	12	81.752	7	3	1	1	1	1	0	0
118	Arc	94940.216	94973.974	75	8	33.758	4	2	1	1	1	1	0	0
119	Arc	95055.073	95097.751	75	8	42.678	5	3	1	1	1	1	0	0
120	Arc	95231.386	95271.156	75	8	39.77	5	2	1	1	1	1	0	0
121	Arc	95359.899	95379.785	50	8	19.886	2	1	1	1	1	1	0	0
122	Arc	95481.869	95490.486	50	8	8.617	1	1	1	1	1	1	0	0
123	Arc	95607.895	95713.558	72	8	105.663	13	7	1	1	1	1	0	0
124	Arc	95823.38	95835.745	60	8	12.365	2	1	1	1	1	0	0	0
125	Arc	95889.394	95903.962	40	6	14.568	2	1	1	1	1	1	0	0
126	Arc	95969.524	95980.811	90	8	11.287	1	1	1	1	1	0	0	0
127	Arc	96034.738	96040.309	80	8	5.571	1	0	1	1	1	0	0	0
128	Arc	96082.318	96093.92	20	6	11.602	2	1	1	1	1	0	0	0
129	Arc	96146.472	96173.376	20	6	26.904	4	2	1	1	1	1	0	0
130	Arc	96248.603	96265.25	20	6	16.647	3	1	1	1	1	1	0	0
131	Arc	96361.363	96434.802	60	8	73.439	9	5	1	1	1	1	0	0
132	Arc	96518.08	96533.942	125	12	15.862	1	1	1	1	1	0	0	0
133	Arc	96613.305	96625.473	200	20	12.168	1	0	1	1	1	0	0	0
134	Arc	96707.381	96721.317	50	8	13.936	2	1	1	1	1	1	0	0
135	Arc	96845.408	96895.971	100	12	50.563	4	2	1	1	1	0	0	0
136	Arc	96993.407	97000.951	100	12	7.544	1	0	1	1	1	0	0	0
137	Arc	97056.437	97063.482	80	8	7.045	1	0	1	1	1	0	0	0
138	Arc	97139.592	97148.351	125	12	8.759	1	0	1	1	1	0	0	0
139	Arc	97202.681	97206.607	80	8	3.926	1	0	1	1	1	0	0	0
140	Arc	97278.619	97300.055	50	8	21.436	3	1	1	1	1	0	0	0
141	Arc	97374.414	97385.91	125	12	11.496	1	0	1	1	1	0	0	0

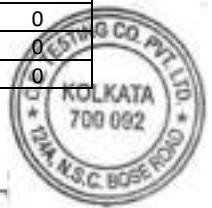


HIP / CURVE NO.	ELEMENT	START	END	RADIUS (m)	Spacing on Curve (S)	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve
		CHAINAGE (m)	CHAINAGE (m)											
142	Arc	97458.687	97493.851	50	8	35.164	4	2	1	1	1	0	0	0
143	Arc	97566.831	97593.067	80	8	26.236	3	2	1	1	1	0	0	0
144	Arc	97649.781	97674.522	80	8	24.741	3	2	1	1	1	0	0	0
145	Arc	97742.175	97776.846	300	25	34.671	1	1	0	1	1	0	0	0
146	Arc	97913.415	97956.355	150	12	42.94	4	2	1	1	1	0	0	0
147	Arc	98041.706	98044.088	30	6	2.382	1	0	1	1	1	1	0	0
148	Arc	98122.717	98128.917	40	6	6.2	1	1	1	1	1	1	0	0
149	Arc	98223.135	98242.465	100	12	19.33	2	1	1	1	1	0	0	0
150	Arc	98341.619	98376.426	50	8	34.807	4	2	1	1	1	1	0	0
151	Arc	98503.605	98507	50	8	3.395	1	0	1	1	1	1	0	1
152	Arc	98682.138	98704.847	100	12	22.709	2	1	1	1	1	1	0	0
153	Arc	98909.451	98937.519	300	25	28.068	1	1	1	0	1	0	0	0
154	Arc	99003.057	99012.273	80	8	9.216	1	1	1	1	1	1	0	0
155	Arc	99138.414	99155.54	100	12	17.126	1	1	1	1	1	0	0	0
156	Arc	99256.6	99312.544	100	12	55.944	5	2	1	1	1	0	0	0
157	Arc	99370.555	99376.962	100	12	6.407	1	0	1	1	1	0	0	0
158	Arc	99461.045	99483.017	150	12	21.972	2	1	1	1	1	0	0	0
159	Arc	99532.479	99573.858	300	25	41.379	2	1	0	1	1	0	0	0
160	Arc	99717.372	99754.391	50	8	37.019	5	2	1	1	1	1	0	0
161	Arc	99894.238	99981.275	75	8	87.037	11	5	1	1	1	1	0	1
162	Arc	100178.02	100203.125	80	8	25.105	3	2	1	1	1	0	1	0
163	Arc	100270.208	100342.733	300	25	72.525	3	1	0	1	1	0	0	0
164	Arc	100452.764	100468.578	300	25	15.814	1	0	1	1	1	0	0	0
165	Arc	100626.624	100692.525	300	25	65.901	3	1	1	0	1	0	0	0
166	Arc	100747.157	100758.718	150	12	11.561	1	0	1	0	1	0	0	0
167	Arc	100789.23	100873.041	300	25	83.811	3	2	0	0	1	0	0	0
168	Arc	100939.308	100964.003	20	6	24.695	4	2	1	1	1	1	0	0
169	Arc	101045.495	101063.161	50	8	17.666	2	1	1	1	1	0	0	0
170	Arc	101137.198	101149.99	70	8	12.792	2	1	1	1	1	0	0	0
171	Arc	101215.777	101226.283	70	8	10.506	1	1	1	1	1	0	0	0
172	Arc	101302.585	101342.956	50	8	40.371	5	3	1	1	1	0	0	0
173	Arc	101399.243	101422.056	50	8	22.813	3	1	1	1	1	0	0	0
174	Arc	101497.596	101532.168	20	6	34.572	6	3	1	1	1	1	0	0
175	Arc	101617.209	101631.466	20	6	14.257	2	1	1	1	1	0	0	0
176	Arc	101681.375	101691.724	80	8	10.349	1	1	1	1	1	1	0	0



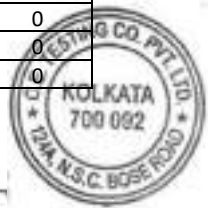
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HIP / CURVE NO.	ELEMENT	START	END	RADIUS (m)	Spacing on Curve (S)	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve
		CHAINAGE (m)	CHAINAGE (m)											
177	Arc	101772.324	101791.634	40	6	19.31	3	2	1	1	1	1	0	0
178	Arc	101878.187	101916.779	40	6	38.592	6	3	1	1	1	1	0	0
179	Arc	101975.076	101987.217	30	6	12.141	2	1	1	1	1	0	0	0
180	Arc	102029.553	102043.837	30	6	14.284	2	1	1	1	1	0	0	0
181	Arc	102096.057	102103.875	20	6	7.818	1	1	1	1	1	0	0	0
182	Arc	102136.855	102138.076	25	6	1.221	1	0	1	1	1	0	0	0
183	Arc	102181.24	102195.658	80	8	14.418	2	1	1	0	1	0	0	0
184	Arc	102220.802	102228.209	50	8	7.407	1	0	0	1	1	0	0	0
185	Arc	102290.136	102296.094	100	12	5.958	1	0	1	1	1	0	0	0
186	Arc	102357.011	102385.894	40	6	28.883	5	2	1	1	1	1	0	0
187	Arc	102448.439	102455.772	80	8	7.333	1	0	1	1	1	0	0	0
188	Arc	102508.861	102511.798	30	6	2.937	1	0	1	1	1	1	0	0
189	Arc	102583.424	102591.575	30	6	8.151	1	1	1	1	1	0	0	0
190	Arc	102637.89	102647.16	30	6	9.27	2	1	1	1	1	0	0	0
191	Arc	102678.895	102699.639	20	6	20.744	3	2	1	1	1	1	0	0
192	Arc	102770.788	102779.401	30	6	8.613	1	1	1	1	1	1	0	0
193	Arc	102854.864	102879.967	20	6	25.103	4	2	1	1	1	1	0	0
194	Arc	102954.586	102961.305	30	6	6.719	1	1	1	1	1	1	0	0
195	Arc	103060.108	103061.867	50	8	1.759	1	0	1	1	1	0	0	0
196	Arc	103121.005	103126.932	50	8	5.927	1	0	1	1	1	1	0	0
197	Arc	103250.334	103252.048	100	12	1.714	1	0	1	0	1	0	0	0
198	Arc	103287.624	103296.799	80	8	9.175	1	1	1	1	1	1	0	0
199	Arc	103383.787	103390.509	50	8	6.722	1	0	1	1	1	0	0	0
200	Arc	103448.032	103454.201	40	6	6.169	1	1	1	1	1	1	0	0
201	Arc	103516.261	103519.809	50	8	3.548	1	0	1	1	1	0	0	0
202	Arc	103588.608	103625.855	20	6	37.247	6	3	1	1	1	1	0	0
203	Arc	103751.192	103757.516	100	12	6.324	1	0	1	1	1	0	0	0
204	Arc	103853.086	103858.867	50	8	5.781	1	0	1	1	1	0	0	0
205	Arc	103933.335	103960.052	100	12	26.717	2	1	1	0	1	0	0	0
206	Arc	103991.928	104033.26	20	6	41.332	7	3	1	1	1	1	0	1
208	Arc	104401.974	104414.954	50	8	12.98	2	1	1	1	1	1	1	0
209	Arc	104500.761	104535.931	150	12	35.17	3	1	1	1	1	1	0	0
210	Arc	104664.898	104715.588	60	8	50.69	6	3	1	1	1	1	0	0
211	Arc	104830.816	105007.523	225	20	176.707	9	4	1	1	1	0	0	0
212	Arc	105086.998	105125.172	60	8	38.174	5	2	1	1	1	1	0	0



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HIP / CURVE NO.	ELEMENT	START	END	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
		CHAINAGE (m)	CHAINAGE (m)											
213	Arc	105229.589	105252.474	300	25	22.885	1	0	1	1	1	0	0	0
214	Arc	105388.552	105493.522	125	12	104.97	9	4	1	1	1	0	0	0
215	Arc	105558.371	105577.468	200	20	19.097	1	0	0	1	1	0	0	0
216	Arc	105762.577	105767.268	50	8	4.691	1	0	1	1	1	0	1	0
217	Arc	105812.059	105825.3	50	8	13.241	2	1	1	1	1	0	0	0
218	Arc	105855.784	105880.56	170	12	24.776	2	1	0	0	1	0	0	0
219	Arc	105911.89	105914.589	65	8	2.699	1	0	1	1	1	0	0	0
220	Arc	105950.248	105951.419	65	8	1.171	1	0	1	1	1	0	0	0
221	Arc	105999.144	106003.574	100	12	4.43	1	0	1	1	1	0	0	0
222	Arc	106087.591	106089.846	25	6	2.255	1	0	1	1	1	0	0	0
223	Arc	106124.49	106128.341	25	6	3.851	1	0	1	1	1	0	0	0
224	Arc	106162.414	106164.434	40	6	2.02	1	0	1	1	1	1	0	0
225	Arc	106267.955	106278.998	50	8	11.043	1	1	1	1	1	1	0	1
226	Arc	106476.257	106483.626	80	8	7.369	1	0	1	1	1	0	1	0
227	Arc	106526.067	106526.342	40	6	0.275	1	0	1	1	1	0	0	0
228	Arc	106557.715	106557.809	20	6	0.094	1	0	1	1	1	1	0	0
229	Arc	106639.543	106649.6	100	12	10.057	1	0	1	1	1	0	0	0
230	Arc	106718.15	106719.232	40	6	1.082	1	0	1	1	1	0	0	0
231	Arc	106769.638	106777.786	50	8	8.148	1	1	1	1	1	0	0	0
232	Arc	106841.633	106842.682	30	6	1.049	1	0	1	1	1	0	0	0
233	Arc	106868.764	106892.341	80	8	23.577	3	1	0	1	1	0	0	0
234	Arc	106925.22	106926.773	20	6	1.553	1	0	1	1	1	0	0	0
235	Arc	106965.585	106967.089	30	6	1.504	1	0	1	1	1	0	0	0
236	Arc	106998.223	107000.706	20	6	2.483	1	0	1	1	1	0	0	0
237	Arc	107039.826	107042.14	25	6	2.314	1	0	1	1	1	0	0	0
238	Arc	107063.969	107075.58	80	8	11.611	1	1	0	0	1	0	0	0
239	Arc	107085.987	107116.084	80	8	30.097	4	2	0	1	1	1	0	0
240	Arc	107213.157	107246.709	300	25	33.552	1	1	1	0	1	0	0	0
241	Arc	107296.248	107320.053	100	12	23.805	2	1	1	1	1	0	0	0
242	Arc	107413.99	107434.87	50	8	20.88	3	1	1	1	1	0	0	0
243	Arc	107499.393	107502.115	30	6	2.722	1	0	1	1	1	0	0	0
244	Arc	107536.707	107555.182	80	8	18.475	2	1	1	0	1	0	0	0
245	Arc	107577.209	107583.239	50	8	6.03	1	0	0	1	1	1	0	0
246	Arc	107669.928	107680.043	70	8	10.115	1	1	1	1	1	0	0	0
247	Arc	107733.557	107737.186	40	6	3.629	1	0	1	0	1	0	0	0



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HIP / CURVE NO.	ELEMENT	START	END	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
		CHAINAGE (m)	CHAINAGE (m)											
248	Arc	107757.462	107773.965	80	8	16.503	2	1	0	1	1	0	0	0
249	Arc	107831.558	107842.86	30	6	11.302	2	1	1	1	1	0	0	0
250	Arc	107877.272	107886.023	100	12	8.751	1	0	0	0	1	0	0	0
251	Arc	107903.237	107930.678	80	8	27.441	3	2	0	1	1	0	0	0
252	Arc	107979.54	107980.911	40	6	1.371	1	0	1	1	1	1	0	0
253	Arc	108057.758	108063.435	80	8	5.677	1	0	1	1	1	1	0	0
254	Arc	108144.985	108149.5	40	6	4.515	1	0	1	1	1	0	0	0
255	Arc	108184.465	108190.473	40	6	6.008	1	1	1	1	1	0	0	0
256	Arc	108233.869	108249.576	200	20	15.707	1	0	0	1	1	0	0	0
257	Arc	108382.655	108389.985	50	8	7.33	1	0	1	1	1	0	0	0
258	Arc	108437.1	108444.427	80	8	7.327	1	0	1	1	1	0	0	0
259	Arc	108498.73	108508.726	30	6	9.996	2	1	1	1	1	0	0	0
260	Arc	108552.293	108557.559	40	6	5.266	1	0	1	1	1	0	0	0
261	Arc	108592.05	108607.491	200	20	15.441	1	0	0	0	1	0	0	0
262	Arc	108637.574	108645.529	80	8	7.955	1	0	1	1	1	0	0	0
263	Arc	108704.108	108711.835	50	8	7.727	1	0	1	0	1	0	0	0
264	Arc	108734.115	108765.753	170	12	31.638	3	1	0	0	1	0	0	0
265	Arc	108797.582	108804.87	50	8	7.288	1	0	1	1	1	1	0	0
266	Arc	108887.098	108889.657	70	8	2.559	1	0	1	1	1	1	0	0
267	Arc	108967.016	108976.941	100	12	9.925	1	0	1	0	1	0	0	0
268	Arc	109009.808	109039.521	200	20	29.713	1	1	0	1	1	0	0	0
269	Arc	109131.422	109142.272	50	8	10.85	1	1	1	1	1	1	0	0
270	Arc	109227.96	109233.893	30	6	5.933	1	0	1	1	1	0	0	0
271	Arc	109270.781	109302.679	20	6	31.898	5	3	1	1	1	1	0	0
272	Arc	109381.988	109409.407	40	6	27.419	5	2	1	0	1	0	0	0
		<b>TOTAL =</b>				7099.782	752	351	273	274	300	131	13	12

Total no. of delineator = 2106



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CALCULATION FOR ROAD STUD

SL. No.	Description of section	START	END	Transition length	START CH.	END CH.	Length	Radius	Spacing on Curve (S)	Total On centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		75151.196	75173.73	40	75091.196	75233.73	142.53	50	6	24	48
		75247.727	75277.054	25	75202.727	75322.054	119.33	80	6	20	40
		75345.039	75358.069	30	75295.039	75408.069	113.03	30	6	19	38
		75419.486	75421.968	30	75369.486	75471.968	102.48	35	6	18	36
		75488.701	75501.459	25	75443.701	75546.459	102.76	100	6	18	36
		75567.233	75625.796	0	75547.233	75645.796	98.56	300	6	17	34
		75700.041	75750.142	15	75665.041	75785.142	120.10	125	6	21	42
		75951.716	75958.51	35	75896.716	76013.51	116.79	60	6	20	40
		76028.023	76028.658	30	75978.023	76078.658	100.63	30	6	17	34
		76103.76	76111.419	35	76048.760	76166.419	117.66	40	6	20	40
		76211.168	76240.286	15	76176.168	76275.286	99.12	200	6	17	34
		76338.789	76461.475	30	76288.789	76511.475	222.69	75	6	38	76
		76595.901	76623.759	40	76535.901	76683.759	147.86	50	6	25	50
		76697.256	76738.096	15	76662.256	76773.096	110.84	200	6	19	38
		76874.218	76892.951	40	76814.218	76952.951	138.73	50	6	24	48
		76986.507	77006.787	30	76936.507	77056.787	120.28	150	6	21	42
		77080.718	77093.013	15	77045.718	77128.013	82.30	200	6	14	28
		77160.079	77178.627	35	77105.079	77233.627	128.55	60	6	22	44
		77289.271	77309.424	30	77239.271	77359.424	120.15	150	6	21	42
		77479.94	77503.6	30	77429.940	77553.6	123.66	150	6	21	42
		77614.737	77625.386	40	77554.737	77685.386	130.65	50	6	22	44
		77716.638	77723.123	35	77661.638	77778.123	116.49	60	6	20	40
		77803.55	77815.941	30	77753.550	77865.941	112.39	75	6	19	38
		77886.745	77923.277	15	77851.745	77958.277	106.53	300	6	18	36
		78020.441	78081.214	20	77980.441	78121.214	140.77	100	6	24	48
		78223.134	78234.824	30	78173.134	78284.824	111.69	30	6	19	38
		78306.829	78322.172	20	78266.829	78362.172	95.34	60	6	16	32
		78411.61	78422.056	20	78371.610	78462.056	90.45	100	6	16	32
		78564.511	78583.616	40	78504.511	78643.616	139.10	50	6	24	48
		78687.321	78718.049	20	78647.321	78758.049	110.73	100	6	19	38
		78859.024	78874.468	40	78799.024	78934.468	135.44	50	6	23	46
		78979.887	79060.81	20	78939.887	79100.81	160.92	100	6	27	54
		79179.396	79189.708	35	79124.396	79244.708	120.31	60	6	21	42
		79245.039	79278.571	0	79225.039	79298.571	73.53	300	6	13	26
		79356.694	79417.612	40	79296.694	79477.612	180.92	50	6	31	62



*[Handwritten signature]*

SL. No.	Description of section	START	END	Transition length	START CH.	END CH.	Length	Radius	Spacing on Curve (S)	Total On centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		79501.777	79587.849	40	79441.777	79647.849	206.07	50	6	35	70
		79706.548	79733.367	20	79666.548	79773.367	106.82	100	6	18	36
		79846.977	79857.428	25	79801.977	79902.428	100.45	80	6	17	34
		80006.52	80016.299	15	79971.520	80051.299	79.78	150	6	14	28
		80089.579	80103.228	20	80049.579	80143.228	93.65	100	6	16	32
		80168.608	80184.365	30	80118.608	80234.365	115.76	30	6	20	40
		80303.585	80312.475	25	80258.585	80357.475	98.89	80	6	17	34
		80420.791	80437.126	30	80370.791	80487.126	116.34	30	6	20	40
		80525.302	80540.618	25	80480.302	80585.618	105.32	80	6	18	36
		80675.176	80700.455	30	80625.176	80750.455	125.28	75	6	21	42
		80774.825	80795.298	15	80739.825	80830.298	90.47	150	6	16	32
		80850.983	80879.384	0	80830.983	80899.384	68.40	300	6	12	24
		81009.489	81050.086	40	80949.489	81110.086	160.60	50	6	27	54
		81167.53	81240.079	0	81147.530	81260.079	112.55	300	6	19	38
		81345.241	81359.26	0	81325.241	81379.26	54.02	300	6	10	20
		81554.77	81607.227	25	81509.770	81652.227	142.46	40	6	24	48
		81672.168	81765.355	15	81637.168	81800.355	163.19	125	6	28	56
		81843.374	81852.463	25	81798.374	81897.463	99.09	40	6	17	34
		81909.701	81937.994	20	81869.701	81977.994	108.29	20	6	19	38
		82004.907	82023.791	20	81964.907	82063.791	98.88	20	6	17	34
		82122.759	82141.043	20	82082.759	82181.043	98.28	100	6	17	34
		82209.52	82244.453	20	82169.520	82284.453	114.93	100	6	20	40
		82371.017	82396.73	20	82331.017	82436.73	105.71	100	6	18	36
		82471.439	82482.932	20	82431.439	82522.932	91.49	100	6	16	32
		82643.474	82648.606	20	82603.474	82688.606	85.13	100	6	15	30
		82777.983	82803.809	20	82737.983	82843.809	105.83	20	6	18	36
		82872.862	82881.634	20	82832.862	82921.634	88.77	30	6	15	30
		82993.386	83016.617	0	82973.386	83036.617	63.23	100	6	11	22
		83067.66	83083.775	20	83027.660	83123.775	96.11	30	6	17	34
		83191.221	83204.295	35	83136.221	83259.295	123.07	60	6	21	42
		83284.313	83298.059	25	83239.313	83343.059	103.75	80	6	18	36
		83381.349	83428.045	30	83331.349	83478.045	146.70	70	6	25	50
		83579.681	83588.037	40	83519.681	83648.037	128.36	50	6	22	44
		83675.128	83689.879	40	83615.128	83749.879	134.75	50	6	23	46
		83822.335	83839.624	15	83787.335	83874.624	87.29	150	6	15	30
		84018.516	84048.522	25	83973.516	84093.522	120.01	25	6	21	42
		84159.215	84205.579	40	84099.215	84265.579	166.36	50	6	28	56
		84267.392	84347.944	15	84232.392	84382.944	150.55	125	6	26	52



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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 centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		84412.138	84426.839	25	84367.138	84471.839	104.70	80	6	18	36
		84528.422	84540.545	40	84468.422	84600.545	132.12	50	6	23	46
		84670.95	84700.544	30	84620.950	84750.544	129.59	300	6	22	44
		84914.461	85088.099	0	84894.461	85108.099	213.64	600	9	24	48
		85221.545	85231.117	15	85186.545	85266.117	79.57	125	6	14	28
		85270.214	85308.038	15	85235.214	85343.038	107.82	150	6	18	36
		85449.009	85456.554	40	85389.009	85516.554	127.54	50	6	22	44
		85585.175	85634.779	0	85565.175	85654.779	89.60	300	6	15	30
		85681.153	85697.161	30	85631.153	85747.161	116.01	30	6	20	40
		85779.827	85790.302	30	85729.827	85840.302	110.47	30	6	19	38
		85876.993	85907.309	20	85836.993	85947.309	110.32	60	6	19	38
		85963.465	86012.899	20	85923.465	86052.899	129.43	100	6	22	44
		86125.664	86149.358	20	86085.664	86189.358	103.69	100	6	18	36
		86234.374	86249.645	15	86199.374	86284.645	85.27	150	6	15	30
		86356.644	86382.817	0	86336.644	86402.817	66.17	300	6	12	24
		86489.598	86517.377	20	86449.598	86557.377	107.78	100	6	18	36
		86647.029	86662.011	20	86607.029	86702.011	94.98	100	6	16	32
		86730.069	86736.258	35	86675.069	86791.258	116.19	60	6	20	40
		86846.264	86882.848	0	86826.264	86902.848	76.58	300	6	13	26
		87045.625	87109.019	0	87025.625	87129.019	103.39	300	6	18	36
		87277.86	87281.712	20	87237.860	87321.712	83.85	100	6	14	28
		87338.696	87371.169	25	87293.696	87416.169	122.47	25	6	21	42
		87465.953	87478.558	35	87410.953	87533.558	122.61	60	6	21	42
		87666.457	87691.569	20	87626.457	87731.569	105.11	100	6	18	36
		87855.446	87872.913	35	87800.446	87927.913	127.47	60	6	22	44
		88097.403	88102.469	45	88032.403	88167.469	135.07	100	6	23	46
		88195.554	88244.909	30	88145.554	88294.909	149.35	70	6	25	50
		88336.411	88349.49	20	88296.411	88389.49	93.08	100	6	16	32
		88503.791	88536.67	30	88453.791	88586.67	132.88	70	6	23	46
		88647.906	88664.823	40	88587.906	88724.823	136.92	50	6	23	46
		88751.087	88793.575	25	88706.087	88838.575	132.49	90	6	23	46
		89023.927	89036.626	35	88968.927	89091.626	122.70	60	6	21	42
		89099.583	89131.069	20	89059.583	89171.069	111.49	100	6	19	38
		89176.472	89190.147	20	89136.472	89230.147	93.68	60	6	16	32
		89251.201	89280.234	25	89206.201	89325.234	119.03	40	6	20	40
		89383.519	89387.559	35	89328.519	89442.559	114.04	60	6	20	40
		89596.623	89689.049	15	89561.623	89724.049	162.43	200	6	28	56
		89789.748	89840.957	15	89754.748	89875.957	121.21	150	6	21	42



SL. No.	Description of section	START	END	Transition length	START CH.	END CH.	Length	Radius	Spacing on Curve (S)	Total On centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		89953.816	89979.142	20	89913.816	90019.142	105.33	100	6	18	36
		90070.087	90084.473	25	90025.087	90129.473	104.39	40	6	18	36
		90143.349	90158.483	20	90103.349	90198.483	95.13	30	6	16	32
		90227.891	90234.081	30	90177.891	90284.081	106.19	30	6	18	36
		90332.854	90349.097	30	90282.854	90399.097	116.24	30	6	20	40
		90517.716	90550.17	20	90477.716	90590.17	112.45	100	6	19	38
		90656.818	90832.781	0	90636.818	90852.781	215.96	350	6	36	72
		91031.212	91053.029	15	90996.212	91088.029	91.82	200	6	16	32
		91246.408	91310.082	20	91206.408	91350.082	143.67	200	6	24	48
		91419.366	91430.886	40	91359.366	91490.886	131.52	50	6	22	44
		91521.911	91543.117	35	91466.911	91598.117	131.21	60	6	22	44
		91687.484	91855.552	0	91667.484	91875.552	208.07	350	6	35	70
		92003.988	92023.258	30	91953.988	92073.258	119.27	70	6	20	40
		92150.785	92164.194	15	92115.785	92199.194	83.41	125	6	14	28
		92213.455	92226.244	25	92168.455	92271.244	102.79	80	6	18	36
		92304.357	92338.81	15	92269.357	92373.81	104.45	150	6	18	36
		92488.978	92501.788	15	92453.978	92536.788	82.81	150	6	14	28
		92596.01	92612.65	15	92561.010	92647.65	86.64	150	6	15	30
		92709.902	92733.337	40	92649.902	92793.337	143.43	50	6	24	48
		92790.039	92808.522	0	92770.039	92828.522	58.48	300	6	10	20
		92872.047	92902.049	30	92822.047	92952.049	130.00	35	6	22	44
		92937.567	93014.517	0	92917.567	93034.517	116.95	170	6	20	40
		93067.05	93100.462	20	93027.050	93140.462	113.41	20	6	19	38
		93164.969	93297.046	15	93129.969	93332.046	202.08	200	6	34	68
		93336.865	93358.62	15	93301.865	93393.62	91.75	125	6	16	32
		93398.962	93495.72	20	93358.962	93535.72	176.76	60	6	30	60
		93546.642	93556.036	20	93506.642	93596.036	89.39	50	6	15	30
		93600.014	93631.22	15	93565.014	93666.22	101.21	100	6	17	34
		93703.191	93720.338	20	93663.191	93760.338	97.15	50	6	17	34
		93832.196	93837.216	25	93787.196	93882.216	95.02	40	6	16	32
		93904.252	93913.421	25	93859.252	93958.421	99.17	40	6	17	34
		93972.137	93973.725	30	93922.137	94023.725	101.59	30	6	17	34
		94024.375	94091.269	20	93984.375	94131.269	146.89	55	6	25	50
		94201.979	94219.077	15	94166.979	94254.077	87.10	150	6	15	30
		94282.445	94303.313	35	94227.445	94358.313	130.87	60	6	22	44
		94494.271	94520.476	20	94454.271	94560.476	106.21	100	6	18	36
		94575.285	94598.357	20	94535.285	94638.357	103.07	100	6	18	36
		94697.579	94779.331	20	94657.579	94819.331	161.75	100	6	27	54



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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 centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		94940.216	94973.974	30	94890.216	95023.974	133.76	75	6	23	46
		95055.073	95097.751	30	95005.073	95147.751	142.68	75	6	24	48
		95231.386	95271.156	30	95181.386	95321.156	139.77	75	6	24	48
		95359.899	95379.785	40	95299.899	95439.785	139.89	50	6	24	48
		95481.869	95490.486	40	95421.869	95550.486	128.62	50	6	22	44
		95607.895	95713.558	30	95557.895	95763.558	205.66	72	6	35	70
		95823.38	95835.745	20	95783.380	95875.745	92.36	60	6	16	32
		95889.394	95903.962	25	95844.394	95948.962	104.57	40	6	18	36
		95969.524	95980.811	15	95934.524	96015.811	81.29	90	6	14	28
		96034.738	96040.309	15	95999.738	96075.309	75.57	80	6	13	26
		96082.318	96093.92	20	96042.318	96133.92	91.60	20	6	16	32
		96146.472	96173.376	20	96106.472	96213.376	106.90	20	6	18	36
		96248.603	96265.25	20	96208.603	96305.25	96.65	20	6	17	34
		96361.363	96434.802	35	96306.363	96489.802	183.44	60	6	31	62
		96518.08	96533.942	15	96483.080	96568.942	85.86	125	6	15	30
		96613.305	96625.473	15	96578.305	96660.473	82.17	200	6	14	28
		96707.381	96721.317	40	96647.381	96781.317	133.94	50	6	23	46
		96845.408	96895.971	20	96805.408	96935.971	130.56	100	6	22	44
		96993.407	97000.951	20	96953.407	97040.951	87.54	100	6	15	30
		97056.437	97063.482	25	97011.437	97108.482	97.04	80	6	17	34
		97139.592	97148.351	15	97104.592	97183.351	78.76	125	6	14	28
		97202.681	97206.607	25	97157.681	97251.607	93.93	80	6	16	32
		97278.619	97300.055	40	97218.619	97360.055	141.44	50	6	24	48
		97374.414	97385.91	15	97339.414	97420.91	81.50	125	6	14	28
		97458.687	97493.851	40	97398.687	97553.851	155.16	50	6	26	52
		97566.831	97593.067	25	97521.831	97638.067	116.24	80	6	20	40
		97649.781	97674.522	25	97604.781	97719.522	114.74	80	6	20	40
		97742.175	97776.846	0	97722.175	97796.846	74.67	300	6	13	26
		97913.415	97956.355	15	97878.415	97991.355	112.94	150	6	19	38
		98041.706	98044.088	30	97991.706	98094.088	102.38	30	6	18	36
		98122.717	98128.917	25	98077.717	98173.917	96.20	40	6	17	34
		98223.135	98242.465	20	98183.135	98282.465	99.33	100	6	17	34
		98341.619	98376.426	40	98281.619	98436.426	154.81	50	6	26	52
		98503.605	98507	40	98443.605	98567	123.40	50	6	21	42
		98682.138	98704.847	20	98642.138	98744.847	102.71	100	6	18	36
		98909.451	98937.519	0	98889.451	98957.519	68.07	300	6	12	24
		99003.057	99012.273	25	98958.057	99057.273	99.22	80	6	17	34
		99138.414	99155.54	20	99098.414	99195.54	97.13	100	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 centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		99256.6	99312.544	20	99216.600	99352.544	135.94	100	6	23	46
		99370.555	99376.962	20	99330.555	99416.962	86.41	100	6	15	30
		99461.045	99483.017	15	99426.045	99518.017	91.97	150	6	16	32
		99532.479	99573.858	0	99512.479	99593.858	81.38	300	6	14	28
		99717.372	99754.391	40	99657.372	99814.391	157.02	50	6	27	54
		99894.238	99981.275	30	99844.238	100031.275	187.04	75	6	32	64
		100178.02	100203.125	25	100133.020	100248.125	115.10	80	6	20	40
		100270.208	100342.733	0	100250.208	100362.733	112.52	300	6	19	38
		100452.764	100468.578	0	100432.764	100488.578	55.81	300	6	10	20
		100626.624	100692.525	0	100606.624	100712.525	105.90	300	6	18	36
		100747.157	100758.718	15	100712.157	100793.718	81.56	150	6	14	28
		100789.23	100873.041	0	100769.230	100893.041	123.81	300	6	21	42
		100939.308	100964.003	20	100899.308	101004.003	104.69	20	6	18	36
		101045.495	101063.161	20	101005.495	101103.161	97.67	50	6	17	34
		101137.198	101149.99	15	101102.198	101184.99	82.79	70	6	14	28
		101215.777	101226.283	30	101165.777	101276.283	110.51	70	6	19	38
		101302.585	101342.956	20	101262.585	101382.956	120.37	50	6	21	42
		101399.243	101422.056	25	101354.243	101467.056	112.81	50	6	19	38
		101497.596	101532.168	20	101457.596	101572.168	114.57	20	6	20	40
		101617.209	101631.466	20	101577.209	101671.466	94.26	20	6	16	32
		101681.375	101691.724	15	101646.375	101726.724	80.35	80	6	14	28
		101772.324	101791.634	15	101737.324	101826.634	89.31	40	6	15	30
		101878.187	101916.779	15	101843.187	101951.779	108.59	40	6	19	38
		101975.076	101987.217	15	101940.076	102022.217	82.14	30	6	14	28
		102029.553	102043.837	15	101994.553	102078.837	84.28	30	6	15	30
		102096.057	102103.875	15	102061.057	102138.875	77.82	20	6	13	26
		102136.855	102138.076	15	102101.855	102173.076	71.22	25	6	12	24
		102181.24	102195.658	0	102161.240	102215.658	54.42	80	6	10	20
		102220.802	102228.209	20	102180.802	102268.209	87.41	50	6	15	30
		102290.136	102296.094	15	102255.136	102331.094	75.96	100	6	13	26
		102357.011	102385.894	25	102312.011	102430.894	118.88	40	6	20	40
		102448.439	102455.772	15	102413.439	102490.772	77.33	80	6	13	26
		102508.861	102511.798	15	102473.861	102546.798	72.94	30	6	13	26
		102583.424	102591.575	15	102548.424	102626.575	78.15	30	6	14	28
		102637.89	102647.16	15	102602.890	102682.16	79.27	30	6	14	28
		102678.895	102699.639	15	102643.895	102734.639	90.74	20	6	16	32
		102770.788	102779.401	15	102735.788	102814.401	78.61	30	6	14	28
		102854.864	102879.967	18	102816.864	102917.967	101.10	20	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 centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		102954.586	102961.305	15	102919.586	102996.305	76.72	30	6	13	26
		103060.108	103061.867	15	103025.108	103096.867	71.76	50	6	12	24
		103121.005	103126.932	20	103081.005	103166.932	85.93	50	6	15	30
		103250.334	103252.048	15	103215.334	103287.048	71.71	100	6	12	24
		103287.624	103296.799	15	103252.624	103331.799	79.18	80	6	14	28
		103383.787	103390.509	20	103343.787	103430.509	86.72	50	6	15	30
		103448.032	103454.201	25	103403.032	103499.201	96.17	40	6	17	34
		103516.261	103519.809	15	103481.261	103554.809	73.55	50	6	13	26
		103588.608	103625.855	15	103553.608	103660.855	107.25	20	6	18	36
		103751.192	103757.516	20	103711.192	103797.516	86.32	100	6	15	30
		103853.086	103858.867	25	103808.086	103903.867	95.78	50	6	16	32
		103933.335	103960.052	0	103913.335	103980.052	66.72	100	6	12	24
		103991.928	104033.26	20	103951.928	104073.26	121.33	20	6	21	42
		104141.87	104204.111	0	104121.870	104224.111	102.24	400	6	18	36
		104401.974	104414.954	40	104341.974	104474.954	132.98	50	6	23	46
		104500.761	104535.931	15	104465.761	104570.931	105.17	150	6	18	36
		104664.898	104715.588	35	104609.898	104770.588	160.69	60	6	27	54
		104830.816	105007.523	15	104795.816	105042.523	246.71	225	6	42	84
		105086.998	105125.172	35	105031.998	105180.172	148.17	60	6	25	50
		105229.589	105252.474	0	105209.589	105272.474	62.88	300	6	11	22
		105388.552	105493.522	15	105353.552	105528.522	174.97	125	6	30	60
		105558.371	105577.468	15	105523.371	105612.468	89.10	200	6	15	30
		105762.577	105767.268	20	105722.577	105807.268	84.69	50	6	15	30
		105812.059	105825.3	20	105772.059	105865.3	93.24	50	6	16	32
		105855.784	105880.56	0	105835.784	105900.56	64.78	170	6	11	22
		105911.89	105914.589	15	105876.890	105949.589	72.70	65	6	13	26
		105950.248	105951.419	15	105915.248	105986.419	71.17	65	6	12	24
		105999.144	106003.574	15	105964.144	106038.574	74.43	100	6	13	26
		106087.591	106089.846	15	106052.591	106124.846	72.26	25	6	13	26
		106124.49	106128.341	15	106089.490	106163.341	73.85	25	6	13	26
		106162.414	106164.434	15	106127.414	106199.434	72.02	40	6	13	26
		106267.955	106278.998	20	106227.955	106318.998	91.04	50	6	16	32
		106476.257	106483.626	15	106441.257	106518.626	77.37	80	6	13	26
		106526.067	106526.342	15	106491.067	106561.342	70.28	40	6	12	24
		106557.715	106557.809	15	106522.715	106592.809	70.09	20	6	12	24
		106639.543	106649.6	15	106604.543	106684.6	80.06	100	6	14	28
		106718.15	106719.232	25	106673.150	106764.232	91.08	40	6	16	32
		106769.638	106777.786	20	106729.638	106817.786	88.15	50	6	15	30



