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

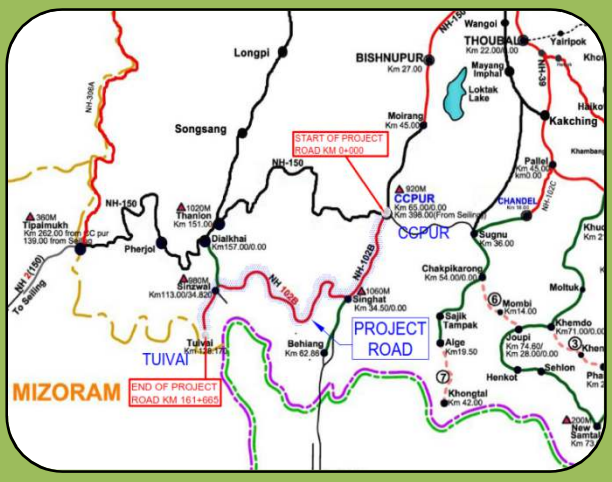
STAGE: IV

PACKAGE – IB
DESIGN CH:
13+747 KM TO
32+835 KM

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

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 -92

CET/4047/NHIDCL/NH-102B/FDPR Rev: R0 January,2020

Contents

SL NO.	Description	Page No.
1	**Volume V - Technical Specifications**	1 - 96
2	**Volume VI - Rate Analysis**	
a	SOR Rate	98 - 117
b	Lead Chart	118 - 119
c	Carriage Cost	120 - 122
d	Finished rate	123 - 152
e	Non Schedule Item	153 - 171
3	**Volume VII - Cost Estimate**	
a	Abstract of cost	173 - 174
b	Bill(Road Part)	175 - 207
c	Bill(Structure Part)	208 - 219
d	Circular	220 - 224
4	**Volume VIII - Bill of Quantity**	
a	Variable Notation and Chainage Details	
i)	Typical Cross Section(TCS)	228 - 275
ii)	Site Clearance & Dismanteling	276 - 285
iii)	Earthwork	286 - 305
iv)	Extra Widening on Flexible Pavement	306 - 322
v)	RCC Cover Drain	323 - 323
vi)	RR Masonry Trapezoidal Drain	324 - 326
vii)	Breast Wall	327 329
viii)	Retaining Wall	330 - 342
ix)	Toe Wall	343 345
x)	Major Junction	346 - 347
xi)	Minor Junction	348 - 350
xii)	Passenger Shelter	351 - 354
xiii)	Overhead Sign	355 - 357
xiv)	Crash Barrier	358 - 359
xv)	Traffic Sign	360 - 376
xvi)	Busbay	377 - 379
xvii)	Errosion Control	380 - 380
xviii)	GSB Reuse Calculation	381 - 381
b	Bill of Quantity(Road Part)	382 - 462
c	Bill of Quantity(Structure Part)	463 - 563

VOLUME - V

TECHNICAL SPECIFICATION

Contents

1.1 General....5
1.1.1. Inclusive Documents....5
1.1.2. Defective Works....5
1.2 Site Information....5
1.2.1 Location....5
1.2.2 District Details....5

2.GENERAL REQUIREMENTS :....6
2.1 PART-I: General Technical Specifications....6
2.2 PART-II: Supplementary Technical Specifications....6
2.3 The latest edition till 28 days before the final date of submission of the bid of all specifications / standard shall be applicable.....7

PART II....8

SUPPLEMENTARY TECHNICAL SPECIFICATION....8
AMENDMENTS/MODIFICATIONS/ADDITIONS TO EXISTING CLAUSES OF GENERAL TECHNICAL SPECIFICATIONS....8
SECTION 100 GENERAL....8
CLAUSE 105 SCOPE OF WORK....8
CLAUSE 106 CONSTRUCTION EQUIPMENT....10
CLAUSE 107 CONTRACT DRAWINGS....11
CLAUSE 108 SITE INFORMATION....11
Clause 109 SETTING OUT....11
Clause 110 PUBLIC UTILITIES....11
Clause 111 PRECAUTIONS FOR SAFEGUARDING THE ENVIRONMENT....12
CLAUSE 112 ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION....16
CLAUSE 114 SCOPE OF RATES FOR DIFFERENT ITEMS OF WORK....18
CLAUSE 120 FIELD LABORATORY....19
SECTION 200 SITE CLEARANCE....26
CLAUSE 201 CLEARING AND GRUBBING....26
CLAUSE 202 DISMANTLING CULVERTS, BRIDGES AND OTHER STRUCTURES/ PAVEMENTS....27
SECTION 300 EARTHWORK, EROSION CONTROL AND DRAINAGE....28
CLAUSE 301 EXCAVATION FOR ROADWAY AND DRAINS....28
Clause 301.3.11 Use & Disposal of excavated materials....29
CLAUSE 304 EXCAVATIONS FOR STRUCTURES....31
CLAUSE 305 EMBANKMENT CONSTRUCTION....31
Clause 306 SOIL EROSION AND SEDIMENTATION CONTROL....34
Clause 309 Surface/Sub-Surface Drains....34
SECTION 400 SUB-BASES, BASES (NON BITUMINOUS) AND SHOULDERS....36
Clause 401 GRANULAR SUB BASE....36
Clause 406 WET MIX MACADAM SUB BASE/BASE....37
Clause 409 CEMENT CONCRETE KERB AND KERB WITH CHANNEL....37
SECTION 500 BASE AND SURFACE COURSES (BITUMINOUS)....38
CLAUSE 502 PRIME COAT OVER GRANULAR BASE....38
CLAUSE 503 TACK COAT....39

CLAUSE 505 DENSE GRADED BITUMINOUS MACADAM 39
Clause 507 BITUMINOUS CONCRETE 40
CLAUSE 516 MASTIC ASPHALT 41
SECTION 800 TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES 41
CLAUSE 801 TRAFFIC SIGNS 41
CLAUSE 802 OVERHEAD SIGNS 42
CLAUSE 803 ROAD MARKINGS 43
CLAUSE 805 DISTANCE INDICATOR POSTS 44
CLAUSE 806 ROAD DELINATORS 44
CLAUSE 807 BOUNDARY STONES 45
CLAUSE 811.2 CONCRETE CRASH BARRIER 45
CLAUSE 811.3 METAL BEAM CRASH BARRIER 45
SECTION 900 QUALITY CONTROL FOR ROAD WORKS 46
Clause 901 GENERAL 46
Clause 903 QUALITY CONTROL TESTS DURING CONSTRUCTION 46
SECTION 1000 MATERIALS FOR STRUCTURES 50
CLAUSE 1007 COARSE AGGREGATES 50
CLAUSE 1008 SAND/FINE AGGREGATES 51
Clause 1010 WATER 51
Clause 1012 CONCRETE ADMIXTURES 51
Clause 1012.3.1 Information Required From the Manufacturer 51
Clause 1014 STORAGE OF MATERIALS 52
CLAUSE 1015 TESTS AND STANDARDS OF ACCEPTANCE 53
CLAUSE 1104 MATERIALS 53
SECTION 1500 FORMWORK 53
CLAUSE 1501 DESCRIPTION 53
CLAUSE 1502 MATERIALS 53
Clause 1503 DESIGN OF FORMWORK 54
CLAUSE 1504 WORKMANSHIP 54
CLAUSE 1506 PRECAUTIONS 54
CLAUSE 1507 PREPARATION OF FORMWORK BEFORE CONCRETING 54
CLAUSE 1508 REMOVAL OF FORMWORK 54
Clause 1509 RE-USE OF FORMWORK 55
CLAUSE 1510 SPECIALISED FORMWORK 55
Clause 1513 RATE 55
SECTION 1600 STEEL REINFORCEMENT (UN-TENSIONED) 55
CLAUSE 1602 GENERAL 55
CLAUSE 1604 BENDING OF REINFORCEMENT 55
CLAUSE 1605 PLACING OF REINFORCEMENT 56
CLAUSE 1606 BAR SPLICES 56
SECTION 1700 STRUCTURAL CONCRETE 57
CLAUSE 1703 GRADES OF CONCRETE 57
Clause 1704 PROPORTIONING OF CONCRETE 58
Clause 1705 ADMIXTURES 58
Clause 1706 SIZE OF COARSE AGGREEGATE 58
Clause 1707 EQUIPMENT 59
CLAUSE 1711 CONCRETING IN EXTREME WEATHER 60
Clause 1712 PROTECTION AND CURING 60
CLAUSE 1716 TOLERANCES 60
CLAUSE 1718 MEASUREMENT FOR PAYMENT 60
SECTION 1800 PRE-STRESSING 61

CLAUSE 1801 GENERAL 61
CLAUSE 1802 MATERIALS 61
CLAUSE 1803 TESTING OF PRESTRESSING STEEL AND ANCHORAGE 62
Clause 1804 WORKMAN SHIP 64
CLAUSE 1806 TENSIONING EQUIPMENT 64
CLAUSE 1807 POST TENSIONING 64
CLAUSE 1808 GROUTING OF PRE-STRESSED TENDONS 65
CLAUSE 1815 RATE 65
CLAUSE 1816 JOINTS IN CONSTRUCTION WITH PRE-CAST-UNIT 65
SECTION 2000 BEARINGS 65
CLAUSE 2001 DESCRIPTION 65
CLAUSE 2004 SPECIAL BEARINGS 66
Clause 2005 ELASTOMERIC BEARINGS 66
CLAUSE 2006 POT BEARINGS 66
SECTION 2100 OPEN FOUNDATIONS 67
SECTION 2200 SUB-STRUCTURE 67
SECTION 2300 CONCRETE SUPER-STRUCTURE 67
SECTION 2600 EXPANSION JOINTS 68
CLAUSE 2613 75
TEST AND STANDARDS OF ACCEPTANCE 75
CLAUSE 2614 76
Measurement for payment 76
CLAUSE 2615 76
RATE 76
SECTION 2700 WEARING COAT AND APPURTENANCES 77
CLAUSE 2702 WEARING COAT 77
CLAUSE 2703 RAILINGS AND CRASH BARRIER 77
Clause 2706 WEEP HOLE 79
CLAUSE 2708 MEASUREMENTS FOR PAYMENT 79
CLAUSE 2709 RATE 79
CLAUSE 2819 PROVIDING AND FIXING DRAINAGE SPOUT INCLUDING SEALING WITH NON-SHRINK FREE FLOW CEMENT GROUT. 80
CLAUSE 2820 REPAIR TO LEACHED, HONEYCOMBED, SPALLED CONCRETE 80
CLAUSE 2821 REPAIR TO VOID IN ARCHES WITH PMC MORTAR 84
CLAUSE 2822 SEALING OF CRACKS IN CONCRETE IN PIER / ABUTMENT CAPS, SLABS, GIRDERS, PEDESTAL WALLS ETC. WITH EPOXY RESIN INJECTION 84
CLAUSE 2823 INSPECTION & CLEANING OF BRIDGE BEARINGS AND GREASING OF STEEL ROCKER-ROLLER / PLATE BEARINGS AND REMOVAL OF ALL DEBRIS AROUND BEARINGS. 84
CLAUSE 2824 CONTROLLED JACKING UP OF SUPER STRUCTURE FOR RESETTING/ REPLACEMENT OF ROCKER AND ROCKER CUM ROLLER BEARINGS, SEGMENTAL BEARINGS AND ELASTOMERIC BEARINGS 85
CLAUSE 2825 APPLYING 1:3 CEMENT MORTAR TO EXPOSED SURFACE OF MASONRY OF EXISTING WING WALLS / RETURNS, ABUTMENT PIERS 86
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 86
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 86

CLAUSE 2828 EARTH FILLING BELOW APPROACH SLAB 86
CLAUSE 2829 CASTING OF APPROACH SLAB 87
CLAUSE 2830 STONE PITCHING ON SLOPES GROUTED WITH 1:3 CEMENT MORTAR 87
CLAUSE 2831 PROVIDING AND PLACING IN POSITION MECHANICALLY FABRICATED GABION WALL AROUND ABUTMENT AND PIERS INCLUDING EXCAVATION AND BACK FILLING 87
CLAUSE 2832 the existing clause 2813 of the Specifications shall be renumbered as 2832 87
CLAUSE 2833 the existing clause 2814 of the Specifications shall be renumbered as 2833. 87
CLAUSE 2834 RATE 88

ADDITIONAL TECHNICAL SPECIFICATION 90

Appendix A-1 :: **SPECIFICATION FOR PASSENGER SHELTER 90**

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 92**

2. Water Proof Cement Painting 93

Appendix A-3 :: **SPECIFICATION FOR DISMANTLED MATERIAL REUSE IN GRANULAR SUB-BASE 95**

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 -IB (Km 13+747 to Km 32+835) of Churachandpur - Tuivai (NH-102B) road is situated in the district of Churachandpur, Manipur.

1.2.2 General Climatic Conditions

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

1.2.3 Seismic Zone

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

2. GENERAL REQUIREMENTS

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

2.1 PART-I: General Technical Specifications

The General Technical Specifications shall be the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (FIFTH REVISION, April 2013)", issued by the Ministry of Road Transport & Highways, Government of India and published by the Indian Roads Congress (IRC), with a cross reference to relevant Bureau of Indian Standards (BIS) for materials or other aspects not covered by the IRC.

2.2 PART-II: Supplementary Technical Specifications

The Supplementary Technical Specifications shall comprise of various Amendments/ Modifications/ Additions to the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS" referred to in PART - I above and Additional Specifications for particular item of works not already covered in PART-I.

2.2.1. A particular clause or a part thereof in "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (FIFTH REVISION, April 2013)" as corrected in the original referred in PART-I above, where Amended/ Modified/Added upon, and incorporated in PART-II, referred to above, such Amendment/Modification /Addition supersedes the relevant Clause or part of the Clause.

2.2.2. When an Amended/Modified/Added Clause supersedes a Clause or part thereof in the said Specifications, then any reference to the superseded Clause shall be deemed to refer to the Amended/Modified/Added Clause or part thereof.

2.2.3. In so far as Amended/Modified/Added Clause may come in conflict or be inconsistent with any of the provisions of the said Specifications under reference, the Amended/Modified/ Added Clause shall always prevail.

2.2.4. The following Clauses in the "SPECIFICATIONS FOR ROAD AND BRIDGE WORKS (FIFTH REVISION, April 2013) have been Amended/ Modified/ Added upon;

Sr. No.	Section No.	Section Title	Clause No.
1.	100	General	100,105,106,107,108,109,110,111, 112,114 and 120
2.	200	Site Clearance	200,201 and 202
3.	300	Earthwork, Erosion Control and Drainage	300,301,304,305,307 and 309
4.	400	Sub-base, Bases (Non-Bituminous) and Shoulder	400,401,404 and 406
5.	500	Bases and Surface Courses (Bituminons)	500, 501, 502, 503, 505, 507, 509, and 516
6.	800	Traffic signs, Markings and	801, 802, 803, 804, 805, 807 and 811

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

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

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

PART II

SUPPLEMENTARY TECHNICAL SPECIFICATION

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

SECTION 100 GENERAL

CLAUSE 102 DEFINITIONS

The following abbreviations shall be added in this Clause:

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

CLAUSE 105 SCOPE OF WORK

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

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

i) The Contractor's organization and management including:

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

- Document control;
- provide a safe, clear and informative system of road signs
- Program for submission of method statements;
- Procedures for the preparation, review and adjustment of programmes for the effective progression of the Works;
- Procedures for the regular review and recording by the Contractor of the quality of the Works;
- Control of personal selection based on skill and experience;
- Management review and audit to monitor and exercise adequate control over the implementation of the quality plan.

ii) The Contractor's detailed method statements and construction procedures for each major activity whether directly controlled or subcontracted including:

- Plant and materials to be used, safety measures, the requirement for skilled labour and/or special supervision and working space;
- Delivering, handling and storage of materials;
- Environmental control in respect of pollution, noise, dust, temperature, working hours, traffic control etc.
- Hold points i.e. the stages at which checks are necessary before continuing;
- Enable standards of reliability, durability, accessibility, maintainability, quality control and assurance, and fitness for purpose appropriate to a highway of the character of the Project Highway to be achieved throughout the Contract Period
- Achieve a high standard in the appearance and aesthetic quality of the Project Highway and achieve integration of the Project Highway with the character of the surrounding landscape through both sensitive design and sensitive management of all visible elements including those on the existing road
- Ensure adequate safety of the Project Workers on the work site.
- Work instructions, quality control procedures, compliance testing, inspection procedures and work acceptance procedures.

iii) The Contractor's construction quality control including;

- A statement of the Contractor's organization for quality control;
- Control of test laboratories;
- Control of test, measuring and inspection equipment;
- Document control;

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

Sub-Clause 105.5 Contractor shall take steps to minimize the negative impact of construction operations on environment.

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

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

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

CLAUSE 106 CONSTRUCTION EQUIPMENT

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

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 1st sentence of Clause 111.5 and substitute the following:

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

Sub-Clause 111.8.2 Air Quality

Add the following text after the end of 1st Para

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

Add the following text after the end of last Para

The Contractor shall monitor air-quality once weekly in all operational areas under the project and take the necessary steps to comply with the specified requirements.

Air quality parameters will include SPM, RPM, SO2, NOX, 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 Contactor shall construct project specific single lane paved roads in settlement areas and gravel roads in open areas conforming to the Ministry of Road Transport and Highways (MORTH) specifications.

The alignment of the haulage roads shall be fixed to avoid agricultural land to the extent possible. In unavoidable circumstances, suitable compensation shall be paid to the people whose land will be temporarily acquired for the duration of the operations. The compensation shall cover for loss of income for the duration of temporary acquisition and land restoration. Prior to the construction of the haul roads, topsoil shall be stripped and stockpiled for re-use. Material dumping sites shall be access controlled to prevent the unauthorized entry of the people, grazing cattle and stray animals. Haulage roads shall be reinstated upon completion of hauling for the use of local communities."

Sub-Clause 111.15 Equipment and Vehicles used for the Works

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

Sub-Clause 111.16 Noise Control

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

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

plant and silencing equipment in good conditions so as to minimize the noise emission during construction works.

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

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

Sub-Clause 111.17 Vibration Control

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

CLAUSE 112 ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

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

This clause shall read as under:

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

i) At least one 5.5m lane to remain open to traffic at all times

ii) The surface used by the through traffic shall at all times be a firm all weather compacted surface free of pot holes and other defects

iii) The maximum continuous length over which construction under traffic may take place shall be limited to 750m. However, for longer stretches, passing places shall be provided at every 0.75 km interval with at least 50m length.

iv) The treatment to paved shoulders shall consist of providing 200 mm thick granular base course grading-I Table 400-1 as per Clause 401 covered by 225 mm thick wet mix macadam layer as per Clause 406 and treated with mix seal surfacing (MSS) type B as per Clause 512.

v) Construction activity shall be restricted to only one side of the existing road.

Sub-Clause 112.3 Passage of Traffic along a Temporary Diversion

Add the following at the end of this Clause.

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

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

Drainage should be provided as directed by the Engineer.

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

Sub-Clause 112.4 Traffic Safety and Control

Add the following Para in the end of Clause 112.4

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

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

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

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

Sub-Clause 112.6 Measurements for payment and rate

Replace this clause by following:

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

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

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

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

CLAUSE 114 SCOPE OF RATES FOR DIFFERENT ITEMS OF WORK

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

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

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

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

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

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

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

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

Sub-Clause 114.4 Add the following as Clause 114.4

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

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

CLAUSE 120FIELD LABORATORY

Sub-Clause 120.1 Scope

Add the following at the end of the clause.

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

Sub-Clause 120.2 Description

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

Add the following at the end of this Clause:

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

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

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

Sub-Clause 120.3 This clause stands deleted.

Sub-Clause 120.4 This clause stands deleted.