*[Handwritten signature]*

SL. No.	Description of section	START	END	Transition length	START CH.	END CH.	Length	Radius	Spacing on Curve (S)	Total On centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		106841.633	106842.682	15	106806.633	106877.682	71.05	30	6	12	24
		106868.764	106892.341	0	106848.764	106912.341	63.58	80	6	11	22
		106925.22	106926.773	20	106885.220	106966.773	81.55	20	6	14	28
		106965.585	106967.089	15	106930.585	107002.089	71.50	30	6	12	24
		106998.223	107000.706	15	106963.223	107035.706	72.48	20	6	13	26
		107039.826	107042.14	15	107004.826	107077.14	72.31	25	6	13	26



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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 centreline (nos)	Total On shoulder (nos)
		CHAINAGE (m)	CHAINAGE (m)		Road Stud	Road stud					
		107063.969	107075.58	0	107043.969	107095.58	51.61	80	6	9	18
		107085.987	107116.084	0	107065.987	107136.084	70.10	80	6	12	24
		107213.157	107246.709	0	107193.157	107266.709	73.55	300	6	13	26
		107296.248	107320.053	20	107256.248	107360.053	103.80	100	6	18	36
		107413.99	107434.87	20	107373.990	107474.87	100.88	50	6	17	34
		107499.393	107502.115	15	107464.393	107537.115	72.72	30	6	13	26
		107536.707	107555.182	0	107516.707	107575.182	58.48	80	6	10	20
		107577.209	107583.239	15	107542.209	107618.239	76.03	50	6	13	26
		107669.928	107680.043	15	107634.928	107715.043	80.12	70	6	14	28
		107733.557	107737.186	15	107698.557	107772.186	73.63	40	6	13	26
		107757.462	107773.965	0	107737.462	107793.965	56.50	80	6	10	20
		107831.558	107842.86	15	107796.558	107877.86	81.30	30	6	14	28
		107877.272	107886.023	0	107857.272	107906.023	48.75	100	6	9	18
		107903.237	107930.678	0	107883.237	107950.678	67.44	80	6	12	24
		107979.54	107980.911	25	107934.540	108025.911	91.37	40	6	16	32
		108057.758	108063.435	15	108022.758	108098.435	75.68	80	6	13	26
		108144.985	108149.5	15	108109.985	108184.5	74.51	40	6	13	26
		108184.465	108190.473	15	108149.465	108225.473	76.01	40	6	13	26
		108233.869	108249.576	0	108213.869	108269.576	55.71	200	6	10	20
		108382.655	108389.985	20	108342.655	108429.985	87.33	50	6	15	30
		108437.1	108444.427	15	108402.100	108479.427	77.33	80	6	13	26
		108498.73	108508.726	15	108463.730	108543.726	80.00	30	6	14	28
		108552.293	108557.559	15	108517.293	108592.559	75.27	40	6	13	26
		108592.05	108607.491	0	108572.050	108627.491	55.44	200	6	10	20
		108637.574	108645.529	15	108602.574	108680.529	77.96	80	6	13	26
		108704.108	108711.835	20	108664.108	108751.835	87.73	50	6	15	30
		108734.115	108765.753	0	108714.115	108785.753	71.64	170	6	12	24
		108797.582	108804.87	20	108757.582	108844.87	87.29	50	6	15	30
		108887.098	108889.657	15	108852.098	108924.657	72.56	70	6	13	26
		108967.016	108976.941	15	108932.016	109011.941	79.93	100	6	14	28
		109009.808	109039.521	0	108989.808	109059.521	69.71	200	6	12	24
		109131.422	109142.272	20	109091.422	109182.272	90.85	50	6	16	32
		109227.96	109233.893	15	109192.960	109268.893	75.93	30	6	13	26
		109270.781	109302.679	18	109232.781	109340.679	107.90	20	6	18	36
		109381.988	109409.407	15	109346.988	109444.407	97.42	40	6	17	34

Total=

5484 10968

Total no. of Road stud =

16452 nos.



HIP/CUR VE NO.	ELEMENT	START	END	CHORD LENGTH (m)					
		CHAINAG E (m)	CHAINAG E (m)						
1	Arc	75151.2	75173.73	22.534	50	15	30	2	2
2	Arc	75247.73	75277.05	29.327	80	15	30	2	2
3	Arc	75345.04	75358.07	13.030	30	15	30	1	1
4	Arc	75419.49	75421.97	2.482	35	15	30	0	0
5	Arc	75488.7	75501.46	12.758	100	20	40	1	1
6	Arc	75567.23	75625.8	58.563	300	45	90	1	1
7	Arc	75700.04	75750.14	50.101	125	20	40	3	3
8	Arc	75951.72	75958.51	6.794	60	15	30	0	0
9	Arc	76028.02	76028.66	0.635	30	15	30	0	0
10	Arc	76103.76	76111.42	7.659	40	15	30	1	1
11	Arc	76211.17	76240.29	29.118	200	30	60	1	1
12	Arc	76595.9	76623.76	27.858	50	15	30	2	2
13	Arc	76697.26	76738.1	40.840	200	30	60	1	1
14	Arc	76874.22	76892.95	18.733	50	15	30	1	1
15	Arc	76986.51	77006.79	20.280	150	20	40	1	1
16	Arc	77080.72	77093.01	12.295	200	30	60	0	0
17	Arc	77160.08	77178.63	18.548	60	15	30	1	1
18	Arc	77289.27	77309.42	20.153	150	20	40	1	1
19	Arc	77479.94	77503.6	23.660	150	20	40	1	1
20	Arc	77614.74	77625.39	10.649	50	15	30	1	1
21	Arc	77716.64	77723.12	6.485	60	15	30	0	0
22	Arc	77886.75	77923.28	36.532	300	45	90	1	1
23	Arc	78020.44	78081.21	60.773	100	20	40	3	3
24	Arc	78223.13	78234.82	11.690	30	15	30	1	1
25	Arc	78306.83	78322.17	15.343	60	15	30	1	1
26	Arc	78411.61	78422.06	10.446	100	20	40	1	1
27	Arc	78564.51	78583.62	19.105	50	15	30	1	1
28	Arc	78687.32	78718.05	30.728	100	20	40	2	2
29	Arc	78859.02	78874.47	15.444	50	15	30	1	1
30	Arc	78979.89	79060.81	80.923	100	20	40	4	4
31	Arc	79179.4	79189.71	10.312	60	15	30	1	1
32	Arc	79245.04	79278.57	33.532	300	45	90	1	1
33	Arc	79356.69	79417.61	60.918	50	15	30	4	4
34	Arc	79501.78	79587.85	86.072	50	15	30	6	6
35	Arc	79706.55	79733.37	26.819	100	20	40	1	1
36	Arc	79846.98	79857.43	10.451	80	15	30	1	1
37	Arc	80006.52	80016.3	9.779	150	20	40	0	0
38	Arc	80089.58	80103.23	13.649	100	20	40	1	1
39	Arc	80168.61	80184.37	15.757	30	15	30	1	1
40	Arc	80303.59	80312.48	8.890	80	15	30	1	1
41	Arc	80420.79	80437.13	16.335	30	15	30	1	1
42	Arc	80525.3	80540.62	15.316	80	15	30	1	1
43	Arc	80774.83	80795.3	20.473	150	20	40	1	1
44	Arc	80850.98	80879.38	28.401	300	45	90	1	1
45	Arc	81009.49	81050.09	40.597	50	15	30	3	3
46	Arc	81167.53	81240.08	72.549	300	45	90	2	2
47	Arc	81345.24	81359.26	14.019	300	45	90	0	0
48	Arc	81554.77	81607.23	52.457	40	15	30	3	3
49	Arc	81672.17	81765.36	93.187		20	40	5	5
50	Arc			9.089		15	30	1	1
51	Arc			28.293		15	30	2	2
52	Arc			18.884		15	30	1	1
53	Arc			18.284		20	40	1	1



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54	Arc	82209.52	82244.45	34.933	100	20	40	2	2
55	Arc	82371.02	82396.73	25.713	100	20	40	1	1
56	Arc	82471.44	82482.93	11.493	100	20	40	1	1
57	Arc	82643.47	82648.61	5.132	100	20	40	0	0
58	Arc	82777.98	82803.81	25.826	20	15	30	2	2
59	Arc	82872.86	82881.63	8.772	30	15	30	1	1
60	Arc	82993.39	83016.62	23.231	100	20	40	1	1
61	Arc	83067.66	83083.78	16.115	30	15	30	1	1
62	Arc	83191.22	83204.3	13.074	60	15	30	1	1
63	Arc	83284.31	83298.06	13.746	80	15	30	1	1
64	Arc	83381.35	83428.05	46.696	70	15	30	3	3
65	Arc	83579.68	83588.04	8.356	50	15	30	1	1
66	Arc	83675.13	83689.88	14.751	50	15	30	1	1
67	Arc	83822.34	83839.62	17.289	150	20	40	1	1
68	Arc	84018.52	84048.52	30.006	25	15	30	2	2
69	Arc	84159.22	84205.58	46.364	50	15	30	3	3
70	Arc	84267.39	84347.94	80.552	125	20	40	4	4
71	Arc	84412.14	84426.84	14.701	80	15	30	1	1
72	Arc	84528.42	84540.55	12.123	50	15	30	1	1
73	Arc	84670.95	84700.54	29.594	300	45	90	1	1
74	Arc	84914.46	85088.1	173.638	600	70	140	2	2
75	Arc	85221.55	85231.12	9.572	125	20	40	0	0
76	Arc	85270.21	85308.04	37.824	150	20	40	2	2
77	Arc	85449.01	85456.55	7.545	50	15	30	1	1
78	Arc	85585.18	85634.78	49.604	300	45	90	1	1
79	Arc	85681.15	85697.16	16.008	30	15	30	1	1
80	Arc	85779.83	85790.3	10.475	30	15	30	1	1
81	Arc	85876.99	85907.31	30.316	60	15	30	2	2
82	Arc	85963.47	86012.9	49.434	100	20	40	2	2
83	Arc	86125.66	86149.36	23.694	100	20	40	1	1
84	Arc	86234.37	86249.65	15.271	150	20	40	1	1
85	Arc	86356.64	86382.82	26.173	300	45	90	1	1
86	Arc	86489.6	86517.38	27.779	100	20	40	1	1
87	Arc	86647.03	86662.01	14.982	100	20	40	1	1
88	Arc	86730.07	86736.26	6.189	60	15	30	0	0
89	Arc	86846.26	86882.85	36.584	300	45	90	1	1
90	Arc	87045.63	87109.02	63.394	300	45	90	1	1
91	Arc	87277.86	87281.71	3.852	100	20	40	0	0
92	Arc	87338.7	87371.17	32.473	25	15	30	2	2
93	Arc	87338.7	87371.17	32.473	25	15	30	2	2
94	Arc	87465.95	87478.56	12.605	60	15	30	1	1
95	Arc	87666.46	87691.57	25.112	100	20	40	1	1
96	Arc	87855.45	87872.91	17.467	60	15	30	1	1
97	Arc	88097.4	88102.47	5.066	100	20	40	0	0
98	Arc	88195.55	88244.91	49.355	70	15	30	3	3
99	Arc	88336.41	88349.49	13.079	100	20	40	1	1
100	Arc	88503.79	88536.67	32.879	70	15	30	2	2
101	Arc	88647.91	88664.82	16.917	50	15	30	1	1
102	Arc	88751.09	88793.58	42.488	90	15	30	3	3
103	Arc	89023.93	89036.63	12.699		15	30	1	1
104	Arc			31.486		20	40	2	2
105	Arc			13.675		15	30	1	1
106	Arc			29.033		15	30	2	2
107	Arc			4.040		15	30	0	0
108	Arc			92.426		30	60	3	3
109	Arc			51.209		20	40	3	3
110	Arc			25.326		20	40	1	1
111	Arc			14.386		15	30	1	1
112	Arc			15.134		15	30	1	1
113	Arc			6.190		15	30	0	0



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114	Arc	90332.85	90349.1	16.243	30	15	30	1	1
115	Arc	90517.72	90550.17	32.454	100	20	40	2	2
107	Arc	90656.82	90832.78	175.963	350	45	90	4	4
108	Arc	91031.21	91053.03	21.817	200	30	60	1	1
109	Arc	91246.41	91310.08	63.674	200	30	60	2	2
110	Arc	91419.37	91430.89	11.520	50	15	30	1	1
111	Arc	91521.91	91543.12	21.206	60	15	30	1	1
112	Arc	91687.48	91855.55	168.068	350	45	90	4	4
113	Arc	92003.99	92023.26	19.270	70	15	30	1	1
114	Arc	92150.79	92164.19	13.409	125	20	40	1	1
115	Arc	92213.46	92226.24	12.789	80	15	30	1	1
116	Arc	92304.36	92338.81	34.453	150	20	40	2	2
117	Arc	92488.98	92501.79	12.810	150	20	40	1	1
118	Arc	92596.01	92612.65	16.640	150	20	40	1	1
119	Arc	92709.9	92733.34	23.435	50	15	30	2	2
120	Arc	92790.04	92808.52	18.483	300	45	90	0	0
121	Arc	92872.05	92902.05	30.002	35	15	30	2	2
122	Arc	92937.57	93014.52	76.950	170	20	40	4	4
123	Arc	93067.05	93100.46	33.412	20	15	30	2	2
124	Arc	93164.97	93297.05	132.077	200	30	60	4	4
125	Arc	93336.87	93358.62	21.755	125	20	40	1	1
126	Arc	93398.96	93495.72	96.758	60	15	30	6	6
127	Arc	93546.64	93556.04	9.394	50	15	30	1	1
128	Arc	93600.01	93631.22	31.206	100	20	40	2	2
129	Arc	93703.19	93720.34	17.147	50	15	30	1	1
130	Arc	93832.2	93837.22	5.020	40	15	30	0	0
131	Arc	93904.25	93913.42	9.169	40	15	30	1	1
132	Arc	93972.14	93973.73	1.588	30	15	30	0	0
133	Arc	94024.38	94091.27	66.894	55	15	30	4	4
134	Arc	94201.98	94219.08	17.098	150	20	40	1	1
135	Arc	94282.45	94303.31	20.868	60	15	30	1	1
136	Arc	94494.27	94520.48	26.205	100	20	40	1	1
137	Arc	94575.29	94598.36	23.072	100	20	40	1	1
138	Arc	94697.58	94779.33	81.752	100	20	40	4	4
139	Arc	95359.9	95379.79	19.886	50	15	30	1	1
140	Arc	95481.87	95490.49	8.617	50	15	30	1	1
141	Arc	95607.9	95713.56	105.663	72	15	30	7	7
142	Arc	95823.38	95835.75	12.365	60	15	30	1	1
143	Arc	95889.39	95903.96	14.568	40	15	30	1	1
144	Arc	95969.52	95980.81	11.287	90	15	30	1	1
145	Arc	96034.74	96040.31	5.571	80	15	30	0	0
146	Arc	96082.32	96093.92	11.602	20	15	30	1	1
147	Arc	96146.47	96173.38	26.904	20	15	30	2	2
148	Arc	96248.6	96265.25	16.647	20	15	30	1	1
149	Arc	96361.36	96434.8	73.439	60	15	30	5	5
150	Arc	96518.08	96533.94	15.862	125	20	40	1	1
151	Arc	96613.31	96625.47	12.168	200	30	60	0	0
152	Arc	96707.38	96721.32	13.936	50	15	30	1	1
153	Arc	96845.41	96895.97	50.563	100	20	40	3	3
154	Arc	96993.41	97000.95	7.544		20	40	0	0
155	Arc			7.045		15	30	0	0
156	Arc			8.759		20	40	0	0
157	Arc			3.926		15	30	0	0
158	Arc			21.436		15	30	1	1
159	Arc			11.496		20	40	1	1
160	Arc			35.164		15	30	2	2
161	Arc			26.236		15	30	2	2
162	Arc			24.741		15	30	2	2
163	Arc			34.671		45	90	1	1
164	Arc			42.940		20	40	2	2



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165	Arc	98041.71	98044.09	2.382	30	15	30	0	0
166	Arc	98122.72	98128.92	6.200	40	15	30	0	0
167	Arc	98223.14	98242.47	19.330	100	20	40	1	1
168	Arc	98341.62	98376.43	34.807	50	15	30	2	2
169	Arc	98503.61	98507	3.395	50	15	30	0	0
170	Arc	98682.14	98704.85	22.709	100	20	40	1	1
171	Arc	98909.45	98937.52	28.068	300	45	90	1	1
172	Arc	99003.06	99012.27	9.216	80	15	30	1	1
173	Arc	99138.41	99155.54	17.126	100	20	40	1	1
174	Arc	99256.6	99312.54	55.944	100	20	40	3	3
175	Arc	99370.56	99376.96	6.407	100	20	40	0	0
176	Arc	99461.05	99483.02	21.972	150	20	40	1	1
177	Arc	99532.48	99573.86	41.379	300	45	90	1	1
178	Arc	99717.37	99754.39	37.019	50	15	30	2	2
179	Arc	100178	100203.1	25.105	80	15	30	2	2
180	Arc	100270.2	100342.7	72.525	300	45	90	2	2
181	Arc	100452.8	100468.6	15.814	300	45	90	0	0
182	Arc	100626.6	100692.5	65.901	300	45	90	1	1
183	Arc	100747.2	100758.7	11.561	150	20	40	1	1
184	Arc	100789.2	100873	83.811	300	45	90	2	2
185	Arc	101045.5	101063.2	17.666	50	15	30	1	1
186	Arc	101137.2	101150	12.792	70	15	30	1	1
187	Arc	101215.8	101226.3	10.506	70	15	30	1	1
188	Arc	101302.6	101343	40.371	50	15	30	3	3
189	Arc	101399.2	101422.1	22.813	50	15	30	2	2
190	Arc	101497.6	101532.2	34.572	20	15	30	2	2
191	Arc	101617.2	101631.5	14.257	20	15	30	1	1
192	Arc	101681.4	101691.7	10.349	80	15	30	1	1
193	Arc	101772.3	101791.6	19.310	40	15	30	1	1
194	Arc	101878.2	101916.8	38.592	40	15	30	3	3
195	Arc	101975.1	101987.2	12.141	30	15	30	1	1
196	Arc	102029.6	102043.8	14.284	30	15	30	1	1
197	Arc	102136.9	102138.1	1.221	25	15	30	0	0
198	Arc	102181.2	102195.7	14.418	80	15	30	1	1
199	Arc	102220.8	102228.2	7.407	50	15	30	0	0
200	Arc	102290.1	102296.1	5.958	100	20	40	0	0
201	Arc	102357	102385.9	28.883	40	15	30	2	2
202	Arc	102448.4	102455.8	7.333	80	15	30	0	0
203	Arc	102508.9	102511.8	2.937	30	15	30	0	0
204	Arc	102583.4	102591.6	8.151	30	15	30	1	1
205	Arc	102637.9	102647.2	9.270	30	15	30	1	1
206	Arc	102770.8	102779.4	8.613	30	15	30	1	1
207	Arc	102954.6	102961.3	6.719	30	15	30	0	0
208	Arc	103060.1	103061.9	1.759	50	15	30	0	0
209	Arc	103121	103126.9	5.927	50	15	30	0	0
210	Arc	103250.3	103252	1.714	100	20	40	0	0
211	Arc	103287.6	103296.8	9.175	80	15	30	1	1
212	Arc	103383.8	103390.5	6.722	50	15	30	0	0
213	Arc	103448	103454.2	6.169	40	15	30	0	0
214	Arc	103516.3	103519.8	3.548		15	30	0	0
215	Arc			6.324		20	40	0	0
216	Arc			5.781		15	30	0	0
217	Arc			26.717		20	40	1	1
218	Arc			41.332		15	30	3	3
219	Arc			62.241		60	120	1	1
220	Arc			12.980		15	30	1	1
221	Arc			35.170		20	40	2	2
222	Arc			50.690		15	30	3	3
223	Arc			176.707		30	60	6	6
224	Arc			38.174		15	30	3	3



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225	Arc	105229.6	105252.5	22.885	300	45	90	1	1
226	Arc	105388.6	105493.5	104.970	125	20	40	5	5
227	Arc	105558.4	105577.5	19.097	200	30	60	1	1
228	Arc	105762.6	105767.3	4.691	50	15	30	0	0
229	Arc	105812.1	105825.3	13.241	50	15	30	1	1
230	Arc	105855.8	105880.6	24.776	170	20	40	1	1
231	Arc	105911.9	105914.6	2.699	65	15	30	0	0
232	Arc	105950.2	105951.4	1.171	65	15	30	0	0
233	Arc	105999.1	106003.6	4.430	100	20	40	0	0
234	Arc	106087.6	106089.8	2.255	25	15	30	0	0
235	Arc	106124.5	106128.3	3.851	25	15	30	0	0
236	Arc	106162.4	106164.4	2.020	40	15	30	0	0
237	Arc	106271.4	106275.9	4.519	30	15	30	0	0
238	Arc	106318.8	106322.3	3.495	50	15	30	0	0
239	Arc	106369.8	106377.8	8.005	50	15	30	1	1
240	Arc	106430.1	106446.4	16.274	200	30	60	1	1
241	Arc	106494	106499.7	5.668	40	15	30	0	0
242	Arc	106530.5	106532.2	1.705	40	15	30	0	0
243	Arc	106562.8	106562.9	0.094	20	15	30	0	0
244	Arc	106644.6	106654.7	10.056	100	20	40	1	1
245	Arc	106723.2	106724.3	1.082	40	15	30	0	0
246	Arc	106774.7	106782.9	8.148	50	15	30	1	1
247	Arc	106846.7	106847.8	1.048	30	15	30	0	0
248	Arc	106873.8	106897.4	23.577	80	15	30	2	2
249	Arc	106930.3	106931.9	1.554	20	15	30	0	0
250	Arc	106970.7	106972.2	1.504	30	15	30	0	0
251	Arc	107003.3	107005.8	2.482	20	15	30	0	0
252	Arc	107044.9	107047.2	2.314	25	15	30	0	0
253	Arc	107069.1	107080.7	11.611	80	15	30	1	1
254	Arc	107090.6	107121.6	31.062	80	15	30	2	2
255	Arc	107128.3	107149.8	21.459	80	15	30	1	1
256	Arc	107185	107191.5	6.502	40	15	30	0	0
257	Arc	107228.9	107238.2	9.386	30	15	30	1	1
258	Arc	107289.3	107316.7	27.415	80	15	30	2	2
259	Arc	107319.7	107351.2	31.494	80	15	30	2	2
260	Arc	107428.9	107430.1	1.198	25	15	30	0	0
261	Arc	107676	107676.7	0.653	30	15	30	0	0
262	Arc	107845.4	107847.3	1.924	50	15	30	0	0
263	Arc	107931.6	107937.6	6.027	80	15	30	0	0
264	Arc	107976.4	107985.3	8.984	50	15	30	1	1
265	Arc	108016.6	108035.1	18.475	80	15	30	1	1
266	Arc	108057.1	108063.2	6.031	50	15	30	0	0
267	Arc	108149.9	108160	10.115	70	15	30	1	1
268	Arc	108213.5	108217.1	3.630	40	15	30	0	0
269	Arc	108237.4	108253.9	16.503	80	15	30	1	1
270	Arc	108311.5	108322.8	11.302	30	15	30	1	1
271	Arc	108357.2	108366	8.750	100	20	40	0	0
272	Arc	108383.2	108410.6	27.441	80	15	30	2	2
273	Arc	108459.5	108460.8	1.371	40	15	30	0	0
274	Arc	108537.7	108543.4	5.677		15	30	0	0
275	Arc			4.515		15	30	0	0
276	Arc			6.008		15	30	0	0
277	Arc			15.706		30	60	1	1
278	Arc			7.331		15	30	0	0
279	Arc			7.327		15	30	0	0
280	Arc			9.996		15	30	1	1
281	Arc			5.266		15	30	0	0
282	Arc			15.442		30	60	1	1
283	Arc			7.955		15	30	1	1
284	Arc			7.727		15	30	1	1



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285	Arc	109214	109245.7	31.638	170	20	40	2	2
286	Arc	109277.5	109284.8	7.289	50	15	30	0	0
287	Arc	109367	109369.6	2.559	70	15	30	0	0
288	Arc	109446.9	109456.9	9.926	100	20	40	0	0
Total						5775	11550	358	358

Total No. of Chevron . 716 nos



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## Errosion Control

### A. QUANTITY CALCULATION OF TURFING

#### **Turfing with Sods ::**

Turfing is provided on TCS 2, TCS 2A, TCS 3, TCS 3A ,TCS 7 ,TCS 17

TCS Type	Length
TCS-2	9482.82
TCS-2A	4159.34
TCS-3	472.2
TCS-3A	322.4
TCS-7	6821
TCS-17	877

Assume ht. of embankment = 2.0 m

Width of Turfing = 4.5 m

Quantity of Turfing = 117835 sqm

### B . Quantity Calculation For Hydro Seeding

TCS-3	472.2
TCS-3A	325
TCS-5	440
TCS-5A	585
TCS-7	6905
TCS-8	2360
TCS-12B	125
TCS-17	885
TCS-18	830
TCS-19	1100
TCS-19A	2050
Total Length=	16077.2

Avg Width of Hydro Seeding = 8.00 m

Total Area of Hydro Seeding= 128618 sqm

#### **Summary**

Turfing= 117835 sqm

Hydroseeding= 128618 sqm



GSB Reuse Calculation

Description	Required GSB Qty	Reusable GSB Quantity	Unit
TCS-05	129.033	87	Cum
TCS-06A	507.3	342	Cum
TCS-19	620.73	419	Cum
TCS-04A	343.71	232	Cum
TCS-14	509.01	344	Cum
TCS-02A	1593.15	1075	Cum
TCS-09	1004.91	678	Cum
TCS-17	454.29	307	Cum
TCS-18	466.83	315	Cum
TCS-11A	39.9	27	Cum
TCS-03	1033.604	698	Cum
TCS-01A	170.4	115	Cum
TCS-19A	1163.997	786	Cum
TCS-07	3636.03	2454	Cum
TCS-12B	71.25	48	Cum
TCS-04	277.749	187	Cum
TCS-02	14259.45	9625	Cum
TCS-08	615.6	416	Cum
TCS-05A	1266.54	855	Cum
TCS-14A	699.39	472	Cum
TCS-03A	183.54	124	Cum
Total=	29046	19606	

Reuseable GSB Quantity= 67.50

Total Dismantle Granular Quantity(cum)= 27999 cum  
 use 70% of Total Dismantle Granular Quantity for GSB (cum)= 19599.3  
 Total Required GSB Qty (Cum)= 29046.42  
 14.03

Re Useabl  
 Remaining



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## OVERHEAD SIGN

Chainage Details:

Location	Chainage (Km)	Nos
End Road	109+494 Km	1
<b>Total=</b>		<b>1</b>

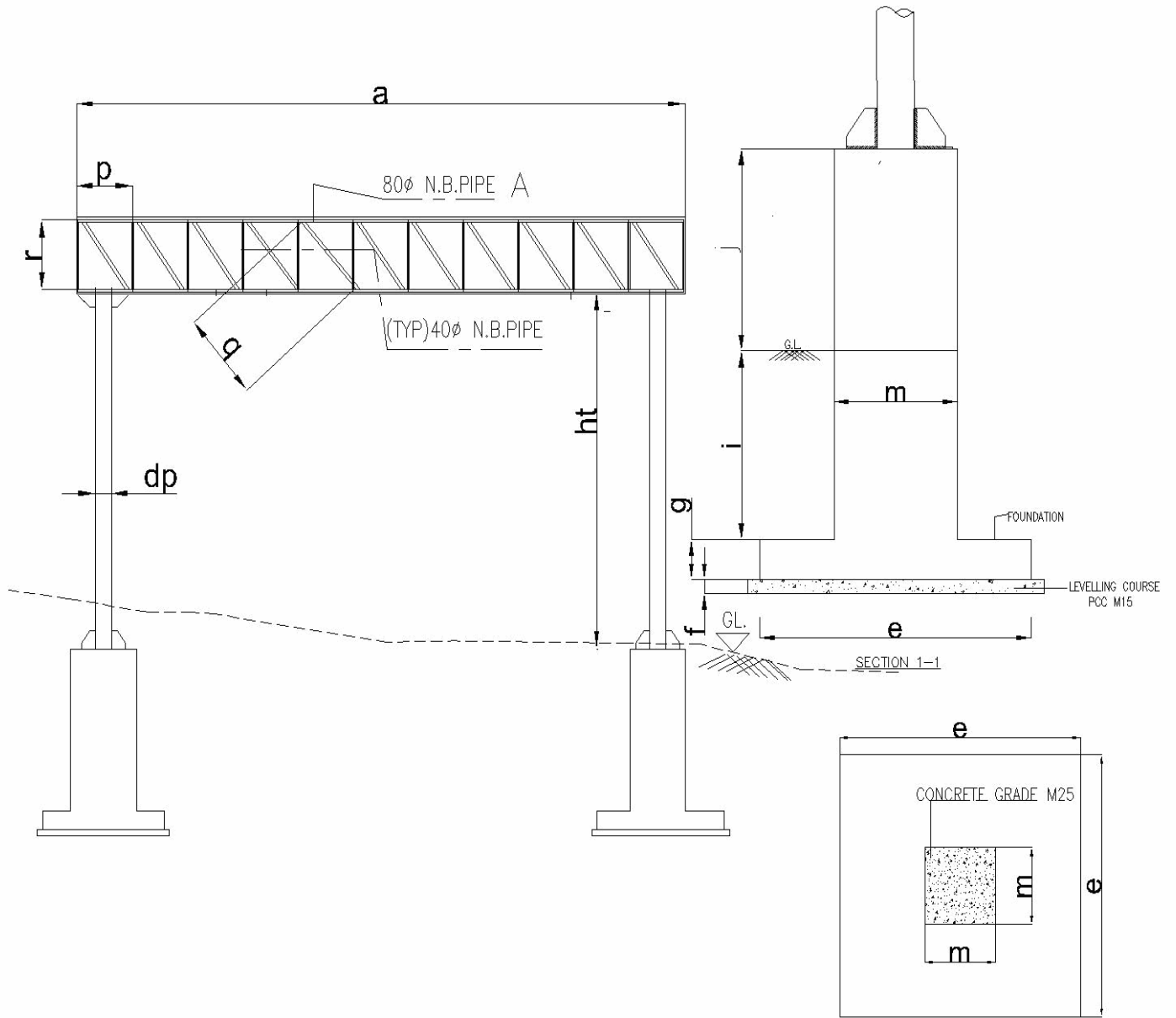


## Variable Declaration

## Overhead Signs

SI No	Variable Description	Variable	Dimension	Unit
1	Nos of Signs	n	1.000	Nos
2	End to end Grantry Distance	a	15.000	m
3	From Fig	p	1.000	m
4	From Fig	q	1.560	m
5	From Fig	r	1.200	m
6	80 NB per meter Weight(IS 1239 -Part-1)	wt	0.010	ton/m
7	40 NB per meter Weight(IS 1239 -Part-1)	ws	0.004	ton/m
8	Height	ht	5.500	m
9	300 NB per meter Weight	wp	0.049	ton/m
10	Foundation PCC width	e	2.200	m
11	Foundation PCC thickness	f	0.100	m
12	From Fig	g	0.300	m
13	From Fig	i	1.400	m
14	From Fig	m	1.000	m
15	From Fig	j	1.000	m
16	Steel At Foundation per cum of RCC	sf	150.000	kg/cum
17	Steel At Sub Structure per cum of RCC	ss	150.000	kg/cum
18	Dia of Vertical Support	dp	0.300	m

Variable Declaration



**Details of Profile Corrective Coarse**

ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
75000	1626.748	1626.597	0.151	0.151	DBM	0.041		12.5	3.075		
75025	1624.998	1624.274	0.724	0				25			
75050	1623.248	1622.715	0.533	0				25			
75075	1621.498	1621.29	0.208	0.208	WMM		0.148	25		22.2	25
75100	1619.748	1619.824	-0.076	0				25			
75125	1617.998	1618.611	-0.613	0				25			
75150	1616.248	1617.747	-1.499	0				25			
75175	1614.498	1616.164	-1.666	0				25			
75200	1612.748	1613.752	-1.004	0				25			
75225	1610.998	1611.707	-0.709	0				25			
75250	1609.248	1609.958	-0.71	0				25			
75275	1607.498	1607.909	-0.411	0				25			
75300	1605.748	1605.503	0.245	0.245	WMM		0.185	25		27.75	25
75325	1603.998	1603.006	0.992	0				25			
75350	1602.248	1600.359	1.889	0				25			
75375	1600.464	1596.514	3.95	0				25			
75400	1598.578	1594.848	3.73	0				25			
75425	1596.596	1593.578	3.018	0				25			
75450	1594.596	1592.228	2.368	0				25			
75475	1592.659	1590.739	1.92	0				25			
75500	1591.253	1589.175	2.078	0				25			
75525	1590.471	1588.65	1.821	0				25			
75550	1590.314	1588.272	2.042	0				25			
75575	1590.782	1588.288	2.494	0				25			
75600	1591.875	1588.421	3.454	0				25			
75625	1593.53	1589.043	4.487	0				25			
75650	1595.28	1590.633	4.647	0				25			
75675	1597.03			0				25			
75700	1598.78	1594.988	3.792	0				25			
75725	1600.53	1597.416	3.114	0				25			
75750	1602.28	1599.941	2.339	0				25			
75775	1604.058	1602.52	1.538	0				25			
75800	1605.938	1605.565	0.373	0.373	WMM		0.313	25		46.95	25
75825	1607.915	1608.106	-0.191	0				25			
75850	1609.915	1610.515	-0.6	0				25			
75875	1611.915	1611.848	0.067	0				25			
75900	1613.915	1615.3	-1.385	0				25			
75925	1615.818	1618.533	-2.715	0				25			
75950	1617.378	1620.868	-3.49	0				25			
75975	1618.606	1623.129	-4.523	0				25			
76000	1619.756	1624.093	-4.337	0				25			
76025	1620.907	1623.536	-2.629	0				25			
76050	1622.058			0				25			
76075	1623.209			0				25			
76100	1624.359			0				25			
76125	1625.51	1625.459	0.051	0				25			
76150	1626.661	1626.494	0.167	0.167	WMM		0.107	25		16.05	25
76175	1627.807	1627.356	0.451	0.451	WMM		0.391	25		58.65	25
76200	1628.876	1628.829	0.047	0				25			
76225	1629.843	1629.712	0.131	0.131	DBM	0.021		25	3.15		
76250	1630.748	1630.629	0.119	0.119	DBM	0.009		25	1.35		
76275	1631.651	1631.503	0.148	0.148	DBM	0.038		25	5.7		
76300	1632.225	1632.183	0.042	0				25			
76325	1632.231	1632.727	-0.496	0				25			
76350	1631.666	1632.398	-0.732	0				25			
76375	1630.534	1630.683	-0.149	0				25			
76400	1629.159	1629.001	0.158	0.158	DBM	0.048		25	7.2		
76425	1627.785	1627.72	0.065	0				25			
76450	1626.457	1626.207	0.25	0.25	WMM		0.19	25		28.5	25
76475	1625.306	1625.189	0.117	0.117	DBM	0.007		25	1.05		
76500	1624.33	1624.346	-0.016	0				25			
76525	1623.398	1623.866	-0.468	0				25			
76550	1622.484	1622.422	0.062	0				25			
76575	1621.708	1621.391	0.317	0.317	WMM		0.257	25		38.55	25
76600	1621.092	1620.83	0.262	0.262	WMM		0.202	25		30.3	25
76625	1620.637	1620.633	0.004	0				25			
76650	1620.342	1620.058	0.284	0.284	WMM		0.224	25		33.6	25
76675	1620.208	1619.869	0.339	0.339	WMM		0.279	25		41.85	25
76700	1620.216	1618.746	1.47	0				25			
76725	1620.248	1620.199	0.049	0				25			
76750	1620.279	1620.091	0.188	0.188	WMM		0.128	25		19.2	25
76775	1620.311	1619.979	0.332	0.332	WMM		0.272	25		40.8	25
76800	1620.342	1619.861	0.481	0				25			
76825	1620.374	1620.123	0.251	0.251	WMM		0.191	25		28.65	25
76850	1620.405	1620.274	0.131	0.131	DBM	0.021		25	3.15		
76875	1620.437	1620.304	0.133	0.133	DBM	0.023		25	3.45		
76900	1620.314	1620.243	0.071	0				25			
76925	1619.864	1619.713	0.151	0.151	DBM	0.041		25	6.15		
76950	1619.086	1618.83	0.256	0.256	WMM		0.196	25		29.4	25
76975	1617.979	1617.798	0.181	0.181	WMM		0.121	25		18.15	25
77000	1616.545	1616.356	0.189	0.189	WMM		0.129	25		19.35	25
77025	1614.804	1614.693	0.111	0.111	DBM	0.001		25	0.15		
77050	1612.998	1612.886	0.112	0.112	DBM	0.002		25	0.3		
77075	1611.213	1610.885	0.328	0.328	WMM		0.268	25		40.2	25
77100	1609.606	1609.42	0.186	0.186	WMM		0.126	25		18.9	25
77125	1608.208	1608.195	0.013	0				25			
77150	1606.907	1607.258	-0.351	0				25			
77175	1605.606	1605.772	-0.166	0				25			
77200	1604.305	1604.074	0.231	0.231	WMM		0.171	25		25.65	25
77225	1603.157	1602.964	0.193	0.193	WMM		0.133	25		19.95	25



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
77250	1602.41	1602.334	0.076	0				25			
77275	1602.067	1602.047	0.02	0				25			
77300	1602.127	1601.957	0.17	0.17	WMM		0.11	25		16.5	25
77325	1602.589	1602.344	0.245	0.245	WMM		0.185	25		27.75	25
77350	1603.225	1603.007	0.218	0.218	WMM		0.158	25		23.7	25
77375	1603.61	1603.552	0.058	0				25			
77400	1603.419	1603.266	0.153	0.153	DBM	0.043		25	6.45		
77425	1602.734	1602.659	0.075	0				25			
77450	1601.985	1601.397	0.588	0				25			
77475	1601.237	1601.131	0.106	0				25			
77500	1600.485	1600.374	0.111	0.111	DBM	0.001		25	0.15		
77525	1599.645	1599.6	0.045	0				25			
77550	1598.68	1598.499	0.181	0.181	WMM		0.121	25		18.15	25
77575	1597.679	1597.532	0.147	0.147	DBM	0.037		25	5.55		
77600	1596.787	1596.651	0.136	0.136	DBM	0.026		25	3.9		
77625	1596.167	1596.092	0.075	0				25			
77650	1595.484	1595.315	0.169	0.169	WMM		0.109	25		16.35	25
77675	1594.5	1594.379	0.121	0.121	DBM	0.011		25	1.65		
77700	1593.443	1593.286	0.157	0.157	DBM	0.047		25	7.05		
77725	1592.364	1592.271	0.093	0				25			
77750	1590.992	1590.887	0.105	0				25			
77775	1589.267	1589.044	0.223	0.223	WMM		0.163	25		24.45	25
77800	1587.614	1587.398	0.216	0.216	WMM		0.156	25		23.4	25
77825	1586.733	1586.654	0.079	0				25			
77850	1586.16	1586.011	0.149	0.149	DBM	0.039		25	5.85		
77875	1585.129	1584.997	0.132	0.132	DBM	0.022		25	3.3		
77900	1583.884	1583.645	0.239	0.239	WMM		0.179	25		26.85	25
77925	1582.729	1582.562	0.167	0.167	WMM		0.107	25		16.05	25
77950	1581.79	1581.554	0.236	0.236	WMM		0.176	25		26.4	25
77975	1581.04	1580.892	0.148	0.148	DBM	0.038		25	5.7		
78000	1580.315	1580.194	0.121	0.121	DBM	0.011		25	1.65		
78025	1579.59	1579.46	0.13	0.13	DBM	0.02		25	3		
78050	1578.865	1578.666	0.199	0.199	WMM		0.139	25		20.85	25
78075	1578.14	1578.006	0.134	0.134	DBM	0.024		25	3.6		
78100	1577.411	1577.145	0.266	0.266	WMM		0.206	25		30.9	25
78125	1576.591	1576.703	-0.112	0				25			
78150	1575.654	1575.553	0.101	0				25			
78175	1574.828	1574.738	0.09	0				25			
78200	1574.44	1574.322	0.118	0.118	DBM	0.008		25	1.2		
78225	1574.358	1574.253	0.105	0				25			
78250	1574.285	1574.152	0.133	0.133	DBM	0.023		25	3.45		
78275	1574.201	1574.08	0.121	0.121	DBM	0.011		25	1.65		
78300	1574.081	1573.998	0.083	0				25			
78325	1573.926	1573.801	0.125	0.125	DBM	0.015		25	2.25		
78350	1573.763	1573.523	0.24	0.24	WMM		0.18	25		27	25
78375	1573.6	1573.446	0.154	0.154	DBM	0.044		25	6.6		
78400	1573.438	1573.216	0.222	0.222	WMM		0.162	25		24.3	25
78425	1573.275	1572.862	0.413	0.413	WMM		0.353	25		52.95	25
78450	1573.112	1572.794	0.318	0.318	WMM		0.258	25		38.7	25
78475	1572.902	1572.858	0.044	0				25			
78500	1572.442	1572.463	-0.021	0				25			
78525	1571.709	1571.42	0.289	0.289	WMM		0.229	25		34.35	25
78550	1570.701	1570.34	0.361	0.361	WMM		0.301	25		45.15	25
78575	1569.42	1569.258	0.162	0.162	WMM		0.102	25		15.3	25
78600	1567.95	1567.896	0.054	0				25			
78625	1566.474	1566.139	0.335	0.335	WMM		0.275	25		41.25	25
78650	1564.998	1564.519	0.479	0				25			
78675	1563.521	1563.321	0.2	0.2	WMM		0.14	25		21	25
78700	1562.045	1561.862	0.183	0.183	WMM		0.123	25		18.45	25
78725	1560.569	1560.361	0.208	0.208	WMM		0.148	25		22.2	25
78750	1558.998	1558.871	0.127	0.127	DBM	0.017		25	2.55		
78775	1557.168	1557.01	0.158	0.158	DBM	0.048		25	7.2		
78800	1555.183	1554.962	0.221	0.221	WMM		0.161	25		24.15	25
78825	1553.469	1553.251	0.218	0.218	WMM		0.158	25		23.7	25
78850	1552.127	1552.069	0.058	0				25			
78875	1550.895	1550.66	0.235	0.235	WMM		0.175	25		26.25	25
78900	1549.662	1549.508	0.154	0.154	DBM	0.044		25	6.6		
78925	1548.429	1548.287	0.142	0.142	DBM	0.032		25	4.8		
78950	1547.215	1546.978	0.237	0.237	WMM		0.177	25		26.55	25
78975	1546.116	1546.089	0.027	0				25			
79000	1545.147	1545.533	-0.386	0				25			
79025	1544.229	1545.271	-1.042	0				25			
79050	1543.311			0				25			
79075	1542.392	1542.271	0.121	0.121	DBM	0.011		25	1.65		
79100	1541.474	1541.318	0.156	0.156	DBM	0.046		25	6.9		
79125	1540.248	1540.034	0.214	0.214	WMM		0.154	25		23.1	25
79150	1538.521	1538.456	0.065	0				25			
79175	1536.898	1536.708	0.19	0.19	WMM		0.13	25		19.5	25
79200	1535.754	1535.636	0.118	0.118	DBM	0.008		25	1.2		
79225	1533.984	1533.779	0.205	0.205	WMM		0.145	25		21.75	25
79250	1532.293	1532.146	0.147	0.147	DBM	0.037		25	5.55		
79275	1530.568	1530.668	-0.1	0				25			
79300	1528.637	1529.375	-0.738	0				25			
79325	1526.637	1527.942	-1.305	0				25			
79350	1524.637	1526.429	-1.792	0				25			
79375	1522.637	1525.035	-2.398	0				25			
79400	1520.661	1523.619	-2.958	0				25			
79425	1518.783	1523.01	-4.227	0				25			
79450	1517.006	1522.225	-5.219	0				25			
79475	1515.256	1521.215	-5.959	0				25			
79500	1513.506	1519.803	-6.297	0				25			
79525	1511.756	1518.88	-7.124	0				25			
79550	1510.006	1517.628	-7.622	0				25			
79575	1508.256	1516.947	-8.691	0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
79600	1506.506	1515.564	-9.058	0				25			
79625	1504.755	1513.789	-9.034	0				25			
79650	1502.942	1511.834	-8.892	0				25			
79675	1501.025	1509.4	-8.375	0				25			
79700	1499.029	1507.223	-8.194	0				25			
79725	1497.029	1506.073	-9.044	0				25			
79750	1495.029	1505.134	-10.105	0				25			
79775	1493.03			0				25			
79800	1491.157			0				25			
79825	1489.492	1497.52	-8.028	0				25			
79850	1487.983	1495.751	-7.768	0				25			
79875	1486.483	1493.595	-7.112	0				25			
79900	1484.983	1491.127	-6.144	0				25			
79925	1483.483	1488.441	-4.958	0				25			
79950	1481.983	1485.119	-3.136	0				25			
79975	1480.483	1482.563	-2.08	0				25			
80000	1478.983	1480.25	-1.267	0				25			
80025	1477.482	1478.115	-0.633	0				25			
80050	1475.855	1476.209	-0.354	0				25			
80075	1474.02	1474.51	-0.49	0				25			
80100	1472.029	1472.617	-0.588	0				25			
80125	1470.029	1469.943	0.086	0				25			
80150	1468.029	1468.388	-0.359	0				25			
80175	1466.03	1466.621	-0.591	0				25			
80200	1464.157	1465.274	-1.117	0				25			
80225	1462.492	1463.587	-1.095	0				25			
80250	1460.983	1462.325	-1.342	0				25			
80275	1459.483	1460.916	-1.433	0				25			
80300	1457.983	1459.368	-1.385	0				25			
80325	1456.483	1457.872	-1.389	0				25			
80350	1454.983	1455.966	-0.983	0				25			
80375	1453.483	1452.166	1.317	0				25			
80400	1451.983	1450.096	1.887	0				25			
80425	1450.482	1448.173	2.309	0				25			
80450	1448.855	1445.48	3.375	0				25			
80475	1447.02	1442.704	4.316	0				25			
80500	1445.029	1441.247	3.782	0				25			
80525	1443.029	1440.506	2.523	0				25			
80550	1441.036	1439.691	1.345	0				25			
80575	1439.284	1438.838	0.446	0.446	WMM		0.386	25		57.9	25
80600	1437.881	1437.163	0.718	0				25			
80625	1436.828	1436.229	0.599	0				25			
80650	1436.124	1435.541	0.583	0				25			
80675	1435.741	1434.277	1.464	0				25			
80700	1435.42	1434.373	1.047	0				25			
80725	1435.098	1434.727	0.371	0.371	WMM		0.311	25		46.65	25
80750	1434.739	1434.773	-0.034	0				25			
80775	1434.147	1434.047	0.1	0				25			
80800	1433.36	1433.151	0.209	0.209	WMM		0.149	25		22.35	25
80825	1432.849	1432.68	0.169	0.169	WMM		0.109	25		16.35	25
80850	1432.68	1432.478	0.202	0.202	WMM		0.142	25		21.3	25
80875	1432.58	1432.42	0.16	0.16	DBM	0.05		25	7.5		
80900	1432.465	1432.36	0.105	0				25			
80925	1432.249	1432.129	0.12	0.12	DBM	0.01		25	1.5		
80950	1431.917	1431.809	0.108	0				25			
80975	1431.539	1431.354	0.185	0.185	WMM		0.125	25		18.75	25
81000	1431.161	1430.906	0.255	0.255	WMM		0.195	25		29.25	25
81025	1430.782	1430.685	0.097	0				25			
81050	1430.167	1430.049	0.118	0.118	DBM	0.008		25	1.2		
81075	1429.1	1429.1	0	0				25			
81100	1427.583	1427.774	-0.191	0				25			
81125	1425.657	1426.086	-0.429	0				25			
81150	1423.657	1424.252	-0.595	0				25			
81175	1421.657	1421.991	-0.334	0				25			
81200	1419.669	1419.837	-0.168	0				25			
81225	1417.787	1417.2	0.587	0				25			
81250	1416.034	1414.68	1.354	0				25			
81275	1414.341	1412.69	1.651	0				25			
81300	1412.648	1410.793	1.855	0				25			
81325	1410.955	1408.68	2.275	0				25			
81350	1409.262	1406.6	2.662	0				25			
81375	1407.578	1405.457	2.121	0				25			
81400	1406.049	1404.826	1.223	0				25			
81425	1404.72	1404.355	0.365	0.365	WMM		0.305	25		45.75	25
81450	1403.591	1403.46	0.131	0.131	DBM	0.021		25	3.15		
81475	1402.604	1402.484	0.12	0.12	DBM	0.01		25	1.5		
81500	1401.554	1401.425	0.129	0.129	DBM	0.019		25	2.85		
81525	1400.43	1400.241	0.189	0.189	WMM		0.129	25		19.35	25
81550	1399.247	1399.129	0.118	0.118	DBM	0.008		25	1.2		
81575	1397.617	1397.552	0.065	0				25			
81600	1395.801	1395.493	0.308	0.308	WMM		0.248	25		37.2	25
81625	1394.728	1394.602	0.126	0.126	DBM	0.016		25	2.4		
81650	1394.006	1394.033	-0.027	0				25			
81675	1393.284	1393.171	0.113	0.113	DBM	0.003		25	0.45		
81700	1392.532	1392.457	0.075	0				25			
81725	1391.614	1391.532	0.082	0				25			
81750	1390.547	1390.362	0.185	0.185	WMM		0.125	25		18.75	25
81775	1389.463	1389.172	0.291	0.291	WMM		0.231	25		34.65	25
81800	1388.38	1388.24	0.14	0.14	DBM	0.03		25	4.5		
81825	1387.421	1387.285	0.136	0.136	DBM	0.026		25	3.9		
81850	1386.81	1386.667	0.143	0.143	DBM	0.033		25	4.95		
81875	1386.517	1386.379	0.138	0.138	DBM	0.028		25	4.2		
81900	1386.28	1386.064	0.216	0.216	WMM		0.156	25		23.4	25
81925	1386.043	1386.097	-0.054	0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
81950	1385.863	1385.725	0.138	0.138	DBM	0.028		25			
81975	1386.005	1385.839	0.166	0.166	WMM		0.106	25	4.2	15.9	25
82000	1386.213	1386.222	-0.009	0				25			
82025	1385.663	1385.562	0.101	0				25			
82050	1384.591	1384.521	0.07	0				25			
82075	1383.31	1383.212	0.098	0				25			
82100	1381.835	1381.571	0.264	0.264	WMM		0.204	25		30.6	25
82125	1380.343	1380.169	0.174	0.174	WMM		0.114	25		17.1	25
82150	1379.047	1378.802	0.245	0.245	WMM		0.185	25		27.75	25
82175	1378.048	1377.947	0.101	0				25			
82200	1377.151	1377.031	0.12	0.12	DBM	0.01		25	1.5		
82225	1376.255	1375.968	0.287	0.287	WMM		0.227	25		34.05	25
82250	1375.304	1375.232	0.072	0				25			
82275	1374.062	1373.962	0.1	0				25			
82300	1372.831	1372.742	0.089	0				25			
82325	1371.74	1371.545	0.195	0.195	WMM		0.135	25		20.25	25
82350	1370.656	1370.515	0.141	0.141	DBM	0.031		25	4.65		
82375	1369.566	1369.388	0.178	0.178	WMM		0.118	25		17.7	25
82400	1368.163	1368.053	0.11	0				25			
82425	1366.569	1366.382	0.187	0.187	WMM		0.127	25		19.05	25
82450	1365.405	1365.313	0.092	0				25			
82475	1364.3	1364.228	0.072	0				25			
82500	1362.995	1362.881	0.114	0.114	DBM	0.004		25	0.6		
82525	1361.543	1361.372	0.171	0.171	WMM		0.111	25		16.65	25
82550	1360.372	1360.296	0.076	0				25			
82575	1359.606	1359.427	0.179	0.179	WMM		0.119	25		17.85	25
82600	1359.204	1359.07	0.134	0.134	DBM	0.024		25	3.6		
82625	1358.864	1358.796	0.068	0				25			
82650	1358.524	1358.36	0.164	0.164	WMM		0.104	25		15.6	25
82675	1358.189	1358.018	0.171	0.171	WMM		0.111	25		16.65	25
82700	1357.952	1357.757	0.195	0.195	WMM		0.135	25		20.25	25
82725	1357.849	1357.746	0.103	0				25			
82750	1357.88	1357.811	0.069	0				25			
82775	1358.045	1357.826	0.219	0.219	WMM		0.159	25		23.85	25
82800	1358.344	1358.187	0.157	0.157	DBM	0.047		25	7.05		
82825	1358.778	1358.522	0.256	0.256	WMM		0.196	25		29.4	25
82850	1359.33	1359.221	0.109	0				25			
82875	1359.849	1359.77	0.079	0				25			
82900	1360.267	1359.993	0.274	0.274	WMM		0.214	25		32.1	25
82925	1360.601	1360.486	0.115	0.115	DBM	0.005		25	0.75		
82950	1360.928	1360.801	0.127	0.127	DBM	0.017		25	2.55		
82975	1361.231	1361.105	0.126	0.126	DBM	0.016		25	2.4		
83000	1361.411	1361.392	0.019	0				25			
83025	1361.48	1361.272	0.208	0.208	WMM		0.148	25		22.2	25
83050	1361.505	1361.389	0.116	0.116	DBM	0.006		25	0.9		
83075	1361.326	1361.54	-0.214	0				25			
83100	1360.95	1360.836	0.114	0.114	DBM	0.004		25	0.6		
83125	1360.564	1360.399	0.165	0.165	WMM		0.105	25		15.75	25
83150	1360.413	1360.274	0.139	0.139	DBM	0.029		25	4.35		
83175	1360.572	1360.432	0.14	0.14	DBM	0.03		25	4.5		
83200	1361.04	1360.92	0.12	0.12	DBM	0.01		25	1.5		
83225	1361.741	1361.626	0.115	0.115	DBM	0.005		25	0.75		
83250	1362.453	1362.298	0.155	0.155	DBM	0.045		25	6.75		
83275	1363.005	1362.912	0.093	0				25			
83300	1363.307	1363.257	0.05	0				25			
83325	1363.36	1363.068	0.292	0.292	WMM		0.232	25		34.8	25
83350	1363.164	1362.982	0.182	0.182	WMM		0.122	25		18.3	25
83375	1362.718	1362.483	0.235	0.235	WMM		0.175	25		26.25	25
83400	1362.026	1361.924	0.102	0				25			
83425	1361.28	1361.096	0.184	0.184	WMM		0.124	25		18.6	25
83450	1360.644	1360.503	0.141	0.141	DBM	0.031		25	4.65		
83475	1360.113	1360.003	0.11	0.11	DBM	1.27329E-13		25	1.9099E-11		
83500	1359.603	1359.429	0.174	0.174	WMM		0.114	25		17.1	25
83525	1359.093	1358.853	0.24	0.24	WMM		0.18	25		27	25
83550	1358.583	1358.391	0.192	0.192	WMM		0.132	25		19.8	25
83575	1357.991	1358.144	-0.153	0				25			
83600	1357.246	1357.6	-0.354	0				25			
83625	1356.348	1356.181	0.167	0.167	WMM		0.107	25		16.05	25
83650	1355.297	1355.266	0.031	0				25			
83675	1354.094	1353.98	0.114	0.114	DBM	0.004		25	0.6		
83700	1352.737	1352.511	0.226	0.226	WMM		0.166	25		24.9	25
83725	1351.309	1350.951	0.358	0.358	WMM		0.298	25		44.7	25
83750	1349.882	1349.641	0.241	0.241	WMM		0.181	25		27.15	25
83775	1348.454	1348.226	0.228	0.228	WMM		0.168	25		25.2	25
83800	1347	1346.887	0.113	0.113	DBM	0.003		25	0.45		
83825	1345.434	1345.306	0.128	0.128	DBM	0.018		25	2.7		
83850	1343.755	1343.644	0.111	0.111	DBM	0.001		25	0.15		
83875	1342.044	1341.885	0.159	0.159	DBM	0.049		25	7.35		
83900	1340.386	1340.334	0.052	0				25			
83925	1339.086	1338.969	0.117	0.117	DBM	0.007		25	1.05		
83950	1338.195	1338.052	0.143	0.143	DBM	0.033		25	4.95		
83975	1337.695	1337.564	0.131	0.131	DBM	0.021		25	3.15		
84000	1337.293	1337.02	0.273	0.273	WMM		0.213	25		31.95	25
84025	1336.892	1336.818	0.074	0				25			
84050	1336.49	1336.618	-0.128	0				25			
84075	1336.089	1336.023	0.066	0				25			
84100	1335.568	1335.506	0.062	0				25			
84125	1334.659	1334.678	-0.019	0				25			
84150	1333.349	1333.758	-0.409	0				25			
84175	1331.641	1332.825	-1.184	0				25			
84200	1329.651	1331.692	-2.041	0				25			
84225	1327.651	1330.55	-2.899	0				25			
84250	1325.681	1329.424	-3.743	0				25			
84275	1323.896	1328.393	-4.497	0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
84300	1322.318	1327.003	-4.685	0				25			
84325	1320.818	1325.695	-4.877	0				25			
84350	1319.318	1324.447	-5.129	0				25			
84375	1317.818	1322.503	-4.685	0				25			
84400	1316.318	1320.505	-4.187	0				25			
84425	1314.818	1318.506	-3.688	0				25			
84450	1313.318	1316.685	-3.367	0				25			
84475	1311.818	1314.155	-2.337	0				25			
84500	1310.289	1311.382	-1.093	0				25			
84525	1308.573	1308.963	-0.39	0				25			
84550	1306.651	1306.786	-0.135	0				25			
84575	1304.651	1304.861	-0.21	0				25			
84600	1302.651	1303.09	-0.439	0				25			
84625	1300.651	1301.291	-0.64	0				25			
84650	1298.681	1299.476	-0.795	0				25			
84675	1296.896	1297.814	-0.918	0				25			
84700	1295.318	1296.445	-1.127	0				25			
84725	1293.818	1295.346	-1.528	0				25			
84750	1292.318	1294.172	-1.854	0				25			
84775	1290.818	1293.131	-2.313	0				25			
84800	1289.318	1291.806	-2.488	0				25			
84825	1287.818	1289.939	-2.121	0				25			
84850	1286.318	1287.727	-1.409	0				25			
84875	1284.818	1285.403	-0.585	0				25			
84900	1283.289	1283.167	0.122	0.122	DBM	0.012		25	1.8		
84925	1281.573	1280.884	0.689	0				25			
84950	1279.651	1278.455	1.196	0				25			
84975	1277.651	1276.224	1.427	0				25			
85000	1275.651	1273.843	1.808	0				25			
85025	1273.651	1271.51	2.141	0				25			
85050	1271.807	1269.205	2.602	0				25			
85075	1270.319	1267.605	2.714	0				25			
85100	1269.187	1266.631	2.556	0				25			
85125	1268.316	1265.849	2.467	0				25			
85150	1267.458	1265.089	2.369	0				25			
85175	1266.6	1264.008	2.592	0				25			
85200	1265.741	1262.801	2.94	0				25			
85225	1264.883	1262.077	2.806	0				25			
85250	1264.025	1261.837	2.188	0				25			
85275	1263.166	1261.917	1.249	0				25			
85300	1262.285	1261.86	0.425	0.425	WMM		0.365	25		54.75	25
85325	1261.262	1261.206	0.056	0				25			
85350	1260.079	1260.536	-0.457	0				25			
85375	1258.737	1259.294	-0.557	0				25			
85400	1257.236	1257.781	-0.545	0				25			
85425	1255.576	1256.196	-0.62	0				25			
85450	1253.826	1254.348	-0.522	0				25			
85475	1252.076	1252.383	-0.307	0				25			
85500	1250.326	1250.626	-0.3	0				25			
85525	1248.576	1248.99	-0.414	0				25			
85550	1246.826	1246.861	-0.035	0				25			
85575	1245.076	1244.346	0.73	0				25			
85600	1243.326	1241.989	1.337	0				25			
85625	1241.576	1240.154	1.422	0				25			
85650	1239.826	1238.181	1.645	0				25			
85675	1238.076	1236.563	1.513	0				25			
85700	1236.326	1234.236	2.09	0				25			
85725	1234.707	1232.703	2.004	0				25			
85750	1233.423	1231.859	1.564	0				25			
85775	1232.477	1231.375	1.102	0				25			
85800	1231.869	1231.125	0.744	0				25			
85825	1231.468	1231.122	0.346	0.346	WMM		0.286	25		42.9	25
85850	1231.069	1231.194	-0.125	0				25			
85875	1230.67	1231.233	-0.563	0				25			
85900	1230.272	1230.935	-0.663	0				25			
85925	1229.873	1230.475	-0.602	0				25			
85950	1229.474	1229.886	-0.412	0				25			
85975	1229.076	1229.13	-0.054	0				25			
86000	1228.677	1228.171	0.506	0				25			
86025	1228.278	1227.119	1.159	0				25			
86050	1227.879	1226.462	1.417	0				25			
86075	1227.481	1226.171	1.31	0				25			
86100	1227.082	1226.166	0.916	0				25			
86125	1226.683	1226.508	0.175	0.175	WMM		0.115	25		17.25	25
86150	1226.285	1226.245	0.04	0				25			
86175	1225.884	1225.629	0.255	0.255	WMM		0.195	25		29.25	25
86200	1225.395	1224.985	0.41	0.41	WMM		0.35	25		52.5	25
86225	1224.766	1224.568	0.198	0.198	WMM		0.138	25		20.7	25
86250	1223.996	1223.805	0.191	0.191	WMM		0.131	25		19.65	25
86275	1223.054	1222.948	0.106	0				25			
86300	1221.899	1221.825	0.074	0				25			
86325	1220.548	1220.415	0.133	0.133	DBM	0.023		25	3.45		
86350	1219.339	1219.198	0.141	0.141	DBM	0.031		25	4.65		
86375	1218.383	1218.278	0.105	0				25			
86400	1217.339	1217.314	0.025	0				25			
86425	1216.03	1215.916	0.114	0.114	DBM	0.004		25	0.6		
86450	1214.686	1214.543	0.143	0.143	DBM	0.033		25	4.95		
86475	1213.627	1213.538	0.089	0				25			
86500	1212.913	1212.653	0.26	0.26	WMM		0.2	25		30	25
86525	1212.543	1212.375	0.168	0.168	WMM		0.108	25		16.2	25
86550	1212.517	1212.324	0.193	0.193	WMM		0.133	25		19.95	25
86575	1212.722	1212.585	0.137	0.137	DBM	0.027		25	4.05		
86600	1212.788	1212.714	0.074	0				25			
86625	1212.537	1212.416	0.121	0.121	DBM	0.011		25	1.65		