Table 100-2 Laboratory Equipment

S. No.	Sub No.	Item, Specifications	Nos. required
		A: General	
i)		Balance	
	(a)	5 kg to 20 kg capacity semi -self-indicating Electronic Type –Accuracy 1 gm.	1
	(b)	500 gm. capacity semi self indicating Electronic Type – Accuracy 0.01 gm.	1
	(c)	Chemical balance 100gm capacity - Accuracy 0.0001gm	1
	(d)	Pan balance 5 kg capacity - Accuracy 0.5 gm.	1
	(e)	Platform Scale – 300 kg capacity	1
ii)		Ovens – Electrically operated, thermostatically controlled	
	(a)	From 0^{o}C to 220^{o}C – Sensitivity	1
iii)		Sieves, as per IS 460-1962	
	(a)	IS Sieves 450 mm internal dia. of sieve sets as per BIS of required sieve sizes complete with lid and pan	1 set
	(b)	IS sieve 200 mm internal dia. (brass frame and steel or brass wire cloth mesh) consisting of sieve sets of required sieve sizes complete with lid and pan	2 set

S. No.	Sub No.	Item, Specifications	Nos. required
iv)		Sieve shaker capable of taking 200 mm and 450 mm dia. Sieves electrically operated with time switch assembly (As per BIS)	1
v)		200 tones compression testing machine	1
vi)		Stop watches 1/5 sec. Accuracy	2
vii)		Glassware comprising of Beakers, Pipettes, dishes, measuring cylinders (100 to 1000 cc capacity) glass rods and funnels, glass thermometers range 0oC to 100oC and metallic thermometers range 300oC	2 Nos. each
viii)		Hot plates 200 mm dia (1500 watt.)	6
ix)		Enamel trays	
	(a)	600 mm x 450 mm x 50 mm	2
	(b)	450 mm x 300 mm x 40 mm	2
	(c)	300 mm x 250 mm x 40 mm	2
	(d)	Circular plates of 250 mm dia.	2
x)		Water Testing Kit	1

Sub-Clause 121.3.2 for Soils and Aggregates

		B: For Soils and Aggregates	
i)		Water still, 3 liter/hr. with fittings and accessories	-
ii)		Liquid limit device with Casagrande and ASTM grooving tools as per IS: 2720	1
iii)		Sampling pipettes fitted with pressure and suction inlets, 10 ml Capacity	1 set
iv)		Compaction apparatus (Proctor) as per IS: 2720 (Part 8) complete with collar, base plate and hammer	1 set
v)		Modified AASHTO compaction apparatus as per IS. 2720 (Part 7) 1980 or Heavy Compaction Apparatus as per IS complete with collar, base plate and hammer	1 set
vi)		Sand pouring cylinder with conical funnel and tap and complete as per IS 2720 (Part 28) 1980 including modified equipment	2
vii)		Sampling tins with lids 100 mm dia x 75 mm ht ½ kg capacity and miscellaneous items like moisture, tins with lid (50 grams) etc.	4
viii)		Lab CBR testing equipment for conducting CBR testing, load frame with 5 Ton capacity, electrically operated with speed control as per IS: 2720 (Part	1 set

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

Sub-Clause 121.3.3 For Bitumen and Bitumen Mixes

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

C: For Bitumen and Bituminous Mixes			
		needles as per IS. 1203 – 1978	
iii)		Solvent extraction or centrifuge type apparatus complete (AASHTO, T-164) with extraction thimbles with stocks of solvent and filter paper	1
iv)		Laboratory mixer including required accessories about .02 cum capacity electrically operated fitted with heating jacket	1
v)		Marshall compaction apparatus automatically operated as per ASTM 1559-62 T and complete with electrically operated loading unit, compaction pedestal heating head assembly, dial micrometer and bracket for flow measurement, load transfer bar, specimen mould 100 mm dia. (4 in) with base plate, collars, specimen extractor, compaction hammer 4.53 kg (10 lb.) x457 mm (18 in) fall	1 set
vi)		Distant Reading Digital Thermometer for Measuring Temperatures in Asphaltic Mixes	As required
vii)		Riffle Box	1
viii)		Automatic Asphalt Content Gauge [Nuclear or equivalent]	1
ix)		Thin film Oven test apparatus to the requirement of AASHTO T 179, including accessories	1
x)		Ring Ball Apparatus as per IS 1205- 1978	1
xi)		Asphalt Institute Vacuum Viscometer as per IS 1206(part II) – 1978	1
xii)		BS U- Tube Modified Reverse Floro Viscometer IS 1206(Part III) – 1978	1
xiii)		Apparatus for Determination of Ductility Test as per IS 1208 – 1978	1
xiv)		Pen Sky – Martars closed Tester for testing flash and fire point as per IS 1209 – 1978.	1
xv)		Apparatus for Float Test – IS – 1210 – 1978	1
xvi)		Apparatus for Determination of water content (Dean and Shark Method) IS – 1211 – 1978	1
xvii)		Apparatus for Determination of Loss on Heating IS – 1212-1978.	1
xviii)		Apparatus of Determination of specified Gravity IS-1202-1978	1
xix)		Core cutting machine with 100mm dia. Diamond cutting Edge	1
xx)		Apparatus for Elastic Recovery test for Modified Bitumen	1
xxi)		Apparatus for Storage Stability test for Modified Bitumen	1

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

Sub-Clause 121.3.4 for Cement, Cement Concrete and Materials

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

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

Sub-Clause 121.3.5 For Control of Profile and Surface Evenness

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

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

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

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

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

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

Sub-Clause 120.5 Rate

"This Clause shall be read as under:"

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

SECTION 200 SITE CLEARANCE

CLAUSE 201 CLEARING AND GRUBBING

Sub-Clause 201.1 Scope

Replace with following Para:

This work shall consist of cutting, excavating, removing, and disposing of all materials such as trees of girth up to 300 mm, bushes, shrubs, stumps, roots, grass weeds, rubbish etc. and top soil up to 150 mm, which in the opinion of Engineer is unsuitable for incorporation in the work including draining out stagnant water if any from the area of road land, drain, cross drainage structure and other area as specified in the drawing or instructed by Engineer. It shall include necessary excavation by harrow discs or any other suitable equipment, back filling of the pits by suitable soil, resulting from uprooting of trees & stumps and making the surface in proper grade by suitable equipment and compacted by power roller to required compaction as per Clause

305.3.4. The work also includes handling, salvaging and disposal of cleared material. Clearing and grubbing shall be performed less than one month in advance of earthwork operation and in accordance with requirement of these specifications.

Sub-Clause 201.5 Measurements for Payment

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

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

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

Sub-Clause 202.7 Rates

Add at the end of this sub clause:

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

SECTION 300 EARTHWORK, EROSION CONTROL AND DRAINAGE

CLAUSE 301 EXCAVATION FOR ROADWAY AND DRAINS

Sub-Clause 301.1 Scope

Add the following as second paragraph under this clause:

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

Sub-Clause 301.2.1 Classification

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

"(a) Soil

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

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

Delete Para b (iv)

Sub-Clause 301.3.3 Excavation – General

The following paragraph is added to the sub-clause 301.3.3

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

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

The title of this Clause shall read as under:

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

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

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

Clause 301.3.11 Use & Disposal of excavated materials

Delete this sub-clause and replace with:

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

i) Filling for roadway embankments with all lifts and leads

ii) Filling existing pits in the right of way as directed by the Engineer, including levelling and spreading with all lifts and leads

iii) For landscaping of the road as directed by the Engineer, including levelling and spreading with all lifts and leads

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

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

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

Sub-Clause 301.6 Preparation of Cut Formation

Second Para shall be read as under:

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

Sub-Clause 301.8 Measurements for Payment

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

Delete the last Para from "works involved……" and substitute:

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

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

Sub-Clause 301.9 Rates

Sub-Clause 301.9.1

Add extra item after item (vii)

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

Sub-Clause 301.9.2 This Clause shall read as under:

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

Sub-Clause 301.9.3

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

Sub-Clause 301.9.6

Add new Sub Clause after 301.9.5 as under;

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

CLAUSE 304 EXCAVATIONS FOR STRUCTURES

Sub-Clause 304.3.2 Excavation

At the end of 1st paragraph of Clause 304.3.2 insert the following additional sentences:
"The Contractor shall ensure the stability and structural integrity of adjacent existing foundations and structures and if necessary shall, at his own expense, install temporary or permanent sheet piles, coffer dams, shoring or similar as support or protection to the satisfaction of the Engineer."

CLAUSE 305 EMBANKMENT CONSTRUCTION

Sub-Clause 305.2 Material and General Requirements

Sub-Clause Physical Requirements:

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

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

Sub-Clause

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

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

Sub-Clause

305.2.1.4 ***Delete second sentence "However, the Engineer ……. Requirements of these Specifications".***

Sub-Clause

305.2.2.4 **Compaction Requirements**

Delete Table 300-2 and substitute the following:

Table 300-2

Compaction Requirements of Embankment and Subgrade

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

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

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

i) The values of maximum dry density and optimum moisture content obtained in accordance with, IS: 2720 (Part 8) for each fill material proposed to be used in the construction of embankment and subgrade.

ii) The graphs of Density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined.

iii) The dry density-moisture content-CBR relationships, heavy compactive efforts conforming to the IS 2720 (part 8) for each of the fill material proposed to be used in the sub grade.

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

Sub-Clause Add the following new sub-clause:

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

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

Sub-Clause 305.3 Construction Operations

Sub-Clause 305.3.1 Setting Out

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

Sub-Clause Compacting Ground Supporting Embankment/Subgrade

305.3.4 ***Para 1 of this clause shall be read as***

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

Add at the end of Para 2

"Backfilling layers in pits, trenches and below the original ground are to be compacted to the relative natural ground density. The natural ground density shall be determined by conducting field density tests at three widely spaced locations along the central line of the proposed additional carriageway at a depth between 0.5m to 1.0m. Samples of natural ground are collected at each location, and are tested in accordance with IS: 2720 (Part 8). The relative density (i.e. the percentage of the field dry density to the laboratory maximum dry density) is assessed for each sample, and the greatest relative density obtained is selected as the "natural ground density". If the natural ground density is less than 90% then these are to be compacted after necessary watering so as to achieve not less than 90% of relative compaction".

"Where necessary to facilitate compaction of the subgrade to 97% relative compaction as stated above, a further depth below the subgrade of maximum thickness of 0.2m shall be loosened, watered and compacted in accordance with Sub Clause 305.3.5 and 305.3.6 to not less than 95% of dry density determined in accordance with IS: 2720(Part-8)".

Sub-Clause

305.3.6 Compaction

The second Para of this Clause shall read as under:

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

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

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

Sub-Clause 305.9 Rates

Sub-Clause 305.9.1

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

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

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

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

Clause 306 SOIL EROSION AND SEDIMENTATION CONTROL

Sub-Clause 306.4 Measurements for Payment

Substitute Clause 306.4 as follows:

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

Sub-Clause 306.5 Rates

This clause shall be deleted.

Clause 309 Surface/Sub-Surface Drains

Sub-Clause 309.2 Surface Drains

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

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

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

Sub-Clause 309.3 Sub-Surface Drains

Sub-Clause 309.3.1 Scope

The first sentence of this clause should read as:

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

Sub-Clause 309.3.2 Materials

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

Sub-Clause 309.3.2.1 Pipe

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

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

Sub-Clause 309.3.4 Laying of Pipe and Backfilling

Delete Para 4 of this clause.

Sub-Clause 309.4 Measurements for Payment

This Clause shall read as:

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

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

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

General

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

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

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

Clause 401 GRANULAR SUB BASE

Sub-Clause 401.2 Materials

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

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

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

Sub-Clause 401.2.2

Add at the end of this clause as under:

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

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

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

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

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

Clause 406 WET MIX MACADAM SUB BASE/BASE

Clause 406.2.1.1 Physical requirement

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

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

The constituents of the aggregates shall be produced by integrated crushing and screening plant (Impact or Cone type of capacity 200T/hour) and, unless otherwise instructed by the Engineer, crushing shall be carried out in at least two stages. The fraction of material passing through 4.75mm sieve shall also be crusher run screening only."

Add the following at the end of the paragraph:

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

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

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

Sub-Clause 406.3.4Spreading of Mix

Substitute 1st sentence of Para 2 of clause 406.3.4.

"The mix shall be spread by a WMM paver".

Sub-Clause 406.3.5 Compaction

Delete second sentence of Para 1 of Clause 406.3.5.

Clause 409 CEMENT CONCRETE KERB AND KERB WITH CHANNEL

Sub-Clause 409.5 Construction Operations

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

Sub-Clause 409.6 Substitute

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

Clause 409.7 This Clause shall read as under:

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

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

SECTION 500 BASE AND SURFACE COURSES (BITUMINOUS)

General

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

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

Sub-Clause 501.2 Materials

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

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

Sub-Clause 501.6 Compaction

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

Add new Para,

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

Sub-Clause

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

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

CLAUSE 502 PRIME COAT OVER GRANULAR BASE

Sub-Clause

Add the Sub-Clause 502.2.5 Choice of Primer after 502.2.4

This clause shall be read as under:

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

CLAUSE 503 TACK COAT

Sub-Clause

503.2 Materials

This clause shall be read as under:

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

CLAUSE 505 DENSE GRADED BITUMINOUS MACADAM

Sub-Clause 505.2.1 Bitumen

This Clause shall be read as under:

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

Sub-Clause 505.2.2 Coarse Aggregates

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

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

Add the following at the end of this clause:

"The constituents of the aggregates shall be produced by integrated crushing and screening plant (Impact or Cone type of capacity 200T/hour) and, unless otherwise instructed by the Engineer, crushing shall be carried out in at least two stages. The fraction of material passing through 4.75mm sieve shall also be crusher run screening only."

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

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

Sub-Clause 505.2.5 Aggregate Grading and Binder Content

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

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

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

Grading	**1**	**2**

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

Sub Clause 505.3 Mix Design

Sub-Clause 505.3.1 Requirement for the Mixture

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

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

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

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

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

Sub-Clause 505.4.9 Rolling

Add at the end of Para 1

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

Add the following Sub-clause after Sub-clause 505.4.9

Clause 507 BITUMINOUS CONCRETE

Sub-Clause 507.1 Scope

Add the Following at the end of this clause:

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

Sub-Clause 507.2.1 Bitumen

This Clause shall be read as under:

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

Sub-Clause 507.2.2 Coarse Aggregates

Add the following as second para:

"The constituents of the aggregates shall be produced by integrated crushing and screening plant (Impact or Cone type of capacity 200T/hour) and, unless otherwise instructed by the Engineer, crushing shall be carried out in at least two stages. The fraction of material passing through 4.75mm sieve shall also be crusher run screening only."

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

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

Sub-Clause 507.2.4 Filler

This clause shall read as under:

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

Sub-Clause 507.3 Mixture Design

Sub-Clause 507.3.1 Requirement for the mixture

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

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

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

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

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

Sub-Clause 507.9 Rate

Delete the existing Para and replace it with the following:

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

CLAUSE 516 MASTIC ASPHALT

Sub-Clause 516.2.2 Coarse Aggregate

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

SECTION 800 TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES

CLAUSE 801 TRAFFIC SIGNS

Sub-Clause 801.2.5 Substrate

2nd sentence of this clause shall read as under:

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

Sub- Clause 801.3 Traffic Signs Having Retro-reflective Sheeting

Sub-Clause 801.3.1 General Requirements

The fifth sentence of this clause should read as under:

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

Sub-clause ***Add following in the clause***

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

Sub-Clause Warranty and Durability

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

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

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

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

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

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

CLAUSE 802 OVERHEAD SIGNS

Sub-Clause 802.4 Materials for Overhead Sign and Support Structures

Sub-Clause 802.4.2

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

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

Sub-Clause 802.4.3 ***Replace "1.5mm" with 2.0mm" in the fifth line.***

Sub-Clause 802.8.1 ***this clause shall read as under:***

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

CLAUSE 803 ROAD MARKINGS

Sub-Clause 803.2 Materials

This clause shall read as under:

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

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

Sub-Clause 803.3 Ordinary Road Marking Paint

This Clause shall be deleted.

Sub-Clause 803.5 Reflectorised Paint

This Clause shall be deleted.

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

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

ii) Faulty Workmanship or Materials

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

CLAUSE 805 DISTANCE INDICATOR POSTS

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

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

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

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

Sub-Clause 804.4 ***Measurement of Payment***

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

Sub-Clause 804.5 Rate

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

CLAUSE 806 ROAD DELINATORS

Sub-Clause806.2 ***This clause shall read as follows:***

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

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

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

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

The post below ground shall be painted with three coats of red lead.

CLAUSE 807 BOUNDARY STONES

Sub-Clause 807.1 Scope

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

CLAUSE 811.2 CONCRETE CRASH BARRIER

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

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

Sub-Clause 809.6 Rate:

Add at the end of the clause:

"And paid as per respective BOQ items."

CLAUSE 811.3 METAL BEAM CRASH BARRIER

Sub-Clause 811.3.1 Materials

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

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

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

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

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

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

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

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

Sub-Clause 811.3.3 Installation of Posts

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

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

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

Sub-Clause 811.3.7 Measurements for Payment

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

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

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

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

Sub-Clause 811.3.8 Rate

Add "and drawings" at the end of last sentence of Clause.

SECTION 900 QUALITY CONTROL FOR ROAD WORKS

Clause 901 GENERAL

Sub-Clause 901.1 ***This clause shall read as under:***

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

Sub-Clause 901.5 ***This Clause shall read as under:***

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

Clause 903 QUALITY CONTROL TESTS DURING CONSTRUCTION

Sub-Clause 903.4 Tests on Bituminous Constructions

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

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

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

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

Note:

Add the following note at the end

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 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^3. For daily productions over 300m^3, two additional beams and two additional cubes shall be cast of each 100m^3, (or part thereof). Each pair of beams and cubes shall be from different deliveries of concrete. All specimens shall be transported in an approved manner to prevent any damage to the specimen. From each pair of beams and cubes one specimen shall be tested at 7 days and one at 28 days. The groups of beams specimens from each day's production tested at 28 days shall be used for assessing the strength for compliance with the strength requirements. The groups of beam specimens from each day's production tested at 7 days shall be used for early indication of the 28 days strength as described in Clause 603.3.3.2. The flexural strength test results shall prevail over compressive strength tests results for compliance."

Sub-Clause 903.5.2.2 Replace 1st para with following:

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

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

Delete fourth para ("In order..... test beams.").

Delete fifth para ("The standard deviation.....the requirements.")

Delete sixth para ("An individual.....is substandard.")

Add at the end of seventh paragraph ("Beams shall……. and cubes required.")

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

Delete ninth para ("The flexural……they were taken.").

Delete eleventh para ("Should the concrete……..flexural strength.")

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

Sub-Clause

903.5.2.2 In-situ density

Add as Para 5 of this clause:

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

Sub-Clause

903.5.2.5 Summary of Control Tests.

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

"On each day's work, at least six pairs of beams and six pairs of cubes for total daily production less than 300 m^3. Two additional beams and two additional cubes for each 100 m^3 (or part thereof) in excess of 300m^3."

Sub-Clause

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

"As per Clause 903.5.2.1".

Sub-Clause 903.5.2.6 Add the following new Clause:

Temperature Measurements

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

SECTION 1000 MATERIALS FOR STRUCTURES

CLAUSE 1007 COARSE AGGREGATES

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

Add the following at the end of Para 2.

"Costs of all tests shall be borne by the Contractor."

Add the following at the end of the Clause:

"Integrated stone crusher with Primary and Secondary (Cone or Impact Type) crushers shall be employed for getting proper size and grading of coarse aggregates."

The alkali aggregate reactivity should be measured and reported for getting approval for the source aggregates at the beginning of the work using methods given in IS: 2386. The tests may be repeated if the source or the type of rock being exploited for winning aggregates, changes.

CLAUSE 1008 SAND/FINE AGGREGATES

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

Add the following at the end of the clause:

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

Clause 1010 WATER

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

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

Clause 1012 CONCRETE ADMIXTURES

Sub-Clause 1012.1General

Add the following at the end

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

2. Storing

A. Shelf life

B. Max. & Min. allowable temperature

C. Other instructions (e.g. requirements of stirring)

3. Dosage

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

Clause 1012.3.1 Information Required From the Manufacturer

Paragraph 1 shall read as follows:

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

Add the following at the end of the para h

i. pH value and colour.

j. If two or more admixtures have to be used in one mix, their compatibility.

k. Latest date of test and name of test laboratory.

Add the following at the end of the clause:

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

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

Workmanship

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

Manufacturer's experts should be available for consultation/trouble-shooting of problems associated with their product. The conditions of storage, shelf life etc., as specified by the manufacturer should be strictly observed. The manufacturer's Quality Assurance Plan during process of production should be obtained and filed for reference/record.

Clause 1014 STORAGE OF MATERIALS

Sub-Clause 1014.3 Aggregates

The following shall be added to this Clause:

"Aggregates shall be stored or stockpiled in such a manner that segregation of fine and coarse sizes will be avoided and also that the various sizes will not become intermixed before proportioning. They shall be stored, stockpiled and handled in such a manner that will prevent contamination by foreign materials."

CLAUSE 1015 TESTS AND STANDARDS OF ACCEPTANCE

Add the following as Para 3:

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

CLAUSE 1104 MATERIALS

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

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

SECTION 1500 FORMWORK

CLAUSE 1501 DESCRIPTION

The Clause shall read as below.

The Contractor shall prepare a formwork mobilization and utilization plan and submit the plan for Engineer's approval at least 28 days before the commencement of construction of structures. The requirement of formwork shall be worked out considering the overall construction program of all the structures to be cast in one or more stages, as specified in the drawings. The plan shall take into account the time required for erection of formwork, retention in position, stripping, and removal and subsequent use in the next and subsequent structures.