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
86650	1212.211	1212.035	0.176	0.176	WMM		0.116	25		17.4	25
86675	1211.885	1211.739	0.146	0.146	DBM	0.036		25	5.4		
86700	1211.637	1211.441	0.196	0.196	WMM		0.136	25		20.4	25
86725	1211.58	1211.399	0.181	0.181	WMM		0.121	25		18.15	25
86750	1211.713	1211.648	0.065	0				25			
86775	1212.037	1211.828	0.209	0.209	WMM		0.149	25		22.35	25
86800	1212.551	1212.33	0.221	0.221	WMM		0.161	25		24.15	25
86825	1213.142	1213.1	0.042	0				25			
86850	1213.732	1213.648	0.084	0				25			
86875	1214.323	1213.974	0.349	0.349	WMM		0.289	25		43.35	25
86900	1214.913	1214.525	0.388	0.388	WMM		0.328	25		49.2	25
86925	1215.463	1215.268	0.195	0.195	WMM		0.135	25		20.25	25
86950	1215.725	1215.599	0.126	0.126	DBM	0.016		25	2.4		
86975	1215.659	1215.414	0.245	0.245	WMM		0.185	25		27.75	25
87000	1215.458	1215.244	0.214	0.214	WMM		0.154	25		23.1	25
87025	1215.258	1215.082	0.176	0.176	WMM		0.116	25		17.4	25
87050	1215.026	1214.955	0.071	0				25			
87075	1214.729	1214.656	0.073	0				25			
87100	1214.376	1214.247	0.129	0.129	DBM	0.019		25	2.85		
87125	1214.068	1213.959	0.109	0				25			
87150	1214.066	1213.948	0.118	0.118	DBM	0.008		25	1.2		
87175	1214.407	1214.324	0.083	0				25			
87200	1215.09	1214.966	0.124	0.124	DBM	0.014		25	2.1		
87225	1216.115	1215.945	0.17	0.17	WMM		0.11	25		16.5	25
87250	1217.402	1217.244	0.158	0.158	DBM	0.048		25	7.2		
87275	1218.561	1218.472	0.089	0				25			
87300	1219.541	1219.418	0.123	0.123	DBM	0.013		25	1.95		
87325	1220.503	1220.31	0.193	0.193	WMM		0.133	25		19.95	25
87350	1221.409	1221.417	-0.008	0				25			
87375	1221.787	1221.716	0.071	0				25			
87400	1221.671	1221.552	0.119	0.119	DBM	0.009		25	1.35		
87425	1221.34	1221.302	0.038	0				25			
87450	1220.802	1220.634	0.168	0.168	WMM		0.108	25		16.2	25
87475	1220.163	1219.936	0.227	0.227	WMM		0.167	25		25.05	25
87500	1219.525	1219.388	0.137	0.137	DBM	0.027		25	4.05		
87525	1219.088	1218.897	0.191	0.191	WMM		0.131	25		19.65	25
87550	1219.009	1218.851	0.158	0.158	DBM	0.048		25	7.2		
87575	1219.279	1219.078	0.201	0.201	WMM		0.141	25		21.15	25
87600	1219.752	1219.668	0.084	0				25			
87625	1220.369	1220.264	0.105	0				25			
87650	1221.131	1220.939	0.192	0.192	WMM		0.132	25		19.8	25
87675	1222.038	1221.976	0.062	0				25			
87700	1223.036	1222.854	0.182	0.182	WMM		0.122	25		18.3	25
87725	1223.965	1223.905	0.06	0				25			
87750	1224.683	1224.518	0.165	0.165	WMM		0.105	25		15.75	25
87775	1225.258	1225.024	0.234	0.234	WMM		0.174	25		26.1	25
87800	1225.828	1225.645	0.183	0.183	WMM		0.123	25		18.45	25
87825	1226.398	1226.243	0.155	0.155	DBM	0.045		25	6.75		
87850	1227.157	1226.83	0.327	0.327	WMM		0.267	25		40.05	25
87875	1228.408	1228.383	0.025	0				25			
87900	1229.967	1229.529	0.438	0.438	WMM		0.378	25		56.7	25
87925	1231.53	1230.733	0.797	0				25			
87950	1233.092	1232.566	0.526	0				25			
87975	1234.655	1234.513	0.142	0.142	DBM	0.032		25	4.8		
88000	1236.178	1236.128	0.05	0				25			
88025	1237.581	1237.488	0.093	0				25			
88050	1238.861	1238.659	0.202	0.202	WMM		0.142	25		21.3	25
88075	1240.019	1239.501	0.518	0				25			
88100	1241.094	1240.685	0.409	0.409	WMM		0.349	25		52.35	25
88125	1242.166	1241.472	0.694	0				25			
88150	1243.239	1242.305	0.934	0				25			
88175	1244.311	1243.414	0.897	0				25			
88200	1245.384	1244.814	0.57	0				25			
88225	1246.455	1246.173	0.282	0.282	WMM		0.222	25		33.3	25
88250	1247.384	1247.359	0.025	0				25			
88275	1248.08	1248.136	-0.056	0				25			
88300	1248.544	1248.376	0.168	0.168	WMM		0.108	25		16.2	25
88325	1248.872	1248.488	0.384	0.384	WMM		0.324	25		48.6	25
88350	1249.2	1248.859	0.341	0.341	WMM		0.281	25		42.15	25
88375	1249.527	1249.279	0.248	0.248	WMM		0.188	25		28.2	25
88400	1249.855	1249.684	0.171	0.171	WMM		0.111	25		16.65	25
88425	1250.182	1249.872	0.31	0.31	WMM		0.25	25		37.5	25
88450	1250.51	1250.416	0.094	0				25			
88475	1250.837	1250.627	0.21	0.21	WMM		0.15	25		22.5	25
88500	1251.13	1250.939	0.191	0.191	WMM		0.131	25		19.65	25
88525	1250.976	1250.896	0.08	0				25			
88550	1250.29	1250.122	0.168	0.168	WMM		0.108	25		16.2	25
88575	1249.485	1249.266	0.219	0.219	WMM		0.159	25		23.85	25
88600	1248.75	1248.709	0.041	0				25			
88625	1248.279	1248.193	0.086	0				25			
88650	1248.082	1247.914	0.168	0.168	WMM		0.108	25		16.2	25
88675	1248.123	1248.018	0.105	0				25			
88700	1248.182	1248.03	0.152	0.152	DBM	0.042		25	6.3		
88725	1248.139	1248.024	0.115	0.115	DBM	0.005		25	0.75		
88750	1247.977	1247.88	0.097	0				25			
88775	1247.888	1247.802	0.086	0				25			
88800	1248.372	1248.206	0.166	0.166	WMM		0.106	25		15.9	25
88825	1249.469	1249.235	0.234	0.234	WMM		0.174	25		26.1	25
88850	1251.181	1251.124	0.057	0				25			
88875	1253.181	1253.71	-0.529	0				25			
88900	1255.181	1255.828	-0.647	0				25			
88925	1257.172	1257.364	-0.192	0				25			
88950	1258.734	1258.662	0.072	0				25			
88975	1259.639	1259.839	-0.2	0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
89000	1260.078	1260.337	-0.259	0				25			
89025	1260.5	1260.486	0.014	0				25			
89050	1260.965	1260.894	0.071	0				25			
89075	1261.682	1261.459	0.223	0.223	WMM		0.163	25		24.45	25
89100	1262.677	1262.377	0.3	0.3	WMM		0.24	25		36	25
89125	1263.772	1263.647	0.125	0.125	DBM	0.015		25	2.25		
89150	1264.866	1264.704	0.162	0.162	WMM		0.102	25		15.3	25
89175	1265.98	1265.797	0.183	0.183	WMM		0.123	25		18.45	25
89200	1267.199	1267.012	0.187	0.187	WMM		0.127	25		19.05	25
89225	1268.531	1268.326	0.205	0.205	WMM		0.145	25		21.75	25
89250	1269.902	1269.567	0.335	0.335	WMM		0.275	25		41.25	25
89275	1271.273	1271.061	0.212	0.212	WMM		0.152	25		22.8	25
89300	1272.644	1272.529	0.115	0.115	DBM	0.005		25	0.75		
89325	1274.015	1273.828	0.187	0.187	WMM		0.127	25		19.05	25
89350	1275.374	1275.145	0.229	0.229	WMM		0.169	25		25.35	25
89375	1276.185	1276.122	0.063	0				25			
89400	1276.258	1276.154	0.104	0				25			
89425	1276.126	1276.047	0.079	0				25			
89450	1275.859	1275.747	0.112	0.112	DBM	0.002		25	0.3		
89475	1275.455	1275.358	0.097	0				25			
89500	1274.937	1274.848	0.089	0				25			
89525	1274.462	1274.296	0.166	0.166	WMM		0.106	25		15.9	25
89550	1274.155	1274.011	0.144	0.144	DBM	0.034		25	5.1		
89575	1274.005	1273.951	0.054	0				25			
89600	1273.885	1273.654	0.231	0.231	WMM		0.171	25		25.65	25
89625	1273.755	1273.517	0.238	0.238	WMM		0.178	25		26.7	25
89650	1273.513	1273.457	0.056	0				25			
89675	1273.139	1273.003	0.136	0.136	DBM	0.026		25	3.9		
89700	1272.756	1272.598	0.158	0.158	DBM	0.048		25	7.2		
89725	1272.57	1272.432	0.138	0.138	DBM	0.028		25	4.2		
89750	1272.602	1272.397	0.205	0.205	WMM		0.145	25		21.75	25
89775	1272.62	1272.261	0.359	0.359	WMM		0.299	25		44.85	25
89800	1272.527	1272.366	0.161	0.161	WMM		0.101	25		15.15	25
89825	1272.323	1272.205	0.118	0.118	DBM	0.008		25	1.2		
89850	1272.042	1271.887	0.155	0.155	DBM	0.045		25	6.75		
89875	1271.759	1271.717	0.042	0				25			
89900	1271.477	1271.541	-0.064	0				25			
89925	1271.194	1271.023	0.171	0.171	WMM		0.111	25		16.65	25
89950	1270.928	1270.727	0.201	0.201	WMM		0.141	25		21.15	25
89975	1271.094	1270.739	0.355	0.355	WMM		0.295	25		44.25	25
90000	1271.873	1271.717	0.156	0.156	DBM	0.046		25	6.9		
90025	1273.053	1272.7	0.353	0.353	WMM		0.293	25		43.95	25
90050	1274.241	1274.114	0.127	0.127	DBM	0.017		25	2.55		
90075	1275.381	1275.337	0.044	0				25			
90100	1276.41	1276.325	0.085	0				25			
90125	1277.345	1277.094	0.251	0.251	WMM		0.191	25		28.65	25
90150	1278.267	1278.191	0.076	0				25			
90175	1279.077	1279.022	0.055	0				25			
90200	1279.665	1279.492	0.173	0.173	WMM		0.113	25		16.95	25
90225	1280.032	1279.815	0.217	0.217	WMM		0.157	25		23.55	25
90250	1280.177	1279.781	0.396	0.396	WMM		0.336	25		50.4	25
90275	1280.101	1279.7	0.401	0.401	WMM		0.341	25		51.15	25
90300	1279.803	1279.644	0.159	0.159	DBM	0.049		25	7.35		
90325	1279.283	1279.366	-0.083	0				25			
90350	1278.615	1278.51	0.105	0				25			
90375	1277.944	1277.681	0.263	0.263	WMM		0.203	25		30.45	25
90400	1277.394	1277.15	0.244	0.244	WMM		0.184	25		27.6	25
90425	1277.065	1276.782	0.283	0.283	WMM		0.223	25		33.45	25
90450	1276.95	1276.664	0.286	0.286	WMM		0.226	25		33.9	25
90475	1276.896	1276.68	0.216	0.216	WMM		0.156	25		23.4	25
90500	1276.843	1276.731	0.112	0.112	DBM	0.002		25	0.3		
90525	1276.882	1276.683	0.199	0.199	WMM		0.139	25		20.85	25
90550	1277.194	1277.027	0.167	0.167	WMM		0.107	25		16.05	25
90575	1277.69	1277.578	0.112	0.112	DBM	0.002		25	0.3		
90600	1278.088	1278.081	0.007	0				25			
90625	1278.195	1278.106	0.089	0				25			
90650	1278.005	1277.86	0.145	0.145	DBM	0.035		25	5.25		
90675	1277.518	1277.39	0.128	0.128	DBM	0.018		25	2.7		
90700	1276.837	1276.683	0.154	0.154	DBM	0.044		25	6.6		
90725	1276.152	1276.06	0.092	0				25			
90750	1275.444	1275.337	0.107	0				25			
90775	1274.599	1274.328	0.271	0.271	WMM		0.211	25		31.65	25
90800	1273.788	1273.57	0.218	0.218	WMM		0.158	25		23.7	25
90825	1273.316	1273.2	0.116	0.116	DBM	0.006		25	0.9		
90850	1272.953	1272.841	0.112	0.112	DBM	0.002		25	0.3		
90875	1272.582	1272.459	0.123	0.123	DBM	0.013		25	1.95		
90900	1271.989	1271.896	0.093	0				25			
90925	1271.07	1270.939	0.131	0.131	DBM	0.021		25	3.15		
90950	1269.825	1269.682	0.143	0.143	DBM	0.033		25	4.95		
90975	1268.42	1268.331	0.089	0				25			
91000	1267.187	1266.928	0.259	0.259	WMM		0.199	25		29.85	25
91025	1266.392	1266.297	0.095	0				25			
91050	1266.036	1265.991	0.045	0				25			
91075	1266.016	1265.861	0.155	0.155	DBM	0.045		25	6.75		
91100	1266.015	1265.896	0.119	0.119	DBM	0.009		25	1.35		
91125	1265.866	1265.717	0.149	0.149	DBM	0.039		25	5.85		
91150	1265.47	1265.205	0.265	0.265	WMM		0.205	25		30.75	25
91175	1264.912	1264.593	0.319	0.319	WMM		0.259	25		38.85	25
91200	1264.585	1264.442	0.143	0.143	DBM	0.033		25	4.95		
91225	1264.556	1264.448	0.108	0				25			
91250	1264.82	1264.69	0.13	0.13	DBM	0.02		25	3		
91275	1265.184	1264.961	0.223	0.223	WMM		0.163	25		24.45	25
91300	1265.548	1265.344	0.204	0.204	WMM		0.144	25		21.6	25
91325	1265.912	1265.718	0.194	0.194	WMM		0.134	25		20.1	25



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
91350	1266.276	1266.148	0.128	0.128	DBM	0.018		25	2.7		
91375	1266.64	1266.399	0.241	0.241	WMM		0.181	25		27.15	25
91400	1267.004	1266.751	0.253	0.253	WMM		0.193	25		28.95	25
91425	1267.696	1267.41	0.286	0.286	WMM		0.226	25		33.9	25
91450	1269.018	1268.906	0.112	0.112	DBM	0.002		25	0.3		
91475	1270.643	1270.362	0.281	0.281	WMM		0.221	25		33.15	25
91500	1272.251	1272.236	0.015	0				25			
91525	1273.359	1273.583	-0.224	0				25			
91550	1273.742	1274.341	-0.599	0				25			
91575	1273.462			0				25			
91600	1273.058			0				25			
91625	1272.655			0				25			
91650	1272.251	1272.197	0.054	0				25			
91675	1271.847	1271.606	0.241	0.241	WMM		0.181	25		27.15	25
91700	1271.443	1271.15	0.293	0.293	WMM		0.233	25		34.95	25
91725	1271.039	1270.631	0.408	0.408	WMM		0.348	25		52.2	25
91750	1270.615	1270.444	0.171	0.171	WMM		0.111	25		16.65	25
91775	1269.995	1269.926	0.069	0				25			
91800	1269.14	1268.709	0.431	0.431	WMM		0.371	25		55.65	25
91825	1268.173	1267.848	0.325	0.325	WMM		0.265	25		39.75	25
91850	1267.205	1267.195	0.01	0				25			
91875	1266.237	1266.239	-0.002	0				25			
91900	1265.259	1265.112	0.147	0.147	DBM	0.037		25	5.55		
91925	1264.216			0				25			
91950	1263.102			0				25			
91975	1261.962	1261.03	0.932	0				25			
92000	1260.821	1260.216	0.605	0				25			
92025	1259.68	1259.116	0.564	0				25			
92050	1258.54	1258.033	0.507	0				25			
92075	1257.399	1257.088	0.311	0.311	WMM		0.251	25		37.65	25
92100	1256.258	1256.03	0.228	0.228	WMM		0.168	25		25.2	25
92125	1255.117	1254.986	0.131	0.131	DBM	0.021		25	3.15		
92150	1253.977	1253.741	0.236	0.236	WMM		0.176	25		26.4	25
92175	1252.836	1252.539	0.297	0.297	WMM		0.237	25		35.55	25
92200	1251.695	1251.594	0.101	0				25			
92225	1250.616	1250.419	0.197	0.197	WMM		0.137	25		20.55	25
92250	1249.663	1249.557	0.106	0				25			
92275	1248.837	1248.966	-0.129	0				25			
92300	1248.139	1248.043	0.096	0				25			
92325	1247.567	1247.256	0.311	0.311	WMM		0.251	25		37.65	25
92350	1247.123	1246.905	0.218	0.218	WMM		0.158	25		23.7	25
92375	1246.804	1246.578	0.226	0.226	WMM		0.166	25		24.9	25
92400	1246.527	1246.515	0.012	0				25			
92425	1246.25	1246.185	0.065	0				25			
92450	1245.983	1245.792	0.191	0.191	WMM		0.131	25		19.65	25
92475	1245.788	1245.679	0.109	0				25			
92500	1245.675	1245.588	0.087	0				25			
92525	1245.644	1245.514	0.13	0.13	DBM	0.02		25	3		
92550	1245.681	1245.547	0.134	0.134	DBM	0.024		25	3.6		
92575	1245.587	1245.38	0.207	0.207	WMM		0.147	25		22.05	25
92600	1245.286	1245.149	0.137	0.137	DBM	0.027		25	4.05		
92625	1244.778	1244.715	0.063	0				25			
92650	1244.067	1244.136	-0.069	0				25			
92675	1243.295	1243.524	-0.229	0				25			
92700	1242.594	1242.504	0.09	0				25			
92725	1241.984	1241.736	0.248	0.248	WMM		0.188	25		28.2	25
92750	1241.465	1241.353	0.112	0.112	DBM	0.002		25	0.3		
92775	1241.033	1240.898	0.135	0.135	DBM	0.025		25	3.75		
92800	1240.622	1240.509	0.113	0.113	DBM	0.003		25	0.45		
92825	1240.116	1239.993	0.123	0.123	DBM	0.013		25	1.95		
92850	1239.416	1239.198	0.218	0.218	WMM		0.158	25		23.7	25
92875	1238.519	1238.251	0.268	0.268	WMM		0.208	25		31.2	25
92900	1237.426	1237.389	0.037	0				25			
92925	1236.138	1236.05	0.088	0				25			
92950	1234.713	1234.581	0.132	0.132	DBM	0.022		25	3.3		
92975	1233.446	1233.252	0.194	0.194	WMM		0.134	25		20.1	25
93000	1232.678	1232.528	0.15	0.15	DBM	0.04		25	6		
93025	1232.251	1232.15	0.101	0				25			
93050	1231.628	1231.561	0.067	0				25			
93075	1230.701	1230.462	0.239	0.239	WMM		0.179	25		26.85	25
93100	1229.566	1229.263	0.303	0.303	WMM		0.243	25		36.45	25
93125	1228.483	1228.322	0.161	0.161	WMM		0.101	25		15.15	25
93150	1227.734	1227.499	0.235	0.235	WMM		0.175	25		26.25	25
93175	1227.351	1227.305	0.046	0				25			
93200	1227.099	1227.187	-0.088	0				25			
93225	1226.848	1226.69	0.158	0.158	DBM	0.048		25	7.2		
93250	1226.557	1226.464	0.093	0				25			
93275	1226.108	1226.136	-0.028	0				25			
93300	1225.533	1225.39	0.143	0.143	DBM	0.033		25	4.95		
93325	1224.95	1224.779	0.171	0.171	WMM		0.111	25		16.65	25
93350	1224.367	1224.237	0.13	0.13	DBM	0.02		25	3		
93375	1223.933	1223.92	0.013	0				25			
93400	1223.788	1223.613	0.175	0.175	WMM		0.115	25		17.25	25
93425	1223.876	1223.376	0.5	0				25			
93450	1223.973	1223.871	0.102	0				25			
93475	1223.827	1223.713	0.114	0.114	DBM	0.004		25	0.6		
93500	1223.347	1223.203	0.144	0.144	DBM	0.034		25	5.1		
93525	1222.536	1222.541	-0.005	0				25			
93550	1221.579	1221.286	0.293	0.293	WMM		0.233	25		34.95	25
93575	1220.623	1220.5	0.123	0.123	DBM	0.013		25	1.95		
93600	1219.753	1219.528	0.225	0.225	WMM		0.165	25		24.75	25
93625	1219.047	1218.692	0.355	0.355	WMM		0.295	25		44.25	25
93650	1218.5	1218.344	0.156	0.156	DBM	0.046		25	6.9		
93675	1218	1217.905	0.095	0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
93700	1217.501	1217.401	0.1	0				25			
93725	1217.001	1216.775	0.226	0.226	WMM		0.166	25		24.9	25
93750	1216.502	1216.416	0.086	0				25			
93775	1216.084	1215.942	0.142	0.142	DBM	0.032		25	4.8		
93800	1215.818	1215.629	0.189	0.189	WMM		0.129	25		19.35	25
93825	1215.674	1215.95	-0.276	0				25			
93850	1215.539	1215.942	-0.403	0				25			
93875	1215.404	1215.328	0.076	0				25			
93900	1215.243	1215.134	0.109	0				25			
93925	1214.958	1214.853	0.105	0				25			
93950	1214.561	1214.598	-0.037	0				25			
93975	1214.155	1214.024	0.131	0.131	DBM	0.021		25	3.15		

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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
94000	1213.932	1213.816	0.116	0.116	DBM	0.006		25	0.9		
94025	1214.1	1214.001	0.099	0				25			
94050	1214.597	1214.483	0.114	0.114	DBM	0.004		25	0.6		
94075	1215.039	1214.96	0.079	0				25			
94100	1215.321	1215.129	0.192	0.192	WMM		0.132	25		19.8	25
94125	1215.443	1215.256	0.187	0.187	WMM		0.127	25		19.05	25
94150	1215.405	1215.289	0.116	0.116	DBM	0.006		25	0.9		
94175	1215.111	1214.957	0.154	0.154	DBM	0.044		25	6.6		
94200	1214.491	1214.404	0.087	0				25			
94225	1213.558	1213.221	0.337	0.337	WMM		0.277	25		41.55	25
94250	1212.541	1211.965	0.576	0				25			
94275	1211.562	1211.374	0.188	0.188	WMM		0.128	25		19.2	25
94300	1210.917	1210.749	0.168	0.168	WMM		0.108	25		16.2	25
94325	1210.671	1210.571	0.1	0				25			
94350	1210.611	1210.295	0.316	0.316	WMM		0.256	25		38.4	25
94375	1210.551	1210.351	0.2	0.2	WMM		0.14	25		21	25
94400	1210.491	1210.344	0.147	0.147	DBM	0.037		25	5.55		
94425	1210.431	1210.315	0.116	0.116	DBM	0.006		25	0.9		
94450	1210.369	1210.25	0.119	0.119	DBM	0.009		25	1.35		
94475	1210.28	1209.969	0.311	0.311	WMM		0.251	25		37.65	25
94500	1210.154	1209.189	0.965	0				25			
94525	1210.005	1208.1	1.905	0				25			
94550	1209.856	1207.842	2.014	0				25			
94575	1209.707	1207.949	1.758	0				25			
94600	1209.559	1207.946	1.613	0				25			
94625	1209.41	1207.777	1.633	0				25			
94650	1209.261	1207.423	1.838	0				25			
94675	1209.112	1207.494	1.618	0				25			
94700	1208.964	1207.851	1.113	0				25			
94725	1208.815	1208.399	0.416	0.416	WMM		0.356	25		53.4	25
94750	1208.666	1208.449	0.217	0.217	WMM		0.157	25		23.55	25
94775	1208.517	1208.373	0.144	0.144	DBM	0.034		25	5.1		
94800	1208.32	1208.246	0.074	0				25			
94825	1208.049	1207.939	0.11	0				25			
94850	1207.703	1207.674	0.029	0				25			
94875	1207.282	1207.163	0.119	0.119	DBM	0.009		25	1.35		
94900	1206.787	1206.673	0.114	0.114	DBM	0.004		25	0.6		
94925	1206.249	1206.104	0.145	0.145	DBM	0.035		25	5.25		
94950	1205.712	1205.643	0.069	0				25			
94975	1205.175	1204.712	0.463	0.463	WMM		0.403	25		60.45	25
95000	1204.638	1204.173	0.465	0.465	WMM		0.405	25		60.75	25
95025	1204.1	1203.752	0.348	0.348	WMM		0.288	25		43.2	25
95050	1203.563	1203.263	0.3	0.3	WMM		0.24	25		36	25
95075	1203.026	1202.862	0.164	0.164	WMM		0.104	25		15.6	25
95100	1202.489	1202.349	0.14	0.14	DBM	0.03		25	4.5		
95125	1201.951	1201.805	0.146	0.146	DBM	0.036		25	5.4		
95150	1201.324	1201.299	0.025	0				25			
95175	1200.509	1200.385	0.124	0.124	DBM	0.014		25	2.1		
95200	1199.538	1199.204	0.334	0.334	WMM		0.274	25		41.1	25
95225	1198.551	1198.244	0.307	0.307	WMM		0.247	25		37.05	25
95250	1197.564	1197.319	0.245	0.245	WMM		0.185	25		27.75	25
95275	1196.577	1196.708	-0.131	0				25			
95300	1195.59	1195.287	0.303	0.303	WMM		0.243	25		36.45	25
95325	1194.603	1193.823	0.78	0				25			
95350	1193.616	1192.974	0.642	0				25			
95375	1192.63	1192.368	0.262	0.262	WMM		0.202	25		30.3	25
95400	1191.643	1191.447	0.196	0.196	WMM		0.136	25		20.4	25
95425	1190.669	1190.292	0.377	0.377	WMM		0.317	25		47.55	25
95450	1189.77	1189.21	0.56	0				25			
95475	1188.936	1188.7	0.236	0.236	WMM		0.176	25		26.4	25
95500	1188.11	1188.016	0.094	0				25			
95525	1187.284	1187.124	0.16	0.16	WMM		0.1	25		15	25
95550	1186.455	1186.278	0.177	0.177	WMM		0.117	25		17.55	25
95575	1185.532	1185.325	0.207	0.207	WMM		0.147	25		22.05	25
95600	1184.464	1184.345	0.119	0.119	DBM	0.009		25	1.35		
95625	1183.252	1183.183	0.069	0				25			
95650	1181.898	1181.679	0.219	0.219	WMM		0.159	25		23.85	25
95675	1180.496	1179.977	0.519	0				25			
95700	1179.093	1178.735	0.358	0.358	WMM		0.298	25		44.7	25
95725	1177.691	1177.588	0.103	0				25			
95750	1176.288	1176.097	0.191	0.191	WMM		0.131	25		19.65	25
95775	1174.886	1174.698	0.188	0.188	WMM		0.128	25		19.2	25
95800	1173.483	1173.296	0.187	0.187	WMM		0.127	25		19.05	25
95825	1172.09	1171.906	0.184	0.184	WMM		0.124	25		18.6	25
95850	1171.031	1170.805	0.226	0.226	WMM		0.166	25		24.9	25
95875	1170.465	1170.278	0.187	0.187	WMM		0.127	25		19.05	25
95900	1170.23	1170.08	0.15	0.15	DBM	0.04		25	6		
95925	1169.791	1169.788	0.003	0				25			
95950	1169.023	1168.872	0.151	0.151	DBM	0.041		25	6.15		
95975	1168.023	1168.11	-0.087	0				25			
96000	1167.013	1166.861	0.152	0.152	DBM	0.042		25	6.3		
96025	1166.003	1165.645	0.358	0.358	WMM		0.298	25		44.7	25
96050	1164.985	1164.772	0.213	0.213	WMM		0.153	25		22.95	25
96075	1163.891	1163.847	0.044	0				25			
96100	1162.704	1162.527	0.177	0.177	WMM		0.117	25		17.55	25
96125	1161.425	1161.164	0.261	0.261	WMM		0.201	25		30.15	25
96150	1160.053	1159.531	0.522	0				25			
96175	1158.589	1158.15	0.439	0.439	WMM		0.379	25		56.85	25
96200	1157.032	1157.019	0.013	0				25			
96225	1155.383	1155.654	-0.271	0				25			
96250	1153.649	1153.785	-0.136	0				25			
96275	1151.899	1151.548	0.351	0.351	WMM		0.291	25		43.65	25
96300	1150.149	1149.659	0.49	0				25			
96325	1148.443	1148.064	0.379	0.379	WMM		0.319	25		47.85	25