Notwithstanding Engineer's approval of mobilization plan, if due to any reason, Contractor has to arrange additional formwork, to meet the requirements of the construction program, it shall be done by the Contractor without any extra cost to the Employer.

CLAUSE 1502 MATERIALS

This Clause shall read as under:

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

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

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

Clause 1503 DESIGN OF FORMWORK

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

"For distribution of load and load transfer to the ground through staging, an appropriately designed base plate must be provided which shall rest on firm sub-strata".

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

"The work of formwork shall not commence without approval of the Engineer"

CLAUSE 1504 WORKMANSHIP

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

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

CLAUSE 1506 PRECAUTIONS

Add the following as items of this clause:

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

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

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

CLAUSE 1507 PREPARATION OF FORMWORK BEFORE CONCRETING

Add at the end of last para :

"Concreting shall not commence without approval of the Engineer"

CLAUSE 1508 REMOVAL OF FORMWORK

Add the following as para 7 Clause. 1508.

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

Clause 1509RE-USE OF FORMWORK

This Clause shall read as under:

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

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

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

CLAUSE 1510 SPECIALISED FORMWORK

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

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

Slip forming is not permitted.

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

Clause 1513 RATE

Add the following at the end of the first para:

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

SECTION 1600 STEEL REINFORCEMENT (UN-TENSIONED)

CLAUSE 1602 GENERAL

Paragraph 2 of Clause 1602 shall read as follows:

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

CLAUSE 1604 BENDING OF REINFORCEMENT

Para 1 shall be read as follows:

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

CLAUSE 1605 PLACING OF REINFORCEMENT

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

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

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

Tolerances:

1. Tolerance of cover: Deviation shall not exceed + 10 mm No negative tolerance is allowed.

2. Tolerance in position: Tolerance for deviation from the positions shown in the drawings shall not exceed the following:

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

CLAUSE 1606 BAR SPLICES

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

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

Add the following as paragraph 2 of Clause 1606.1:

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

Sub-Clause 1606.2 Welding

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

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

SECTION 1700 STRUCTURAL CONCRETE

CLAUSE 1703 GRADES OF CONCRETE

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

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

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

A) Minimum cement content and maximum water cement ratio

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

B) Minimum strength of concrete

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

TABLE 1700-3 For culverts and other incidental structures:

A) Minimum cement content and maximum water cement ratio

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

B) Minimum strength of concrete

Member	Grade
PCC Members	M20
RCC Members	M25

Notes:

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

2. For under water concreting, the cement shall be increased by 10 per cent.

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

Clause 1704 PROPORTIONING OF CONCRETE

Add the following at the end of this Clause:

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

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

Sub-Clause 1704.4 Additional Requirements

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

Clause 1705 ADMIXTURES

This Clause shall read as under:

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

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

Clause 1706 SIZE OF COARSE AGGREEGATE

Table 1700-7 shall be modified as given below :

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

Clause 1707 EQUIPMENT

Para 1 of this Clause shall read as under:

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

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

Measurement of Aggregate	±	2% of the quantity of Aggregate in each batch.
Measurement of Admixture	±	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 1712PROTECTION AND CURING

Sub-Clause 1712.2 Water Curing

Add the following at the end of Para I:

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

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

CLAUSE 1716 TOLERANCES

Add the following at the end of Clause:

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

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

CLAUSE 1718 MEASUREMENT FOR PAYMENT

The clause may be read as under :

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

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

SECTION 1800 PRE-STRESSING

CLAUSE 1801 GENERAL

Add the following as the last paragraph of this clause:

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

CLAUSE 1802 MATERIALS

Sub-Clause 1802.2 Sheathing

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

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

Add the following at the end of Para 6:

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

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

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

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

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

Add the following as additional Sub-clause

Sub-Clause 1802.2.4 Corrugated HDPE sheathing ducts

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

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

-15 sec. Value	:	58
Notch impact strength at 23 °C	:	10 KJ/m^2
- 40 °C	:	4 KJ/m^2
Coefficient of Thermal Expansion for		
20 °C - 80 °C	:	1.50 x 10^{-4} KJ/m^2

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

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

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

Screwed together with male and female threads.

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

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

Sub-Clause 1802.3 Anchorages

Heading of the clause shall be “Anchorages and Tendon couplers”

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

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

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

CLAUSE 1803 TESTING OF PRESTRESSING STEEL AND ANCHORAGE

Add following Paragraphs to the section.

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

The frequency of such tests should be as follows:

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

2) Acceptance Testing for the works

a) Static load test for tendon-anchorage assembly

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

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

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

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

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

The measured anchorage efficiency should be:

(Refer CEB/FIP Guidelines for details).

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

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 $\Delta\sigma_p$ min = 80 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 1804WORKMAN SHIP

Sub-Clause 1804.3.1 Post-tensioning

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

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

Sub-Clause 1804.5 Insert following Para after Para 1

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

CLAUSE 1806 TENSIONING EQUIPMENT

Add the following at the end of Para 2:

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

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

Add the following at the end:

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

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

CLAUSE 1807 POST TENSIONING

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

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

Add the following at the end of this Clause:

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

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

CLAUSE 1808 GROUTING OF PRE-STRESSED TENDONS

Add new Para at the end of Clause as under:

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

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

CLAUSE 1815 RATE

Add at end of Para 4:

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

CLAUSE 1816 JOINTS IN CONSTRUCTION WITH PRE-CAST-UNIT

Add new clause:

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

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

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

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

SECTION 2000 BEARINGS

CLAUSE 2001 DESCRIPTION

Add the following as paragraph 2 of this clause:

"Within 90 days of award, the Contractor shall submit detailed specifications, designs and drawings including installation drawings and maintenance manual, for the approval of the Engineer. Designs shall also include review and modifications of designs and drawings of bearing pedestals and other elements required for installation. The installation of bearings shall be carried out under the supervision of the manufacturer of the bearings. The Contractor shall provide the bearings only from the manufacturers approved and enlisted by the Department**.** In addition to routine testing of the materials and bearings at manufactures premises, the Contractor shall arrange at his own cost testing of random samples of 1 % (Minimum 1 no. of each type) of bearings from independent agencies, other than manufactures' own facilities, duly approved by the Engineer. The bearings shall be selected by the Engineer / his authorised representative and duly sealed in his presence for dispatch to the independent agency."

CLAUSE 2004 SPECIAL BEARINGS

The clause shall read as follows:

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

Clause 2005 ELASTOMERIC BEARINGS

Sub-Clause 2005.4 Acceptance Specifications

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

Sub-Clause 2005.3.5 Inspection Certificate

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

Sub-Clause 2005.4.6 Quality Control Certificate

Delete the words "/Inspector" in the third paragraph.

CLAUSE 2006 POT BEARINGS

The clause shall read follows:

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

Sub-Clause 2006.1 General

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

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

renumbered as 2010 and 2011 respectively :

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

Clause 2010 MEASUREMENTS FOR PAYMENT

Add the following after Para 2:

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

SECTION 2100 OPEN FOUNDATIONS

CLAUSE 2106 TOLERANCES

Reference to Tolerance shall be made to Clause 1716.

SECTION 2200 SUB-STRUCTURE

CLAUSE 2204 PIERS AND ABUTMENTS

Sub-Clause 2204.2 replaced as follows:

"Slip forming will not be allowed."

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

"Wherever necessary, suitable cofferdams or other means shall be provided to exclude water from the construction area. The Contractor shall provide necessary pumping equipment for dewatering areas. No payment will be made for these operations as per Clause 304.5.1."

Sub-Clause 2210 Rate

This Clause shall read as follows:

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

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

SECTION 2300 CONCRETE SUPER-STRUCTURE

Clause 2305 PRESTRESSED CONCRETE CONSTRUCTION

Sub-Clause 2305.2 Box Girder

Add the following at the end of paragraph 1:

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

joints for Engineer's approval."

Add new sub clause 2305.5 as under:

Sub-Clause 2305.5 PSC Solid Slab

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

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

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

Sub-Clause 2504.2.2 Filter Media

Add after 1st Para:

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

Clause 2507 CURTAIN WALL AND FLEXIBLE APRON

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

Sub-Clause 2507.1 Curtain Wall

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

Sub-Clause 2507.2 Flexible Apron

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

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

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

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

SECTION 2600 EXPANSION JOINTS

Clause 2602 GENERAL

Add the following at the end of the clause.

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

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

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

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

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

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

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

Sub-Clause2608.3 Installation

(a) The Expansion joint shall be installed by the manufacturer/ Supplier.

(b) The block out for the joint shall be marked and constructed to the dimensions as indicated in the drawing or recommended by the

manufacturer/ supplier.

(c) The recess for the block out shall thoroughly cleaned of any loose or foreign material wire brushing and air blowing and dried with hot compressed air.

(d) The recess in the deck slab, if required, shall be repaired with epoxy mortar and cleaned and dried again.

(e) The foam caulking/backing rod shall be placed about 25 mm down in the joint opening.

(f) The aggregate shall be washed, cleaned and heated to a temperature between 170°-180°C prior to placement.

(g) The binder shall be preheated to temperature of 170 – 190° C before application.

(h) While sealing the joint opening with preheated binder, care shall be taken that the binder does not spill on to the joint surface of the deck.

(i) The joint shall not be installed when the ambient temperature goes below + 5 deg. C or above + 35 deg.C. or while it is raining/ snowing. (Planning for installation must taken into account the weather condition).

(j) When clement weather resumes, the joint installation may be continued after the upper layer and/or exposed surface of the partially completed joint has been re-prepared by heating and/ or coating with binder as necessary.

Sub-Clause 2608.4 Handling and Storage

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

Clause 2608.5 Tests and Standard of Acceptance

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

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

The clause 2609 be replaced fully as below:

Clause 2609 **COMPRESSION SEAL JOINT**

Clause 2609.1 **Compression seal joint seal joint shall consist of steel armoured nosing at two edges of the joint gap suitably anchored to the deck concrete and a performed chloprene elastomer or closed cell foam joint sealer compressed and fixed in to the joint gap with special adhesive binder.**

Clause 2609.2 **Material**

(a) Steel nosing

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

(b) Anchorage

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

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

(c) Corrosion Protection

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

(d) Joint Seal

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

movement upto 40 mm and vertical movement of 3 mm.

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

Chloroprene Seal

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

Closed Cell Foam Seal

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

Table – 1

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

(e) Lubricant cum Adhesive

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

Sub-Clause 2609.3 Handling and Storage

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

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

Sub-Clause 2609.4 Installation

(a) The expansion joint shall be installed by the manufacturer/ supplier or their authorized representative, who will ensure compliance of installation procedure and instructions.

(b) The dimension of the joint recess and the width of the gap shall conform to the approved drawings.

(c) Anchoring steel shall be welded to the main reinforcement in the deck maintaining the level and alignment of the joint.

(d) Concreting of pocket/ recess shall be done with great care using proper mix conforming to same grade as that of the deck concrete but not less than M30 grade in any case. The water cement ratio shall not be more than 0.40. If needed, suitable admixtures may be used to achieve the workability. The width of pocket shall not be less than 300 mm on either side of the joint. Care shall also be taken to ensure efficient bonding between already cast/ existing deck concrete and the concrete in the joint recess.

(e) At the time of installation, joint shall be clean and dry and free from spalls and irregularities, which might impair a proper joint seal.

(f) Concrete or metal surfaces shall be clean, free of rust, laitance, oils, dirt, dust or other deleterious materials.

(g) The lubricant cum Adhesive shall be applied to both faces of the joint and joint seal prior to installation in accordance with the manufacturer's instructions. The joint seal shall be compressed to the specified thickness for the rated joint opening and ambient temperature at the time of installation, which shall be between +5 to 35°C.

(h) The joint seal shall be installed without damage to the seal. Loose fitting or open joints shall not be permitted.

Sub-Clause 2609.5 Acceptance Criteria

(a) All steel elements shall be furnished with corrosion protection system.

(b) For the joint seal the acceptance test shall conform to the requirements stipulated in Para above. The manufacturer/ supplier of this type of joint shall produce a test certificate to this effect conducted in a recognized laboratory in India or aboard.

(c) Prior to acceptance 25 percent of the completed and installed joints, subject to a minimum of one joint, shall be subjected to water tightness test. Water shall be continuously ponded along the entire length for a minimum period of 4 hours for a depth of 25 mm above the highest point

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

CLAUSE 2613 TEST AND STANDARDS OF ACCEPTANCE

The clause 2613 be replaced fully as Below

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

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

CLAUSE 2614 **Measurement for payment**

The clause 2614 be replaced fully as below

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

CLAUSE 2615 **RATE**

The clause 2615 be replaced fully as below

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

SECTION 2700 WEARING COAT AND APPURTENANCES

CLAUSE 2702 WEARING COAT

Sub-Clause 2702.1 Bituminous Wearing Coat

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

CLAUSE 2703 RAILINGS AND CRASH BARRIER

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

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

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

Add the following additional clauses:

Sub-Clause 2703.5 Concrete crash barrier for bridges

Sub-Clause 2703.5.1General

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 2703.5.2Materials

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

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

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

Sub-Clause 2703.5.3 Construction Operations

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

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

Sub-Clause 2703.5.4 Tolerance

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

Sub-Clause 2703.5.5 Measurements for Payment

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

Sub-Clause 2703.5.6 Rate

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

Sub-Clause 2703.6 Polysulphide Rubber Joint Sealant

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

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

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

Tensile strength	-	0.4 MPa ± 10%
Modulus of elasticity	-	At 100% elongation: 0.15 MPa
Elongation	-	Elongation at break 550%
Hardness	-	Shore'A' hardness 22 ± 3

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

Movement capability

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

Measurements for Payments

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

Clause 2706 WEEP HOLE

This clause shall read as under:

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

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

CLAUSE 2708 MEASUREMENTS FOR PAYMENT

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

CLAUSE 2709 RATE

The second paragraph shall be read follows:

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

Add at the end of Para 2:

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

CLAUSE 2819 PROVIDING AND FIXING DRAINAGE SPOUT INCLUDING SEALING WITH NON-SHRINK FREE FLOW CEMENT GROUT.

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

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

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

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

CLAUSE 2820 REPAIR TO LEACHED, HONEYCOMBED, SPALLED CONCRETE

Leached, honeycombed, spelled concrete (area of damage less than 0.5 m^2) 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 cementatious (PMC) mortar / debonding slurry are as under:

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

Solid content: The polymer solid content shall be 36 ±1 percent. The particles shall be of nearly spherical shape with a diameter of 0.35ï0.05 micron. The manufacturer shall certify the above requirements about solid content & grain size. In order to

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

Mixing proportion: Anti-corrosive polymer modified mortar

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

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

a) Coarse Silica and

b) Fine Silica

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

Quartz sand.

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

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

Curing

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

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

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

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

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

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

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

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

Mixing PMC

Methods of Mortar mixing

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

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

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

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

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

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

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

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

Mechanical Strength of Mortar

Anti-corrosive polymer modified mortar shall have the following:

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

For anti –corrosion polymer modified bonding slurry

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

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

Mixing proportions of Bonding Slurry are as follows:

Cement - 100 parts by weight

MONOBOND 2000 - 40 parts by weight

Fine Silica sand - 100 parts by weight

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

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

Mechanical Strength of Bonding Slurry

Bond Strength –

- WET - 3-4 N/MM^2
- DRY - 7-8 N/MM^2

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, Section2500.

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

Clause 3004.2.5 Measurement of Pavement

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

ADDITIONAL TECHNICAL SPECIFICATION

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

1. Scope

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

2. Description

2.1 Passenger Shelter

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

3.0 Measurement for Payment

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

4.0 Rate

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

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

1. Painting with Synthetic Enamel Paint

Materials

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

Painting on New Surface

Preparation of surface.:

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

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

(a) **Under coat:** One coat of the specified ordinary paint of shade suited to the shade of the top coat, shall be applied and allowed to dry overnight. It shall be rubbed next day with the finest grade of wet abrasive paper to ensure a smooth and even surface, free from brush marks and all loose particles dusted off.

(b) **Top Coat:** Two top coats of synthetic enamel paint of desired shade shall be applied after the undercoat is thoroughly dry. Additional finishing coats shall be applied if found necessary to ensure properly uniform glossy surface.

Lettering and Numbering on New Surface:

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

Measurement for payment:

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

Rate:

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

2. Water Proof Cement Painting

Material:

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

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

Preparation of Surface:

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

Preparation of mix:

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

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

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

Application :

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

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

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

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

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

Precaution:

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

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

Measurement for Payment:

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

Rate:

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

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

1. Scope

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

2. Materials

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

3.0 Measurement for Payment

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

4.0 Rate

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

i.) Making arrangements for traffic to clause 112 except for initial treatment to verges, shoulders and construction of diversions.

ii.) Supplying all materials to be incorporated in the work including all royalties, fees, rents where applicable with all leads and lifts

iii.) All labour tools, equipments and incidentals to complete work to the specifications.

iv.) Carrying out the work in part widths of road where directed: and

v.) Carrying out the required tests for quality control.

VOLUME - VI

RATE ANALYSIS

SCHEDULE OF RATE

Schedule Of Rate

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

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

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

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

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

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

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

Sl No	SOR Ref	Item description	Unit	SOR Rate
69	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	2,997.00
72	04.02/i	Sub-base with Close Graded Material (Table:- 400-1) By Mix in Place Method Construction of granular sub-base by providing close graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401 For Grading- II Material	Cum	2,413.12
75	04.02/ii	Sub-base with Close Graded Material (Table:- 400-1) By Mix in Place Method Construction of granular sub-base by providing close graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401 For Grading-III Material	Cum	2,356.25
78	04.03/i	Granular Sub-Base with Coarse Graded Material (Table:- 400- 2) Construction of granular sub-base by providing coarse graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401 For Grading- II Material	Cum	2,285.30
80	04.03/ii	Granular Sub-Base with Coarse Graded Material (Table:- 400- 2) Construction of granular sub-base by providing coarse graded material, spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method with rotavator at OMC, and compacting with vibratory roller to achieve the desired density, complete as per clause 401 For Grading-III Material	Cum	2,230.59
82	04.04	Granular Sub-Base with Naturally Occuring Sand Gravel Material Providing, laying, spreading and compacting granular base/sub-base according to lines, grades and cross sections by using naturally occurred sand gravel/conforming to IRC-Grd-II of MOST specification free from organic or other 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
84	04.06/a	Lime Stabilisation for Improving Subgrade (Laying and spreading available soil in the subgrade on a prepared surface, pulverising, mixing the spread soil in place with rotavator with 3 % slaked lime having minimum content of 70% of CaO, grading with motor grader and compacting with the road roller at OMC to the desired density to form a layer of improved sub grade) By Mechanical Means	Cum	1,652.44

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

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

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

Item Rate Analysis has been done considering

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

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

Sl No	SOR Ref	Item description	Unit	SOR Rate
167	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	5,706.23
171	08.11/v	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm x 45 cm rectangular	each	4,249.15
175	08.11/vi	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm x 60 cm square	each	5,200.94
179	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon	each	8,165.25
183	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign 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	12,223.04
187	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro- reflectorised sign 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 concrete45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,831.40

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

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

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

Item Rate Analysis has been done considering

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

Item Rate Analysis has been done considering

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

LEAD CHART

Leads for Various Materials

Sl. No.	Name of Material	Name of Source	Distance from Source to Project Road (Km)	length of Project Road (Km)	Total Lead (Km)
1	Sand (Fine)	Serou	34	7	41
2	Filling Material	Local	-	-	10
3	Stone Metal	Serou	34	7	41
4	Stone Boulder	Chakpi river	31	7	38
5	Stone Chips, Aggregate	Chakpi river	31	7	38
6	Coarse Sand	Chakpi river	31	7	38
7	Cement	Imphal	70	7	77
8	Steel	Imphal	70	7	77
9	Bitumen	Imphal	70	7	77
10	Bitumen Emulsion	Imphal	70	7	77
11	Structural Steel	Imphal	70	7	77
12	RCC Pipe	Imphal	70	7	77

CARRIAGE COST

Carriage Cost of Material (Including loading & unloading)

Rubbish

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

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

Stone aggregate below 40mm nominal size

Name of Quarries **Serou**
Lead Upto Site (Km)= **40.87**

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
2	40.87	Upto 5	per m^3	5	254.79	254.79
		for Every km beyond 5 km up to 10 km	per m^3	5	25.33	126.65
		for Every km beyond10 km up to 20 km	per m^3	10	20.42	204.20
		for Every km beyond 20 km	per m^3	20.87	16.51	344.62
					Total	**930.26**

Sand

Name of Quarries **Serou**
Lead Upto Site (Km)= **40.87**

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
3	40.87	Upto 5	per m^3	5	254.79	254.79
		for Every km beyond 5 km up to 10 km	per m^3	5	25.33	126.65
		for Every km beyond10 km up to 20 km	per m^3	10	20.42	204.20
		for Every km beyond 20 km	per m^3	20.87	16.51	344.62
					Total	**930.26**

Boulder

Name of Quarries **Chakpi river**
Lead Upto Site (Km)= **37.87**

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
4	37.87	Upto 5	per m^3	5	282.63	282.63
		for Every km beyond 5 km up to 10 km	per m^3	5.00	28.10	140.50
		for Every km beyond10 km up to 20 km	per m^3	10.00	22.65	226.50
		for Every km beyond 20 km	per m^3	17.87	18.31	327.26
					Total	**976.89**

Cement, Steel

Name of Quarries **Imphal**
Lead Upto Site (Km)= **76.87**

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
5	76.87	Upto 5	per Tone	5	182.77	182.77
		for Every km beyond 5 km up to 10 km	per Tone	5	18.17	90.85
		for Every km beyond10 km up to 20 km	per Tone	10	14.65	146.50
		for Every km beyond 20 km	per Tone	56.87	11.84	673.38
					Total	**1093.50**

Bitumen

Name of Quarries **Imphal**
Lead Upto Site (Km)= **76.87**

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
6	76.87	Upto 5	per Tone	5	182.77	182.77
		for Every km beyond 5 km up to 10 km	per Tone	5	18.17	90.85
		for Every km beyond10 km up to 20 km	per Tone	10	14.65	146.50
		for Every km beyond 20 km	per Tone	56.87	11.84	673.38
					Total	**1093.50**

PIPE

300 mm Dia RCC Pipe from Imphal
Lead Upto Site (Km)= **76.87**

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
7	86.50	upto 5	Rm	5	18.73	18.73
		for Every km beyond 5 km up to 10 km	Rm	5	1.86	9.30
		for Every km beyond10 km up to 20 km	Rm	10	1.50	15.00
		for Every km beyond 20 km	Rm	66.5	1.21	80.47
					Total	**123.50**

FINISHED RATE

FINISHER RATE

Road Works

Sl 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	02.03/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

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
5	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
6	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	489.32					0.00	494.21
7	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	264.99					0.00	267.64
8	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	358.77					0.00	362.36
9	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	614.08					0.00	620.22
10	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

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

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
11	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
12	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface	sqm	315.00					0.00	318.15
13	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
14	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

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
15	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
16	03.19	Turfing with Sods Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of sods and watering	sqm	61.87					0.00	62.49
17	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
18	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

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
19	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	2,997.00					1,525.56	4,567.79
					Course Sand	0.380	cum	1,201.23		
					Stone Chips/Aggregate	0.250	cum	1,201.23		
					Stone Metal Cat1	0.640	cum	1,201.23		
20	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
21	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	2,965.34					1,585.62	4,596.47
					Course Sand	0.396	cum	1,201.23		

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

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FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Metal Cat1	0.924	cum	1,201.23		
22	05.03	Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 25 mm thick cement concrete grade M15, over laid with pre-cast concrete tiles in cement mortar including provision of all drainage arrangements but excluding kerb channel.	sqm	1,374.51					309.76	1,701.11
					Cement	0.012	Ton	1,287.83		
					Sand	0.064	cum	1,201.23		
					Stone Chips/Aggregate	0.112	cum	1,201.23		
					Stone Metal Cat1	0.069	cum	1,201.23		
23	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					0.90	59.02
					Bitumen Emulsion	0.001	Ton	1,287.83		
24	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 bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	15.63					0.26	16.05
					Bitumen Emulsion	0.000	Ton	1,287.83		

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

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FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
25	06.02/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					0.32	17.65
					Bitumen Emulsion	0.000	Ton	1,287.83		
26	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					1,879.67	13,275.11
					Aggregate	1.440	cum	1,201.23		
					Bitumen 30/40	0.104	Ton	1,287.83		
					Filler	0.040	Ton	399.23		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
27	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	12,371.00					1,928.39	14,442.38
					Aggregate	1.456	cum	1,201.23		
					Bitumen 30/40	0.130	Ton	1,287.83		
					Filler	0.030	Ton	399.23		
28	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	622.79					129.92	760.24
					Cement	0.016	Ton	1,287.83		
					Course Sand	0.030	cum	1,201.23		
					Stone Chips/Aggregate	0.061	cum	1,201.23		
29	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					779.69	5,389.90
					Cement	0.108	Ton	1,287.83		
					Sand	0.176	cum	1,201.23		
					Steel	0.004	Ton	1,287.83		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.353	cum	1,201.23		
30	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					533.79	3,242.13
					Cement	0.074	Ton	1,287.83		
					Sand	0.121	cum	1,201.23		
					Steel	0.002	Ton	1,287.83		
					Stone Chips/Aggregate	0.242	cum	1,201.23		
31	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design,fixed in position including finishing but excluding painting	each	843.03					2,164.34	3,037.44
					Sand	0.566	cum	1,201.23		
					Steel	0.080	Ton	1,287.83		
					Stone Chips/Aggregate	1.150	cum	1,201.23		
32	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
33	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

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FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
34	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle	each	4,931.35					845.36	5,834.48
					Cement	0.033	Ton	1,287.83		
					Sand	0.540	cum	1,201.23		
					Steel	0.019	Ton	1,287.83		
					Stone Chips/Aggregate	0.108	cum	1,201.23		
35	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular	each	4,440.80					845.36	5,339.02
					Cement	0.033	Ton	1,287.83		
					Sand	0.540	cum	1,201.23		
					Steel	0.019	Ton	1,287.83		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.108	cum	1,201.23		
36	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	5,706.23					845.36	6,617.11
					Cement	0.033	Ton	1,287.83		
					Sand	0.540	cum	1,201.23		
					Steel	0.019	Ton	1,287.83		
					Stone Chips	0.108	cum	1,201.23		
37	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					845.36	9,100.72
					Cement	0.033	Ton	1,287.83		
					Sand	0.540	cum	1,201.23		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Steel	0.019	Ton	1,287.83		
					Stone Chips/Aggregate	0.108	cum	1,201.23		
38	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign asper IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,223.04					290.92	12,639.10
					Cement	0.037	Ton	1,287.83		
					Sand	0.060	cum	1,201.23		
					Steel	0.021	Ton	1,287.83		
					Stone Chips/Aggregate	0.120	cum	1,201.23		
39	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 concrete45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	12,831.40					365.07	13,328.43

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

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Cement	0.044	Ton	1,287.83		
					Sand	0.072	cum	1,201.23		
					Steel	0.038	Ton	1,287.83		
					Stone Chips/Aggregate	0.144	cum	1,201.23		
40	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
41	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) 120x120 -Road Delineator	each	1,063.19					0.00	1,073.82

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

FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
42	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
43	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 morter, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	383.64					0.00	387.48
44	08.22	Lighting on BridgesProviding & 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

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FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
45	08/nsc/2	Convex Mirror For Blind Curve	nos	5,000.00					0.00	5,050.00
46	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	1,287.83	1,352.22	186,864.36
47	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign	sqm	695.00					0.00	701.95

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

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

Sl 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/5	Reinforced Cement Concrete Crash Barrier-Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-40 grade concrete with HYSD reinforcement conforming to IRC:21 and dowel bars 25 mm dia, 450 mm long at expansion joints filled with pre-moulded asphalt filler board, keyed to the structure on which it is built and installed as per design given in the enclosure to MOST circular No. RW/NH - 33022/1/94-DO III dated 24 June 1994 as per dimensions in the approved drawing and at locations directed by the Engineer, all as specified	m	6,927.00					0.00	6,996.27
49	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 formrvork. At Protection	cum	7,496.35					1,986.58	9,577.76
					Aggregate	0.850	cum	1,201.23		
					Cement	0.330	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
50	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					1,352.22	75,079.17
					Steel	1.050	Ton	1,287.83		
51	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					1,352.22	75,079.17

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

Item Rate Analysis has been done considering

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Steel	1.050	Ton	1,287.83		
52	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3	sqm	223.49					0.00	225.72
53	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					1,441.48	2,641.95
					Stone Chips/Aggregate	1.200	cum	1,201.23		
54	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					1,441.48	2,624.75
					Stone Chips/Aggregate	1.200	cum	1,201.23		
55	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 formrvork.	cum	7,496.35					1,986.58	9,577.76
					Aggregate	0.850	cum	1,201.23		
					Cement	0.330	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
56	24/i/b	Galvanised Mild steel J /L hook	kg	120.00					0.00	121.20

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

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
57	40	Gextextile material (fine net)	sqm	25.50					0.00	25.76

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

Item Rate Analysis has been done considering

FINISHER RATE

Minor Bridge

Sl 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/Nsc	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/a/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth 3 m to 6 m	cum	294.28					0.00	297.22
4	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
5	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	1,007.86					1,441.48	2,473.83

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

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FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	1.200	cum	1,201.23		
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					1,441.48	2,079.09
					Sand	1.200	cum	1,201.23		
7	13.04	Filter medium behind abutment,wing wall and return wall complete as per drawing and technical specification .	cum	1,274.65					1,441.48	2,743.29
					Stone Chips/Aggregate	1.200	cum	1,201.23		
8	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications	cum	11,849.87					0.00	11,968.37
9	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	6,306.36					1,972.73	8,361.88
					Cement	0.170	Ton	1,287.83		
					Sand	0.300	cum	1,201.23		
					Stone Metal Cat1	1.160	cum	1,201.23		
10	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	8,348.21					1,986.58	10,438.14
					Aggregate	0.850	cum	1,201.23		
					Cement	0.330	Ton	1,287.83		

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FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Sand	0.450	cum	1,201.23		
11	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					2,111.04	11,559.24
					Aggregate	0.900	cum	1,201.23		
					Cement	0.380	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
12	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	9,077.25					2,149.67	11,339.19
					Aggregate	0.900	cum	1,201.23		
					Cement	0.410	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
13	14.03/g	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M30 Grade	cum	10,966.06					2,129.11	13,226.12
					Aggregate	0.860	cum	1,201.23		
					Cement	0.450	Ton	1,287.83		
					Sand	0.430	cum	1,201.23		
14	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	77,427.65					1,352.22	79,567.67
					Steel	1.050	Ton	1,287.83		

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FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
15	14/nsc1/i	Filler joint i)Providing & fixing 2 mm thick corrugated copper plate in expansion joint complete as per drawing & Technical Specification.	m	2,060.00					0.00	2,080.60
16	14/nsc1/ii	Filler joint Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification.	m	698.00					0.00	704.98
17	14/nsc1/iii	Filler joint iii)Providing and fixing in position 20 mm thick premoulded joint filler in expansion joint for fixed ends of simply supported spans not exceeding 10 m to cater for a horizontal movement upto 20 mm, covered with sealant complete as per drawing and technical specifications.	m	223.00					0.00	225.23
18	14/nsc1/iv	Filler joint iv)Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6 per cent bitumen by weight.	m	36.00					0.00	36.36
19	14/nsc2	Brick Flat Soling at Foundation	Sqm	1,077.89	Brick	1.000	Sqm	40.00	40.00	1,129.07

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

Item Rate Analysis has been done considering

FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
20	15.01	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications	cum	11,961.59					0.00	12,081.21
21	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					1,972.73	8,848.19
					Cement	0.170	Ton	1,287.83		
					Sand	0.300	cum	1,201.23		
					Stone Metal Cat1	1.160	cum	1,201.23		
22	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m	cum	9,067.33					2,064.67	11,243.32
					Cement	0.344	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
					Stone Chips/Aggregate	0.900	cum	1,201.23		
23	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	9,938.25					2,140.66	12,199.70
					Cement	0.403	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.900	cum	1,201.23		
24	15.03/g/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade upto 5m height	cum	11,786.08					2,145.81	14,071.21
					Aggregate	0.900	cum	1,201.23		
					Cement	0.407	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
25	15.03/g/ii	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade Between 5 to 10 m height	cum	12,921.64					2,145.81	15,218.12
					Aggregate	0.900	cum	1,201.23		
					Cement	0.407	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
26	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	77,427.65					1,352.22	79,567.67
					Steel	1.050	Ton	1,287.83		
27	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	445.75					3.32	453.56
					Cement	0.001	Ton	1,287.83		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Sand	0.002	cum	1,201.23		
28	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	10,446.36					2,139.19	12,711.41
					Cement	0.400	Ton	1,287.83		
					Course Sand	0.452	cum	1,201.23		
					Stone Chips/Aggregate	0.900	cum	1,201.23		
29	16.01/b/i/c 2/ii	RCC Grade M30 For solid slab super-structure Approach Slab	cum	13,287.15					0.00	13,420.02
30	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	85,183.86					1,352.22	87,401.44
					Steel	1.050	Ton	1,287.83		
31	16.05	Cement concrete wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications	cum	18,782.51					2,129.11	21,120.74
					Aggregate	0.860	cum	1,201.23		
					Cement	0.450	Ton	1,287.83		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Course Sand	0.430	cum	1,201.23		
32	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	2,711.68					206.85	2,947.72
					Cement	0.035	Ton	1,287.83		
					Sand	0.039	cum	1,201.23		
					Steel	0.018	Ton	1,287.83		
					Stone Chips/Aggregate	0.077	cum	1,201.23		
33	16.11	Drainage Spouts complete as per drawing and Technical specification	each	2,158.99					5.15	2,185.78
					Structural Steel	0.004	Ton	1,287.83		
34	16.12/Nsc	Reinforced cement concrete approach slab M-30 including reinforcement and formwork complete as per drawing and Technical specification	cum	15,325.00					3,489.01	19,002.15
					Aggregate	0.900	cum	1,201.23		
					Cement	0.400	Ton	1,287.83		
					Course Sand	0.450	cum	1,201.23		
					Steel	1.050	Ton	1,287.83		
35	16.13	PCC M15 ordinary Grade leveling course below approach slab complete as per drawing and Technical specification Below Approach Slab	cum	8,109.93					1,976.20	10,186.99
					Cement	0.275	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.900	cum	1,201.23		
36	16.16	Providing single gap(unitary) strip/seal type of expansion joint of movement capacity of 80 mm with fatigue tested structure section at the nosing and ancourage assembly complete as per approved drawing and standard specification to be installed under supervision of a specialist manufacture	Rm	41,863.77					0.00	42,282.41
37	16.17	Mastic asphalt (providing and laying 12mm thik mastic asphalt wearing coures on top of deck slab excluding prime coat with paving grade bitumem meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	532.56					21.82	559.92
					Bitumen	0.003	Ton	1,287.83		
					Lime	0.005	Ton	399.23		
					Stone Chips/Aggregate	0.014	cum	1,201.23		

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
38	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					2,064.67	11,243.32
					Cement	0.344	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
					Stone Chips/Aggregate	0.900	cum	1,201.23		
39	17.01/a	laying apron complete as per drawing and Technical specification. Boulder	cum	2,280.25					1,532.89	3,851.27
					Stone Bolder	1.200	cum	1,277.41		
40	17.01/c	laying apron complete as per drawing and Technical specification. Cement concrete block (M-15grade) (Filter Blanket+Toe Wall)	cum	8,348.21					2,029.94	10,481.93
					Aggregate	0.275	cum	1,201.23		
					Cement	0.900	Ton	1,287.83		
					Sand	0.450	cum	1,201.23		
41	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	2,426.95					1,441.48	3,907.11
					Aggregate	1.200	cum	1,201.23		
42	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	1,655.65					1,532.89	3,220.43

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

Item Rate Analysis has been done considering *Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)*

FINISHER RATE

Minor Bridge

Sl No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Bolder	1.200	cum	1,277.41		
43	17/nsc1	Flexible Apron - Construction of flexible apron 750mm thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall.	cum	1,638.00					1,532.89	3,202.60
					Stone Bolder	1.200	cum	1,277.41		

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

Item Rate Analysis has been done considering

NON SCHEDULE ITEM

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

CHAPTER - 3							
EARTH WORK, EROSION CONTROL AND DRAINAGE							
Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs
3.12	305		**Construction of Embankment with Material obtained from Borrowpits**				
			Construction of embankment with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2.	cum		226.26	----------i
3.13	305		**Construction of Embankment with Material Deposited from Roadway Cutting**				
			Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2.	cum		160.20	----------ii
			So, Cost of Material obtained from Borrow Pit is Rs. =			66.06	----------(iii=i-ii)
3.14	305		**Construction of Subgrade and Earthen Shoulders**				
			Construction of sub-grade and earthen shoulders with approved material obtained from borrow pits with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum		312.34	----------iv
			So,				
			Construction of Subgrade and Earthen Shoulders				
			Construction of embankment with approved material obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2.	cum		246.28	--------(v=iv-iii)

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

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

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

Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
14.18	**2605**		**Filler joint**					
		(i)	**Providing & fixing 2 mm thick corrugated copper plate in expansion joint complete as per drawing & Technical Specification.**					
			Unit = Running meter					
			Taking output = 12 m					
			a) Labour					
			Cutting, bending, carrying & fixing etc.					
			Mate	day	0.04	550.00	22.00	L-12
			Mazdoor	day	0.50	400.00	200.00	L-13
			Mazdoor (Skilled)	day	0.50	450.00	225.00	L-15
			b) Material					
			Copper plate - 12m long x 250 mm wide	kg	55.00	325.45	17899.75	M-086
			Area = 12 x 0.25 = 3 sqm					
			Weight = 3 x 0.002 x 8900 = 53.4 kg					
			Wastage @ 2.5 per cent = 1.33 kg/54.73 kg say = 55 kg.					
			c) Overhead charges @ 0.25 on (a+b)				4586.69	
			d) Contractor's profit @ 0.1 on (a+b+c)				2293.34	
			Cost for 12 m = (a+b+c+d)				25226.78	
			Rate per m = (a+b+c+d)/12				2102.23	
						say	***2102.00***	
							2102.00	
14.18		**(ii)**	**Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification.**					
			Unit = Running meter					
			Taking output = 12 m					
			a) Labour					
			For carrying, placing & fixing.					
			Mate	day	0.01	550.00	4.40	L-12
			Mazdoor	day	0.10	400.00	40.00	L-13
			Mazdoor (Skilled)	day	0.10	450.00	45.00	L-15
			b) Material					
			20 mm thick compressible fibre board 12 m long x 25 cm deep.	sqm	3.00	2042.05	6126.15	M-084
			Area = 12 x 0.25 = 3 sqm					
			c) Overhead charges @ 0.25 on (a+b)				1553.89	
			d) Contractor's profit @ 0.1 on (a+b+c)				776.94	
			Cost for 12 m = (a+b+c+d)				8546.38	
			Rate per m = (a+b+c+d)/12				712.20	
						say	***712.00***	
							712.00	
14.18		**(iii)**	**Providing and fixing in position 20 mm thick premoulded joint filler in expansion joint for fixed ends of simply supported spans not exceeding 10 m to cater for a horizontal movement upto 20 mm, covered with sealant complete as per drawing and technical specifications.**					
			Unit = Running meter					
			Taking output = 12 m					
			a) Labour					
			Mate	day	0.01	550.00	5.50	L-12
			Mazdoor	day	0.20	400.00	80.00	L-13
			Mazdoor (Skilled)	day	0.10	450.00	45.00	L-15
			b) Material					
			Premoulded joint filler 12 m long,20 mm thick and 300 mm deep.	sqm	3.60	516.12	1858.03	M-141
			c) Overhead charges @ 0.25 on (a+b)				497.13	
			d) Contractor's profit @ 0.1 on (a+b+c)				248.57	
			Cost for 12 m = (a+b+c+d)				2734.23	
			Rate per m = (a+b+c+d)/12				227.85	
						say	***228.00***	
							228.00	

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

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

Flexible Apron

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

Approach Slab

Sr No	Ref. to MoRTH Spec.		Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks / Input ref.
14.11	**1500,1600,1700 & 2704**		**Reinforced cement concrete approach slab including reinforcement and formwork complete as per drawing and Technical specification**					
			Unit = 1 cum					
			Taking output = 1 cum					
			a) Material					
			Cement concreteM30 Grade Refer relevant item of concrete in item 12.8(G)by using batching plant, excluding formwork i.e. per cum basic cost (a+b+c) (Excluding OH & CP)	cum	1.00	8235.60	8235.60	Item 12.8 (G)
			(Refer relevant item of concrete in item No. 13.8 (G) except that form work may be added at the rate of 2 per cent of cost against 3.5 per cent provided in the foundation concrete.				164.71	
			HYSD bar reinforcement Rate as per item No 14.2(Excluding OH & CP)	tonne	0.05	59458.22	2972.91	Item 14.2 A
			b) Overhead charges @ 22.5%on (a)				2558.97	
			c) Contractor's profit @ 10% on(a+b)				1393.22	
			Rate per cum (a+b+c)				15325.42	
						say	***15325.00***	
							15325.00	