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
96350	1147.037	1146.883	0.154	0.154	DBM	0.044		25			
96375	1145.972	1145.675	0.297	0.297	WMM		0.237	25	6.6	35.55	25
96400	1145.248	1144.551	0.697	0				25			
96425	1144.865	1143.916	0.949	0				25			
96450	1144.822	1143.947	0.875	0				25			
96475	1145.12	1144.38	0.74	0				25			
96500	1145.743	1145.349	0.394	0.394	WMM		0.334	25		50.1	25
96525	1146.448	1146.279	0.169	0.169	WMM		0.109	25		16.35	25
96550	1147.152	1147.008	0.144	0.144	DBM	0.034		25	5.1		
96575	1147.809	1147.779	0.03	0				25			
96600	1148.143	1148.374	-0.231	0				25			
96625	1148.109	1148.775	-0.666	0				25			
96650	1147.708	1148.899	-1.191	0				25			
96675	1146.939	1149.115	-2.176	0				25			
96700	1145.803	1148.931	-3.128	0				25			
96725	1144.347	1148.442	-4.095	0				25			
96750	1142.847	1147.978	-5.131	0				25			
96775	1141.347	1147.46	-6.113	0				25			
96800	1139.847	1146.432	-6.585	0				25			
96825	1138.347	1145.394	-7.047	0				25			
96850	1136.847	1144.745	-7.898	0				25			
96875	1135.347	1143.791	-8.444	0				25			
96900	1133.847	1142.772	-8.925	0				25			
96925	1132.347	1141.621	-9.274	0				25			
96950	1130.847	1140.213	-9.366	0				25			
96975	1129.347	1138.399	-9.052	0				25			
97000	1127.847	1136.613	-8.766	0				25			
97025	1126.347	1134.504	-8.157	0				25			
97050	1124.847	1132.408	-7.561	0				25			
97075	1123.347	1130.608	-7.261	0				25			
97100	1121.746	1129.495	-7.749	0				25			
97125	1119.937	1128.96	-9.023	0				25			
97150	1117.955	1128.504	-10.549	0				25			
97175	1115.955	1127.8	-11.845	0				25			
97200	1113.955	1126.278	-12.323	0				25			
97225	1111.955	1125.003	-13.048	0				25			
97250	1110.056	1124.042	-13.986	0				25			
97275	1108.365	1123.288	-14.923	0				25			
97300	1106.847	1122.614	-15.767	0				25			
97325	1105.347	1121.01	-15.663	0				25			
97350	1103.847	1118.944	-15.097	0				25			
97375	1102.347	1116.628	-14.281	0				25			
97400	1100.847	1113.992	-13.145	0				25			
97425	1099.347	1112.034	-12.687	0				25			
97450	1097.847	1110.681	-12.834	0				25			
97475	1096.347	1109.458	-13.111	0				25			
97500	1094.847	1108.259	-13.412	0				25			
97525	1093.347	1106.775	-13.428	0				25			
97550	1091.796	1105.919	-14.123	0				25			
97575	1090.142	1105.105	-14.963	0				25			
97600	1088.401	1104.04	-15.639	0				25			
97625	1086.651	1103.334	-16.683	0				25			
97650	1084.901	1102.64	-17.739	0				25			
97675	1083.151	1101.385	-18.234	0				25			
97700	1081.401	1100.22	-18.819	0				25			
97725	1079.651	1098.948	-19.297	0				25			
97750	1077.901	1097.545	-19.644	0				25			
97775	1076.151	1096.008	-19.857	0				25			
97800	1074.35	1094.388	-20.038	0				25			
97825	1072.446	1092.742	-20.296	0				25			
97850	1070.455	1090.546	-20.091	0				25			
97875	1068.455	1087.817	-19.362	0				25			
97900	1066.455	1085.336	-18.881	0				25			
97925	1064.455	1083.359	-18.904	0				25			
97950	1062.556	1081.272	-18.716	0				25			
97975	1060.655	1078.95	-18.085	0				25			
98000	1059.347	1076.536	-17.189	0				25			
98025	1057.847	1074.805	-16.958	0				25			
98050	1056.347	1072.823	-16.476	0				25			
98075	1054.847	1070.169	-15.322	0				25			
98100	1053.347	1067.66	-14.313	0				25			
98125	1051.847	1065.903	-14.056	0				25			
98150	1050.347	1063.611	-13.264	0				25			
98175	1048.847	1061.281	-12.434	0				25			
98200	1047.347	1059.249	-11.902	0				25			
98225	1045.847	1057.41	-11.563	0				25			
98250	1044.296	1056.263	-11.967	0				25			
98275	1042.642	1055.323	-12.681	0				25			
98300	1040.901	1054.338	-13.437	0				25			
98325	1039.151	1052.924	-13.773	0				25			
98350	1037.401	1050.703	-13.302	0				25			
98375	1035.651	1048.252	-12.601	0				25			
98400	1033.901	1045.964	-12.063	0				25			
98425	1032.151	1044.063	-11.912	0				25			
98450	1030.401	1041.933	-11.532	0				25			
98475	1028.651	1039.845	-11.194	0				25			
98500	1026.85	1037.284	-10.434	0				25			
98525	1024.945	1033.214	-8.269	0				25			
98550	1022.954	1032.03	-9.076	0				25			
98575	1020.954	1029.574	-8.62	0				25			
98600	1018.954	1027.869	-8.915	0				25			
98625	1016.954	1026.595	-9.641	0				25			
98650	1015.056	1025.678	-10.622	0				25			
98675	1013.365	1024.57	-11.205	0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
98700	1011.847	1022.942	-11.095	0				25			
98725	1010.347	1020.88	-10.533	0				25			
98750	1008.847	1018.377	-9.53	0				25			
98775	1007.347	1015.681	-8.334	0				25			
98800	1005.847	1013.087	-7.24	0				25			
98825	1004.347	1010.359	-6.012	0				25			
98850	1002.847	1007.84	-4.993	0				25			
98875	1001.347	1005.603	-4.256	0				25			
98900	999.847	1003.205	-3.358	0				25			
98925	998.347	1000.486	-2.139	0				25			
98950	996.746	997.566	-0.82	0				25			
98975	994.936	994.571	0.365	0.365	WMM		0.305	25		45.75	25
99000	992.954	991.74	1.214	0				25			
99025	990.954	988.883	2.071	0				25			
99050	988.954	986.374	2.58	0				25			
99075	986.954	984.432	2.522	0				25			
99100	985.084	982.868	2.216	0				25			
99125	983.482	982.007	1.475	0				25			
99150	982.102	981.309	0.793	0				25			
99175	980.745	979.822	0.923	0				25			
99200	979.387	978.874	0.513	0				25			
99225	978.03	978.195	-0.165	0				25			
99250	976.673	977.422	-0.749	0				25			
99275	975.316	976.399	-1.083	0				25			
99300	973.931	974.533	-0.602	0				25			
99325	972.396	972.566	-0.17	0				25			
99350	970.7	970.433	0.267	0.267	WMM		0.207	25		31.05	25
99375	968.95	968.55	0.4	0.4	WMM		0.34	25		51	25
99400	967.2	966.941	0.259	0.259	WMM		0.199	25		29.85	25
99425	965.45	965.213	0.237	0.237	WMM		0.177	25		26.55	25
99450	963.7	963.503	0.197	0.197	WMM		0.137	25		20.55	25
99475	961.961	961.944	0.017	0				25			
99500	960.434	960.422	0.012	0				25			
99525	959.195	958.904	0.291	0.291	WMM		0.231	25		34.65	25
99550	958.244	957.859	0.385	0.385	WMM		0.325	25		48.75	25
99575	957.57	957.069	0.501	0				25			
99600	956.973	956.476	0.497	0				25			
99625	956.375	956.037	0.338	0.338	WMM		0.278	25		41.7	25
99650	955.777	955.485	0.292	0.292	WMM		0.232	25		34.8	25
99675	955.179	955.04	0.139	0.139	DBM	0.029		25	4.35		
99700	954.582	954.678	-0.096	0				25			
99725	953.984	954.292	-0.308	0				25			
99750	953.386	953.874	-0.488	0				25			
99775	952.788	953.039	-0.251	0				25			
99800	952.191	952.473	-0.282	0				25			
99825	951.593	951.797	-0.204	0				25			
99850	950.995	950.693	0.302	0.302	WMM		0.242	25		36.3	25
99875	950.397	949.637	0.76	0				25			
99900	949.8	949.181	0.619	0				25			
99925	949.202	948.734	0.468	0.468	WMM		0.408	25		61.2	25
99950	948.604	948.27	0.334	0.334	WMM		0.274	25		41.1	25
99975	947.994	947.552	0.442	0.442	WMM		0.382	25		57.3	25
100000	947.072	946.29	0.782	0				25			
100025	945.712	945.053	0.659	0				25			
100050	943.914	944.2	-0.286	0				25			
100075	941.914	942.879	-0.965	0				25			
100100	939.914	941.701	-1.787	0				25			
100125	937.913	940.825	-2.912	0				25			
100150	935.987	939.88	-3.893	0				25			
100175	934.266	938.775	-4.509	0				25			
100200	932.733	936.726	-3.993	0				25			
100225	931.233	934.18	-2.947	0				25			
100250	929.733	931.878	-2.145	0				25			
100275	928.233	929.756	-1.523	0				25			
100300	926.733	928.141	-1.408	0				25			
100325	925.233	927.181	-1.948	0				25			
100350	923.66	926.409	-2.749	0				25			
100375	921.881	925.555	-3.674	0				25			
100400	919.913	924.16	-4.247	0				25			
100425	917.913	922.682	-4.769	0				25			
100450	915.914	920.875	-4.961	0				25			
100475	913.914	919.227	-5.313	0				25			
100500	911.987	918.131	-6.144	0				25			
100525	910.266	916.837	-6.571	0				25			
100550	908.734	915.58	-6.846	0				25			
100575	907.234	914.133	-6.899	0				25			
100600	905.734	912.393	-6.659	0				25			
100625	904.233	910.615	-6.382	0				25			
100650	902.733	909.166	-6.433	0				25			
100675	901.233	907.483	-6.25	0				25			
100700	899.66	905.123	-5.463	0				25			
100725	897.881	902.889	-5.008	0				25			
100750	895.914	901.349	-5.435	0				25			
100775	893.914	900.05	-6.136	0				25			
100800	891.914	898.508	-6.594	0				25			
100825	889.914	897.123	-7.209	0				25			
100850	888.054	895.26	-7.206	0				25			
100875	886.838	893.384	-6.546	0				25			
100900	886.168	891.568	-5.4	0				25			
100925	885.543	889.502	-3.959	0				25			
100950	884.918	888.402	-3.484	0				25			
100975	884.293	887.099	-2.806	0				25			
101000	883.528	884.964	-1.436	0				25			
101025	882.119	882.469	-0.35	0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
101050	880.164	880.206	-0.042	0				25			
101075	878.164	878.381	-0.217	0				25			
101100	876.164	876.909	-0.745	0				25			
101125	874.168	875.284	-1.116	0				25			
101150	872.284	872.959	-0.675	0				25			
101175	870.556	869.87	0.686	0				25			
101200	868.984	867.244	1.74	0				25			
101225	867.484	865.156	2.328	0				25			
101250	865.984	863.984	2	0				25			
101275	864.484	863.335	1.149	0				25			
101300	862.984	862.209	0.775	0				25			
101325	861.484	861.032	0.452	0.452	WMM		0.392	25		58.8	25
101350	859.98	859.62	0.36	0.36	WMM		0.3	25		45	25
101375	858.336	858.007	0.329	0.329	WMM		0.269	25		40.35	25
101400	856.484	856.386	0.098	0				25			
101425	854.488	855.028	-0.54	0				25			
101450	852.488	853.88	-1.392	0				25			
101475	850.488	852.423	-1.935	0				25			
101500	848.492	850.653	-2.161	0				25			
101525	846.636	848.501	-1.865	0				25			
101550	844.988	846.248	-1.26	0				25			
101575	843.483	843.833	-0.35	0				25			
101600	841.983	841.974	0.009	0				25			
101625	840.483	840.517	-0.034	0				25			
101650	838.983	838.762	0.221	0.221	WMM		0.161	25		24.15	25
101675	837.484	837.509	-0.025	0				25			
101700	835.984	836.212	-0.228	0				25			
101725	834.414	834.248	0.166	0.166	WMM		0.106	25		15.9	25
101750	832.689	832.143	0.546	0				25			
101775	830.808	830.074	0.734	0				25			
101800	828.813	827.782	1.031	0				25			
101825	826.813	825.677	1.136	0				25			
101850	824.813	823.417	1.396	0				25			
101875	822.814	821.751	1.063	0				25			
101900	820.966	820.265	0.701	0				25			
101925	819.373	818.083	1.29	0				25			
101950	818.037	816.295	1.742	0				25			
101975	816.957	814.807	2.15	0				25			
102000	816.134	812.941	3.193	0				25			
102025	815.565	810.443	5.122	0				25			
102050	815.102			0				25			
102075	814.64			0				25			
102100	814.177			0				25			
102125	813.714			0				25			
102150	813.252			0				25			
102175	812.789			0				25			
102200	812.326			0				25			
102225	811.864			0				25			
102250	811.401			0				25			
102275	810.938			0				25			
102300	810.475			0				25			
102325	809.305			0				25			
102350	808.057			0				25			
102375	806.788			0				25			
102400	805.519			0				25			
102425	804.25			0				25			
102450	802.981			0				25			
102475	801.649			0				25			
102500	800.032			0				25			
102525	798.119			0				25			
102550	796.119			0				25			
102575	794.119			0				25			
102600	792.119			0				25			
102625	790.238			0				25			
102650	788.893			0				25			
102675	788.105			0				25			
102700	787.48			0				25			
102725	786.855			0				25			
102750	786.23			0				25			
102775	785.605			0				25			
102800	784.98			0				25			
102825	784.355			0				25			
102850	783.73			0				25			
102875	783.105			0				25			
102900	782.412			0				25			
102925	781.331			0				25			
102950	779.82			0				25			
102975	777.907			0				25			
103000	775.907			0				25			
103025	773.907			0				25			
103050	771.907			0				25			
103075	769.911			0				25			
103100	767.945			0				25			
103125	766.013			0				25			
103150	764.116			0				25			
103175	762.254			0				25			
103200	760.426			0				25			
103225	758.633			0				25			
103250	756.874			0				25			
103275	755.124			0				25			
103300	753.374			0				25			
103325	751.623			0				25			
103350	749.815			0				25			
103375	747.902			0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
103400	745.907			0				25			
103425	743.907			0				25			
103450	741.907			0				25			
103475	739.909			0				25			
103500	738.232			0				25			
103525	737.129			0				25			
103550	736.472			0				25			
103575	735.847	737.558	-1.711	0				25			
103600	735.222	737.023	-1.801	0				25			
103625	734.597	737.017	-2.42	0				25			
103650	733.934	736.298	-2.364	0				25			
103675	732.822	735.94	-3.118	0				25			
103700	731.185	734.272	-3.087	0				25			
103725	729.435	729.649	-0.214	0				25			
103750	727.677	726.101	1.576	0				25			
103775	725.853	723.487	2.366	0				25			
103800	723.95	720.985	2.965	0				25			
103825	721.972	718.82	3.152	0				25			
103850	719.972	716.987	2.985	0				25			
103875	717.972	715.845	2.127	0				25			
103900	715.972	714.833	1.139	0				25			
103925	714.001	715.918	-1.917	0				25			
103950	712.473	724.521	-12.048	0				25			
103975	711.517	727.781	-16.264	0				25			
104000	710.891	719.726	-8.835	0				25			
104025	710.266	710.831	-0.565	0				25			
104050	709.639	709.088	0.551	0				25			
104075	708.888	707.841	0.847	0				25			
104100	707.164	706.494	0.67	0				25			
104125	705.195	704.155	1.04	0				25			
104150	703.195	702.195	1	0				25			
104175	701.195	699.658	1.537	0				25			
104200	699.195	698.127	1.068	0				25			
104225	697.296	697.077	0.219	0.219	WMM		0.159	25		23.85	25
104250	695.741	696.111	-0.37	0				25			
104275	694.522	695.118	-0.596	0				25			
104300	693.377	693.87	-0.493	0				25			
104325	692.232	692.492	-0.26	0				25			
104350	691.087	691.642	-0.555	0				25			
104375	689.88	690.819	-0.939	0				25			
104400	688.346	689.641	-1.295	0				25			
104425	686.463	688.39	-1.927	0				25			
104450	684.463	686.427	-1.964	0				25			
104475	682.463	683.588	-1.125	0				25			
104500	680.463	681.353	-0.89	0				25			
104525	678.47	678.858	-0.388	0				25			
104550	676.631	675.986	0.645	0				25			
104575	675.001	673.497	1.504	0				25			
104600	673.499	671.63	1.869	0				25			
104625	671.999	669.839	2.16	0				25			
104650	670.499	667.987	2.512	0				25			
104675	668.999	666.555	2.444	0				25			
104700	667.499	665.317	2.182	0				25			
104725	666.064	664.278	1.786	0				25			
104750	664.797	663.409	1.388	0				25			
104775	663.678	662.88	0.798	0				25			
104800	662.583	662.81	-0.227	0				25			
104825	661.488	662.859	-1.371	0				25			
104850	660.393	661.485	-1.092	0				25			
104875	659.194	659.284	-0.09	0				25			
104900	657.63	657.028	0.602	0				25			
104925	655.712	654.758	0.954	0				25			
104950	653.712	652.715	0.997	0				25			
104975	651.966	651.59	0.376	0.376	WMM		0.316	25		47.4	25
105000	650.818	650.809	0.009	0				25			
105025	650.185	650.659	-0.474	0				25			
105050	649.622	650.126	-0.504	0				25			
105075	649.058	649.87	-0.812	0				25			
105100	648.494	649.493	-0.999	0				25			
105125	647.903	648.609	-0.706	0				25			
105150	647.169	646.868	0.301	0.301	WMM		0.241	25		36.15	25
105175	646.275	645.287	0.988	0				25			
105200	645.223	644.099	1.124	0				25			
105225	644.04	643.056	0.984	0				25			
105250	642.842	641.866	0.976	0				25			
105275	641.646	641.051	0.595	0				25			
105300	640.714	640.337	0.377	0.377	WMM		0.317	25		47.55	25
105325	640.232	639.831	0.401	0.401	WMM		0.341	25		51.15	25
105350	640.2	639.772	0.428	0.428	WMM		0.368	25		55.2	25
105375	640.617	640.071	0.546	0				25			
105400	641.483	640.946	0.537	0				25			
105425	642.798	642.186	0.612	0				25			
105450	644.298	643.723	0.575	0				25			
105475	645.798	645.046	0.752	0				25			
105500	647.298	646.246	1.052	0				25			
105525	648.798	648.545	0.253	0.253	WMM		0.193	25		28.95	25
105550	650.298			0				25			
105575	651.798			0				25			
105600	653.298			0				25			
105625	654.798			0				25			
105650	656.298			0				25			
105675	657.85			0				25			
105700	658.721			0				25			
105725	659.513			0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
105750	660.119			0				25			
105775	660.721			0				25			
105800	661.323			0				25			
105825	661.926			0				25			
105850	662.528			0				25			
105875	663.13			0				25			
105900	663.733			0				25			
105925	664.332			0				25			
105950	665.69			0				25			
105975	667.207			0				25			
106000	668.953			0				25			
106025	670.703			0				25			
106050	672.453			0				25			
106075	674.203			0				25			
106100	675.953			0				25			
106125	677.703			0				25			
106150	679.453			0				25			
106175	681.203			0				25			
106200	682.953			0				25			
106225	684.703			0				25			
106250	686.341			0				25			
106275	687.721			0				25			
106300	688.843			0				25			
106325	689.706			0				25			
106350	690.421			0				25			
106375	691.136			0				25			
106400	691.85			0				25			
106425	692.565			0				25			
106450	693.28			0				25			
106475	693.994			0				25			
106500	694.709			0				25			
106525	695.424			0				25			
106550	696.139			0				25			
106575	696.853			0				25			
106600	697.56			0				25			
106625	698.251			0				25			
106650	698.926			0				25			
106675	699.585			0				25			
106700	700.235			0				25			
106725	700.885			0				25			
106750	701.535			0				25			
106775	702.186			0				25			
106800	702.836			0				25			
106825	703.486			0				25			
106850	704.136			0				25			
106875	704.786			0				25			
106900	705.437			0				25			
106925	706.087			0				25			
106950	706.737			0				25			
106975	707.387			0				25			
107000	708.174			0				25			
107025	709.235			0				25			
107050	710.572			0				25			
107075	712.184			0				25			
107100	713.934			0				25			
107125	715.684			0				25			
107150	717.434			0				25			
107175	719.184			0				25			
107200	720.934			0				25			
107225	722.684			0				25			
107250	724.434			0				25			
107275	726.184			0				25			
107300	727.934			0				25			
107325	729.684			0				25			
107350	731.434			0				25			
107375	733.184			0				25			
107400	734.934			0				25			
107425	736.673			0				25			
107450	737.933			0				25			
107475	738.463			0				25			
107500	738.265			0				25			
107525	737.337			0				25			
107550	735.731			0				25			
107575	733.981			0				25			
107600	732.231			0				25			
107625	730.481			0				25			
107650	728.731			0				25			
107675	726.981			0				25			
107700	725.231			0				25			
107725	723.527			0				25			
107750	722.161			0				25			
107775	721.185			0				25			
107800	720.599			0				25			
107825	720.356			0				25			
107850	720.164			0				25			
107875	719.973			0				25			
107900	719.781			0				25			
107925	719.59			0				25			
107950	719.398			0				25			
107975	719.207			0				25			
108000	719.015			0				25			
108025	718.824			0				25			
108050	718.632			0				25			
108075	718.441			0				25			



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ch.	FRL	EGL	Difference	PCC Thickness	PCC by DBM/WMM	DBM thickness	WMM thickness	Length	DBM quantity	WMM quantity	Scarification Length
108100	718.249			0				25			
108125	718.058			0				25			
108150	717.866			0				25			
108175	717.675			0				25			
108200	717.483			0				25			
108225	717.292			0				25			
108250	717.1			0				25			
108275	716.909			0				25			
108300	716.717			0				25			
108325	716.526			0				25			
108350	716.334			0				25			
108375	716.169			0				25			
108400	716.179			0				25			
108425	716.388			0				25			
108450	716.786			0				25			
108475	717.233			0				25			
108500	717.679			0				25			
108525	718.125			0				25			
108550	718.571			0				25			
108575	719.003			0				25			
108600	719.118			0				25			
108625	718.794			0				25			
108650	718.032			0				25			
108675	717.075			0				25			
108700	716.117			0				25			
108725	715.16			0				25			
108750	714.203			0				25			
108775	713.246			0				25			
108800	712.289			0				25			
108825	711.331			0				25			
108850	710.46			0				25			
108875	709.92			0				25			
108900	709.726			0				25			
108925	709.834			0				25			
108950	709.985			0				25			
108975	710.137			0				25			
109000	710.288			0				25			
109025	710.439			0				25			
109050	710.571			0				25			
109075	710.585			0				25			
109100	710.471			0				25			
109125	710.227			0				25			
109150	709.853			0				25			
109175	709.351			0				25			
109200	708.739			0				25			
109225	708.114			0				25			
109250	707.489			0				25			
109275	706.864			0				25			
109300	706.239			0				25			
109325	705.614			0				25			
109350	705.073			0				25			
109375	704.726			0				25			
109400	704.574			0				25			
109425	704.567			0				25			
109450	704.567			0				25			
109475	704.567			0				22			
109494	704.567			0				19			

570.075 8361.45 7225

DBM Quantity = 570.075 cum  
WMM Quantity = 8361.45 cum  
Scarification Length = 7225 m  
Cutting Length = 16741 m

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**Variable Declaration****Profile Corrective Course**

SI No	Variable Description	Variable	Dimension	Unit
1	Reusable GSB Percentage	gsb_per	23.900	percentage
2	Profile Corrective Course(WMM)	pc_wmm	8361.000	cum
3	Profile Corrective Course(GSB)	pc_gsb	0.000	cum
4	Profile Corrective Course(dbm)	pc_dbm	570.000	cum

## Triangular Drain & Chut Drain

Chainage (m)		Length of CD (m)	Net Length(m)	TCS No.	Side
From	To				
75320	75430	2.7	107.3	TCS-9	Hill
75430	75515	3.96	81.04	TCS-4A	Hill
75515	75575	0	60	TCS-9	Hill
75640	75700	3.96	56.04	TCS-9	Hill
75775	75825	0	50	TCS-9	Hill
75875	75985	0	110	TCS-7	Hill
75985	76010	16.6	8.4	TCS-2A	Hill
76010	76125	0	115	TCS-7	Hill
76325	76400	0	75	TCS-9	Hill
76490	76600	2.7	107.3	TCS-4	Hill
76600	76975	3.96	371.04	TCS-2A	Hill
76975	77025	0	50	TCS-2A	Hill
77025	77130	0	105	TCS-2A	Hill
77130	77180	2.7	47.3	TCS-4A	Hill
77180	77280	0	100	TCS-7	Hill
77280	77310	3.96	26.04	TCS-4	Hill
77310	77380	0	70	TCS-7	Hill
77380	77420	0	40	TCS-2	Hill
77650	77700	0	50	TCS-4	Hill
77700	77950	2.6	247.4	TCS-2	Hill
77950	78000	0	50	TCS-4	Hill
78000	78050	2.6	47.4	TCS-2	Hill
78050	78100	0	50	TCS-7	Hill
78100	78170	0	70	TCS-9	Hill
78170	78400	5.3	224.7	TCS-2	Hill
78400	78450	2.6	47.4	TCS-4	Hill
78450	78500	0	50	TCS-2	Hill
78550	78920	2.6	367.4	TCS-2	Hill
78920	79030	2.7	107.3	TCS-7	Hill
79080	79110	0	30	TCS-7	Hill
79110	79280	2.6	167.4	TCS-2	Hill
79280	79480	0	200	TCS-19	Hill
79480	79550	0	70	TCS-11A	Hill
79550	79725	0	350	TCS-8	Both
79800	79990	0	380	TCS-8	Both
79990	80080	0	90	TCS-2A	Hill
80500	80560	0	60	TCS-2A	Hill
80560	80650	0	90	TCS-7	Hill
80700	80760	0	60	TCS-7	Hill
80760	81000	2.6	237.4	TCS-2	Hill
81000	81080	0	80	TCS-2A	Hill
81150	81380	5.3	224.7	TCS-2A	Hill
81380	81470	0	90	TCS-7	Hill
81470	81910	6.66	433.34	TCS-2	Hill
81910	81940	0	30	TCS-7	Hill
81940	82110	5.3	164.7	TCS-2	Hill
82220	82575	5.2	349.8	TCS-2	Hill
82575	82650	0	75	TCS-2A	Hill
82650	82960	5.3	304.7	TCS-2	Hill
82960	83100	2.7	137.3	TCS-7	Hill
83100	83570	5.4	464.6	TCS-2	Hill



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83570	83625	0	55	TCS-19	Hill
83625	83660	0	35	TCS-7	Hill
83660	83775	2.7	112.3	TCS-2	Hill
83775	83825	0	50	TCS-7	Hill
83825	84040	2.6	212.4	TCS-2	Hill
84040	84100	0	60	TCS-7	Hill
84100	84175	0	75	TCS-2	Hill
84550	84700	2.7	147.3	TCS-2A	Hill
84820	85300	5.2	474.8	TCS-4A	Hill
85600	85900	2.6	297.4	TCS-2A	Hill
85920	86130	5.3	204.7	TCS-2A	Hill
86230	86950	8	712	TCS-2	Hill
87000	87520	5.3	514.7	TCS-2	Hill
87600	87750	2.7	147.3	TCS-2	Hill
87750	88400	7.9	642.1	TCS-7	Hill
88400	88830	9.26	420.74	TCS-2	Hill
89130	89350	2.7	217.3	TCS-2	Hill
89350	89400	0	50	TCS-7	Hill
89400	89590	2.6	187.4	TCS-2	Hill
89650	89700	0	50	TCS-2	Hill
89700	89800	3.96	96.04	TCS-7	Hill
89800	89950	2.7	147.3	TCS-2	Hill
89950	90000	2.6	47.4	TCS-19	Hill
90000	90300	5.3	294.7	TCS-7	Hill
90300	90450	2.6	147.4	TCS-2	Hill
90500	90570	3.96	66.04	TCS-2	Hill
90570	90660	0	90	TCS-7	Hill
90660	90750	0	90	TCS-2	Hill
90800	90850	0	50	TCS-2	Hill
91100	91120	0	20	TCS-2	Hill
91120	91180	0	60	TCS-7	Hill
91180	91240	2.7	57.3	TCS-2	Hill
91240	91320	0	80	TCS-7	Hill
91320	91410	2.7	87.3	TCS-2	Hill
91410	91470	0	60	TCS-7	Hill
91470	91540	0	70	TCS-2	Hill
91540	91625	0	85	TCS-19	Hill
91625	91700	2.7	72.3	TCS-7	Hill
91700	91900	2.7	197.3	TCS-2	Hill
91900	91975	0	150	TCS-8	Both
91975	92375	7.92	392.08	TCS-7	Hill
92375	92425	0	100	TCS-8	Both
92425	92720	2.7	292.3	TCS-7	Hill
92720	92770	2.7	47.3	TCS-2	Hill
92770	92850	0	80	TCS-7	Hill
92850	93440	10.5	579.5	TCS-2	Hill
93440	93580	0	140	TCS-7	Hill
93580	93660	2.7	77.3	TCS-2	Hill
93660	94020	5.3	354.7	TCS-7	Hill
94020	94290	5.4	264.6	TCS-2	Hill
94290	94380	2.6	87.4	TCS-7	Hill
94380	94480	0	100	TCS-4	Hill
94480	94800	8	312	TCS-7	Hill
94800	94930	2.7	127.3	TCS-2	Hill
94930	95060	0	130	TCS-7	Hill



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95140	95250	6.14	103.86	TCS-2	Hill
95250	95350	0	100	TCS-7	Hill
95350	95830	13.2	466.8	TCS-2	Hill
95830	95960	3.96	126.04	TCS-7	Hill
95960	96750	9.16	780.84	TCS-2	Hill
98160	98230	0	140	TCS-8	Both
98230	98400	0	340	TCS-6A	Both
98400	98460	0	120	TCS-8	Both
99680	99740	0	60	TCS-7	Hill
99740	99760	0	20	TCS-2A	Hill
99760	100230	8.1	461.9	TCS-7	Hill
100230	100340	5.3	104.7	TCS-2A	Hill
100340	100400	0	120	TCS-8	Both
100400	100975	5.3	1139.4	TCS-6A	Both
100975	101425	5.3	444.7	TCS-2A	Hill
101425	101525	0	200	TCS-6A	Both
101940	102020	0	80	TCS-7	Hill
102020	102070	0	50	TCS-9	Hill
102070	102200	2.7	127.3	TCS-7	Hill
102200	102500	0	600	TCS-8	Both
102500	102675	2.7	172.3	TCS-19	Hill
103075	103250	0	175	TCS-7	Hill
103250	103600	2.7	347.3	TCS-19	Hill
103600	103650	0	100	TCS-6A	Both
103650	103800	0	150	TCS-2A	Hill
103800	103860	0	60	TCS-2A	Hill
103860	103925	0	65	TCS-7	Hill
103925	104000	0	75	TCS-19	Hill
104000	104050	0	50	TCS-7	Hill
104050	104250	2.6	197.4	TCS-2	Hill
104250	104400	2.7	147.3	TCS-7	Hill
104400	104510	2.6	107.4	TCS-19	Hill
104510	104670	2.7	157.3	TCS-2A	Hill
104670	104740	0	70	TCS-7	Hill
104740	104820	0	80	TCS-2A	Hill
104820	105260	3.96	436.04	TCS-7	Hill
105260	105325	0	65	TCS-2A	Hill
107910	107975	0	65	TCS-7	Hill
107975	109175	8	1192	TCS-9	Hill
109175	109275	0	200	TCS-8	Both
109275	109325	2.7	47.3	TCS-7	Hill
109325	109494	66.5	102.5	TCS-9	Hill

Total =

26345.38



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## Catchwater Drain

Chainage (m)		Length of CD	Net Length(m)
From	To		
76200	76325	0	125
76400	76490	2.7	87.3
77420	77470	0	50
77470	77650	5.2	174.8
78500	78550	0	50
79030	79080	0	50
79280	79480	0	200
79480	79550	0	70
79725	79800	0	75
80400	80500	2.6	97.4
80650	80700	2.7	47.3
81080	81150	2.6	67.4
82110	82220	5.2	104.8
83570	83625	0	55
84175	84500	2.6	322.4
84500	84550	0	50
84700	84820	0	120
85300	85370	0	70
85550	85600	2.7	47.3
85900	85920	0	20
86130	86230	0	100
86950	87000	0	50
87520	87600	0	80
88830	89130	0	300
89590	89650	2.6	57.4
89950	90000	2.6	47.4
90450	90500	0	50
90750	90800	2.6	47.4
90850	91100	2.6	247.4
91540	91625	0	85
95060	95140	3.96	76.04
96750	97000	0	250
97000	97050	0	50
102500	102675	2.7	172.3
102675	103075	5.4	394.6
103250	103600	2.7	347.3
103925	104000	0	75
104400	104510	2.6	107.4
105325	105860	8	527
105860	107910	7.9	2042.1
Total =			6990.04

Total Length of Triangular Drain = 33335 m

Chute Drain (of avg 8 m height @ 50m Interval) 1118 m

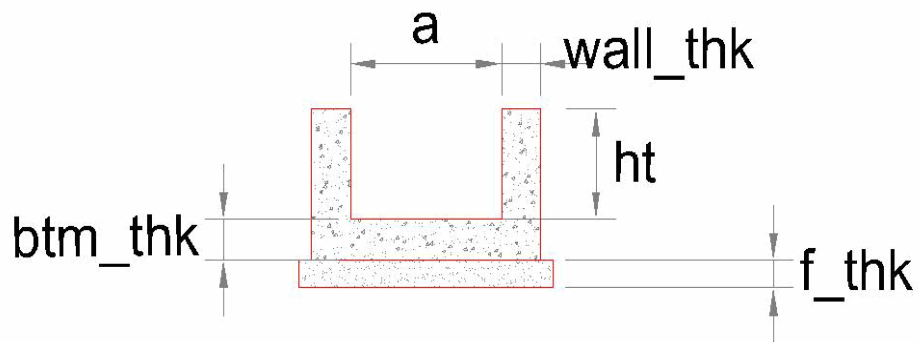


## Variable Declaration

## PCC Chut Drain

SI No	Variable Description	Variable	Dimension	Unit
1	Ref Drawing	a	0.600	m
2	Ref Drawing	wall_thk	0.150	m
3	Ref Drawing	btm_thk	0.150	m
4	Ref Drawing	f_thk	0.100	m
5	Ref Drawing	ht	0.400	m
6	Length	l	1132.000	m

Variable Declaration



CHUT DRAIN

### Quantity Calculation For Gabian Structure

Chainage		side	Length (m)
From	To		
105860	107910	Valley	2050

Dimensions of Units		Total Area	Total Length (m)	Quantity (cum)
B	H			
5	1.2	6		
5	1.2	6		
4	1.2	4.8		
3	1.2	3.6		
3	1.2	3.6		
3	1.2	3.6		
3	1.2	3.6	2050	78720
3	1.2	3.6		
		38.4	2050	78720

Total Quantity of Gabian Structure in valley side=

78720 Cum



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### RCC Covered Drain

Chainage (m)		Length of CD	Net Length	TCS No.	Side
From	To				
75000	75320	0	640	TCS-1A	Both
Total =			640		

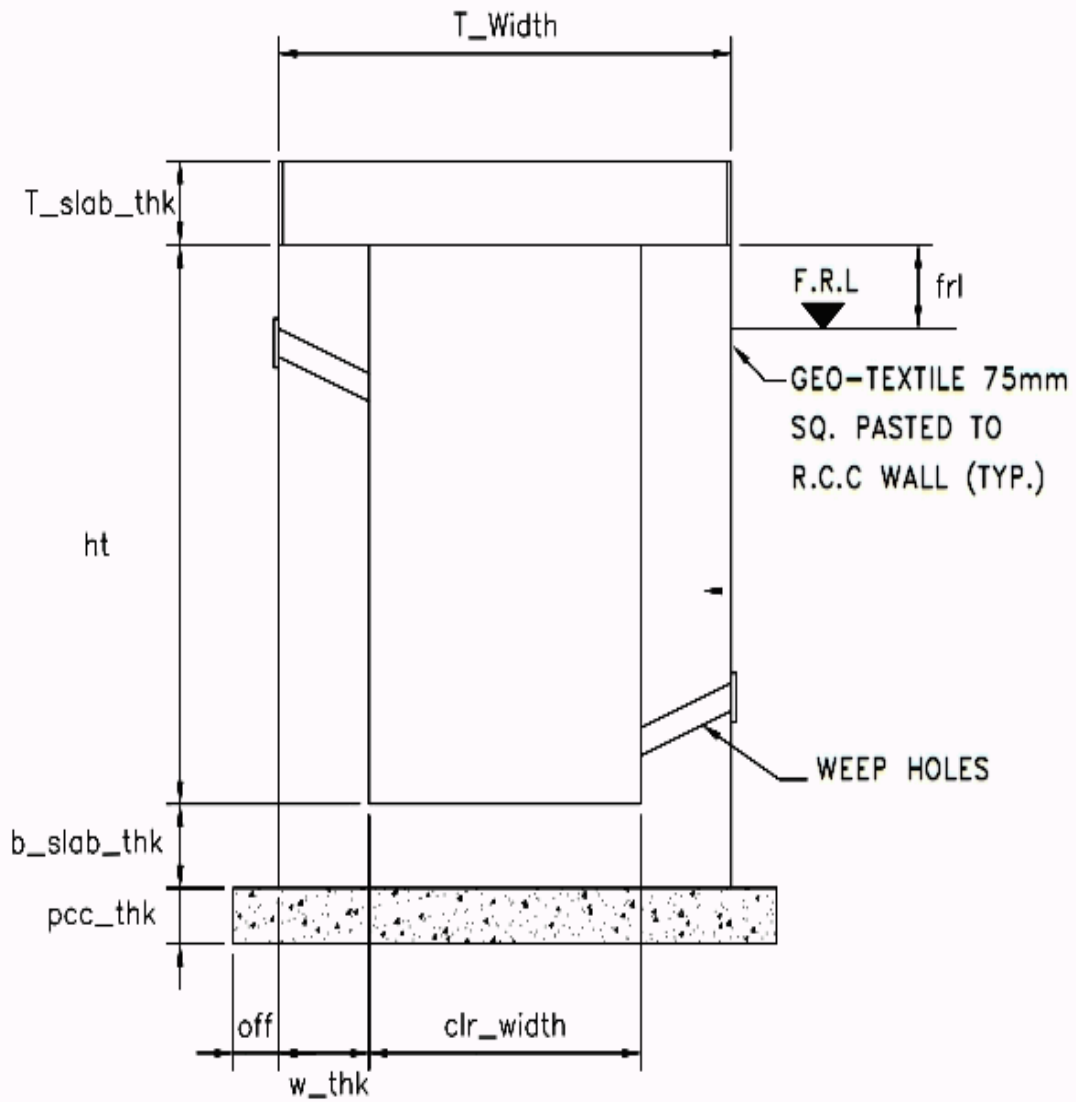
  


## Variable Declaration

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

Variable Declaration



## Crash Barrier

Chainage (m)		Net Length(m)	Side
From	To		
76000	76125	125	Valley
78800	78900	100	Valley
79300	79400	100	Valley
80100	80250	150	Valley
80950	81100	150	Valley
81850	82000	150	Valley
82700	82850	150	Valley
83950	84150	200	Valley
85650	85850	200	Valley
87250	87400	150	Valley
89200	89300	100	Valley
90100	90170	70	Valley
90300	90400	100	Valley
91370	91520	150	Valley
93000	93150	150	Valley
95200	95350	150	Valley
96050	96130	80	Valley
96220	96300	80	Valley
96350	96450	100	Valley
98300	98400	100	Valley
99650	99780	130	Valley
100900	101000	100	Valley
103550	103650	100	Valley
103950	104050	100	Valley
106850	107000	150	Valley