BASES AND SURFACE COURSES (BITUMINOUS VG-40)								
Sr No	**Ref. to MoRTH Spec.**		**Description**	**Unit**	**Quantity**	**Rate Rs**	**Cost Rs**	**Remarks/ Input ref.**
5.6	**507**		**Dense Graded Bituminous Macadam**					
			Providing and laying dense graded bituminous macadam with 100-120 TPH batch type HMP producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.0 to 4.5 per cent by weight of total mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in					
			Unit = cum					
			Taking output = 195 cum (450 tonnes)					
			a) Labour					
			Mate	day	0.840	550.00	462.00	L-12
			Mazdoor working with HMP, mechanical broom, paver, roller, asphalt cutter and assistance for setting out lines, levels and layout of construction	day	16.000	400.00	6400.00	L-13
			Skilled mazdoor for checking line & levels	day	5.000	450.00	2250.00	L-15
			b) Machinery					
			Batch mix HMP @ 75 tonne per hour	hour	6.000	49595.33	297572.00	P&M-022
			Paver finisher hydrostatic with sensor control @ 75 cum per hour	hour	6.000	6852.67	41116.00	P&M-034
			Generator 250 KVA	hour	6.000	3441.41	20648.44	P&M-081
			Front end loader 1 cum bucket capacity	hour	6.000	1755.33	10532.00	P&M-017
			Tipper 10 tonne capacity	tonne.km	450 x L	547.69	246459.54	Lead =1 km & P&M-058
			Add 10 per cent of cost of carriage to cover cost of loading and unloading				24645.95	
			smooth wheeled roller 8-10 tonnes for initial break down rolling.	hour	6.00x0.65*	1072.88	4184.25	P&M-044
			Vibratory roller 8 tonnes for intermediate rolling.	hour	6.00x0.65*	1743.33	6799.00	P&M-059
			Finish rolling with 6-8 tonnes smooth wheeled tandem roller.	hour	6.00x0.65*	1191.66	4647.47	P&M-045

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

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

5.8	**509**		**Bituminous Concrete**					
			Providing and laying bituminous concrete with 100-120 TPH batch type hot mix plant producing an average output of 75 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.4 to 5.6 per cent of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all					
			Unit = cum					
			Taking output = 191 cum (450 tonnes)					
			a) Labour					
			Mate	day	0.840	550.00	462.00	L-12
			Mazdoor working with HMP, mechanical broom, paver, roller, asphalt cutter and assistance for setting out lines, levels and layout of construction	day	16.000	400.00	6400.00	L-13
			Skilled mazdoor for checking line & levels	day	5.000	450.00	2250.00	L-15
			b) Machinery					
			Batch mix HMP @ 75 tonne per hour	hour	6.000	49595.33	297572.00	P&M-022
			Paver finisher hydrostatic with sensor control @ 75 cum per hour	hour	6.000	6852.67	41116.00	P&M-034
			Generator 250 KVA	hour	6.000	3441.41	20648.44	P&M-081
			Front end loader 1 cum bucket capacity	hour	6.000	1755.33	10532.00	P&M-017
			Tipper 10 tonne capacity	tonne.km	450 x L	547.69	246459.54	Lead =1 km & P&M-058
			Add 10 per cent of cost of carriage to cover cost of loading and unloading				24645.95	
			Smooth wheeled roller 8-10 tonnes for initial break down rolling.	hour	6.00x0.65*	1072.88	4184.25	P&M-044
			Vibratory roller 8 tonnes for intermediate rolling.	hour	6.00x0.65*	1743.33	6799.00	P&M-059
			Finish rolling with 6-8 tonnes smooth wheeled tandem roller.	hour	6.00x0.65*	1191.66	4647.47	P&M-045
			c) Material					
			i) Bitumen@ 5 per cent of weight of mix	tonne	22.500	42361.44	953132.40	M-074
			ii) Aggregate					
			Total weight of mix = 450 tonnes					
			Weight of bitumen = 22.5 tonnes					
			Weight of aggregate = 450 -22.50 = 427.50 tonnes					
			Taking density of aggregate = 1.5 ton/cum					
			Volume of aggregate = 285 cum					
			Grading - I (19 mm Nominal Size)					
			20 - 10 mm 35 per cent	cum	99.750	1399.51	139601.46	M-045
			10 - 5 mm 23 per cent	cum	65.550	1224.55	80269.25	M-040
			5 mm and below 40 per cent	cum	114.000	1174.20	133858.80	M-030
			Filler @ 2 per cent of weight of aggregates.	tonne	8.620	2653.22	22870.79	M-188
			or					
			Grading - II (13 mm Nominal Size)					
			13.2 - 10 mm30 per cent	cum	85.500	1358.50	116151.75	M-044
			10 - 5 mm 25 per cent	cum	71.250	1224.55	87249.19	M-040
			5 mm and below 43 per cent	cum	122.550	1174.20	143898.21	M-030
			Filler @ 2 per cent of weight of aggregates.	tonne	8.620	2653.22	22870.79	M-188
			***Any one of the alternative may be adopted as per approved design**					

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

CHAPTER-9

PIPE CULVERTS

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

CHAPTER - 4

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

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

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

VOLUME VII

COST ESTIMATE

ABSTRACT OF COST

Road name- Churachandpur -Tuivai road section on NH-102B in the State of Manipur on EPC Mode (PKG - I-B) (13.747 km to 32.825 km)

GENERAL ABSTRACT OF COST

Length of Road (KM) : 19.088

DESCRIPTION OF WORKS				
A.	**ROAD WORKS**	**TOTAL COST (IN LAKHS.)**	**COST PER KM. OF TOTAL ROAD LENGTH (IN cr.)**	**% of Cost of Civil Works (% of C)**
1	Site Clearance and Dismantling	0.68	0.04	0.44%
2	Earth work ,Subgrade and Erosion control	19.85	1.04	12.78%
3	Sub-Base & Base	45.40	2.38	29.22%
4	Bituminous Courses	22.66	1.19	14.59%
5	Junction Improvement (Major & Minor)	0.80	0.04	0.51%
6	Traffic signs, Road marking & other road appurtenances	3.46	0.18	2.23%
7	Passenger Shelter	0.29	0.02	0.19%
8	Busbay	2.22	0.12	1.43%
	Drainage and Protective Works			
9	Longitudinal Drains	14.65	0.77	9.43%
10	Retaining wall	10.67	0.56	6.87%
11	Breast wall	10.12	0.53	6.51%
12	Toe Wall	0.91	0.05	0.59%
B.	**BRIDGES & CULVERTS**			
13	Culvert	14.97	0.78	9.64%
14	Minor Bridges	8.67	0.45	5.58%
15	Repairing & Rehabilitation of Minor Bridges	0.00	0.00	0.00%
C.	**COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)**	**155.35**	**8.14**	
D.	Maintenance for 5 years, i.e 2.5% on civil cost (C)	3.88		
E.	GST @ 12% of (C)	18.64		
F.	Contingencies @ 2.8% over Civil Cost (C)	4.35		
G.	Supervision Charges @ 3% of (C)	4.66		
H.	Agency Charges @3% of (C)	4.66		
I.	Escalation Cost @ 10% during Construction Period	15.54		
J.	**TOTAL CONSTRUCTION COST * (C+D+E+F+G+H+I)=J**	**207.08**	**10.85**	
K.	**DEPARTMENTAL COST**			
a.	LA Cost	15.82		
b.	R&R Cost	1.54		
c.	Utility Shifting(Electrical+PHE)	1.55		
d.	Environmental Budget +FC Clearance	15.54		
L.	**Sub Total (K)**	**34.45**		
M.	**TOTAL PROJECT COST (K+L)=M**	**241.53**	**12.65**	

BILL

(ROAD PART)

Summary of Bill of Quantity

Bill No : 01. Site Clearance and Dismantling

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	02.01/i	Cutting of Girth 300-600mm	Each	150.00	392.30	58,845
2	02.01/ii	Cutting of Girth 600-900mm	Each	13.00	723.48	9,405
3	02.01/iii	Cutting of Girth 900-1800mm	Each	1.00	1,373.64	1,374
4	02.03/b	Clearing & grubbing of road by Mechanical means in Light Jungle	Ha	13.99	59,912.85	838,181
5	02.04/i/c	Dismantling Structure RCC	cum	212.00	1,756.40	372,357
6	02.04/iii/b	Dismantling Structure Rubble Stone Masonry Cement Morter	Cum	1,259.00	494.21	622,210
7	02.04/vii/a	Dismantle HP (300-600)	rm	9.00	267.64	2,409
8	02.04/vii/b	Dismantle HP (upto 600 - 900 mm dia)	rm	19.00	362.36	6,885
9	02.04/vii/c	Dismantle HP (above 900 mm dia)	rm	31.00	620.22	19,227
10	02.04/viii/e	Dismantle Flexible Pavement Granular	sqm	68,589.00	34.33	2,354,660
11	02.04/viii/f/ii	Dismantle Flexible Pavement Bituminous(Roller & Scarifier)	sqm	42,818.00	57.65	2,468,458
					Total of Bill	**6,754,010**

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	02/nsc/1	Hydro Seeding On Cutting Surface	sqm	24,418.00	318.15	7,768,587
2	03.13	Embankment fill from Roadway Cutting	cum	205,316.00	161.80	33,220,129
3	03.14/Nsc	Subgrade and Earthen Shoulder Fill From Roadway Cutting	cum	88,916.66	248.74	22,117,129
4	03.15	Compacting original ground supporting sub-grade	cum	30,393.06	87.52	2,660,001
5	03.19	Turfing	sqm	16,509.00	62.49	1,031,647
6	03.31	Excavation in Hill in Soil For Roadway	cum	453,501.60	213.50	96,822,592
7	03.32	Excavation for Roadway Ordinary Rock Mechanical (Without Blasting)	cum	113,375.40	307.61	34,875,407
					Total of Bill	**198,495,491**

Bill No : 03. Sub-Base & Base Courses

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	04.01/Nsc1	GSB Close Graded GR V	Cum	57,517.60	4,567.79	262,728,327
2	04/nsc1	GSB Reuse	Cum	9,012.25	2,083.63	18,778,190
3	05.02	WMM	Cum	37,536.88	4,596.47	172,537,129
					Total of Bill	**454,043,647**

Item Rate Analysis has been done considering Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

Summary of Bill of Quantity

Bill No : 04. Bituminous Courses

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	06.01/a	Prime Coat	sqm	143,078.00	59.02	8,444,464
2	06.02/i	Tack Coat(Bituminous Layer)	sqm	11,114.00	16.05	178,380
3	06.02/ii	Tack Coat(Granular Layer)	sqm	131,964.00	17.65	2,329,165
4	06/Nsc1	DBM GR II	cum	10,015.46	13,275.11	132,956,333
5	06/Nsc2	BC GR II	cum	5,723.12	14,442.38	82,655,474
					Total of Bill	**226,563,815**

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	03.13	Embankment fill from Roadway Cutting	cum	132.88	161.80	21,500
2	04.01/Nsc1	GSB Close Graded GR V	Cum	389.33	4,567.79	1,778,382
3	04/nsc1	GSB Reuse	Cum	40.87	2,083.63	85,156
4	05.02	WMM	Cum	537.75	4,596.47	2,471,752
5	06.01/a	Prime Coat	sqm	2,151.00	59.02	126,952
6	06.02/i	Tack Coat(Bituminous Layer)	sqm	2,151.00	16.05	34,524
7	06/Nsc1	DBM GR II	cum	150.57	13,275.11	1,998,833
8	06/Nsc2	BC GR II	cum	86.04	14,442.38	1,242,622
9	08.01	Precast Concrete Kerb(M20) fix at site	rm	270.29	760.24	205,485
10	08.14	Paint on Bituminous Surface	sqm	7.00	1,012.16	7,085
					Total of Bill	**7,972,292**

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	08.02/a	5 th km Stone	each	4.00	5,389.90	21,560
2	08.02/b	Ordinary km Stone	each	16.00	3,242.13	51,874
3	08.04	Boundary Stone	each	193.00	3,037.44	586,226
4	08.06	Paint on Steel Surface	sqm	36.00	85.91	3,093
5	08.11/i	90 cm equilateral triangle	each	339.00	5,834.48	1,977,889
6	08.11/iii	60 cm circular	each	5.00	5,339.02	26,695
7	08.11/iv	80 cm x 60 cm rectangular	each	16.00	6,617.11	105,874
8	08.11/vii	90 cm high octagon	each	8.00	9,100.72	72,806
9	08.12	Direction Sign(<.0.9 sqm)	sqm	16.20	12,639.10	204,753

Summary of Bill of Quantity

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
10	08.13	Direction Sign(>.0.9 sqm)	sqm	9.00	13,328.43	119,956
11	08.14	Paint on Bituminous Surface	sqm	6,288.60	1,012.16	6,365,068
12	08.15/c/v	Road Delineators(100 cm long above Road)	each	1,608.00	1,073.82	1,726,703
13	08.18/A/b	Type-A, "W" Metal Beam Crash Barrier	Rm	3,692.00	3,367.42	12,432,515
14	08.20/ii	Road Stud/Road Markers	nos	9,570.00	387.48	3,708,184
15	08.22	Lighting on Bridges	nos	309.00	21,376.67	6,605,391
16	08/nsc/2	Convex Mirror for Blind Curve	nos	30.00	5,050.00	151,500
17	08/nsc/4/a	Overhead Signs-Truss and Vertical Support	Ton	1.04	186,864.36	195,086
18	08/nsc/4/b	Overhead Signs-Aluminium Alloy Plate for Over Head Sign	sqm	36.00	701.95	25,270
19	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	26.24	221.12	5,803
20	14.03/a	Foundation PCC M15	cum	0.97	10,438.14	10,104
21	14.03/e/II	Foundation RCC M25	cum	5.70	11,339.19	64,679
22	14.08	Foundation Steel (HYSD)	MT	0.86	79,567.67	68,110
23	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	2.00	12,199.70	24,399
24	15.05	Sub Structure Steel (HYSD)	MT	0.30	79,567.67	23,870
					Total of Bill	**34,577,407**

Bill No : 07. Passenger Shelter

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	08.05	Paint on Concrete Surface(2 Coat)	sqm	924.95	94.34	87,259
2	10.16	Sub Structure Plaster with 1:3 Cement Morter	sqm	924.95	225.72	208,779
3	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	138.72	221.12	30,673
4	14.01	Foundation Brick Work C.M. 1:3	cum	21.26	11,968.37	254,483
5	14.03/a	Foundation PCC M15	cum	14.09	10,438.14	147,053
6	14.03/e/II	Foundation RCC M25	cum	9.71	11,339.19	110,138
7	14.08	Foundation Steel (HYSD)	MT	1.17	79,567.67	92,776
8	14/nsc2	Brick Flat Soling	Sqm	188.13	1,129.07	212,406
9	15.01	Sub Structure Brick Work	cum	45.34	12,081.21	547,798
10	16.01/a/i	Super Structure RCC M25 - Solid Slab Super Structure(Upto 5m)	cum	58.12	12,711.41	738,800
11	16.03	Super Structure Steel(HYSD)	MT	5.81	87,401.44	507,977
					Total of Bill	**2,938,142**

Item Rate Analysis has been done considering Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

Summary of Bill of Quantity

Bill No : 08. Bus Bay

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	03.14/Nsc	Subgrade and Earthen Shoulder Fill From Roadway Cutting	cum	2,478.00	248.74	616,378
2	04.01/Nsc1	GSB Close Graded GR V	Cum	897.04	4,567.79	4,097,472
3	04/nsc1	GSB Reuse	Cum	94.16	2,083.63	196,203
4	05.02	WMM	Cum	1,239.00	4,596.47	5,695,026
5	05.03	Foothpath Area	sqm	2,065.00	1,701.11	3,512,792
6	06.01/a	Prime Coat	sqm	4,956.00	59.02	292,503
7	06.02/i	Tack Coat(Bituminous Layer)	sqm	4,956.00	16.05	79,544
8	06/Nsc1	DBM GR II	cum	346.92	13,275.11	4,605,401
9	06/Nsc2	BC GR II	cum	198.24	14,442.38	2,863,057
10	08.14	Paint on Bituminous Surface	sqm	210.00	1,012.16	212,554
					Total of Bill	**22,170,930**

Bill No : 09. Longitudinal Drains

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	29,323.95	221.12	6,484,112
2	14.02/b	Foundation Random Rubble Masonry (coursed/uncoursed) Cement Morter(1:3)	cum	11,157.87	8,361.88	93,300,770
3	14.03/a	Foundation PCC M15	cum	433.68	10,438.14	4,526,813
4	15.02/b	Sub Structure Random Rubble Masonry Cement Morter(1:3)	cum	1,238.92	8,848.19	10,962,182
5	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	1,879.28	12,199.70	22,926,652
6	15.05	Sub Structure Steel (HYSD)	MT	93.96	79,567.67	7,476,497
7	15.12	Sub Structure Weepholes per Meter	Rm	1,808.00	453.56	820,036
8	24/i/b	MS Hook(300gm each)	kg	289.12	121.20	35,041
9	40	Geotextile filter(75mm sqm)	sqm	325.26	25.76	8,379
					Total of Bill	**146,540,482**

Bill No : 10. Retaining wall

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	4,960.57	221.12	1,096,881
2	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	1,108.17	211.31	234,168
3	13.04	Sub Structure Filter Media	cum	4,722.00	2,743.29	12,953,824

Summary of Bill of Quantity

Bill No : 10. Retaining wall

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
4	14.02/b	Foundation Random Rubble Masonry (	cum	2,872.19	8,361.88	24,016,900
5	14.03/a	coursed/uncoursed) Cement Morter(1:3) Foundation PCC M15	cum	1,487.98	10,438.14	15,531,702
6	15.02/b	Sub Structure Random Rubble Masonry Cement	cum	5,561.53	8,848.19	49,209,439
7	15.12	Morter(1:3) Sub Structure Weepholes per Meter	Rm	8,070.00	453.56	3,660,229
					Total of Bill	**106,703,142**

Bill No : 11. Breast wall

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	8,872.77	221.12	1,961,948
2	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	2,218.19	211.31	468,727
3	13.03/a	Sub Structure Backfill Granular Material	cum	961.38	2,473.83	2,378,291
4	13.03/b	Sub Structure Backfill Sandy Material	cum	412.02	2,079.09	856,627
5	14.02/b	Foundation Random Rubble Masonry (	cum	4,179.53	8,361.88	34,948,737
6	14.03/a	coursed/uncoursed) Cement Morter(1:3) Foundation PCC M15	cum	2,014.32	10,438.14	21,025,754
7	15.02/b	Sub Structure Random Rubble Masonry Cement	cum	4,349.10	8,848.19	38,481,663
8	15.12	Morter(1:3) Sub Structure Weepholes per Meter	Rm	2,441.60	453.56	1,107,412
					Total of Bill	**101,229,158**

Bill No : 12. Toe Wall

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	610.47	221.12	134,987
2	14.03/a	Foundation PCC M15	cum	87.21	10,438.14	910,310
3	14.03/b	Foundation PCC M20	cum	358.02	11,559.24	4,138,439
4	15.03/b/i	Sub Structure PCC M20	cum	344.25	11,243.32	3,870,513
					Total of Bill	**9,054,249**

Bill No : 01. Site Clearance and Dismantling

Sl 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	150.00	392.30	58,845.00
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	13.00	723.48	9,405.24
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	1.00	1373.64	1,373.64
4	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	13.99	59912.85	838,180.77
5	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	212.00	1756.40	372,356.80
6	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	1,259.00	494.21	622,210.39

Bill No : 01. Site Clearance and Dismantling

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	02.04/vii /a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	9.00	267.64	2,408.76
8	02.04/vii /b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	19.00	362.36	6,884.84
9	02.04/vii /c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	31.00	620.22	19,226.82
10	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	68,589.00	34.33	2,354,660.37
11	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	42,818.00	57.65	2,468,457.70
		Total of Bill 01. Site Clearance and Dismantling				**6,754,010.33**

Item Rate Analysis has been done considering

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface	sqm	24,418.00	318.15	7,768,586.70
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	205,316.00	161.80	33,220,128.80
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	88,916.66	248.74	22,117,128.76
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	30,393.06	87.52	2,660,000.70
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	16,509.00	62.49	1,031,647.41
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	453,501.60	213.50	96,822,591.60

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

Sl 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	113,375.40	307.61	34,875,406.79
		Total of Bill 02. Earth work,Subgrade and Erosion control				**198,495,490.77**

Bill No : 03. Sub-Base & Base Courses

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Nsc1	Sub-base with Close Graded Material (Table:-400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	57,517.60	4567.79	262,728,327.24
2	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401	Cum	9,012.25	2083.63	18,778,190.30
3	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	37,536.88	4596.47	172,537,129.02
		Total of Bill 03. Sub-Base & Base Courses				**454,043,646.56**

Bill No : 04. Bituminous Courses

Sl 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	143,078.00	59.02	8,444,463.56
2	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	11,114.00	16.05	178,379.70
3	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	131,964.00	17.65	2,329,164.60
4	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	10,015.46	13275.11	132,956,333.20

Bill No : 04. Bituminous Courses

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	5,723.12	14442.38	82,655,473.83
		Total of Bill 04. Bituminous Courses				**226,563,814.89**

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2	cum	132.88	161.80	21,500.15
2	04.01/Nsc1	Sub-base with Close Graded Material (Table:-400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	389.33	4567.79	1,778,382.25
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	40.87	2083.63	85,155.87
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	537.75	4596.47	2,471,751.74

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	2,151.00	59.02	126,952.02
6	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 bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	2,151.00	16.05	34,523.55
7	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	150.57	13275.11	1,998,833.31

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
8	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	86.04	14442.38	1,242,622.38
9	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	270.29	760.24	205,485.27
10	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	7.00	1012.16	7,085.12
		Total of Bill 05. Junction Improvement (Major & Minor)				**7,972,291.66**

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

Sl 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	4.00	5389.90	21,559.60
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	16.00	3242.13	51,874.08
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design,fixed in position including finishing but excluding painting	each	193.00	3037.44	586,225.92
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	339.00	5834.48	1,977,888.72

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

Sl 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	5.00	5339.02	26,695.10
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	16.00	6617.11	105,873.76
8	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon	each	8.00	9100.72	72,805.76

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign asper IRC:67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing)	sqm	16.20	12639.10	204,753.42
10	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro- reflectorised sign asper IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	9.00	13328.43	119,955.87
11	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	6,288.60	1012.16	6,365,068.36

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
12	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) 120x120 -Road Delineator	each	1,608.00	1073.82	1,726,702.56
13	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m	Rm	3,692.00	3367.42	12,432,514.64
14	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy morter, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	9,570.00	387.48	3,708,183.60
15	08.22	Lighting on BridgesProviding & 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	309.00	21376.67	6,605,391.03

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
16	08/nsc/2	Convex Mirror For Blind Curve	nos	30.00	5050.00	151,500.00
17	08/nsc/4 /a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.	Ton	1.04	186864.36	195,086.39
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	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
20	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	10438.14	10,104.12

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
21	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.70	11339.19	64,678.74
22	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.86	79567.67	68,109.93
23	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	12199.70	24,399.40
24	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	0.30	79567.67	23,870.30
		Total of Bill 06. Traffic signs, Road marking & other road appurtenances				**34,577,407.33**

Bill No : 07. Passenger Shelter

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	924.95	94.34	87,259.31
2	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3	sqm	924.95	225.72	208,778.59
3	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	138.72	221.12	30,672.88
4	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications	cum	21.26	11968.37	254,483.45
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	14.09	10438.14	147,052.52
6	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	9.71	11339.19	110,137.55
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	1.17	79567.67	92,775.90
8	14/nsc2	Brick Flat Soling at Foundation	Sqm	188.13	1129.07	212,406.29
9	15.01	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications				

Bill No : 07. Passenger Shelter

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	45.34	12081.21	547,798.31
10	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	58.12	12711.41	738,799.86
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	5.81	87401.44	507,977.17
		Total of Bill 07. Passenger Shelter				**2,938,141.83**

Bill No : 08. Bus Bay

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	2,478.00	248.74	616,377.72
2	04.01/Nsc1	Sub-base with Close Graded Material (Table:-400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	897.04	4567.79	4,097,472.07
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	94.16	2083.63	196,202.94
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	1,239.00	4596.47	5,695,026.33

Bill No : 08. Bus Bay

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	05.03	Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 25 mm thick cement concrete grade M15, over laid with pre-cast concrete tiles in cement mortar including provision of all drainage arrangements but excluding kerb channel.	sqm	2,065.00	1701.11	3,512,792.15
6	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	4,956.00	59.02	292,503.12
7	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	4,956.00	16.05	79,543.80
8	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	346.92	13275.11	4,605,401.16

Bill No : 08. Bus Bay

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	198.24	14442.38	2,863,057.41
10	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	210.00	1012.16	212,553.60
		Total of Bill 08. Bus Bay				**22,170,930.30**

Bill No : 09. Longitudinal Drains

Sl 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	29,323.95	221.12	6,484,111.82
2	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	11,157.87	8361.88	93,300,770.00
3	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	433.68	10438.14	4,526,812.56
4	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	1,238.92	8848.19	10,962,181.86
5	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	1,879.28	12199.70	22,926,652.22
6	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	93.96	79567.67	7,476,496.54
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	1,808.00	453.56	820,036.48
8	24/i/b	Galvanised Mild steel J /L hook	kg	289.12	121.20	35,041.34

Item Rate Analysis has been done considering

Bill No : 09. Longitudinal Drains

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	40	Gextextile material (fine net)	sqm	325.26	25.76	8,378.70
		Total of Bill 09. Longitudinal Drains				**146,540,481.51**

Item Rate Analysis has been done considering

Bill No : 10. Retaining wall

Sl 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	4,960.57	221.12	1,096,880.58
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	cum	1,108.17	211.31	234,168.04
3	13.04	Filter medium behind abutment,wing wall and return wall complete as per drawing and technical specification .	cum	4,722.00	2743.29	12,953,823.61
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	2,872.19	8361.88	24,016,899.76
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	1,487.98	10438.14	15,531,701.80
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	5,561.53	8848.19	49,209,438.74
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	8,070.00	453.56	3,660,229.20
		Total of Bill 10. Retaining wall				**106,703,141.72**

Bill No : 11. Breast wall

Sl 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	8,872.77	221.12	1,961,947.79
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	cum	2,218.19	211.31	468,726.57
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	961.38	2473.83	2,378,290.69
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	412.02	2079.09	856,626.66
5	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,179.53	8361.88	34,948,736.68
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	2,014.32	10438.14	21,025,754.16
7	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,349.10	8848.19	38,481,663.13
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	2,441.60	453.56	1,107,412.10
		Total of Bill 11. Breast wall				**101,229,157.78**

Item Rate Analysis has been done considering Manipur Schedule of Rates For National Highways - Works 2018(PWD,Manipur)

Bill No : 12. Toe Wall

Sl 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	610.47	221.12	134,987.13
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	87.21	10438.14	910,310.19
3	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	358.02	11559.24	4,138,439.10
4	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m	cum	344.25	11243.32	3,870,512.91
		Total of Bill 12. Toe Wall				**9,054,249.33**

BILL

(STRUCTURE PART)

Summary of Bill of Quantity

Bill No : 13. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
		Foundation				
1	10.20	Foundation Culvert PCC M15	cum	613.44	9,577.76	5,875,352
2	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	8,270.99	221.12	1,828,880
		End of Sub Total Foundation				**7,704,233**
		Sub Structure				
3	10.06/a	Steel culvert for Sub-Structure	Ton	257.56	75,079.17	19,337,616
4	10.20/b	Culvert Backfilling culvert by Gravelly materials	cum	890.03	2,641.95	2,351,417
5	10.20/c	Filter Media culvert behind abutment, wing and return wall	cum	2,841.01	2,624.75	7,456,930
6	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	3,679.47	12,199.70	44,888,455
7	15.12	Sub Structure Weepholes per Meter	Rm	2,000.12	453.56	907,174
		End of Sub Total Sub Structure				**74,941,593**
		Super Structure				
8	06.02/i	Tack Coat(Bituminous Layer)	sqm	2,126.96	16.05	34,138
9	06/Nsc2	BC GR II	cum	138.25	14,442.38	1,996,688
10	10.06/b	Steel culvert for Super-Structure	Ton	92.53	75,079.17	6,947,076
11	16.01/a/i	Super Structure RCC M25 - Solid Slab Super Structure(Upto 5m)	cum	1,233.74	12,711.41	15,682,562
12	16.08	Protection Work RCC Railing M30 (Precast 12mm Aggregate)	Rm	386.72	2,947.72	1,139,942
13	16.11	Super Structure Drainage Spout	each	124.00	2,185.78	271,037
14	16.17	Super Structure Mastic Asphalt	sqm	2,126.96	559.92	1,190,927
		End of Sub Total Super Structure				**27,262,370**
		Protection Work				
15	10.02/Nsc	Protection Work Culvert M15	cum	905.20	9,577.76	8,669,779
16	13.01/a/i/Nsc	Excavation For Protection work	cum	10,098.18	221.12	2,232,910
17	16/nsc	Protection Work Curtain Wall- PCC (M-15)	cum	2,038.21	11,243.32	22,916,225
18	17.03/a	Protection Work Pitching on slopes laid over prepared filter media(Stone)	cum	915.41	3,220.43	2,948,001
19	17/nsc1	Protection Work Flexible Apron	cum	929.08	3,202.60	2,975,484
		End of Sub Total Protection Work				**39,742,399**
		Miscellanneous Work				
20	08.05	Paint on Concrete Surface(2 Coat)	sqm	989.23	94.34	93,324
		End of Sub Total Miscellanneous Work				**93,324**
					Total	**149,743,919**

Item Rate Analysis has been done considering

Summary of Bill of Quantity

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	17.01/c	Protection Work PCC M15 Cement Concrete	cum	251.86	10,481.93	2,639,979
2	17.02	Block at Protection Protection Work Filter material underneath	cum	465.61	3,907.11	1,819,174
3	17.03/a	pitching in slopes Protection Work Pitching on slopes laid over	cum	931.12	3,220.43	2,998,610
		prepared filter media(Stone)				
		End of Sub Total				**7,457,763**
		Foundation				
4	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	2,497.49	221.12	552,245
5	13.01/a/ii	Foundation Earthwork Ordinary Soil (3m-6m)	cum	1,173.85	297.22	348,892
6	13.01/b/ii	Foundation Earthwork Ordinary Rock(0-3m)	cum	473.66	211.31	100,088
7	14.03/a	Foundation PCC M15	cum	119.63	10,438.14	1,248,756
8	14.03/g	Foundation RCC M30	cum	894.62	13,226.12	11,832,325
9	14.08	Foundation Steel (HYSD)	MT	116.30	79,567.67	9,253,720
		End of Sub Total Foundation				**23,336,028**
		Sub Structure				
10	13.03/a	Sub Structure Backfill Granular Material	cum	136.94	2,473.83	338,754
11	13.03/b	Sub Structure Backfill Sandy Material	cum	2,141.27	2,079.09	4,451,883
12	13.04	Sub Structure Filter Media	cum	576.08	2,743.29	1,580,352
13	15.03/g/i	Sub Structure RCC M30 (Upto 5m)	cum	638.60	14,071.21	8,985,917
14	15.03/g/ii	Sub Structure RCC M30 (5m-10m)	cum	419.02	15,218.12	6,376,636
15	15.05	Sub Structure Steel (HYSD)	MT	158.64	79,567.67	12,622,854
16	15.12	Sub Structure Weepholes per Meter	Rm	655.00	453.56	297,082
		End of Sub Total Sub Structure				**34,653,477**
		Super Structure				
17	06.02/i	Tack Coat(Bituminous Layer)	sqm	602.14	16.05	9,664
18	06/Nsc2	BC GR II	cum	24.09	14,442.38	347,859
19	14/nsc1/i	Super Structure Filler (Copper Plate)	m	96.00	2,080.60	199,738
20	14/nsc1/ii	Super Structure Filler (Fibre Board)	m	96.00	704.98	67,678
21	14/nsc1/iii	Super Structure Filler (Premoulder Joint)	m	96.00	225.23	21,622
22	14/nsc1/iv	Super Structure Filler (Sealing Compound)	m	96.00	36.36	3,491
23	16.01/b/i/c2/i	Super Structure RCC M30 (T Beam & Slab)	cum	401.68	13,420.02	5,390,594
24	i 16.03	(5m-10m) Super Structure Steel(HYSD)	MT	80.34	87,401.44	7,021,482
25	16.05	Cement concrete wearing coat M30	cum	12.32	21,120.74	260,144
26	16.08	Protection Work RCC Railing M30 (Precast	Rm	109.48	2,947.72	322,716
27	16.11	12mm Aggregate) Super Structure Drainage Spout	each	12.00	2,185.78	26,229

Summary of Bill of Quantity

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
28	16.12/Nsc	Super Structure Approach Slab (M30)	cum	116.96	19,002.15	2,222,453
29	16.13	Super Structure PCC M15 Levelling Course Below Approach Slab	cum	45.78	10,186.99	466,350
30	16.16	Super Structure Strip Seal Expansion Joint	Rm	64.00	42,282.41	2,706,074
31	16.17	Super Structure Mastic Asphalt	sqm	602.41	559.92	337,301
		End of Sub Total Super Structure				**19,403,397**
		Protection Work				
32	08/nsc/5	Crash Barrier RCC M40	m	109.48	6,996.27	765,952
33	17.01/a	Protection Work Boulder Apron Laid in Wire Crates	cum	275.96	3,851.27	1,062,804
		End of Sub Total Protection Work				**1,828,756**
		Miscellanneous Work				
34	08.05	Paint on Concrete Surface(2 Coat)	sqm	636.46	94.34	60,044
		End of Sub Total Miscellanneous Work				**60,044**
					Total	**86,739,464**

Item Rate Analysis has been done considering

Bill No : 13. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
		Foundation				
1	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formrvork.	cum	613.44	9577.76	5,875,352.36
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	8,270.99	221.12	1,828,880.42
		Sub Total of Foundation				**7,704,232.79**
		Sub Structure				
3	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure	Ton	257.56	75079.17	19,337,616.26
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	890.03	2641.95	2,351,417.40
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	2,841.01	2624.75	7,456,930.50
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	3,679.47	12199.70	44,888,454.56

Bill No : 13. Culvert

Sl 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	2,000.12	453.56	907,174.43
		Sub Total of Sub Structure				**74,941,593.15**
		Super Structure				
8	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	2,126.96	16.05	34,137.71
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	138.25	14442.38	1,996,687.92
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	92.53	75079.17	6,947,075.60
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	1,233.74	12711.41	15,682,562.26

Bill No : 13. Culvert

Sl 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	386.72	2947.72	1,139,942.28
13	16.11	Drainage Spouts complete as per drawing and Technical specification	each	124.00	2185.78	271,036.72
14	16.17	Mastic asphalt (providing and laying 12mm thik mastic asphalt wearing coures on top of deck slab excluding prime coat with paving grade bitumem meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	2,126.96	559.92	1,190,927.44
		Sub Total of Super Structure				**27,262,369.93**
		Protection Work				
15	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formrvork. At Protection	cum	905.20	9577.76	8,669,778.77
16	13.01/a/i/Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	10,098.18	221.12	2,232,910.45
17	16/nsc	For Protection Work - cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade upto 5m height				

Bill No : 13. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	2,038.21	11243.32	22,916,224.77
18	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	915.41	3220.43	2,948,000.94
19	17/nsc1	Flexible Apron - Construction of flexible apron 750mm thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall.	cum	929.08	3202.60	2,975,484.42
		Sub Total of Protection Work				**39,742,399.35**
		Miscellanneous Work				
20	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	989.23	94.34	93,323.96
		Sub Total of Miscellanneous Work				**93,323.96**
		Total of Bill 13. Culvert				**149,743,919.18**

Item Rate Analysis has been done considering

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	17.01/c	laying apron complete as per drawing and Technical specification. Cement concrete block (M-15grade) (Filter Blanket+Toe Wall)	cum	251.86	10481.93	2,639,978.89
2	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	465.61	3907.11	1,819,173.86
3	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	931.12	3220.43	2,998,610.00
		Sub Total of				**7,457,762.75**
		Foundation				
4	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	2,497.49	221.12	552,245.43
5	13.01/a/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth 3 m to 6 m	cum	1,173.85	297.22	348,892.29
6	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	473.66	211.31	100,088.46
7	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	119.63	10438.14	1,248,756.44
8	14.03/g	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M30 Grade	cum	894.62	13226.12	11,832,325.02

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	116.30	79567.67	9,253,720.02
		Sub Total of Foundation				**23,336,027.67**
		Sub Structure				
10	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	136.94	2473.83	338,753.91
11	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	2,141.27	2079.09	4,451,882.65
12	13.04	Filter medium behind abutment,wing wall and return wall complete as per drawing and technical specification .	cum	576.08	2743.29	1,580,351.76
13	15.03/g/ i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade upto 5m height	cum	638.60	14071.21	8,985,916.92
14	15.03/g/ ii	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade Between 5 to 10 m height	cum	419.02	15218.12	6,376,635.77
15	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	158.64	79567.67	12,622,853.87
16	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	655.00	453.56	297,081.80

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
		Sub Total of Sub Structure				**34,653,476.68**
		Super Structure				
17	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 bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	602.14	16.05	9,664.35
18	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	24.09	14442.38	347,859.16
19	14/nsc1 /i	Filler joint i)Providing & fixing 2 mm thick corrugated copper plate in expansion joint complete as per drawing & Technical Specification.	m	96.00	2080.60	199,737.60
20	14/nsc1 /ii	Filler joint Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification.	m	96.00	704.98	67,678.08
21	14/nsc1 /iii	Filler joint iii)Providing and fixing in position 20 mm thick premoulded joint filler in expansion joint for fixed ends of simply supported spans not exceeding 10 m to cater for a horizontal movement upto 20 mm, covered with sealant complete as per drawing and technical specifications.	m	96.00	225.23	21,622.08

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
22	14/nsc1 /iv	Filler joint iv)Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6 per cent bitumen by weight.	m	96.00	36.36	3,490.56
23	16.01/b/ i/c2/ii	RCC Grade M30 For solid slab super-structure Approach Slab	cum	401.68	13420.02	5,390,593.89
24	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	80.34	87401.44	7,021,482.08
25	16.05	Cement concrete wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications	cum	12.32	21120.74	260,144.15
26	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	109.48	2947.72	322,716.39
27	16.11	Drainage Spouts complete as per drawing and Technical specification	each	12.00	2185.78	26,229.36
28	16.12/N sc	Reinforced cement concrete approach slab M-30 including reinforcement and formwork complete as per drawing and Technical specification	cum	116.96	19002.15	2,222,453.46
29	16.13	PCC M15 ordinary Grade leveling course below approach slab complete as per drawing and Technical specification Below Approach Slab	cum	45.78	10186.99	466,350.22
30	16.16	Providing single gap(unitary) strip/seal type of expansion joint of movement capacity of 80 mm with fatigue tested structure section at the nosing and ancourage assembly complete as per approved drawing and standard specification to be installed under supervision of a specialist manufacture	Rm	64.00	42282.41	2,706,074.24

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
31	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	602.41	559.92	337,301.41
		Sub Total of Super Structure				**19,403,397.03**
		Protection Work				
32	08/nsc/5	Reinforced Cement Concrete Crash Barrier-Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-40 grade concrete with HYSD reinforcement conforming to IRC:21 and dowel bars 25 mm dia, 450 mm long at expansion joints filled with pre-moulded asphalt filler board, keyed to the structure on which it is built and installed as per design given in the enclosure to MOST circular No. RW/NH - 33022/1/94-DO III dated 24 June 1994 as per dimensions in the approved drawing and at locations directed by the Engineer, all as specified	m	109.48	6996.27	765,951.64
33	17.01/a	laying apron complete as per drawing and Technical specification. Boulder	cum	275.96	3851.27	1,062,804.17
		Sub Total of Protection Work				**1,828,755.81**
		Miscellanneous Work				
34	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	636.46	94.34	60,043.64
		Sub Total of Miscellanneous Work				**60,043.64**
		Total of Bill 14. Minor Bridge				**86,739,463.58**

Item Rate Analysis has been done considering

CIRCULAR

TA
Circulate amongst all concerned, incl. Consultants
7/8/19

S.E., NH P & D Circle
Receipt No./Date 417/08.03.19
File No. GL-264/1
Recd. through mail
Recd. By M.S.O.S-I

No RW-NH-33044/10/2019-S&R(P&B)
Government of India
Ministry of Road Transport & Highways
S&R(P&B) Zone
Transport Bhawan, 01 Parliament Street, New Delhi-110 001

Dated: 7th March, 2019

To,

1. The Chief Secretaries of all the State Governments/ UTs
2. The Principal Secretaries/ Secretaries of all States/ UTs Public Works Department dealing with National Highways, other centrally sponsored schemes.
3. All Engineers-in-Chief and Chief Engineers of Public Works Department of States/ UTs dealing with National Highways, other centrally sponsored schemes.
4. The Director General (Border Roads), Seema Sadak Bhawan, Ring Road, New Delhi-110 010.
5. The Chairman, National Highways Authority of India, G-5 & 6, Sector-10, Dwarka, New Delhi-110 075.
6. The Managing Director, NHIDCL, PTI Building, New Delhi-110001
7. All CE-ROs, ROs and ELOs of the Ministry

Subject: Cost of construction for work on EPC mode reg.