Total = 3135

Total no. of Bridges on the project= 2

Approach length on valley side for each bridge (25 m on both : 50

Hence, Crash barrier length for 2 bridges = 200

Therefore, total length of crash barrier= 3335



**VOLUME VIII**  
**BILL OF QUANTITY**



**BILL OF QUANTITY  
(ROAD PART)**



**Bill No : 01. Site Clearance and Dismantling**

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02.01/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	13.00		
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	25.00		
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	86.00		
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	15.00		
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	5.00		
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	19.00		



**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	128.00		
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	2,402.00		
9	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	20.00		
10	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	1,500.00		
11	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	550.00		
12	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier	sqm	186,660.00		
13	02.04/viii/f/ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier	sqm	34,328.00		
<b>Total of Bill 01. Site Clearance and Dismantling</b>						



**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	135,525.00		
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	171,494.00		
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	26,304.98		
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	106,980.05		
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	111,311.00		
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	3,653,691.20		



**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	913,422.80		
<b>Total of Bill 02. Earth work,Subgrade and Erosion control</b>						



## Bill No : 03. Sub-Base &amp; 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	9,440.09		
2	04.06/NS C1	Cement Treated Crushed Rock or combination as per clause 403.2 and table 400.4 in Sub base/ Base (Providing, laying and spreading Material on a prepared sub grade, adding the designed quantity of cement to the spread Material, mixing in place with rotavator, grading with the motor grader and compacting with the road roller at OMC to achieve the desired unconfined compressive strength and to form a layer of sub-base/base.) For Sub-Base course	Cum	55,242.64		
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	19,606.33		
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	37,703.97		



		<b>Total of Bill</b>	<b>03. Sub-Base &amp; Base Courses</b>	
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## 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	252,812.70		
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	252,812.70		
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	4,266.00		



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**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	9,373.31		
		<b>Total of Bill 04. Bituminous Courses</b>				



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	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	86.10		
2	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	574.00		
3	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	574.00		
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	22.96		
		<b>Total of Bill 05. Junction Improvement (Major &amp; Minor)</b>				



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone	each	7.00		
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone	each	28.00		
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	347.00		
4	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade	sqm	36.00		
5	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle	each	427.00		
6	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular				



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			each	42.00		
7	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	2.00		
8	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	120.00		
9	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	6.00		



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	08.12	Direction and Place Identification signs upto 0.9sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign asper IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	2.00		
11	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro- reflectorised sign asper IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	16.00		
12	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	9,377.44		



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
13	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	1,398.00		
14	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	3,335.00		
15	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	6,302.00		
16	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	22.00		



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
17	08/nsc/4 /a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.	Ton	1.04		
18	08/nsc/4 /b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign	sqm	36.00		
19	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.	sqm	14.00		
20	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	26.24		
21	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade				



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	0.97		
22	14.03/e/l	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.70		
23	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.86		
24	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	2.00		
25	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	0.30		
		<b>Total of Bill 06. Traffic signs, Road marking &amp; other road appurtenances</b>				



## Bill No : 07. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3	sqm	41,402.07		
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	6,806.23		
3	13.02/i	Filling in Foundation Trenches as per drawing & technical specification using Coarse sand	cum	1,035.05		
4	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	2,146.90		
5	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	122.98		
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	4,140.21		
7	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	285.09		
8	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	332.80		



**Bill No : 07. Longitudinal Drains**

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	15.05	HYSB bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	16.64		
10	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	321.00		
11	24/i/b	Galvanised Mild steel J /L hook	kg	51.20		
12	40	Gextextile material (fine net)	sqm	57.60		
<b>Total of Bill 07. Longitudinal Drains</b>						



## Bill No : 08. 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	27,887.10		
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	6,103.31		
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .	cum	28,389.00		
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	19,215.89		
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	7,227.52		
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	49,167.92		
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	8,036.00		
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	54,924.00		
<b>Total of Bill 08. Retaining wall</b>						



## Bill No : 09. 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	25,250.23		
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	6,312.56		
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	3,585.38		
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	1,142.78		
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	12,097.15		
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	5,623.66		
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	16,197.68		
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	6,875.80		
<b>Total of Bill 09. Breast wall</b>						



## Bill No : 10. Protection Work

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	15.12/Nsc	Supply and Installation of Mechanically woven double twisted hexagonal shaped steel wire mesh gabion boxes with Zinc + PVC coating having mesh size of 100 mm x 120 mm by using mesh wire 2.7 mm (Inner dia) and 3.7 (outer dia) with slevded wire 3.4 mm(inner dia) and 4.4 mm (outer dia) and lacing with 2.2mm inner dia and 3.3 mm outer dia.placing at indicated places in dry condition at easily accessible location as per direction of Engineer including tools, plant, labour etc. complete in all respect, carrying the material from nearest approach with all leads & lifts, manpower & machinery, materials, labor etc. complete as per detailed technical specifications and as directed by Engineer-In-Charge.	cum	78,720.00		
		<b>Total of Bill 10. Protection Work</b>				



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# QUANTITY CALCULATION (ROAD PART)



**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			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 13	13	13.00	Each
			<b>Total :</b>	<b>13.00</b>	<b>Each</b>
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			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 25	25	25.00	Each
			<b>Total :</b>	<b>25.00</b>	<b>Each</b>
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			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 86	86	86.00	Each
			<b>Total :</b>	<b>86.00</b>	<b>Each</b>
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			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 15	15	15.00	Each
			<b>Total :</b>	<b>15.00</b>	<b>Each</b>



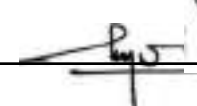
  
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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 5	5	5.00	Each
			<b>Total :</b>	<b>5.00</b>	<b>Each</b>
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 un-serviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 19	19	19.00	Ha
			<b>Total :</b>	<b>19.00</b>	<b>Ha</b>
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			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 128	128	128.00	cum
			<b>Total :</b>	<b>128.00</b>	<b>cum</b>
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 2402	2402	2,402.00	Cum
			<b>Total :</b>	<b>2,402.00</b>	<b>Cum</b>



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
9	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 20	20	20.00	rm
			<b>Total :</b>	<b>20.00</b>	<b>rm</b>
10	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 1500	1500	1,500.00	rm
			<b>Total :</b>	<b>1,500.00</b>	<b>rm</b>
11	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 550	550	550.00	rm
			<b>Total :</b>	<b>550.00</b>	<b>rm</b>
12	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 186660	186660	186,660.00	sqm
			<b>Total :</b>	<b>186,660.00</b>	<b>sqm</b>



  
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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
13	12.04/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			
		<b>Refer:</b> Site Clearance and Dismantling <b>Formula:</b> 34328	34328	34,328.00	sqm
			<b>Total :</b>	<b>34,328.00</b>	<b>sqm</b>



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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface			
		<b>Refer:</b> Errosion Control <b>Formula:</b> 135525	135525	135,525.00	sqm
			<b>Total :</b>	<b>135,525.00</b>	<b>sqm</b>
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			
		<b>Refer:</b> Earthwork <b>Formula:</b> tot_fill	171494.000	171,494.00	cum
			<b>Total :</b>	<b>171,494.00</b>	<b>cum</b>
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			
		<b>Refer:</b> TCS-02 <b>Formula:</b> ar_es*I	0.453*9326.000	4,224.68	cum
		<b>Refer:</b> TCS-02A <b>Formula:</b> ar_es*I	0.110*2795.000	307.45	cum
		<b>Refer:</b> TCS-03 <b>Formula:</b> ar_es*I	0.440*676.000	297.44	cum
		<b>Refer:</b> TCS-03A <b>Formula:</b> ar_es*I	0.440*322.000	141.68	cum
		<b>Refer:</b> TCS-04 <b>Formula:</b> ar_es*I	0.440*381.000	167.64	cum



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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-04A Formula: $es*(bc+wmm1)*l$	$1.000*(0.040+0.150)*603.000$	114.57	cum
		Refer: TCS-05 Formula: $ar\_es*l$	$0.440*177.000$	77.88	cum
		Refer: TCS-05A Formula: $(bc+wmm1)*es*l$	$(0.040+0.150)*1.000*2222.000$	422.18	cum
		Refer: TCS-07 Formula: $ar\_es*l$	$0.264*6379.000$	1,684.06	cum
		Refer: TCS-09 Formula: $es*(bc+wmm1)*l$	$1.000*(0.040+0.150)*1763.000$	334.97	cum
		Refer: TCS-14 Formula: $es*(bc+wmm1)*l+(cw+2*hs+2*es)*sg*l$	$1.000*(0.040+0.150)*893.000+$ $(7.000+2*1.500+2*1.000)$ $*0.500*893.000$	5,527.67	cum
		Refer: TCS-14A Formula: $es*(bc+wmm1)*l+(cw+2*hs+2*es)*sg*l$	$1.000*(0.040+0.150)*1227.000+$ $(7.000+2*1.500+2*1.000)$ $*0.500*1227.000$	7,595.13	cum
		Refer: TCS-17 Formula: $ar\_es*l$	$0.264*797.000$	210.41	cum
		Refer: TCS-18 Formula: $es*(bc+wmm1)*l+(cw+2*hs+es)*sg*l$	$1.000*(0.040+0.150)*819.000+$ $(7.000+2*1.500+1.000)*0.500*819.000$	4,660.11	cum
		Refer: TCS-19A Formula: $ar\_es*l$	$0.264*2042.100$	539.11	cum
			<b>Total :</b>	<b>26,304.98</b>	<b>cum</b>
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-01A Formula: $(cw-ext\_pav+2*hs)*sg*l$	$(7.000-6.500+2*1.500)*0.500*320.000$	560.00	cum
		Refer: TCS-02 Formula: $(cw-ext\_pav+2*hs)*sg*l$	$(7.000-6.000+2*1.500)*0.500*9326.000$	18,652.00	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-02A Formula: (cw-ext_pav+2*hs+es)*sg*I	(7.000-0.000+2*1.500+1.000) *0.500*2795.000	15,372.50	cum
		Refer: TCS-03 Formula: (cw-ext_pav+2*hs)*sg*I	(7.000-6.000+2*1.500)*0.500*676.000	1,352.00	cum
		Refer: TCS-03A Formula: (cw-ext_pav+2*hs+es)*sg*I	(7.000-0.000+2*1.500+1.000) *0.500*322.000	1,771.00	cum
		Refer: TCS-04 Formula: (cw-ext_pav+2*hs)*sg*I	(7.000-6.000+2*1.500)*0.500*381.000	762.00	cum
		Refer: TCS-04A Formula: (cw-ext_pav+2*hs+es)*sg*I	(7.000-0.000+2*1.500+1.000) *0.500*603.000	3,316.50	cum
		Refer: TCS-05 Formula: (cw-ext_pav+2*hs)*sg*I	(7.000-6.000+2*1.500)*0.500*177.000	354.00	cum
		Refer: TCS-05A Formula: (cw-ext_pav+2*hs)*sg*I	(7.000-6.000+2*1.500)*0.500*2222.000	4,444.00	cum
		Refer: TCS-07 Formula: (cw-ext_pav+2*hs+es)*sg*I	(7.000-0.000+2*1.500+1.000) *0.500*6379.000	35,084.50	cum
		Refer: TCS-09 Formula: (cw+2*hs+es)*sg*I	(7.000+2*1.500+1.000)*0.500*1763.000	9,696.50	cum
		Refer: TCS-17 Formula: (cw-ext_pav+2*hs+es)*sg*I	(7.000-0.000+2*1.500+1.000) *0.500*797.000	4,383.50	cum
		Refer: TCS-19A Formula: (cw-ext_pav+2*hs+es)*sg*I	(7.000-0.000+2*1.500+1.000) *0.500*2042.100	11,231.55	cum
			<b>Total :</b>	<b>106,980.05</b>	<b>cum</b>
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: 111311	111311	111,311.00	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			<b>Total :</b>	<b>111,311.00</b>	<b>sqm</b>
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			
		<b>Refer:</b> Earthwork <b>Formula:</b> tot_cut*(1-per_rock/100)	4567114.000*(1-20.000/100)	3,653,691.20	cum
			<b>Total :</b>	<b>3,653,691.20</b>	<b>cum</b>
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			
		<b>Refer:</b> Earthwork <b>Formula:</b> tot_cut*(per_rock/100)	4567114.000*(20.000/100)	913,422.80	cum
			<b>Total :</b>	<b>913,422.80</b>	<b>cum</b>



  
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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			
		<b>Refer:</b> TCS-01A <b>Formula:</b> $((bc+wmm1)*hs*I-.125*wmm1*I)*2*(1-gsb\_per/100)$	$((0.040+0.150)*1.500*320.000-.125*0.150*320.000)*2*(1-67.500/100)$	55.38	Cum
		<b>Refer:</b> TCS-02 <b>Formula:</b> $(hs\_area*I+(cw-ext\_pav+2*hs*es)*gsb*I)*(1-gsb\_per/100)$	$(0.729*9326.000+(7.000-6.000+2*1.500*1.000)*0.200*9326.000)*(1-67.500/100)$	4,634.32	Cum
		<b>Refer:</b> TCS-02A <b>Formula:</b> $hs*(bc+wmm1)*2*I*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*2*2795.000*(1-67.500/100)$	517.77	Cum
		<b>Refer:</b> TCS-03 <b>Formula:</b> $(hs\_area*I+(cw-ext\_pav+2*hs*es)*gsb*I)*(1-gsb\_per/100)$	$(0.729*676.000+(7.000-6.000+2*1.500*1.000)*0.200*676.000)*(1-67.500/100)$	335.92	Cum
		<b>Refer:</b> TCS-03A <b>Formula:</b> $hs*(bc+wmm1)*2*I*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*2*322.000*(1-67.500/100)$	59.65	Cum
		<b>Refer:</b> TCS-04 <b>Formula:</b> $(hs\_area*I+(cw-ext\_pav+2*hs*es)*gsb*I)*(1-gsb\_per/100)$	$(0.729*381.000+(7.000-6.000+2*1.500*1.000)*0.000*381.000)*(1-67.500/100)$	90.27	Cum
		<b>Refer:</b> TCS-04A <b>Formula:</b> $hs*(bc+wmm1)*2*I*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*2*603.000*(1-67.500/100)$	111.71	Cum
		<b>Refer:</b> TCS-05 <b>Formula:</b> $(hs\_area*I+(cw-ext\_pav+2*hs*es)*gsb*I)*(1-gsb\_per/100)$	$(0.729*177.000+(7.000-6.000+2*1.500*1.000)*0.000*177.000)*(1-67.500/100)$	41.94	Cum
		<b>Refer:</b> TCS-05A <b>Formula:</b> $hs*(bc+wmm1)*2*I*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*2*2222.000*(1-67.500/100)$	411.63	Cum
		<b>Refer:</b> TCS-06A <b>Formula:</b> $hs*(bc+wmm1)*I*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*890.000*2*(1-67.500/100)$	164.87	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-07 Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*6379.000*2*$ $(1-67.500/100)$	1,181.71	Cum
		Refer: TCS-08 Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*1080.000*2*$ $(1-67.500/100)$	200.07	Cum
		Refer: TCS-09 Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*1763.000*2*$ $(1-67.500/100)$	326.60	Cum
		Refer: TCS-11A Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*70.000*2*$ $(1-67.500/100)$	12.97	Cum
		Refer: TCS-12B Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*125.000*2*$ $(1-67.500/100)$	23.16	Cum
		Refer: TCS-14 Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*893.000*2*$ $(1-67.500/100)$	165.43	Cum
		Refer: TCS-14A Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*1227.000*2*$ $(1-67.500/100)$	227.30	Cum
		Refer: TCS-17 Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*797.000*2*$ $(1-67.500/100)$	147.64	Cum
		Refer: TCS-18 Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*819.000*2*$ $(1-67.500/100)$	151.72	Cum
		Refer: TCS-19 Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*1089.000*2*$ $(1-67.500/100)$	201.74	Cum
		Refer: TCS-19A Formula: $hs*(bc+wmm1)*2*(1-gsb\_per/100)$	$1.500*(0.040+0.150)*2042.100*2*$ $(1-67.500/100)$	378.30	Cum
			<b>Total :</b>	<b>9,440.09</b>	<b>Cum</b>



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
2	04.06/NSC1	Cement Treated Crushed Rock or combination as per clause 403.2 and table 400.4 in Sub base/ Base (Providing, laying and spreading Material on a prepared sub grade, adding the designed quantity of cement to the spread Material, mixing in place with rotavator, grading with the motor grader and compacting with the road roller at OMC to achieve the desired unconfined compressive strength and to form a layer of sub-base/base.) For Sub-Base course			
		<b>Refer:</b> Extra Widening on Flexible <b>Formula:</b> Pavement $ew\_area*cts$	$14840.000*0.200$	2,968.00	Cum
		<b>Refer:</b> Minor Junction <b>Formula:</b> $tot\_area*cts$	$574.000*0.200$	114.80	Cum
		<b>Refer:</b> TCS-01A <b>Formula:</b> $(cw+2*hs)*cts*I$	$(7.000+2*1.500)*0.200*320.000$	640.00	Cum
		<b>Refer:</b> TCS-02A <b>Formula:</b> $(cw+2*hs+es)*cts*I$	$(7.000+2*1.500+1.000)*0.200*2795.000$	6,149.00	Cum
		<b>Refer:</b> TCS-03A <b>Formula:</b> $(cw+2*hs+es)*cts*I$	$(7.000+2*1.500+1.000)*0.200*322.000$	708.40	Cum
		<b>Refer:</b> TCS-04A <b>Formula:</b> $(cw+2*hs+es)*cts*I$	$(7.000+2*1.500+1.000)*0.200*603.000$	1,326.60	Cum
		<b>Refer:</b> TCS-05A <b>Formula:</b> $(cw+2*hs+es)*cts*I$	$(7.000+2*1.500+1.000)*0.200*2222.000$	4,888.40	Cum
		<b>Refer:</b> TCS-06A <b>Formula:</b> $(cw+2*hs)*cts*I$	$(7.000+2*1.500)*0.200*890.000$	1,780.00	Cum
		<b>Refer:</b> TCS-07 <b>Formula:</b> $(cw+2*hs+es+(bc+wmm1+cts*0.5)*2)*cts*I$	$(7.000+2*1.500+1.000+(0.040+0.150+0.200*0.5)*2)*0.200*6379.000$	14,773.76	Cum
		<b>Refer:</b> TCS-08 <b>Formula:</b> $(cw+2*hs)*cts*I$	$(7.000+2*1.500)*0.200*1080.000$	2,160.00	Cum
		<b>Refer:</b> TCS-09 <b>Formula:</b> $(cw+2*hs+es)*cts*I$	$(7.000+2*1.500+1.000)*0.200*1763.000$	3,878.60	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		<b>Refer:</b> TCS-11A <b>Formula:</b> (cw+2*hs)*cts*I	$(7.000+2*1.500)*0.200*70.000$	140.00	Cum
		<b>Refer:</b> TCS-12B <b>Formula:</b> (cw+2*hs)*cts*I	$(7.000+2*1.500)*0.200*125.000$	250.00	Cum
		<b>Refer:</b> TCS-14 <b>Formula:</b> (cw+2*hs+es+(bc+wmm1+cts*0.5)*2)*cts*I	$(7.000+2*1.500+1.000+(0.040+0.150+0.200*0.5)*2)*0.200*893.000$	2,068.19	Cum
		<b>Refer:</b> TCS-14A <b>Formula:</b> (cw+2*hs+es+(bc+wmm1+cts*0.5)*2)*cts*I	$(7.000+2*1.500+1.000+(0.040+0.150+0.200*0.5)*2)*0.200*1227.000$	2,841.73	Cum
		<b>Refer:</b> TCS-17 <b>Formula:</b> (cw+2*hs+es+(bc+wmm1+cts*0.5)*2)*cts*I	$(7.000+2*1.500+1.000+(0.040+0.150+0.200*0.5)*2)*0.200*797.000$	1,845.85	Cum
		<b>Refer:</b> TCS-18 <b>Formula:</b> (cw+2*hs+es)*cts*I	$(7.000+2*1.500+1.000)*0.200*819.000$	1,801.80	Cum
		<b>Refer:</b> TCS-19 <b>Formula:</b> (cw+2*hs)*cts*I	$(7.000+2*1.500)*0.200*1089.000$	2,178.00	Cum
		<b>Refer:</b> TCS-19A <b>Formula:</b> (cw+2*hs+es+(bc+wmm1+cts*0.5)*2)*cts*I	$(7.000+2*1.500+1.000+(0.040+0.150+0.200*0.5)*2)*0.200*2042.100$	4,729.50	Cum
			<b>Total :</b>	<b>55,242.64</b>	<b>Cum</b>
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			
		<b>Refer:</b> TCS-01A <b>Formula:</b> ((bc+wmm1)*hs*I-.125*wmm1*I)*2*(gsb_per/100)	$((0.040+0.150)*1.500*320.000-.125*0.150*320.000)*2*(67.500/100)$	115.02	Cum
		<b>Refer:</b> TCS-02 <b>Formula:</b> (hs_area*I+(cw-ext_pav+2*hs*es)*gsb*I)*(gsb_per/100)	$(0.729*9326.000+(7.000-6.000+2*1.500*1.000)*0.200*9326.000)*(67.500/100)$	9,625.13	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		<b>Refer:</b> TCS-02A <b>Formula:</b> $hs*(bc+wmm1)*2*I*(gsb\_per/100)$	$1.500*(0.040+0.150)*2*2795.000*$ $(67.500/100)$	1,075.38	Cum
		<b>Refer:</b> TCS-03 <b>Formula:</b> $(hs\_area*I+(cw-ext\_pav+2*hs*es)*gsb*I)*$ $(gsb\_per/100)$	$(0.729*676.000+$ $(7.000-6.000+2*1.500*1.000)$ $*0.200*676.000)*(67.500/100)$	697.68	Cum
		<b>Refer:</b> TCS-03A <b>Formula:</b> $hs*(bc+wmm1)*2*I*(gsb\_per/100)$	$1.500*(0.040+0.150)*2*322.000*$ $(67.500/100)$	123.89	Cum
		<b>Refer:</b> TCS-04 <b>Formula:</b> $(hs\_area*I+(cw-ext\_pav+2*hs*es)*gsb*I)*$ $(gsb\_per/100)$	$(0.729*381.000+$ $(7.000-6.000+2*1.500*1.000)$ $*0.000*381.000)*(67.500/100)$	187.48	Cum
		<b>Refer:</b> TCS-04A <b>Formula:</b> $hs*(bc+wmm1)*2*I*(gsb\_per/100)$	$1.500*(0.040+0.150)*2*603.000*$ $(67.500/100)$	232.00	Cum
		<b>Refer:</b> TCS-05 <b>Formula:</b> $(hs\_area*I+(cw-ext\_pav+2*hs*es)*gsb*I)*$ $(gsb\_per/100)$	$(0.729*177.000+$ $(7.000-6.000+2*1.500*1.000)$ $*0.000*177.000)*(67.500/100)$	87.10	Cum
		<b>Refer:</b> TCS-05A <b>Formula:</b> $hs*(bc+wmm1)*2*I*(gsb\_per/100)$	$1.500*(0.040+0.150)*2*2222.000*$ $(67.500/100)$	854.92	Cum
		<b>Refer:</b> TCS-06A <b>Formula:</b> $hs*(bc+wmm1)*I*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*890.000*2*$ $(67.500/100)$	342.43	Cum
		<b>Refer:</b> TCS-07 <b>Formula:</b> $hs*(bc+wmm1)*I*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*6379.000*2*$ $(67.500/100)$	2,454.32	Cum
		<b>Refer:</b> TCS-08 <b>Formula:</b> $hs*(bc+wmm1)*I*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*1080.000*2*$ $(67.500/100)$	415.53	Cum
		<b>Refer:</b> TCS-09 <b>Formula:</b> $hs*(bc+wmm1)*I*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*1763.000*2*$ $(67.500/100)$	678.31	Cum
		<b>Refer:</b> TCS-11A <b>Formula:</b> $hs*(bc+wmm1)*I*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*70.000*2*$ $(67.500/100)$	26.93	Cum
		<b>Refer:</b> TCS-12B <b>Formula:</b> $hs*(bc+wmm1)*I*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*125.000*2*$ $(67.500/100)$	48.09	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		<b>Refer:</b> TCS-14 <b>Formula:</b> $hs*(bc+wmm1)*l*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*893.000*2*$ $(67.500/100)$	343.58	Cum
		<b>Refer:</b> TCS-14A <b>Formula:</b> $hs*(bc+wmm1)*l*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*1227.000*2*$ $(67.500/100)$	472.09	Cum
		<b>Refer:</b> TCS-17 <b>Formula:</b> $hs*(bc+wmm1)*l*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*797.000*2*$ $(67.500/100)$	306.65	Cum
		<b>Refer:</b> TCS-18 <b>Formula:</b> $hs*(bc+wmm1)*l*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*819.000*2*$ $(67.500/100)$	315.11	Cum
		<b>Refer:</b> TCS-19 <b>Formula:</b> $hs*(bc+wmm1)*l*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*1089.000*2*$ $(67.500/100)$	418.99	Cum
		<b>Refer:</b> TCS-19A <b>Formula:</b> $hs*(bc+wmm1)*l*2*(gsb\_per/100)$	$1.500*(0.040+0.150)*2042.100*2*$ $(67.500/100)$	785.70	Cum
			<b>Total :</b>	<b>19,606.33</b>	<b>Cum</b>
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.)			
		<b>Refer:</b> Extra Widening on Flexible <b>Formula:</b> Pavement $ew\_area*(wmm1+wmm2)$	$14840.000*(0.150+0.000)$	2,226.00	Cum
		<b>Refer:</b> Profile Corrective Course <b>Formula:</b> $pc\_wmm$	8361.000	8,361.00	Cum
		<b>Refer:</b> TCS-01A <b>Formula:</b> $(((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)$	$((((7.000+0.125*2)*0.150)+$ $((7.000+0.250*2)*0.000))*320.000)$	348.00	Cum
		<b>Refer:</b> TCS-02 <b>Formula:</b> $(((cw-ext\_pav+0.125*2)*wmm1)+$ $((cw-ext\_pav+0.250*2)*wmm2))*l)$	$((((7.000-6.000+0.125*2)*0.125)+$ $((7.000-6.000+0.250*2)*0.125))$ $*9326.000)$	3,205.81	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		<b>Refer:</b> TCS-02A <b>Formula:</b> (((cw-ext_pav+0.125*2)*wmm1)+ ((cw-ext_pav+0.250*2)*wmm2))*I)	(((7.000-0.000+0.125*2)*0.150)+ ((7.000-0.000+0.250*2)*0.000)) *2795.000)	3,039.56	Cum
		<b>Refer:</b> TCS-03 <b>Formula:</b> (((cw-ext_pav+0.125*2)*wmm1)+ ((cw-ext_pav+0.250*2)*wmm2))*I)	(((7.000-6.000+0.125*2)*0.125)+ ((7.000-6.000+0.250*2)*0.125)) *676.000)	232.38	Cum
		<b>Refer:</b> TCS-03A <b>Formula:</b> (((cw-ext_pav+0.125*2)*wmm1)+ ((cw-ext_pav+0.250*2)*wmm2))*I)	(((7.000-0.000+0.125*2)*0.150)+ ((7.000-0.000+0.250*2)*0.000)) *322.000)	350.18	Cum
		<b>Refer:</b> TCS-04 <b>Formula:</b> (((cw-ext_pav+0.125*2)*wmm1)+ ((cw-ext_pav+0.250*2)*wmm2))*I)	(((7.000-6.000+0.125*2)*0.125)+ ((7.000-6.000+0.250*2)*0.125)) *381.000)	130.97	Cum
		<b>Refer:</b> TCS-04A <b>Formula:</b> (((cw-ext_pav+0.125*2)*wmm1)+ ((cw-ext_pav+0.250*2)*wmm2))*I)	(((7.000-0.000+0.125*2)*0.150)+ ((7.000-0.000+0.250*2)*0.000)) *603.000)	655.76	Cum
		<b>Refer:</b> TCS-05 <b>Formula:</b> (((cw-ext_pav+0.125*2)*wmm1)+ ((cw-ext_pav+0.250*2)*wmm2))*I)	(((7.000-6.000+0.125*2)*0.125)+ ((7.000-6.000+0.250*2)*0.125)) *177.000)	60.84	Cum
		<b>Refer:</b> TCS-05A <b>Formula:</b> (((cw-ext_pav+0.125*2)*wmm1)+ ((cw-ext_pav+0.250*2)*wmm2))*I)	(((7.000-6.000+0.125*2)*0.150)+ ((7.000-6.000+0.250*2)*0.000)) *2222.000)	416.63	Cum
		<b>Refer:</b> TCS-06A <b>Formula:</b> (((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*I)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*890.000)	967.88	Cum
		<b>Refer:</b> TCS-07 <b>Formula:</b> (((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*I)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*6379.000)	6,937.16	Cum
		<b>Refer:</b> TCS-08 <b>Formula:</b> (((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*I)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*1080.000)	1,174.50	Cum
		<b>Refer:</b> TCS-09 <b>Formula:</b> (((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*I)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*1763.000)	1,917.26	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-11A Formula: (((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*70.000)	76.13	Cum
		Refer: TCS-12B Formula: (((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*125.000)	135.94	Cum
		Refer: TCS-14 Formula: (((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*893.000)	971.14	Cum
		Refer: TCS-14A Formula: (((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*1227.000)	1,334.36	Cum
		Refer: TCS-17 Formula: (((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*797.000)	866.74	Cum
		Refer: TCS-18 Formula: (((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*819.000)	890.66	Cum
		Refer: TCS-19 Formula: (((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*1089.000)	1,184.29	Cum
		Refer: TCS-19A Formula: (((cw+0.125*2)*wmm1)+((cw+0.250*2)*wmm2))*l)	(((7.000+0.125*2)*0.150)+ ((7.000+0.250*2)*0.000))*2042.100)	2,220.78	Cum
			<b>Total :</b>	<b>37,703.96</b>	<b>Cum</b>



P. S.

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			
		<b>Refer:</b> Extra Widening on Flexible <b>Formula:</b> Pavement ew_area	14840.000	14,840.00	sqm
		<b>Refer:</b> TCS-01A <b>Formula:</b> cw*I	7.000*320.000	2,240.00	sqm
		<b>Refer:</b> TCS-02 <b>Formula:</b> cw*I	7.000*9326.000	65,282.00	sqm
		<b>Refer:</b> TCS-02A <b>Formula:</b> cw*I	7.000*2795.000	19,565.00	sqm
		<b>Refer:</b> TCS-03 <b>Formula:</b> cw*I	7.000*676.000	4,732.00	sqm
		<b>Refer:</b> TCS-03A <b>Formula:</b> cw*I	7.000*322.000	2,254.00	sqm
		<b>Refer:</b> TCS-04 <b>Formula:</b> cw*I	7.000*381.000	2,667.00	sqm
		<b>Refer:</b> TCS-04A <b>Formula:</b> cw*I	7.000*603.000	4,221.00	sqm
		<b>Refer:</b> TCS-05 <b>Formula:</b> cw*I	7.000*177.000	1,239.00	sqm
		<b>Refer:</b> TCS-05A <b>Formula:</b> cw*I	7.000*2222.000	15,554.00	sqm
		<b>Refer:</b> TCS-06A <b>Formula:</b> cw*I	7.000*890.000	6,230.00	sqm
		<b>Refer:</b> TCS-07 <b>Formula:</b> cw*I	7.000*6379.000	44,653.00	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 Formula: cw*I	7.000*1080.000	7,560.00	sqm
		Refer: TCS-09 Formula: cw*I	7.000*1763.000	12,341.00	sqm
		Refer: TCS-11A Formula: cw*I	7.000*70.000	490.00	sqm
		Refer: TCS-12B Formula: cw*I	7.000*125.000	875.00	sqm
		Refer: TCS-14 Formula: cw*I	7.000*893.000	6,251.00	sqm
		Refer: TCS-14A Formula: cw*I	7.000*1227.000	8,589.00	sqm
		Refer: TCS-17 Formula: cw*I	7.000*797.000	5,579.00	sqm
		Refer: TCS-18 Formula: cw*I	7.000*819.000	5,733.00	sqm
		Refer: TCS-19 Formula: cw*I	7.000*1089.000	7,623.00	sqm
		Refer: TCS-19A Formula: cw*I	7.000*2042.100	14,294.70	sqm
			<b>Total :</b>	<b>252,812.70</b>	<b>sqm</b>
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	14840.000	14,840.00	sqm
		Refer: TCS-01A Formula: cw*I	7.000*320.000	2,240.00	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-02 Formula: cw*I	7.000*9326.000	65,282.00	sqm
		Refer: TCS-02A Formula: cw*I	7.000*2795.000	19,565.00	sqm
		Refer: TCS-03 Formula: cw*I	7.000*676.000	4,732.00	sqm
		Refer: TCS-03A Formula: cw*I	7.000*322.000	2,254.00	sqm
		Refer: TCS-04 Formula: cw*I	7.000*381.000	2,667.00	sqm
		Refer: TCS-04A Formula: cw*I	7.000*603.000	4,221.00	sqm
		Refer: TCS-05 Formula: cw*I	7.000*177.000	1,239.00	sqm
		Refer: TCS-05A Formula: cw*I	7.000*2222.000	15,554.00	sqm
		Refer: TCS-06A Formula: cw*I	7.000*890.000	6,230.00	sqm
		Refer: TCS-07 Formula: cw*I	7.000*6379.000	44,653.00	sqm
		Refer: TCS-08 Formula: cw*I	7.000*1080.000	7,560.00	sqm
		Refer: TCS-09 Formula: cw*I	7.000*1763.000	12,341.00	sqm
		Refer: TCS-11A Formula: cw*I	7.000*70.000	490.00	sqm
		Refer: TCS-12B Formula: cw*I	7.000*125.000	875.00	sqm