While arriving at the total cost of construction for work under EPC mode, the agency charges etc. are to be provided as follows:

a) Civil cost
b) GST - 12% of(a)
c) Contingencies - 2.8% of (a)
d) Supervision charges - 3% of (a)
e) Agency charges - 3% of (a)

2. For EPC contracts, no separate quality control and road safety charges are to be provided in the estimate as these are considered to be included in the civil cost.

3. Similarly, avenue plantation is not to be provided in the estimate separately. However, the cost of forestation against the tree cutting in the ROW, need to be provided separately as per the demand of Forest/Other Concerned Authority.

4. All the executive agency should strictly adhere to this circular.

Yours faithfully,

(Md Shadab Imam)
Assistant Executive Engineer-S&R (P&B)RS
For Director General (Road Development) & SS

No.RW/NH-37010/4/2010-EAP(Printing) Vol.-IV

Government of India

Ministry of Road Transport & Highways

(EAP Section)

Transport Bhawan, 1, Parliament Street, New Delhi - 110001

Dated: 05.03.2019

To,

1. The Principal Secretaries/Secretaries of all States/UTs Public Works Department dealing with National Highways, other Centrally Sponsored Schemes & State Schemes.
2. The Engineers-in-Chief and Chief Engineers of all States/UTs Public Works Department dealing with National Highways, other Centrally Sponsored Schemes & State Schemes.
3. The Chairman, National Highways Authority of India (NHAI), G-5&6, Sector-It), Dwarka, New Delhi-110 075.
4. The Managing Director, National Highway Infrastructure Development Corporation Ltd.,3rd floor, PTI Building, Parliament Street, New Delhi- 110 001

Sub: Standard EPC Agreement for National Highways and Centrally Sponsored road works proposed to be implemented on Engineering Procurement and Construction (EPC) mode of Contract.

Ref: Ministry's letter no. RW/NH-37010/4/2010/PIC-EAP (Printing) dated 28.11.2018.

Sir,

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

2. This Standard EPC Agreement shall be used for all the National Highways and centrally sponsored road works proposed to be implemented on EPC Mode of Contract for which the bids will be invited in future from the date of issue of this circular.

3. This document is available on Ministry's Web Portal(www.morth.nic.in).

4. Contents of this circular may be brought to the notice of all the concerned for immediate compliance.

5. This issues with approval of Competent Authority

Yours faithfully,

(Khushal Chand)
Chief Engineer (EAP)

Encl: As above

Copy to:

1. All Technical Officers at the Headquarters
2. Secretary General, Indian Roads Congress
3. Director, IAHE, NOIDA
4. All CE-ROs/SE-ROs of MoRT&H.

Copy for information to:

1. PPS to Secretary (RT&H), PPS to DG(RD) & SS, PPS to AS&FA, PPS to AS, PPS to JS(H), PS to ADG I/II.
2. NIC- with the request to upload on the Ministry's portal

Article 14

Maintenance

14.1 Maintenance obligations of the Contractor

(i) The Contractor shall maintain the Project Highway for a period of [5 (five) / 10 (ten)] years, corresponding to the Defects Liability Period, commencing from the date of the Completion Certificate (the "**Maintenance Period**"). For the performance of its Maintenance obligations, the Contractor shall be paid:

(a) For flexible pavement with 5 years Maintenance Period including structures: no maintenance charges shall be paid for the first year; 0.50%of the Contract Price each for the second, third and fourth year; and 1% of the Contract Price for the fifth year

(b) For rigid pavement with 10 years Maintenance Period including structures: 0.25% of the Contract Price each for the first, second and third year, 0.5% of the Contract Price each for fourth, fifth, sixth and seventh year, and 0.75% of the Contract Price each for eighth, ninth and tenth year.

(c) For flexible perpetual pavement with 10 years maintenance period including structures: no maintenance charges shall be paid for the first year; 0.5% of the Contract Price each for the second, third and fourth year; 0.75% of the Contract Price each for the subsequent years till laying of the renewal layer or end of maintenance period, whichever is earlier. The requirement for the renewal layer shall be worked out based on the survey and investigation of the existing pavement and the cost of such renewal works shall be made separately to the Contractor based on the principles defined under clause 13.2(iii). After laying of the renewal layer, the Contractor shall be paid @ 0.5% of the original Contract Price each for the remaining years till the end of maintenance period.

(d) For stand-alone Bridge/ Tunnel works: the contractor shall be paid @ 0.25% of the Contract Price each for the first five years and @ 0.50% of the Contract Price each for the remaining period of five years.

Above amount for the performance of Contractors' Maintenance obligations shall be, inclusive of all taxes. The amount payable for maintenance shall be adjusted to reflect any increase or decrease arising out of variation in WPI to be determined in accordance with the provisions of Clause 19.12. It is further agreed that the Contract Price hereunder shall be reckoned with reference to the amount specified in Clause 19.1 (i), which shall be adjusted to the extent of Change of Scope and the works withdrawn under the provisions of Clause 8.3 (iii), but shall not include any price adjustments in pursuance of Clause 19.10.

VOLUME VIII

BILL OF QUANTITY

TCS TYPE	DESCRIPTION
TCS 1	2 Lane carriageway with hard shoulder in built up area with both side foothpath cum RCC covered drain (existing pavement)
TCS 2	2 Lane carriageway with hard shoulder and one side toe wall & one side ret wall (existing pavement)
TCS 3	2 Lane carriageway with hard shoulder and one side toe wall (existing pavement)
TCS 4	2 Lane carriageway with hard shoulder in rural area (existing pavement)
TCS 4A	2 Lane carriageway with hard shoulder in rural area (realignment strech)
TCS 5	2 Lane carriageway with hard shoulder and one side toe wall & one side trapizoidal drain (existing pavement)
TCS 6	2 Lane carriageway with hard shoulder and both side trapizoidal drain (existing pavement)
TCS 6A	2 Lane carriageway with hard shoulder and both side trapizoidal drain (realignment strech)
TCS 7	2 Lane carriageway with hard shoulder and one side trapizoidal drain (existing pavement)
TCS 8	2 Lane carriageway with hard shoulder and one side breast wall (existing pavement)
TCS 9	2 Lane carriageway with hard shoulder and one side breast wall & one side drain (existing pavement)
TCS 10	2 Lane carriageway with hard shoulder and one side ret wall (existing pavement)
TCS 10A	2 Lane carriageway with hard shoulder and one side ret wall (realignment strech)
TCS 11	2 Lane carriageway with hard shoulder and one side ret wall & one side drain (existing pavement)
TCS 12	2 Lane carriageway with hard shoulder and one side ret wall & one breast wall (existing pavement)
TCS 13	2 Lane carriageway with hard shoulder and both side ret wall (existing pavement)

Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
13747	13830		83	TCS-4
13830	14120	15.2	274.8	TCS-7
14120	14270		150	TCS-4
14270	14420		150	TCS-7
14420	14520	2.7	97.3	TCS-3
14520	14720		200	TCS-6
14720	15120	10.3	389.7	TCS-7
15120	15220	2.7	97.3	TCS-2
15220	15370	2.6	147.4	TCS-7
15370	15470	9	91	TCS-2
15470	15570		100	TCS-7
15570	15620	2.6	47.4	TCS-10
15620	15820		200	TCS-6
15820	15870		50	TCS-10
15870	15920	2.7	47.3	TCS-4
15920	16030		110	TCS-9
16030	16080		50	TCS-4
16080	16130	5	45	TCS-10
16130	16230	2.6	97.4	TCS-6
16230	16780	7.9	542.1	TCS-7
16780	16870	2.6	87.4	TCS-11
16870	16970		100	TCS-8
16970	17070	2.6	97.4	TCS-4
17070	17270		200	TCS-6
17270	17320	2.6	47.4	TCS-10
17320	17520	3.96	196.04	TCS-6
17520	17610		90	TCS-5
17610	17820	2.6	207.4	TCS-6
17820	18020	14.5	185.5	TCS-11
18020	18170		150	TCS-6
18170	18220	2.6	47.4	TCS-10
18220	18420	2.6	197.4	TCS-6
18420	18830	7.6	402.4	TCS-9
18830	18920	2.7	87.3	TCS-4
18920	19030		110	TCS-9
19030	19220	2.6	187.4	TCS-7
19220	19520	5.3	294.7	TCS-6
19520	19820	5	295	TCS-8
19820	19920		100	TCS-5
19920	20460	2.6	537.4	TCS-7
20460	20570	2.6	107.4	TCS-4
20570	20620		50	TCS-10
20620	21070	5.4	444.6	TCS-7
21070	21120		50	TCS-10
21120	21270		150	TCS-2
21270	21370		100	TCS-13

Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
21370	21520	5.3	144.7	TCS-11
21520	21670		150	TCS-9
21670	21720	2.6	47.4	TCS-4
21720	21770		50	TCS-8
21770	22070		300	TCS-12
22070	22120		50	TCS-8
22120	22420	10	290	TCS-7
22420	22520	2.6	97.4	TCS-6
22520	22570	2.6	47.4	TCS-13
22570	22620		50	TCS-11
22620	22970		350	TCS-9
22970	23120		150	TCS-6
23120	23230		110	TCS-11
23230	23920	5.2	684.8	TCS-6
23920	24070		150	TCS-11
24070	24170	6.4	93.6	TCS-10
24170	24220		50	TCS-7
24220	24320		100	TCS-5
24320	24420	2.7	97.3	TCS-3
24420	24520		100	TCS-6
24520	24620		100	TCS-7
24620	24850	5.2	224.8	TCS-12
24850	25610		760	TCS-1
25610	25720	2.7	107.3	TCS-10
25720	26070	3.96	346.04	TCS-6
26070	26170		100	TCS-13
26170	26220		50	TCS-7
26220	26320		100	TCS-9
26320	26570		250	TCS-6
26570	26620		50	TCS-11
26620	26770		150	TCS-4
26770	26870		100	TCS-6
26870	27020	2.7	147.3	TCS-7
27020	27320	5.4	294.6	TCS-4
27320	27670		350	TCS-6
27670	27820		150	TCS-4
27820	27870		50	TCS-5
27870	28070		200	TCS-6
28070	28220	2.7	147.3	TCS-4
28220	28420		200	TCS-6
28420	28520	2.6	97.4	TCS-4
28520	28670	2.7	147.3	TCS-7
28670	28820	2.6	147.4	TCS-4
28820	28870		50	TCS-9
28870	29320	7.8	442.2	TCS-6
29320	29520	2.6	197.4	TCS-4

Chainage (Km)		Length of CD	Net Length (m)	TCS No.
From	To			
29520	29770		250	TCS-6
29770	29870	2.7	97.3	TCS-4
29870	29970		100	TCS-11
29970	30020	5	45	TCS-3
30020	30120		100	TCS-4
30120	30720		600	TCS-9
30720	30820	2.6	97.4	TCS-4
30820	31070	2.6	247.4	TCS-6
31070	31220	2.7	147.3	TCS-4
31220	31620	2.6	397.4	TCS-6
31620	31780		160	TCS-9
31780	32835	7.8	1047.2	TCS-1
Total Length		**235.52**	**18852.48**	

Summary of TCS Length

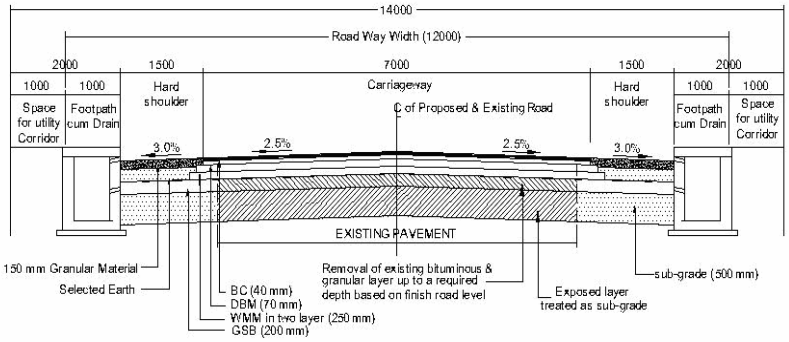
TCS No.	Length (m)		
TCS-1	1807		
TCS-2	338		
TCS-3	240		
TCS-4	2296		
TCS-4A	0		
TCS-5	340		
TCS-6	5558		
TCS-6A	0		
TCS-7	3558		
TCS-8	495		
TCS-9	2032		
TCS-10	538		
TCS-10A	0		
TCS-11	878		
TCS-12	525	**CD Length (m)**	**Total Length (m)**
TCS-13	247		
Total=	**18852**	**236**	**19088**

Variable Declaration

TCS-01

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	1807.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	9.500	

Variable Declaration



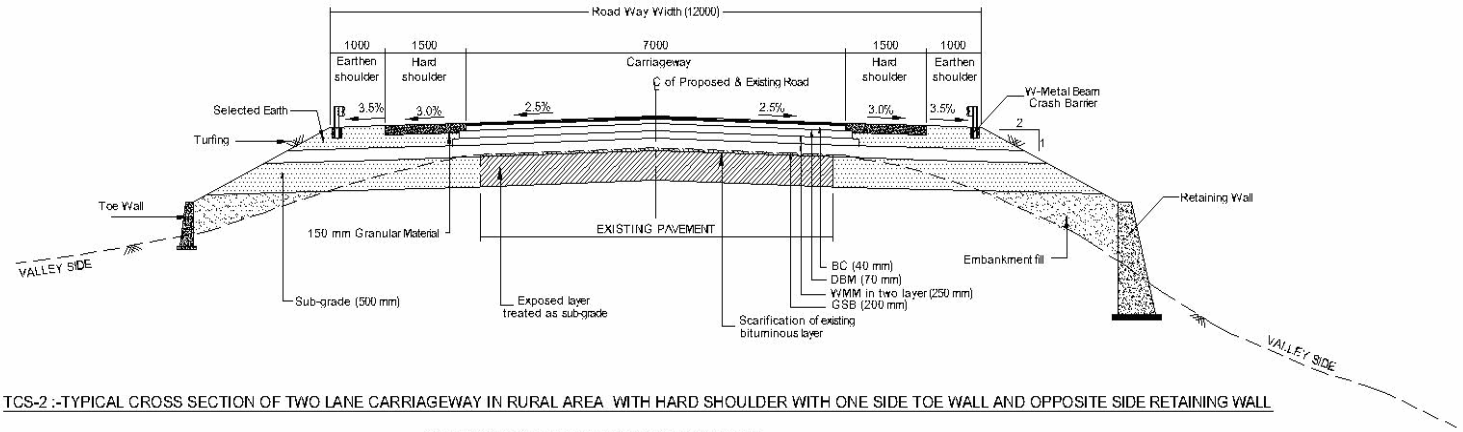
TCS-1 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN BUILT UP AREA WITH BOTH SIDE FOOTPATH CUM RCC RECTENGULAR DRAIN (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-02

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	338.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



TCS-2 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY IN RURAL AREA WITH HARD SHOULDER WITH ONE SIDE TOE WALL AND OPPOSITE SIDE RETAINING WALL

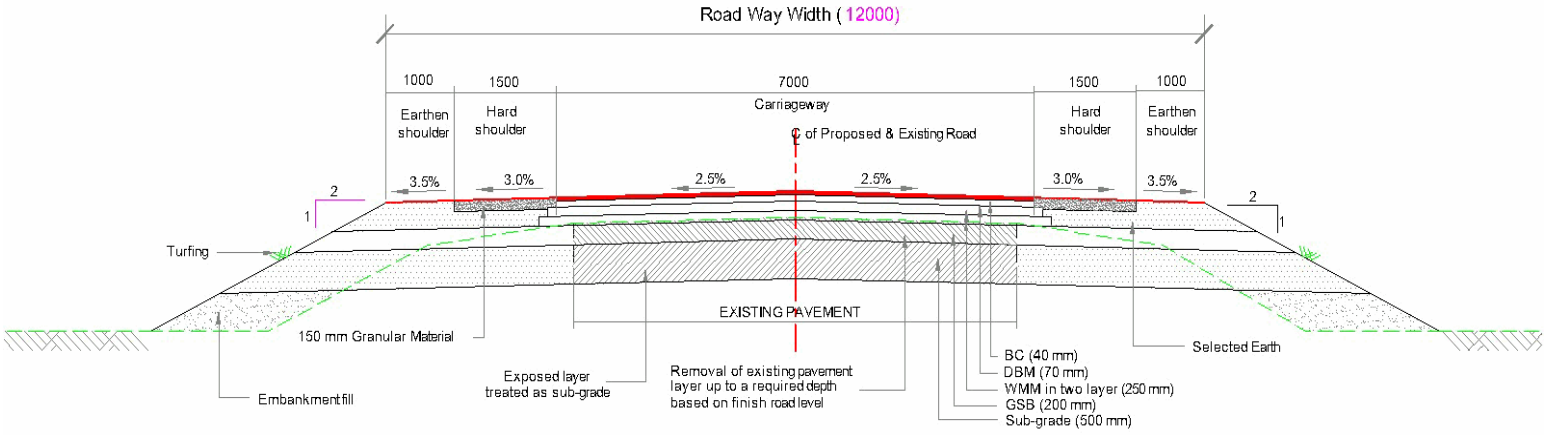
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-03

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	240.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



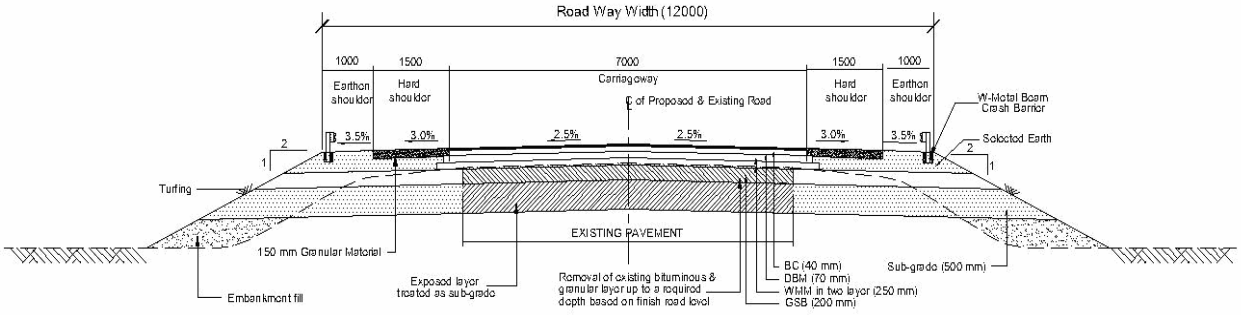
TCS- 3 :-Typical Cross Section of Two Lane Carriageway in Rural Area (Reconstruction of Existing Pavement)

Variable Declaration

TCS-04

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	2296.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



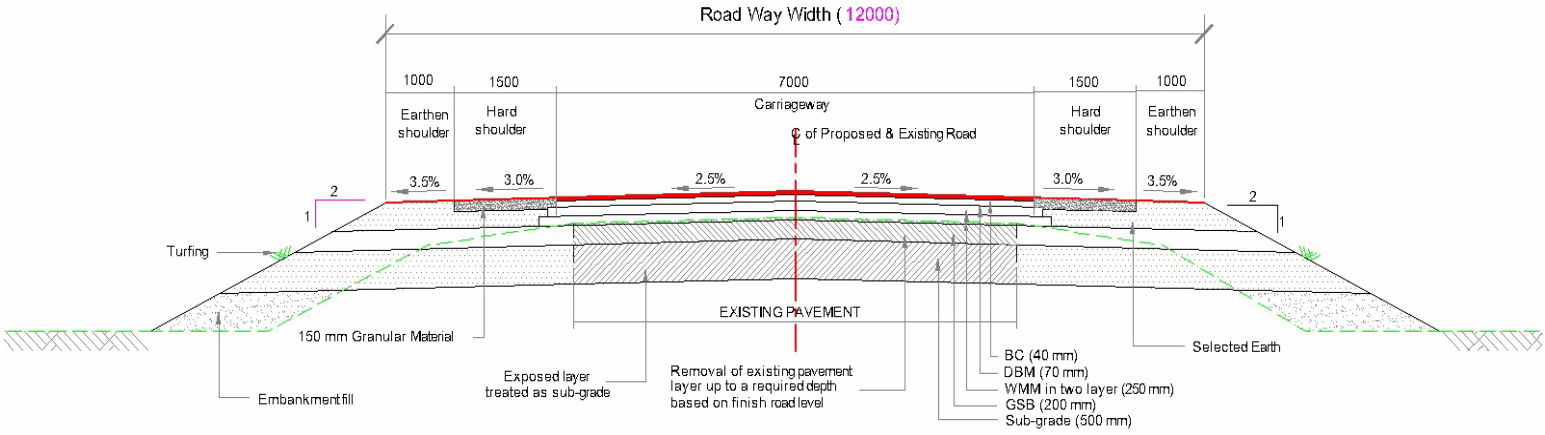
TCS- 4 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA