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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-14 Formula: cw*I	7.000*893.000	6,251.00	sqm
		Refer: TCS-14A Formula: cw*I	7.000*1227.000	8,589.00	sqm
		Refer: TCS-17 Formula: cw*I	7.000*797.000	5,579.00	sqm
		Refer: TCS-18 Formula: cw*I	7.000*819.000	5,733.00	sqm
		Refer: TCS-19 Formula: cw*I	7.000*1089.000	7,623.00	sqm
		Refer: TCS-19A Formula: cw*I	7.000*2042.100	14,294.70	sqm
			<b>Total :</b>	<b>252,812.70</b>	<b>sqm</b>
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			
		Refer: Profile Corrective Course Formula: pc_dbm	570.000	570.00	cum
		Refer: TCS-02 Formula: cw*dbm*I	7.000*0.050*9326.000	3,264.10	cum
		Refer: TCS-03 Formula: cw*dbm*I	7.000*0.050*676.000	236.60	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-04 Formula: cw*dbm*I	7.000*0.050*381.000	133.35	cum
		Refer: TCS-05 Formula: cw*dbm*I	7.000*0.050*177.000	61.95	cum
			<b>Total :</b>	<b>4,266.00</b>	<b>cum</b>
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	14840.000*0.040	593.60	cum
		Refer: TCS-01A Formula: cw*bc*I	7.000*0.040*320.000	89.60	cum
		Refer: TCS-02 Formula: cw*bc*I	7.000*0.030*9326.000	1,958.46	cum
		Refer: TCS-02A Formula: cw*bc*I	7.000*0.040*2795.000	782.60	cum
		Refer: TCS-03 Formula: cw*bc*I	7.000*0.030*676.000	141.96	cum
		Refer: TCS-03A Formula: cw*bc*I	7.000*0.040*322.000	90.16	cum
		Refer: TCS-04 Formula: cw*bc*I	7.000*0.030*381.000	80.01	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-04A Formula: cw*bc*I	7.000*0.040*603.000	168.84	cum
		Refer: TCS-05 Formula: cw*bc*I	7.000*0.030*177.000	37.17	cum
		Refer: TCS-05A Formula: cw*bc*I	7.000*0.040*2222.000	622.16	cum
		Refer: TCS-06A Formula: cw*bc*I	7.000*0.040*890.000	249.20	cum
		Refer: TCS-07 Formula: cw*bc*I	7.000*0.040*6379.000	1,786.12	cum
		Refer: TCS-08 Formula: cw*bc*I	7.000*0.040*1080.000	302.40	cum
		Refer: TCS-09 Formula: cw*bc*I	7.000*0.040*1763.000	493.64	cum
		Refer: TCS-11A Formula: cw*bc*I	7.000*0.040*70.000	19.60	cum
		Refer: TCS-12B Formula: cw*bc*I	7.000*0.040*125.000	35.00	cum
		Refer: TCS-14 Formula: cw*bc*I	7.000*0.040*893.000	250.04	cum
		Refer: TCS-14A Formula: cw*bc*I	7.000*0.040*1227.000	343.56	cum
		Refer: TCS-17 Formula: cw*bc*I	7.000*0.040*797.000	223.16	cum
		Refer: TCS-18 Formula: cw*bc*I	7.000*0.040*819.000	229.32	cum
		Refer: TCS-19 Formula: cw*bc*I	7.000*0.040*1089.000	304.92	cum



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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-19A Formula: $cw*bc*l$	$7.000*0.040*2042.100$	571.79	cum
			Total :	9,373.31	cum



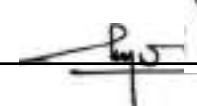
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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix 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.)			
		<b>Refer:</b> Minor Junction <b>Formula:</b> tot_area*(wmm1+wmm2)	574.000*(0.150+0.000)	86.10	Cum
			<b>Total :</b>	<b>86.10</b>	<b>Cum</b>
2	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			
		<b>Refer:</b> Minor Junction <b>Formula:</b> tot_area	574.000	574.00	sqm
			<b>Total :</b>	<b>574.00</b>	<b>sqm</b>
3	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			
		<b>Refer:</b> Minor Junction <b>Formula:</b> tot_area	574.000	574.00	sqm
			<b>Total :</b>	<b>574.00</b>	<b>sqm</b>



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
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			
		<b>Refer:</b> Minor Junction <b>Formula:</b> tot_area*bc	574.000*0.040	22.96	cum
			<b>Total :</b>	<b>22.96</b>	<b>cum</b>



  
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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 7	7	7.00	each
			<b>Total :</b>	<b>7.00</b>	<b>each</b>
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 28	28	28.00	each
			<b>Total :</b>	<b>28.00</b>	<b>each</b>
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 347	347	347.00	each
			<b>Total :</b>	<b>347.00</b>	<b>each</b>
4	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade			
		<b>Refer:</b> Overhead Signs <b>Formula:</b> $a*r*2*n$	$15.000*1.200*2*1.000$	36.00	sqm
			<b>Total :</b>	<b>36.00</b>	<b>sqm</b>



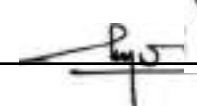
SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 427	427	427.00	each
			<b>Total :</b>	<b>427.00</b>	<b>each</b>
6	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 42	42	42.00	each
			<b>Total :</b>	<b>42.00</b>	<b>each</b>



  
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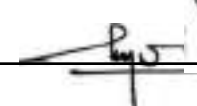
SI No	SOR Ref No	Description	Calculation	Quantity	Unit
7	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 2	2	2.00	each
			<b>Total :</b>	<b>2.00</b>	<b>each</b>
8	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			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 120	120	120.00	each
			<b>Total :</b>	<b>120.00</b>	<b>each</b>



  
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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
9	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and inforatory 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			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 6	6	6.00	each
			<b>Total :</b>	<b>6.00</b>	<b>each</b>
10	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)			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 2	2	2.00	sqm
			<b>Total :</b>	<b>2.00</b>	<b>sqm</b>



  
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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
11	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)			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 16	16	16.00	sqm
			<b>Total :</b>	<b>16.00</b>	<b>sqm</b>
12	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.)			
		<b>Refer:</b> TCS-01A <b>Formula:</b> $((lc^*)/(l+g))*wc+(l^2*wid\_mar)$	$((3.000*320.000)/(320.000+6.000))*0.100+(320.000^2*0.100)$	64.29	sqm
		<b>Refer:</b> TCS-02 <b>Formula:</b> $((lc^*)/(l+g))*wc+(l^2*wid\_mar)$	$((3.000*9326.000)/(9326.000+6.000))*0.100+(9326.000^2*0.150)$	2,798.10	sqm
		<b>Refer:</b> TCS-02A <b>Formula:</b> $((lc^*)/(l+g))*wc+(l^2*wid\_mar)$	$((3.000*2795.000)/(2795.000+6.000))*0.100+(2795.000^2*0.150)$	838.80	sqm
		<b>Refer:</b> TCS-03 <b>Formula:</b> $((lc^*)/(l+g))*wc+(l^2*wid\_mar)$	$((3.000*676.000)/(676.000+6.000))*0.100+(676.000^2*0.150)$	203.10	sqm
		<b>Refer:</b> TCS-03A <b>Formula:</b> $((lc^*)/(l+g))*wc+(l^2*wid\_mar)$	$((3.000*322.000)/(322.000+6.000))*0.100+(322.000^2*0.150)$	96.90	sqm
		<b>Refer:</b> TCS-04 <b>Formula:</b> $((lc^*)/(l+g))*wc+(l^2*wid\_mar)$	$((3.000*381.000)/(381.000+6.000))*0.100+(381.000^2*0.150)$	114.60	sqm



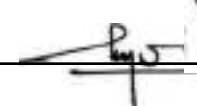
SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-04A Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*603.000)/(603.000+6.000))*0.100+(603.000*2*0.150)$	181.20	sqm
		Refer: TCS-05 Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*177.000)/(177.000+6.000))*0.100+(177.000*2*0.150)$	53.39	sqm
		Refer: TCS-05A Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*2222.000)/(2222.000+6.000))*0.100+(2222.000*2*0.150)$	666.90	sqm
		Refer: TCS-06A Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*890.000)/(890.000+6.000))*0.100+(890.000*2*0.100)$	178.30	sqm
		Refer: TCS-07 Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*6379.000)/(6379.000+6.000))*0.100+(6379.000*2*0.150)$	1,914.00	sqm
		Refer: TCS-08 Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*1080.000)/(1080.000+6.000))*0.100+(1080.000*2*0.100)$	216.30	sqm
		Refer: TCS-09 Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*1763.000)/(1763.000+6.000))*0.100+(1763.000*2*0.100)$	352.90	sqm
		Refer: TCS-11A Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*70.000)/(70.000+6.000))*0.100+(70.000*2*0.100)$	14.28	sqm
		Refer: TCS-12B Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*125.000)/(125.000+6.000))*0.100+(125.000*2*0.100)$	25.29	sqm
		Refer: TCS-14 Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*893.000)/(893.000+6.000))*0.100+(893.000*2*0.100)$	178.90	sqm
		Refer: TCS-14A Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*1227.000)/(1227.000+6.000))*0.100+(1227.000*2*0.100)$	245.70	sqm
		Refer: TCS-17 Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*797.000)/(797.000+6.000))*0.100+(797.000*2*0.150)$	239.40	sqm
		Refer: TCS-18 Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*819.000)/(819.000+6.000))*0.100+(819.000*2*0.100)$	164.10	sqm
		Refer: TCS-19 Formula: $((lc)/(l+g))*wc+(l*2*wid\_mar)$	$((3.000*1089.000)/(1089.000+6.000))*0.100+(1089.000*2*0.100)$	218.10	sqm



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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-19A Formula: (((lc*1)/(l+g))*wc)+(l*2*wid_mar)	$\frac{((3.000*2042.100)/(2042.100+6.000)) * 0.100}{(2042.100*2*0.150)}$	612.93	sqm
			<b>Total :</b>	<b>9,377.44</b>	<b>sqm</b>
13	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 conforming to IRC-79 and the drawings.) 120x120 -Road Delineator			
		Refer: Traffic Signs Formula: 1398	1398	1,398.00	each
			<b>Total :</b>	<b>1,398.00</b>	<b>each</b>
14	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fittings to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m			
		Refer: Crash Barrier Formula: 3335	3335	3,335.00	Rm
			<b>Total :</b>	<b>3,335.00</b>	<b>Rm</b>



  
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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
15	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			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 5586+716	5586+716	6,302.00	nos
			<b>Total :</b>	<b>6,302.00</b>	<b>nos</b>
16	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			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 22	22	22.00	nos
			<b>Total :</b>	<b>22.00</b>	<b>nos</b>
17	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.			
		<b>Refer:</b> Overhead Signs <b>Formula:</b> $(p*(a/p^2+r^2)*wt+q*((a/p)+(a/p-1))*ws+ht*wp^2)*n$	$(1.000*(15.000/1.000^2+1.200^2)*0.010+1.560*((15.000/1.000)+(15.000/1.000-1))*0.004+5.500*0.049^2)*1.000$	1.04	Ton
			<b>Total :</b>	<b>1.04</b>	<b>Ton</b>



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
18	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign			
		<b>Refer:</b> Overhead Signs <b>Formula:</b> $a*r*2*n$	$15.000*1.200*2*1.000$	36.00	sqm
			<b>Total :</b>	<b>36.00</b>	<b>sqm</b>
19	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.			
		<b>Refer:</b> Traffic Signs <b>Formula:</b> 14	14	14.00	sqm
			<b>Total :</b>	<b>14.00</b>	<b>sqm</b>
20	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		<b>Refer:</b> Overhead Signs <b>Formula:</b> $(i+g+f)*(e+.5)*(e+.5)*2*n$	$(1.400+0.300+0.100)*(2.200+.5)*$ $(2.200+.5)*2*1.000$	26.24	cum
			<b>Total :</b>	<b>26.24</b>	<b>cum</b>
21	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Overhead Signs Formula: $e*e*f*2*n$	$2.200*2.200*0.100*2*1.000$	0.97	cum
			<b>Total :</b>	<b>0.97</b>	<b>cum</b>
22	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade			
		Refer: Overhead Signs Formula: $(e*e*g+m*m*i)*2*n$	$(2.200*2.200*0.300+1.000*1.000*1.400)*2*1.000$	5.70	cum
			<b>Total :</b>	<b>5.70</b>	<b>cum</b>
23	14.08	HYSB bar reinforcement in foundation complete as per drawing and technical specification			
		Refer: Overhead Signs Formula: $(e*e*g+m*m*i)*2*n*sf/1000$	$(2.200*2.200*0.300+1.000*1.000*1.400)*2*1.000*150.000/1000$	0.86	MT
			<b>Total :</b>	<b>0.86</b>	<b>MT</b>
24	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height			
		Refer: Overhead Signs Formula: $m*m*j*2*n$	$1.000*1.000*1.000*2*1.000$	2.00	cum
			<b>Total :</b>	<b>2.00</b>	<b>cum</b>
25	15.05	HYSB bar reinforcement in Sub-structure complete as per drawing and technical specification			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Overhead Signs Formula: $m*m*j*2*n*ss/1000$	$1.000*1.000*1.000*2*1.000*150.000/1000$	0.30	MT
			Total :	0.30	MT



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SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3			
		<b>Refer:</b> Traingular Shape Drain <b>Formula:</b> $(l3+l4)*l$	$(0.712+0.530)*33335.000$	41,402.07	sqm
		<b>Total :</b>		<b>41,402.07</b>	<b>sqm</b>
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			
		<b>Refer:</b> PCC Chut Drain <b>Formula:</b> $(a+2*wall\_thk+0.1*2)*f\_thk*l$	$(0.600+2*0.150+0.1*2)*0.100*1118.000$	122.98	cum
		<b>Refer:</b> RCC Cover Drain <b>Formula:</b> $(t\_width+off*2)*((ht+b\_slab\_thk)/2)*l$	$(1.000+0.100*2)*((0.900+0.125)/2)*640.000$	393.60	cum
		<b>Refer:</b> Traingular Shape Drain <b>Formula:</b> $0.5*l4*l3*l$	$0.5*0.530*0.712*33335.000$	6,289.65	cum
		<b>Total :</b>		<b>6,806.23</b>	<b>cum</b>
3	13.02/i	Filling in Foundation Trenches as per drawing & technical specification using Coarse sand			
		<b>Refer:</b> Traingular Shape Drain <b>Formula:</b> $(l3+l4)*t4*l$	$(0.712+0.530)*0.025*33335.000$	1,035.05	cum
		<b>Total :</b>		<b>1,035.05</b>	<b>cum</b>
4	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		<b>Refer:</b> RCC Cover Drain <b>Formula:</b> $(t\_width+off*2)*pcc\_thk*l$	$(1.000+0.100*2)*0.100*640.000$	76.80	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Traingular Shape Drain Formula: $(l3+l4)*t2*I$	$(0.712+0.530)*0.050*33335.000$	2,070.10	cum
			<b>Total :</b>	<b>2,146.90</b>	<b>cum</b>
5	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade			
		Refer: PCC Chut Drain Formula: $(a+2*wall\_thk+0.1*2)*f\_thk*I$	$(0.600+2*0.150+0.1*2)*0.100*1118.000$	122.98	cum
			<b>Total :</b>	<b>122.98</b>	<b>cum</b>
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: Traingular Shape Drain Formula: $(l3+l4)*t1*I$	$(0.712+0.530)*0.100*33335.000$	4,140.21	cum
			<b>Total :</b>	<b>4,140.21</b>	<b>cum</b>
7	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 Chut Drain Formula: $((a+wall\_thk*2)*btm\_thk+ht*wall\_thk*2)*I$	$((0.600+0.150*2)*0.150+0.400*0.150*2)*1118.000$	285.09	cum
			<b>Total :</b>	<b>285.09</b>	<b>cum</b>
8	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			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		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)*640.000	332.80	cum
			<b>Total :</b>	<b>332.80</b>	<b>cum</b>
9	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)*640.000*0.050	16.64	MT
			<b>Total :</b>	<b>16.64</b>	<b>MT</b>
10	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)	(640.000/2+1)	321.00	Rm
			<b>Total :</b>	<b>321.00</b>	<b>Rm</b>
11	24/i/b	Galvanised Mild steel J /L hook			
		Refer: RCC Cover Drain Formula: l/15*4*.3	640.000/15*4*.3	51.20	kg
			<b>Total :</b>	<b>51.20</b>	<b>kg</b>
12	40	Gextextile material (fine net)			
		Refer: RCC Cover Drain Formula: (l/1)*4*(150*150/1000^2)	(640.000/1)*4*(150*150/1000^2)	57.60	sqm
			<b>Total :</b>	<b>57.60</b>	<b>sqm</b>



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			
		<b>Refer:</b> Retaining Wall 2.0m <b>Formula:</b> (((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))) *3092.000)*(1-0.200)	4,807.65	cum
		<b>Refer:</b> Retaining Wall 3.0m <b>Formula:</b> (((0.5*((pcc_tH1k+H2+d)+(pcc_tH1k+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))) *330.000)*(1-0.200)	621.40	cum
		<b>Refer:</b> Retaining Wall 4.0m <b>Formula:</b> (((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))) *2009.000)*(1-0.200)	4,474.63	cum
		<b>Refer:</b> Retaining Wall 6.0m <b>Formula:</b> (((0.5*((pcc_tH1k+H2+d)+(pcc_tH1k+d))* (B1+2*o))+((H2+d)*(mw-o)))*I)*(1-p_c)	(((0.5*((0.300+0.433+0.900)+ (0.300+0.900))*(2.600+2*0.150))+ ((0.433+0.900)*(0.600-0.150))) *4775.000)*(1-0.200)	17,983.41	cum
			<b>Total :</b>	<b>27,887.10</b>	<b>cum</b>
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			
		<b>Refer:</b> Retaining Wall 2.0m <b>Formula:</b> (((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))) *3092.000)*0.200	1,201.91	cum
		<b>Refer:</b> Retaining Wall 3.0m <b>Formula:</b> (((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)))*330.000)*0.200	117.73	cum
		<b>Refer:</b> Retaining Wall 4.0m <b>Formula:</b> (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (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))) *2009.000)*0.200	1,118.66	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Retaining Wall 6.0m Formula: $((0.5*((pcc\_thk+H2+d)+(pcc\_thk+d))*(B1+2*o))+((H2+d)*(mw-o))*l)*p\_c$	$((0.5*((+0.433+0.900)+(+0.900))*(2.600+2*0.150))+((0.433+0.900)*(0.600-0.150)))*4775.000*0.200$	3,665.00	cum
			<b>Total :</b>	<b>6,103.31</b>	<b>cum</b>
3	13.04	Filter medium behind abutment, wing wall and return wall complete as per drawing and technical specification .			
		Refer: Retaining Wall 2.0m Formula: $mw*(H2+H1)*l$	$0.600*(0.211+2.000)*3092.000$	4,101.85	cum
		Refer: Retaining Wall 3.0m Formula: $mw*(H2+H1)*l$	$0.600*(0.267+3.000)*330.000$	646.87	cum
		Refer: Retaining Wall 4.0m Formula: $mw*(H2+H1)*l$	$0.600*(0.322+4.000)*2009.000$	5,209.74	cum
		Refer: Retaining Wall 6.0m Formula: $mw*(H2+H1)*l$	$0.600*(0.433+6.000)*4775.000$	18,430.55	cum
			<b>Total :</b>	<b>28,389.00</b>	<b>cum</b>
4	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification R a n d o m R u b b l e M a s o n r y (coursed/uncoursed )			
		Refer: Retaining Wall 2.0m Formula: $((0.5*(B1+e)*d)+(0.5*B1*H2))*l$	$((0.5*(1.270+1.067)*0.600)+(0.5*1.270*0.211))*3092.000$	2,582.08	cum
		Refer: Retaining Wall 3.0m Formula: $((0.5*(B1+B3)*d)+(0.5*B1*H2))*l$	$((0.5*(1.600+1.400)*0.600)+(0.5*1.600*0.267))*330.000$	367.49	cum
		Refer: Retaining Wall 4.0m Formula: $((0.5*(B1+B3)*d)+(0.5*B1*H2))*l$	$((0.5*(1.933+1.733)*0.600)+(0.5*1.933*0.322))*2009.000$	2,834.73	cum
		Refer: Retaining Wall 6.0m Formula: $((0.5*(B1+B3)*d)+(0.5*B1*H2))*l$	$((0.5*(2.600+2.400)*0.900)+(0.5*2.600*0.433))*4775.000$	13,431.60	cum
			<b>Total :</b>	<b>19,215.89</b>	<b>cum</b>



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			
		<b>Refer:</b> Retaining Wall 2.0m <b>Formula:</b> (B2+2*o)*pcc_thk*I	$(1.284+2*0.150)*0.300*3092.000$	1,469.32	cum
		<b>Refer:</b> Retaining Wall 3.0m <b>Formula:</b> (B2+2*o)*pcc_tH1k*I	$(1.622+2*0.150)*0.300*330.000$	190.28	cum
		<b>Refer:</b> Retaining Wall 4.0m <b>Formula:</b> (B2+2*o)*pcc_thk*I	$(1.960+2*0.150)*0.300*2009.000$	1,362.10	cum
		<b>Refer:</b> Retaining Wall 6.0m <b>Formula:</b> (B2+2*o)*pcc_tH1k*I	$(2.636+2*0.150)*0.300*4775.000$	4,205.82	cum
			<b>Total :</b>	<b>7,227.52</b>	<b>cum</b>
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 )			
		<b>Refer:</b> Retaining Wall 2.0m <b>Formula:</b> (0.5*(T+e)*(H1-d))*I	$(0.5*(0.600+1.067)*(2.000-0.600))$ *3092.000	3,608.06	cum
		<b>Refer:</b> Retaining Wall 3.0m <b>Formula:</b> (0.5*(T+B3)*(H1-d))*I	$(0.5*(0.600+1.400)*(3.000-0.600))$ *330.000	792.00	cum
		<b>Refer:</b> Retaining Wall 4.0m <b>Formula:</b> ((0.5*(T+b3)*(H1-d))+ (para_ht*para_w))*I	$((0.5*(0.600+1.733)*(4.000-0.600))+$ $(0.450*0.300))*2009.000$	8,239.11	cum
		<b>Refer:</b> Retaining Wall 6.0m <b>Formula:</b> (0.5*(T+B3)*(H1-d))*I	$(0.5*(0.600+2.400)*(6.000-0.900))$ *4775.000	36,528.75	cum
			<b>Total :</b>	<b>49,167.92</b>	<b>cum</b>



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			
		<b>Refer:</b> Retaining Wall 4.0m <b>Formula:</b> n*l	4.000*2009.000	8,036.00	Rm
			<b>Total :</b>	<b>8,036.00</b>	<b>Rm</b>
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			
		<b>Refer:</b> Retaining Wall 2.0m <b>Formula:</b> n*l	2.000*3092.000	6,184.00	Rm
		<b>Refer:</b> Retaining Wall 3.0m <b>Formula:</b> n*l	3.000*330.000	990.00	Rm
		<b>Refer:</b> Retaining Wall 6.0m <b>Formula:</b> n*l	10.000*4775.000	47,750.00	Rm
			<b>Total :</b>	<b>54,924.00</b>	<b>Rm</b>



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			
		<b>Refer:</b> Breast Wall (3m) <b>Formula:</b> $(h+2*0.5)*(e+f)*(1-p)*l$	$(2.221+2*0.5)*(0.950+0.300)*(1-0.200)$ *2042.000	6,577.28	cum
		<b>Refer:</b> Breast Wall(1.5m) <b>Formula:</b> $(h+2*0.5)*(e+f)*(1-p)*l$	$(2.160+2*0.5)*(0.850+0.300)*(1-0.200)$ *6423.000	18,672.95	cum
		<b>Total :</b>	<b>25,250.23</b>	<b>cum</b>	
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			
		<b>Refer:</b> Breast Wall (3m) <b>Formula:</b> $(h+2*0.5)*(e+f)*p*l$	$(2.221+2*0.5)*(0.950+0.300)$ *0.200*2042.000	1,644.32	cum
		<b>Refer:</b> Breast Wall(1.5m) <b>Formula:</b> $(h+2*0.5)*(e+f)*p*l$	$(2.160+2*0.5)*(0.850+0.300)$ *0.200*6423.000	4,668.24	cum
		<b>Total :</b>	<b>6,312.56</b>	<b>cum</b>	
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials			
		<b>Refer:</b> Breast Wall (3m) <b>Formula:</b> $c*b*l$	$2.550*0.300*2042.000$	1,562.13	cum
		<b>Refer:</b> Breast Wall(1.5m) <b>Formula:</b> $c*b*l$	$1.050*0.300*6423.000$	2,023.25	cum
		<b>Total :</b>	<b>3,585.38</b>	<b>cum</b>	



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
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			
		<b>Refer:</b> Breast Wall (3m) <b>Formula:</b> $d*b*l$	$0.450*0.300*2042.000$	275.67	cum
		<b>Refer:</b> Breast Wall(1.5m) <b>Formula:</b> $d*b*l$	$0.450*0.300*6423.000$	867.11	cum
		<b>Total :</b>	<b>1,142.78</b>	<b>cum</b>	
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 )			
		<b>Refer:</b> Breast Wall (3m) <b>Formula:</b> $0.5*(e+(e-(h/5)))*h*l$	$0.5*(0.950+(0.950-(2.221/5)))*2.221*2042.000$	3,301.23	cum
		<b>Refer:</b> Breast Wall(1.5m) <b>Formula:</b> $0.5*(e+(e-(h/5)))*h*l$	$0.5*(0.850+(0.850-(2.160/5)))*2.160*6423.000$	8,795.91	cum
		<b>Total :</b>	<b>12,097.15</b>	<b>cum</b>	
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		<b>Refer:</b> Breast Wall (3m) <b>Formula:</b> $g*f*l$	$2.260*0.300*2042.000$	1,384.48	cum
		<b>Refer:</b> Breast Wall(1.5m) <b>Formula:</b> $g*f*l$	$2.200*0.300*6423.000$	4,239.18	cum
		<b>Total :</b>	<b>5,623.66</b>	<b>cum</b>	



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
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 )			
		<b>Refer:</b> Breast Wall (3m) <b>Formula:</b> (0.5*((a+(c+d)/3)+a)*(d+c)+i*d+i*m)*l	(0.5*((0.600+(2.550+0.450)/3)+0.600)* (0.450+2.550) +0.200*0.450+0.200*0.300)*2042.000	7,044.90	cum
		<b>Refer:</b> Breast Wall(1.5m) <b>Formula:</b> (0.5*((a+(c+d)/3)+a)*(d+c)+i*d+i*m)*l	(0.5*((0.600+(1.050+0.450)/3)+0.600)* (0.450+1.050) +0.200*0.450+0.200*0.300)*6423.000	9,152.78	cum
		<b>Total :</b>	<b>16,197.68</b>	<b>cum</b>	
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			
		<b>Refer:</b> Breast Wall (3m) <b>Formula:</b> (l/1.2)*(h-j-i)	(2042.000/1.2)*(2.221-1.000-0.200)	1,737.40	Rm
		<b>Refer:</b> Breast Wall(1.5m) <b>Formula:</b> (l/1.2)*(h-j-i)	(6423.000/1.2)*(2.160-1.000-0.200)	5,138.40	Rm
		<b>Total :</b>	<b>6,875.80</b>	<b>Rm</b>	



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	15.12/Nsc	Supply and Installation of Mechanically woven double twisted hexagonal shaped steel wire mesh gabion boxes with Zinc + PVC coating having mesh size of 100 mm x 120 mm by using mesh wire 2.7 mm (Inner dia) and 3.7 (outer dia) with sledged wire 3.4 mm(inner dia) and 4.4 mm (outer dia) and lacing with 2.2mm inner dia and 3.3 mm outer dia.placing at indicated places in dry condition at easily accessible location as per direction of Engineer including tools, plant, labour etc. complete in all respect, carrying the material from nearest approach with all leads & lifts, manpower & machinery, materials, labor etc. complete as per detailed technical specifications and as directed by Engineer-In-Charge.			
		<b>Refer:</b> Gabion Structure	78720	78,720.00	cum
		<b>Formula:</b> 78720			
			<b>Total :</b>	<b>78,720.00</b>	<b>cum</b>



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# QUANTITY CALCULATION (STRUCTURE PART)



## Quantity Backup Calculation For Bill : 11. Culvert

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
<b>Foundation</b>					
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.			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 431	431	431.00	cum
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 810	810	810.00	cum
			<b>Total :</b>	<b>1,241.00</b>	<b>cum</b>
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			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 11605	11605	11,605.00	cum
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 6249	6249	6,249.00	cum
			<b>Total :</b>	<b>17,854.00</b>	<b>cum</b>
<b>Sub Structure</b>					
3	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 350	350	350.00	Ton
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 182	182	182.00	Ton
			<b>Total :</b>	<b>532.00</b>	<b>Ton</b>



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
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			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 663	663	663.00	cum
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 1202	1202	1,202.00	cum
		<b>Total :</b>		<b>1,865.00</b>	<b>cum</b>
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			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 2089	2089	2,089.00	cum
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 4018	4018	4,018.00	cum
		<b>Total :</b>		<b>6,107.00</b>	<b>cum</b>
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			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 4998	4998	4,998.00	cum
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 2597	2597	2,597.00	cum
		<b>Total :</b>		<b>7,595.00</b>	<b>cum</b>
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 2701	2701	2,701.00	Rm
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 1415	1415	1,415.00	Rm
			<b>Total :</b>	<b>4,116.00</b>	<b>Rm</b>
		<b>Super Structure</b>			
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			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 1753	1753	1,753.00	sqm
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 1042	1042	1,042.00	sqm
			<b>Total :</b>	<b>2,795.00</b>	<b>sqm</b>
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			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 70	70	70.00	cum
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 42	42	42.00	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			<b>Total :</b>	<b>112.00</b>	<b>cum</b>
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 116	116	116.00	Ton
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 62	62	62.00	Ton
			<b>Total :</b>	<b>178.00</b>	<b>Ton</b>
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			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 833	833	833.00	cum
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 1547	1547	1,547.00	cum
			<b>Total :</b>	<b>2,380.00</b>	<b>cum</b>
12	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 351	351	351.00	Rm
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 208	208	208.00	Rm
			<b>Total :</b>	<b>559.00</b>	<b>Rm</b>
13	16.11	Drainage Spouts complete as per drawing and Technical specification			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 78	78	78.00	each
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 122	122	122.00	each
			<b>Total :</b>	<b>200.00</b>	<b>each</b>
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)			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 1042	1042	1,042.00	sqm
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 1753	1753	1,753.00	sqm
			<b>Total :</b>	<b>2,795.00</b>	<b>sqm</b>
<b>Protection Work</b>					
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			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 71+624	71+624	695.00	cum
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 135+1113	135+1113	1,248.00	cum
			<b>Total :</b>	<b>1,943.00</b>	<b>cum</b>



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
16	13.01/a/i/N sc	Earth work in excavation Ordinary soil For Protection Work			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 5349	5349	5,349.00	cum
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 9524	9524	9,524.00	cum
		<b>Total :</b>		<b>14,873.00</b>	<b>cum</b>
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			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 1060	1060	1,060.00	cum
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 1883	1883	1,883.00	cum
		<b>Total :</b>		<b>2,943.00</b>	<b>cum</b>
18	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 185+1258	185+1258	1,443.00	cum
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 104+705	104+705	809.00	cum
		<b>Total :</b>		<b>2,252.00</b>	<b>cum</b>
<b>Miscellaneous Work</b>					
19	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.			
		<b>Refer:</b> Structure Culvert_75 to 87.350 <b>Formula:</b> 533	533	533.00	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 897	897	897.00	sqm
			<b>Total :</b>	<b>1,430.00</b>	<b>sqm</b>
20	09.01/nsc1	Laying Reinforced Cement Concrete Pipe NP4 / Prestressed Concrete Pipe on First Class Bedding in Single Row . B)1200 mm dia			
		<b>Refer:</b> Structure Culvert_87.350 to109.494 <b>Formula:</b> 60	60	60.00	Rm
			<b>Total :</b>	<b>60.00</b>	<b>Rm</b>



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From Chainage 75.0 Km to 87.350 Km

Summary sheet of Small Culvert (Quantities & amount)											
		Span (m) x Height (m) =	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 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 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_TW-11M	TYPE 16_4.0 X 5.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	Total Quantity
	No. of Culverts =		24	9	30	16	5	2	5	1	
ITEM NO.	Description	Unit									
<b>A. Foundation</b>											
Item no 1(a)	Excavation (upto 3 m depth)	cum	98.00	101.78	135.73	122.42	165.43	175.06	182.61	216.05	11605
Item no 3	P.C.C (M-15)	cum	6.51	7.09	9.51	8.88	11.70	11.93	13.04	14.92	810
<b>B. SubStructure</b>											
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	34.10	36.70	58.80	52.84	89.59	86.61	95.41	142.04	4998
Item no 3	Steel (Substructure)	ton	2.39	2.57	4.12	3.70	6.27	6.06	6.68	9.94	350
Item no 4	Weep Holes	metre	20.40	27.00	28.80	33.60	43.20	39.36	42.00	62.16	2701
Item no 5	Backfilling - Granular Material	cum	11.22	10.67	14.00	12.02	16.30	17.74	17.44	20.42	1202
Item no 7	Filter Media	cum	27.78	30.79	47.95	50.85	63.55	39.96	68.08	83.53	4018
<b>C. Super Structure</b>											
Item no 1(b)	R.C.C M30 (Superstructure) upto 5m	cum	12.05	17.88	13.09	20.39	29.05	38.24	22.35	44.75	1547
Item no 2	Steel (Superstructure)	ton	0.90	1.34	0.98	1.53	2.18	2.87	1.68	3.36	116
Item no 3(a)	Bituminous Concrete Wearing Coat(40mm)	cum	1.04	0.00	1.08	0.00	0.00	2.46	1.57	0.00	70
Item no 3(b)	Mastic Asphalt (12mm)	sqm	26.00	0.00	27.00	0.00	0.00	61.40	39.20	0.00	1753
Item no 3(c)	Tack Coat	sqm	26.00	0.00	27.00	0.00	0.00	61.40	39.20	0.00	1753
Item no 5	Crash Barrier/RCC railing	metre	5.20	0.00	5.40	0.00	0.00	12.28	7.84	0.00	351
Item no 6	Drainage Spout	each	2.00	0.00	2.00	0.00	0.00	2.00	2.00	0.00	122
<b>D. Protection Work</b>											
Item no 1	Earth work for excavation	cum	100.49	100.49	100.49	100.49	115.95	146.85	115.95	131.40	9524
Item no 2	Catch Pit PCC M15 slab	cum	1.08	1.44	1.44	1.44	2.04	3.24	2.04	2.64	135
Item no 3	Catch Pit Stone Masonry	cum	1.94	1.94	1.94	1.94	2.30	3.02	2.30	2.66	185
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	21.96	16.05	19.01	1258
Item no 6	Curtain Wall & Guide Wall- PCC (M-20)	cum	20.09	20.09	20.09	20.09	21.99	25.78	21.99	23.89	1883
Item no 7	PCC M15	cum	11.65	11.65	11.65	11.65	13.92	18.45	13.92	16.19	1113
<b>D. Miscellaneous</b>											
Item no 1	Painting	cum	13.30	0.00	13.81	0.00	0.00	31.41	20.05	0.00	897



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From Chainage 87.350 Km to 109.494 Km

Summary sheet of Small Culvert (Quantities & amount)										
		Span (m) x Height (m) =	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 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 15_3.0 X 4.0 M_1 CELL_BOX C_STEPPED Ap_NC_TW-11M	TYPE 17_5.0 X 3.0 M_1 CELL_BOX C_STEPPED Ap_NC_11M with EC	Total Quantity
	No. of Culverts =		23	2	15	6	4	1	1	
<b>ITEM NO.</b>	<b>Description</b>	<b>Unit</b>								
	<b>A. Foundation</b>									
Item no 1(a)	Excavation (upto 3 m depth)	cum	98.00	101.78	135.73	122.42	165.43	182.61	176.60	6249
Item no 3	P.C.C (M-15)	cum	6.51	7.09	9.51	8.88	11.70	13.04	11.61	431
	<b>B. SubStructure</b>									
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	34.10	36.70	58.80	52.84	89.59	95.41	86.99	2597
Item no 3	Steel (Substructure)	ton	2.39	2.57	4.12	3.70	6.27	6.68	6.09	182
Item no 4	Weep Holes	metre	20.40	27.00	28.80	33.60	43.20	42.00	43.20	1415
Item no 5	Backfilling - Granular Material	cum	11.22	10.67	14.00	12.02	16.30	17.44	18.51	663
Item no 7	Filter Media	cum	27.78	30.79	47.95	50.85	63.55	68.08	42.20	2089
	<b>C. Super Structure</b>									
Item no 1(b)	R.C.C M30 (Superstructure) upto 5m	cum	12.05	17.88	13.09	20.39	29.05	22.35	62.43	833
Item no 2	Steel (Superstructure)	ton	0.90	1.34	0.98	1.53	2.18	1.68	4.68	62
Item no 3(a)	Bituminous Concrete Wearing Coat(40mm)	cum	1.04	0.00	1.08	0.00	0.00	1.57	0.00	42
Item no 3(b)	Mastic Asphalt (12mm)	sqm	26.00	0.00	27.00	0.00	0.00	39.20	0.00	1042
Item no 3(c)	Tack Coat	sqm	26.00	0.00	27.00	0.00	0.00	39.20	0.00	1042
Item no 5	Crash Barrier/RCC railing	metre	5.20	0.00	5.40	0.00	0.00	7.84	0.00	208
Item no 6	Drainage Spout	each	2.00	0.00	2.00	0.00	0.00	2.00	0.00	78
	<b>D. Protection Work</b>									
Item no 1	Eath work for excavation	cum	100.49	100.49	100.49	100.49	115.95	115.95	146.85	5349
Item no 2	Catch Pit PCC M15 slab	cum	1.08	1.44	1.44	1.44	2.04	2.04	3.24	71
Item no 3	Catch Pit Stone Masonry	cum	1.94	1.94	1.94	1.94	2.30	2.30	3.02	104
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	705
Item no 6	Curtain Wall & Guide Wall- PCC (M-20)	cum	20.09	20.09	20.09	20.09	21.99	21.99	25.78	1060
Item no 7	PCC M15	cum	11.65	11.65	11.65	11.65	13.92	13.92	18.45	624
	<b>D. Miscellaneous</b>									
Item no 1	Painting	cum	13.30	0.00	13.81	0.00	0.00	20.05	0.00	533



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***1 Cell Box Culvert\_2m x 2m  
with  
Stepped Footing  
TW - 11m***



## 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
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### 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
<b>Total</b>							<b>98.00</b>

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
<b>Total</b>							<b>6.51</b>

### 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 = $0.5/2+1 =$						2
	No of weep holes in vertical direction per return wall I = $2.4/1+1 =$						4
	Total no of Weep holes per side wall = $6 \times 3$						18
	Total no of Weep holes per return wall I = $2 \times 4$						8
	Total length of weep holes = $18 \times 2 + 8 \times 4$						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
<b>Total=</b>							<b>34.10</b>

5	Steel						
	@ 70 Kg per cum of concrete	ton					2.387
<b>Total</b>							<b>2.387</b>

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
<b>Total</b>							<b>27.78</b>

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
<b>Total</b>							<b>11.22</b>



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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
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### 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
						<b>Total</b>	<b>12.045</b>

9	Steel						
	@ 75 Kg per cum of concrete	ton					0.903
						<b>Total</b>	<b>0.903</b>

10	Crash Barrier	m	2	2.60			5.20
						<b>Total</b>	<b>5.20</b>

11	Drainage Spout	nos.	2				2.00
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12	Bituminas Concrete Wearing Coat						
		cum	1	2.60	10.00	0.040	1.04
						<b>Total</b>	<b>1.04</b>

13	Tack Coat						
		sqm	1	2.60	10.00		26.00
						<b>Total</b>	<b>26.00</b>

14	Mastic Asphalt						
		sqm	1	2.60	10.00		26.00
						<b>Total</b>	<b>26.00</b>

### PROTECTION WORK

Upstream side

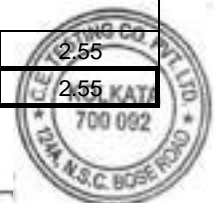
15	Eatrh work for excavation						
		cum	1	3.40	2.00	1.00	6.80
						<b>Total</b>	<b>6.80</b>

16	Catch Pit PCC M15 slab						
		cum	1	2.40	1.50	0.30	1.08
						<b>Total</b>	<b>1.08</b>

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
						<b>Total</b>	<b>1.94</b>

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
						<b>Total=</b>	<b>8.11</b>

19	Guide wall - PCC (M-20)						
		cum	2	4.24		0.30	2.55
						<b>Total=</b>	<b>2.55</b>



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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	
<b>Downstream side</b>								
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	
<b>Total</b>							<b>11.65</b>	
21	Eatrth 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
<b>Total</b>							<b>93.69</b>	
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	
<b>Total</b>							<b>17.546</b>	
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		
<b>Total</b>							<b>4.99</b>	
<b>Miscellaneous</b>								
24	Painting							
	Crash Barrier	sqm	2	2.60	2.558		13.30	
<b>Total</b>							<b>13.30</b>	



***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
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### 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
<b>Total</b>							<b>101.78</b>

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
<b>Total</b>							<b>7.09</b>

### 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 = $6 \times 3$						18
	Total no of Weep holes per return wall I = $2 \times 6$						12
	Total length of weep holes = $18 \times 2 + 12 \times 4$						<b>27.00</b>

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
<b>Total=</b>							<b>36.70</b>

5	Steel						
	@70 Kg per cum of concrete	ton					2.569
<b>Total</b>							<b>2.569</b>

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
<b>Total</b>							<b>30.79</b>

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
<b>Total</b>							<b>10.67</b>



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## 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
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### 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	Eath 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	Eathr work for excavation						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
		cum	1	3.23		1.100	3.55
	stone Pitching	cum	1	4.89		1.700	8.32
		cum	1	6.56		1.700	11.15
		cum	1	6.73		0.500	3.37
						Total	93.69
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  
Stepped Footing  
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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
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### 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
<b>Total</b>							<b>135.73</b>

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
<b>Total</b>							<b>9.51</b>

### 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 l = $1.3/2+1 =$						2
	No of weep holes in vertical direction per return wall l = $3.4/1+1 =$						5
	Total no of Weep holes per side wall = 6 x 4						24
	Total no of Weep holes per return wall l = 2 x 5						10
	Total length of weep holes = 24 x 2 + 10 x 4						<b>28.80</b>

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 l	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
<b>Total=</b>							<b>58.80</b>

5	Steel						
	@ 70 Kg per cum of concrete	ton					4.116
<b>Total</b>							<b>4.116</b>

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	3.000	37.44
	Behind Return Wall l	cum	4	1.300	0.60	3.370	10.51
<b>Total</b>							<b>47.95</b>

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
<b>Total</b>							<b>14.00</b>



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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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
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### 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
						<b>Total</b>	<b>13.093</b>

9	Steel						
	@ 75 Kg per cum of concrete	ton					0.982
						<b>Total</b>	<b>0.982</b>

10	Crash Barrier	m	2	2.70			5.40
						<b>Total</b>	<b>5.40</b>

11	Drainage Spout	nos.	2				2.00
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12	Bituminas Concrete Wearing Coat						
		cum	1	2.70	10.00	0.040	1.08
						<b>Total</b>	<b>1.08</b>

13	Tack Coat						
		sqm	1	2.70	10.00		27.00
						<b>Total</b>	<b>27.00</b>

14	Mastic Asphalt						
		sqm	1	2.70	10.00		27.00
						<b>Total</b>	<b>27.00</b>

### PROTECTION WORK

Upstream side

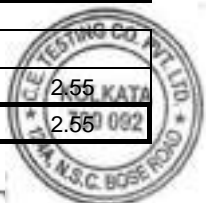
15	Eathr work for excavation						
		cum	1	3.40	2.00	1.00	6.80
						<b>Total</b>	<b>6.80</b>

16	Catch Pit PCC M15 slab						
		cum	1	2.40	2.00	0.30	1.44
						<b>Total</b>	<b>1.44</b>

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
						<b>Total</b>	<b>1.94</b>

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
						<b>Total=</b>	<b>8.11</b>

19	Guide wall - PCC (M-20)						
		cum	2	4.24		0.30	2.55
						<b>Total=</b>	<b>2.55</b>



*[Handwritten Signature]*

## 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	
<b>Total</b>							<b>11.65</b>	
21	Eatrth 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
<b>Total</b>							<b>93.69</b>	
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	
<b>Total</b>							<b>17.546</b>	
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		
<b>Total</b>							<b>4.99</b>	
Miscellaneous								
24	Painting							
	Crash Barrier	sqm	2	2.70	2.558		13.81	
<b>Total</b>							<b>13.81</b>	



*[Handwritten Signature]*

***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
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### 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
<b>Total</b>							<b>122.42</b>

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
<b>Total</b>							<b>8.88</b>

### 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 x 4						24
	Total no of Weep holes per return wall I = 2 x 7						14
	Total length of weep holes = 24 x 2 + 14 x 4						<b>33.60</b>

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
<b>Total=</b>							<b>52.84</b>

5	Steel						
	@70 Kg per cum of concrete	ton					3.699
<b>Total</b>							<b>3.699</b>

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
<b>Total</b>							<b>50.85</b>

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
<b>Total</b>							<b>12.02</b>



*[Handwritten Signature]*

## 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
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### 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	Eathr 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	Eathr work for excavation						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
		cum	1	3.23		1.100	3.55
	stone Pitching	cum	1	4.89		1.700	8.32
		cum	1	6.56		1.700	11.15
		cum	1	6.73		0.500	3.37
						Total	93.69
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



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***1 Cell Box Culvert\_3m x 4m  
with  
Stepped Footing &  
Earth Cushion  
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
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### 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
<b>Total</b>							<b>165.43</b>

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
<b>Total</b>							<b>11.70</b>

### 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 l = $1.3/2+1 =$						2
	No of weep holes in vertical direction per return wall l = $4.4/1+1 =$						6
	Total no of Weep holes per side wall = 6 x 5						30
	Total no of Weep holes per return wall l = 2 x 6						12
	Total length of weep holes = 30 x 2 + 12 x 4						<b>43.20</b>

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 l	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
<b>Total=</b>							<b>89.59</b>

5	Steel						
	@ 70 Kg per cum of concrete	ton					6.271
<b>Total</b>							<b>6.271</b>

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	4.000	49.92
	Behind Return Wall l	cum	4	1.300	0.60	4.370	13.63
<b>Total</b>							<b>63.55</b>

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
<b>Total</b>							<b>16.30</b>



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## 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
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### 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
	<b>Total</b>						<b>29.051</b>
9	Steel						
	@ 75 Kg per cum of concrete	ton					2.179
	<b>Total</b>						<b>2.179</b>

### PROTECTION WORK

Upstream side

10	Eathr work for excavation						
		cum	1	4.40	2.00	1.00	8.80
	<b>Total</b>						<b>8.80</b>
11	Catch Pit PCC M15 slab						
		cum	1	3.40	2.00	0.30	2.04
	<b>Total</b>						<b>2.04</b>
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
	<b>Total</b>						<b>2.30</b>
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
	<b>Total=</b>						<b>10.00</b>
14	Guide wall - PCC (M-20)						
		cum	2	4.24		0.30	2.55
	<b>Total=</b>						<b>2.55</b>



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## 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	
	<b>Total</b>							<b>13.92</b>
16	Eatrh work for excavation							
	Curtain Wall	cum	1	9.91	2.85	2.65	74.86	
	stone Pitching		cum	1	4.43		1.100	4.87
			cum	1	6.09		1.700	10.36
			cum	1	7.76		1.700	13.19
			cum	1	7.73		0.500	3.87
<b>Total</b>							<b>107.15</b>	
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	
<b>Total</b>							<b>19.443</b>	
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		
<b>Total</b>							<b>6.05</b>	



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***1 Cell Box Culvert\_2m x 3m  
with  
Stepped Footing  
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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
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### 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
<b>Total</b>							<b>175.06</b>

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
<b>Total</b>							<b>11.93</b>

### 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 = $6 \times 4$						24
	Total no of Weep holes per return wall = $2 \times 5$						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
<b>Total=</b>							<b>86.61</b>

5	Steel						
	@ 70 Kg per cum of concrete	ton					6.063
<b>Total</b>							<b>6.063</b>

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
<b>Total</b>							<b>39.96</b>

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
<b>Total</b>							<b>17.74</b>



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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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
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### 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
	<b>Total</b>						<b>38.239</b>

9	Steel						
	@ 75 Kg per cum of concrete	ton					2.868
	<b>Total</b>						<b>2.868</b>

10	Crash Barrier	m	2	6.14			12.28
	<b>Total</b>						<b>12.28</b>

11	Drainage Spout	nos.	2				2.00
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12	Bituminas Concrete Wearing Coat						
		cum	1	6.14	10.00	0.040	2.46
	<b>Total</b>						<b>2.46</b>

13	Tack Coat						
		sqm	1	6.14	10.00		61.40
	<b>Total</b>						<b>61.40</b>

14	Mastic Asphalt						
		sqm	1	6.14	10.00		61.40
	<b>Total</b>						<b>61.40</b>

### PROTECTION WORK

Upstream side

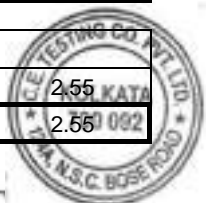
15	Eatrh work for excavation						
		cum	1	6.40	2.00	1.00	12.80
	<b>Total</b>						<b>12.80</b>

16	Catch Pit PCC M15 slab						
		cum	1	5.40	2.00	0.30	3.24
	<b>Total</b>						<b>3.24</b>

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
	<b>Total</b>						<b>3.02</b>

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
	<b>Total=</b>						<b>13.78</b>

19	Guide wall - PCC (M-20)						
		cum	2	4.24		0.30	2.55
	<b>Total=</b>						<b>2.55</b>



## 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	
<b>Downstream side</b>								
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	
<b>Total</b>							<b>18.45</b>	
21	Eatrth 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
<b>Total</b>							<b>134.05</b>	
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	
<b>Total</b>							<b>23.238</b>	
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		
<b>Total</b>							<b>8.18</b>	
<b>Miscellaneous</b>								
24	Painting							
	Crash Barrier	sqm	2	6.14	2.558		31.41	
<b>Total</b>							<b>31.41</b>	



*[Handwritten 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 x4m  
3.0x4.0x1 Cell\_With Catch Pit\_Step Protection\_Normal Camber

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

1	Excavation						
	Box culvert	cum	1	8.32	12.00	1.630	162.74
	Shear Key	cum	2	8.52	1.620	0.720	19.88
<b>Total</b>							<b>182.61</b>

2	PCC-M15						
	Box culvert	cum	1	7.32	8.96	0.15	9.84
	Shear Key	cum	2	7.52	1.418	0.15	3.20
<b>Total</b>							<b>13.04</b>

### 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 l = $1.7/2+1 =$						2
	No of weep holes in vertical direction per return wall l = $4.5/1+1 =$						6
	Total no of Weep holes per side wall = 6 x 5						30
	Total no of Weep holes per return wall l = 2 x 6						12
	Total length of weep holes = 30 x 2 + 12 x 4						42.00

4	RCC-M30						
	Bottom Slab	cum	1	7.32	11.00	0.48	38.65
	Box Side Wall	cum	2	11.00	0.46	4.00	40.48
	Return wall l	cum	4	1.700	0.30	4.45	9.08
	Shear key	cum	2	7.320	0.475		6.96
	Haunch	cum	2	11.000	0.011		0.25
<b>Total=</b>							<b>95.41</b>

5	Steel						
	@ 70 Kg per cum of concrete	ton					6.679
<b>Total</b>							<b>6.679</b>

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	4.000	49.92
	Behind Return Wall l	cum	4	1.700	0.60	4.450	18.16
<b>Total</b>							<b>68.08</b>

7	Backfilling by granular material						
	Box culvert	cum	1	19.32		0.63	12.17
	Shear Key	cum	2	3.66		0.72	5.27
<b>Total</b>							<b>17.44</b>



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## ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size: - 1 cell of 3m x4m  
3.0x4.0x1 Cell\_With Catch Pit\_Step Protection\_Normal Camber

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

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	3.920	11.000	0.513	22.099
	(+)Haunch	cum	2	11.000	0.011		0.248
						<b>Total</b>	<b>22.347</b>

9	Steel						
	@ 75 Kg per cum of concrete	ton					1.676
						<b>Total</b>	<b>1.676</b>

10	Crash Barrier	m	2	3.92			7.84
						<b>Total</b>	<b>7.84</b>

11	Drainage Spout	nos.	2				2.00
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12	Bituminas Concrete Wearing Coat						
		cum	1	3.92	10.00	0.040	1.57
						<b>Total</b>	<b>1.57</b>

13	Tack Coat						
		sqm	1	3.92	10.00		39.20
						<b>Total</b>	<b>39.20</b>

14	Mastic Asphalt						
		sqm	1	3.92	10.00		39.20
						<b>Total</b>	<b>39.20</b>

### PROTECTION WORK

Upstream side

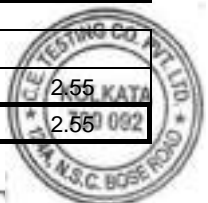
15	Eatrh work for excavation						
		cum	1	4.40	2.00	1.00	8.80
						<b>Total</b>	<b>8.80</b>

16	Catch Pit PCC M15 slab						
		cum	1	3.40	2.00	0.30	2.04
						<b>Total</b>	<b>2.04</b>

17	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
						<b>Total</b>	<b>2.30</b>

18	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
						<b>Total=</b>	<b>10.00</b>

19	Guide wall - PCC (M-20)						
		cum	2	4.24		0.30	2.55
						<b>Total=</b>	<b>2.55</b>



## ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size: - 1 cell of 3m x4m  
3.0x4.0x1 Cell\_With Catch Pit\_Step Protection\_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity	
<b>Downstream side</b>								
20	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	
	<b>Total</b>							<b>13.92</b>
21	Eatrth work for excavation							
	Curtain Wall	cum	1	9.91	2.85	2.65	74.86	
	stone Pitching		cum	1	4.43		1.100	4.87
			cum	1	6.09		1.700	10.36
			cum	1	7.76		1.700	13.19
			cum	1	7.73		0.500	3.87
<b>Total</b>							<b>107.15</b>	
22	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	
<b>Total</b>							<b>19.443</b>	
23	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		
<b>Total</b>							<b>6.05</b>	
<b>Miscellaneous</b>								
24	Painting							
	Crash Barrier	sqm	2	3.92	2.558		20.05	
<b>Total</b>							<b>20.05</b>	



***1 Cell Box Culvert\_4m x 5m  
with  
Stepped Footing, Earth Cushion  
& RE Wall Encasing  
TW - 11m***



## ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size: - 1 cell of 4m x 5m  
1 cell of 4m x 5m With Catch Pit\_Step Protection\_Normal Camber with EC

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

1	Excavation						
	Box culvert	cum	1	9.46	12.00	1.750	198.66
	Shear Key	cum	2	9.66	1.500	0.600	17.39
<b>Total</b>							<b>216.05</b>

2	PCC-M15						
	Box culvert	cum	1	8.46	9.20	0.15	11.67
	Shear Key	cum	2	8.66	1.249	0.15	3.24
<b>Total</b>							<b>14.92</b>

### 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 = $5/1+1 =$						6
	No of weep holes in horizontal direction per return wall l = $1.6/2+1 =$						2
	No of weep holes in vertical direction per return wall l = $5.5/1+1 =$						7
	Total no of Weep holes per side wall = 6 x 6						36
	Total no of Weep holes per return wall l = 2 x 7						14
	Total length of weep holes = 36 x 2 + 14 x 4						62.16

4	RCC-M30						
	Bottom Slab	cum	1	8.46	11.00	0.60	55.84
	Box Side Wall	cum	2	11.00	0.63	5.00	69.30
	Return wall l	cum	4	1.600	0.30	5.50	10.56
	Shear key	cum	2	8.460	0.360		6.09
	Haunch	cum	2	11.000	0.011		0.25
<b>Total=</b>							<b>142.04</b>

5	Steel						
	@ 70 Kg per cum of concrete	ton					9.943
<b>Total</b>							<b>9.943</b>

6	Filter media						
	Behind Side Wall	cum	2	10.400	0.60	5.000	62.40
	Behind Return Wall l	cum	4	1.600	0.60	5.503	21.13
<b>Total</b>							<b>83.53</b>

7	Backfilling by granular material						
	Box culvert	cum	1	20.46		0.75	15.35
	Shear Key	cum	2	4.23		0.60	5.08
<b>Total</b>							<b>20.42</b>



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## ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size: - 1 cell of 4m x 5m  
1 cell of 4m x 5m With Catch Pit\_Step Protection\_Normal Camber with EC

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

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	5.260	11.000	0.503	29.080
	(+)Haunch	cum	2	11.000	0.011		0.248
	RCC wall	cum	2	8.46	0.30	2.40	12.18
	RCC column beside Wall	cum	4	0.60	0.90	1.50	3.24
						<b>Total</b>	<b>44.750</b>
9	Steel						
	@ 75 Kg per cum of concrete	ton					3.356
						<b>Total</b>	<b>3.356</b>

### PROTECTION WORK

Upstream side

10	Eathr work for excavation						
		cum	1	5.40	2.00	1.00	10.80
						<b>Total</b>	<b>10.80</b>
11	Catch Pit PCC M15 slab						
		cum	1	4.40	2.00	0.30	2.64
						<b>Total</b>	<b>2.64</b>
12	Catch Pit Stone Masonry						
	Side wall length parallel to road	cum	1	4.40	0.36		1.58
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						<b>Total</b>	<b>2.66</b>
13	300 mm thick Boulder Pitching						
		cum	1	4.00	1.30	0.30	1.56
		cum	1	6.89	5.00	0.30	10.33
						<b>Total=</b>	<b>11.89</b>
14	Guide wall - PCC (M-20)						
		cum	2	4.24		0.30	2.55
						<b>Total=</b>	<b>2.55</b>



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## ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size: - 1 cell of 4m x 5m  
1 cell of 4m x 5m 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	9.912	1.85	0.15	2.75	
	For PCC wall							
		cum	1	5.184	0.35	1.00	1.81	
		cum	1	6.569	0.35	1.60	3.68	
		cum	1	7.955	0.35	1.60	4.45	
	Below PCC Wall							
		cum	1	5.38	0.55	0.10	0.30	
		cum	1	6.77	0.55	0.10	0.37	
		cum	1	8.15	0.55	0.10	0.45	
	On trades							
		cum	1	4.491	0.85	0.10	0.38	
		cum	1	5.876	0.85	0.10	0.50	
		cum	1	7.262	0.85	0.10	0.62	
		cum	1	8.734	1.00	0.10	0.87	
<b>Total</b>							<b>16.19</b>	
16	Eatrth work for excavation							
	Curtain Wall	cum	1	10.91	2.85	2.65	82.41	
	stone Pitching		cum	1	5.63		1.100	6.19
			cum	1	7.29		1.700	12.40
			cum	1	8.96		1.700	15.23
			cum	1	8.73		0.500	4.37
<b>Total</b>							<b>120.60</b>	
17	Curtain Wall & guide wall - PCC (M-20)							
	Curtain Wall	cum	1	9.912	1.898		18.807	
	Guide wall	cum	2	4.22		0.300	2.533	
<b>Total</b>							<b>21.341</b>	
18	300 MM thk stone pitching							
	Below trades							
		cum	1	4.491	0.85	0.30	1.15	
		cum	1	5.876	0.85	0.30	1.50	
		cum	1	7.262	0.85	0.30	1.85	
	cum	1	8.734	1.00	0.30	2.62		
<b>Total</b>							<b>7.12</b>	



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***1 Cell Box Culvert\_5m x 3m  
with  
Stepped Footing,Earth Cushion  
& RE Wall Encasing  
TW - 11m***



## ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size: - 1 cell of 5m x 3m  
1 cell of 5m x 3m With Catch Pit\_Step Protection\_Normal Camber with EC

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

1	Excavation						
	Box culvert	cum	1	7.60	12.00	1.800	164.16
	Shear Key	cum	2	7.80	1.450	0.550	12.44
<b>Total</b>							<b>176.60</b>

2	PCC-M15						
	Box culvert	cum	1	6.60	9.30	0.15	9.21
	Shear Key	cum	2	6.80	1.178	0.15	2.40
<b>Total</b>							<b>11.61</b>

### 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 = $0.3/2+1 =$						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 4						24
	Total no of Weep holes per return wall I = 2 x 8						16
	Total length of weep holes = 24 x 2 + 16 x 4						43.20

4	RCC-M30						
	Bottom Slab	cum	1	6.60	11.00	0.65	47.19
	Box Side Wall	cum	2	11.00	0.50	3.00	33.00
	Return wall I	cum	4	0.300	0.30	6.61	2.38
	Shear key	cum	2	6.600	0.316		4.17
	Haunch	cum	2	11.000	0.011		0.25
<b>Total=</b>							<b>86.99</b>

5	Steel						
	@70 Kg per cum of concrete	ton					6.089
<b>Total</b>							<b>6.089</b>

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	6.610	4.76
<b>Total</b>							<b>42.20</b>

7	Backfilling by granular material						
	Box culvert	cum	1	18.60		0.80	14.88
	Shear Key	cum	2	3.30		0.55	3.63
<b>Total</b>							<b>18.51</b>



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## ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size: - 1 cell of 5m x 3m  
1 cell of 5m x 3m With Catch Pit\_Step Protection\_Normal Camber with EC

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

8	RCC-M30(up to 5m)						
	Top Slab	cum	1	6.000	11.000	0.610	40.260
	(+)Haunch	cum	2	11.000	0.011		0.248
	RCC wall	cum	2	6.60	0.30	3.90	15.44
	RCC column beside Wall	cum	4	0.60	0.90	3.00	6.48
						Total	62.432
9	Steel						
	@ 75 Kg per cum of concrete	ton					4.682
						Total	4.682

### PROTECTION WORK

Upstream side

10	Eathr 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



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## ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size: - 1 cell of 5m x 3m  
1 cell of 5m 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	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
<b>Total</b>							<b>18.45</b>
16	Eathr 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
<b>Total</b>							<b>134.05</b>
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
<b>Total</b>							<b>23.238</b>
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
<b>Total</b>							<b>8.18</b>



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**Cost Comparison between Conventional Method  
and  
Cement Treated Method**

For above table we can conclude that conventional method is little costlier than other two methods. Below table show the figures.

<b>Method</b>	<b>Civil Cost in Cr.</b>	<b>Civil Cost / km</b>	<b>% variation</b>
CTSB -Granular base-Course	336.78	9.76	0%
CT BASE & SUBBASE	353.97	10.26	-5.12%
Conventional Method	363.44	10.54	-8.0%
Use of CTB-SAMI & CTB-GSB	366.82	10.63	-11.15%

Here, use of Conventional Method, CT BASE & SUBBASE or CTB – SAMI will increase cost 5% to 11% of civil cost as compared with CTSB -Granular base-Course. The proposed alignment follows the existing alignment except the stretches with bad horizontal geometry to achieve the minimum of acquisition of forest land. Hence, the existing road way to be improve

Considering the above facts, CTSB -Granular base-Course method has been chosen for pavement procedure due to lesser Cost. A detailed cost comparison is attached.



**Road name- Maram to Peren road section on NH-129A in the State of Manipur  
(Package - III)  
(75 km to 109+494 km)**

**GENERAL ABSTRACT OF COST COMPARISON**

Length of Road (KM) :: : 34.494

DESCRIPTION OF WORKS		UNIT	Conventional		CT BASE & SUBBASE		CTS-B-Granular Base		CTB-SAMI & CTB-GSB	
			TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	TOTAL COST (In Cr.)	COST PER KM. OF TOTAL ROAD LENGTH
<b>A.</b>	<b>ROAD WORKS</b>									
1	Site Clearance and Dismantling	km	1.20	0.03	1.20	0.03	1.20	0.03	1.20	0.03
2	Earth work ,Subgrade and Erosion control	km	115.48	3.35	115.48	3.35	115.48	3.35	115.48	3.35
3	Sub-Base & Base	km	48.85	1.42	56.61	1.64	41.93	1.22	57.66	1.67
4	Bituminous Courses	km	38.55	1.12	21.71	0.63	19.69	0.57	33.08	0.96
5	Junction Improvement (Major & Minor)		0.18	0.01	0.07	0.00	0.07	0.00	0.13	0.00
6	Traffic signs, Road marking & other road appurtenances	km	2.96	0.09	2.96	0.09	2.97	0.09	2.96	0.09
	<b>Drainage and Protective Works</b>									
7	Longitudinal Drains	km	7.68	0.22	7.68	0.22	7.68	0.22	7.68	0.22
8	Retaining wall	km	68.52	1.99	68.52	1.99	68.52	761.33	68.52	1.99
9	Breast wall	km	28.86	0.84	28.86	0.84	28.86	0.84	28.86	0.84
10	Protection Work		13.57	0.39	13.57	0.39	13.57	0.39	13.57	0.39
<b>B.</b>	<b>BRIDGES &amp; CULVERTS</b>									
11	Culvert	nos	26.33	0.76	26.33	0.76	26.33	0.76	26.33	0.76
	Utility Shifting(Electrical+PHE)	nos	0.69	0.02	0.69	0.02	0.69	0.02	0.69	0.02
<b>C.</b>	<b>COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)</b>		<b>352.87</b>	<b>10.23</b>	<b>343.68</b>	<b>9.96</b>	<b>326.99</b>	<b>9.48</b>	<b>356.16</b>	<b>10.33</b>
<b>D.</b>	<b>Escalation @ 3% WPI</b>		<b>10.57</b>		<b>10.29</b>		<b>9.79</b>		<b>10.66</b>	
<b>E.</b>	<b>Total Civil Cost including Escalation@3%</b>	<b>Total =</b>	<b>363.44</b>	<b>10.54</b>	<b>353.97</b>	<b>10.26</b>	<b>336.78</b>	<b>9.76</b>	<b>366.82</b>	<b>10.63</b>
<b>F.</b>	Maintenance for 5 years, i.e 2.5% on civil cost (E)		9.07		8.83		8.40		9.15	
<b>G.</b>	GST @ 12% of (E)		43.53		42.39		40.33		43.94	
<b>H.</b>	Contingencies @ 2.8% over Civil Cost (E)		10.16		9.89		9.41		10.25	
<b>I.</b>	Supervision Charges @ 3% of (E)		10.88		10.60		10.08		10.98	
<b>J.</b>	Agency Charges @3% of (E)		10.88		10.60		10.08		10.98	
<b>K.</b>	Escalation Cost @ 2.5% during Construction Period(For 1.5 Yrs of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)		9.07		8.83		8.40		9.15	
<b>J.</b>	<b>TOTAL CONSTRUCTION COST * (C+D+E+F+G+H+I)=J</b>		<b>457.03</b>	<b>13.25</b>	<b>445.11</b>	<b>12.90</b>	<b>423.48</b>	<b>12.28</b>	<b>461.27</b>	<b>13.37</b>
<b>K.</b>	<b>DEPARTMENTAL COST</b>									
<b>a.</b>	LA & Structure Cost(Tentative)		25.75		25.75		25.75		25.75	
<b>b.</b>	Forest Clearance & Environment Cost (Forest+Environmental Budget+Muck Disposal)		15.61		15.61		15.61		15.61	
<b>L.</b>	<b>Sub Total (K)</b>		<b>41.36</b>		<b>41.36</b>		<b>41.36</b>		<b>41.36</b>	
<b>M.</b>	<b>TOTAL CAPITAL COST (K+L)=M</b>		<b>498.39</b>	<b>14.45</b>	<b>486.47</b>	<b>14.10</b>	<b>464.84</b>	<b>13.48</b>	<b>502.63</b>	<b>14.57</b>



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