Variable Declaration

TCS-04A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



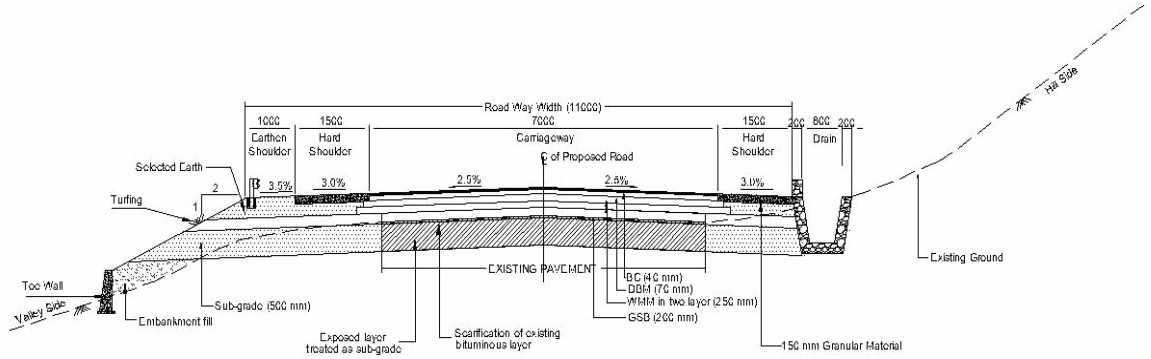
TCS- 3 :-Typical Cross Section of Two Lane Carriageway in Rural Area (Reconstruction of Existing Pavement)

Variable Declaration

TCS-05

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	340.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



TCS-5 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH TOE WALL ON VALLEY SIDE & OPEN TRAPEZOIDAL DRAIN ON HILL SIDE

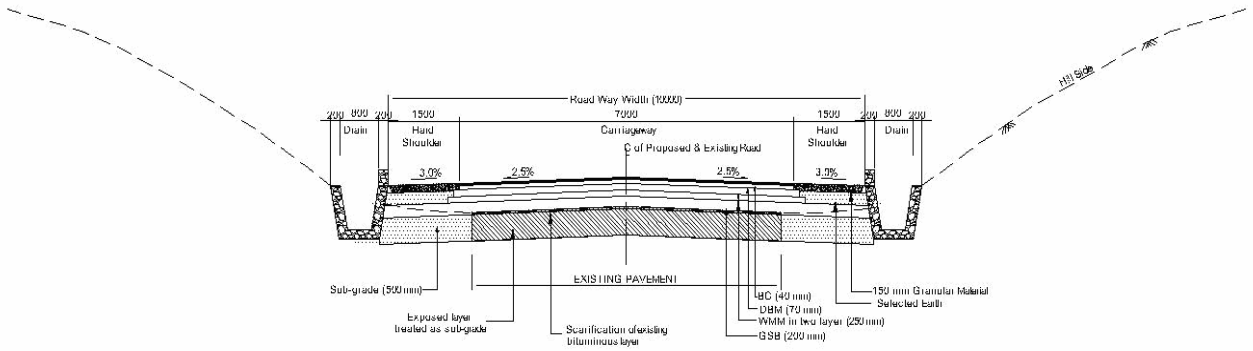
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-06

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	5558.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	9.500	

Variable Declaration



TCS-6 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH BOTH SIDE OPEN TRAPEZOIDAL DRAIN ON HILL SECTION

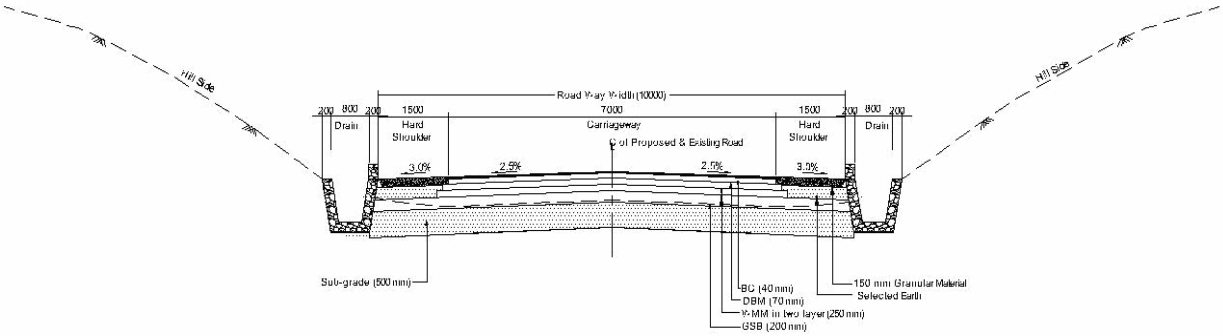
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-06A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	9.500	

Variable Declaration



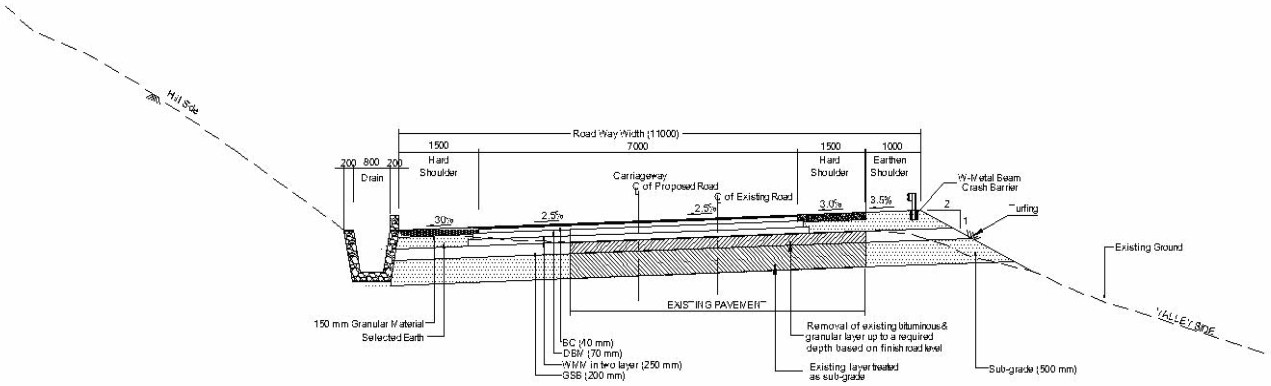
TCS-6A :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH BOTH SIDE OPEN TRAPEZOIDAL DRAIN ON HILL SECTION (REALIGNMENT STRECH)

Variable Declaration

TCS-07

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	3558.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



TCS-7 : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH OPEN TRAPEZOIDAL DRAIN ON HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE

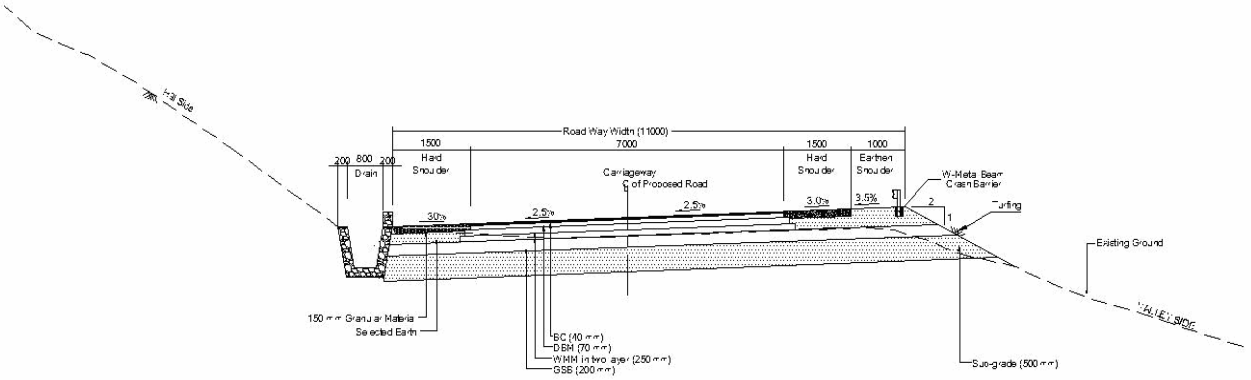
(RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-07A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



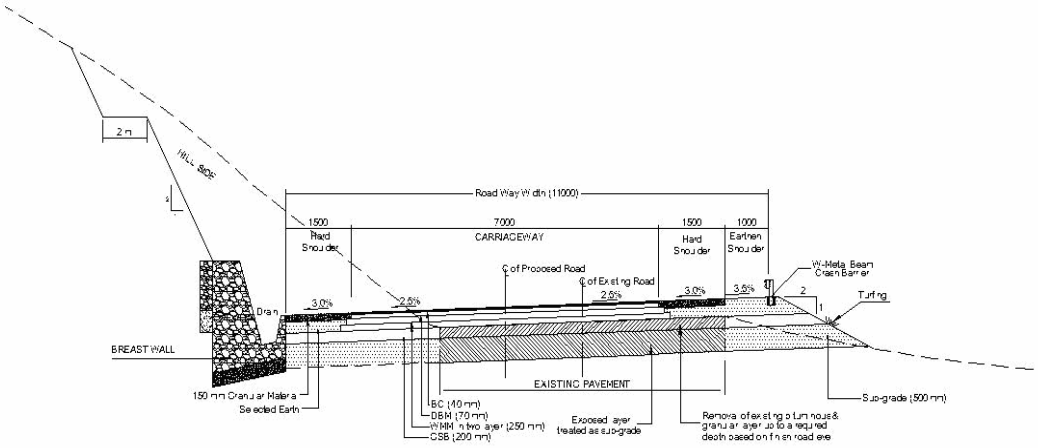
TCS-7A : TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH OPEN TRAPEZOIDAL DRAIN ON HILL SIDE AND EARTHEN SHOULDER ON VALLEY SIDE (NEW CONSTRUCTION)

Variable Declaration

TCS-08

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	495.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



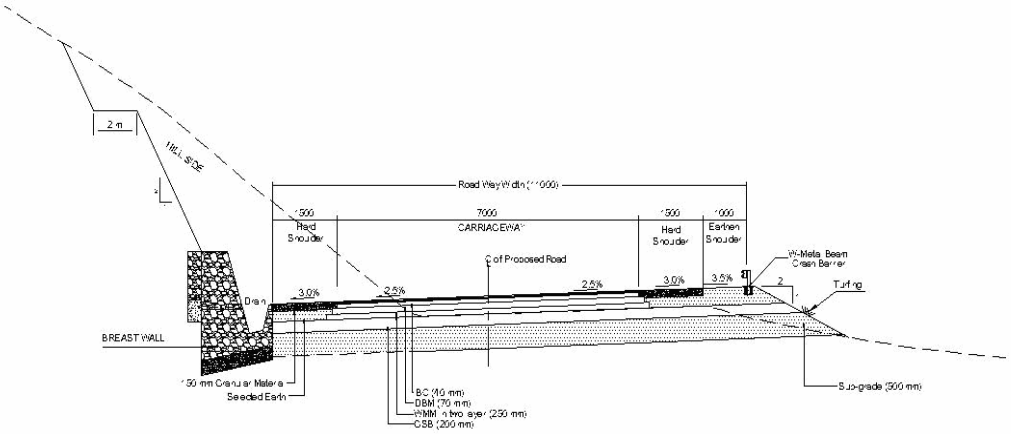
TCS-8 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOILDER IN RURAL AREA WITH BREAST WALL ON HILL SIDE (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-08A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



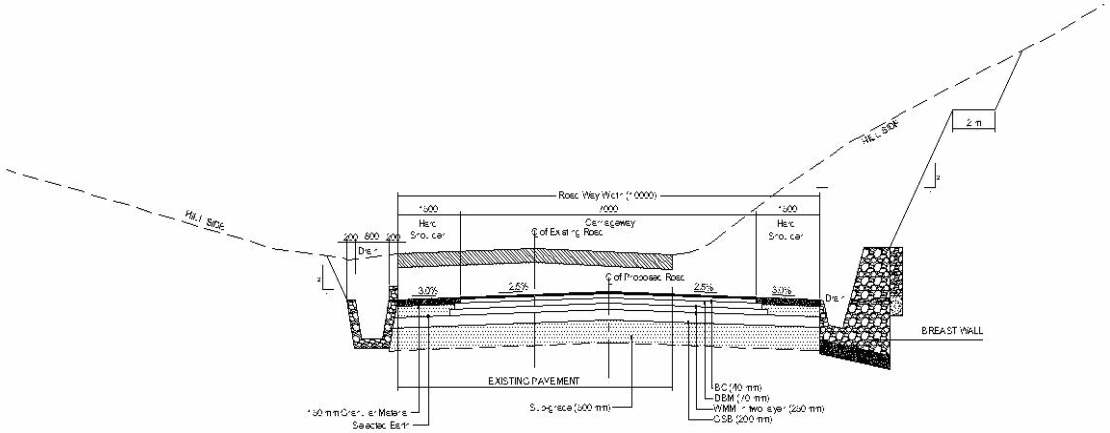
TCS-8A :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOILDER IN RURAL AREA WITH BREAST WALL ON HILL SIDE (NEW CONSTRUCTION)

Variable Declaration

TCS-09

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	2032.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	9.500	

Variable Declaration



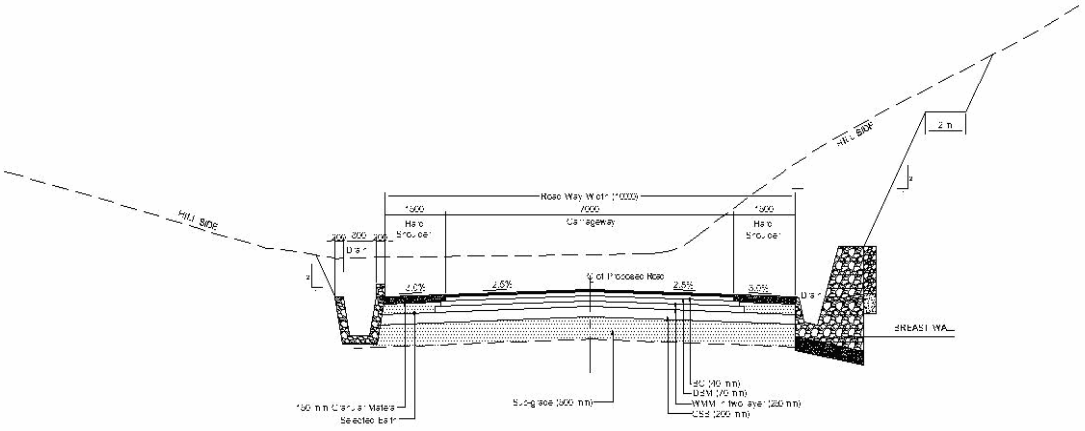
TCS-9 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER AT CUTTING SECTION IN RURAL AREA WITH BREAST WALL ON HILL SIDE AND 'V' DRAIN ON VALLEY SIDE. (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-09A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	9.500	

Variable Declaration



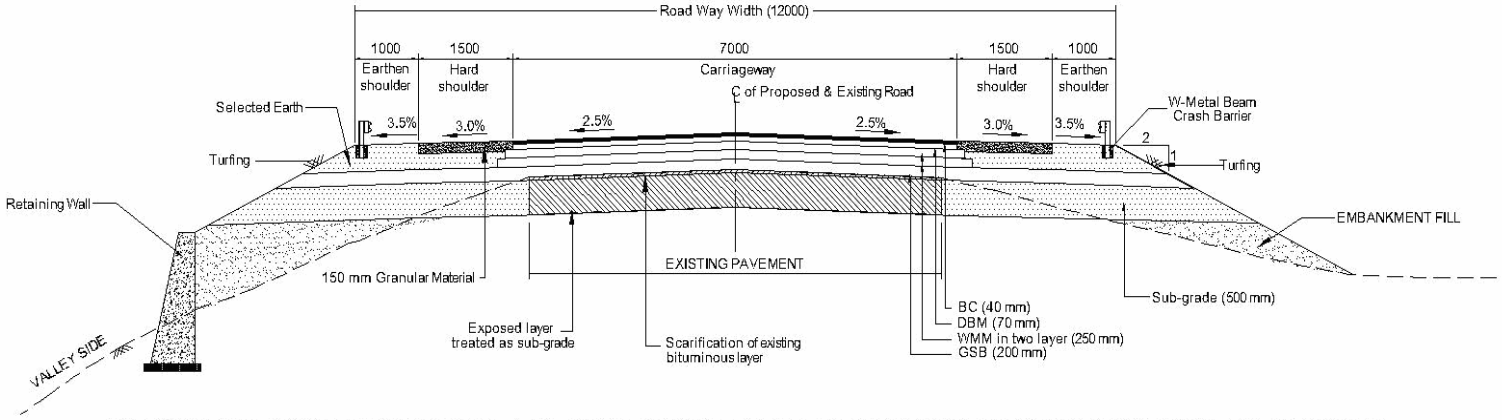
TCS-9A :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER AT CUTTING SECTION IN RURAL AREA WITH BREAST WALL ON HILL SIDE AND V DRAIN ON VALLEY SIDE (NEW CONSTRUCTION)

Variable Declaration

TCS-10

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	538.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



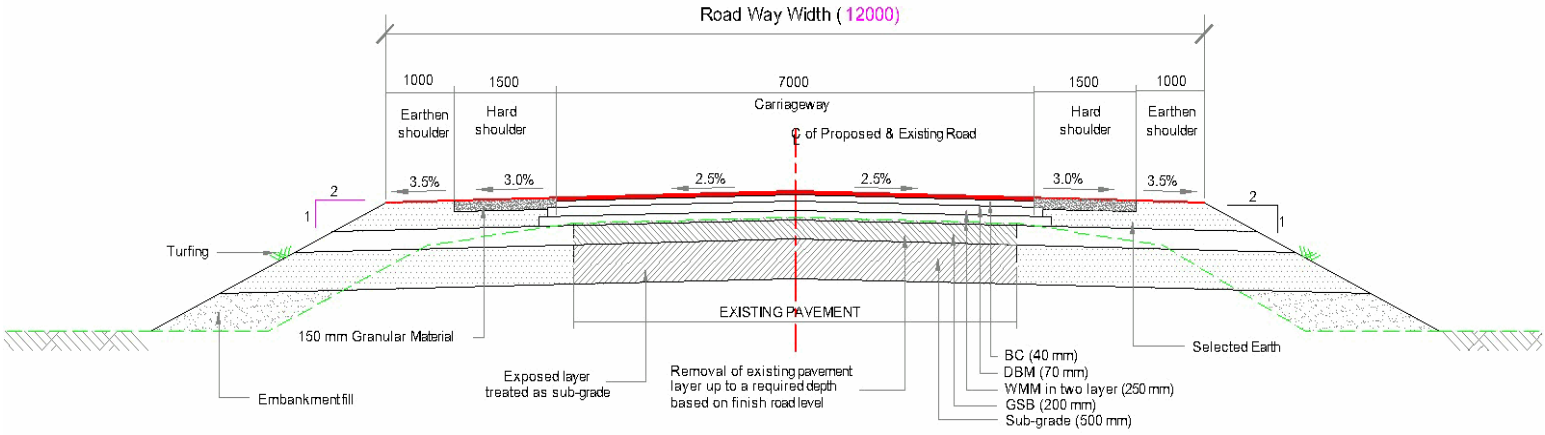
TCS-10 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-10A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



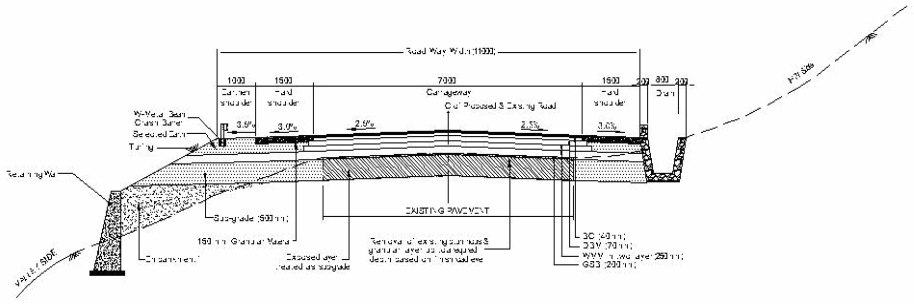
TCS- 3 :-Typical Cross Section of Two Lane Carriageway in Rural Area (Reconstruction of Existing Pavement)

Variable Declaration

TCS-11

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	878.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



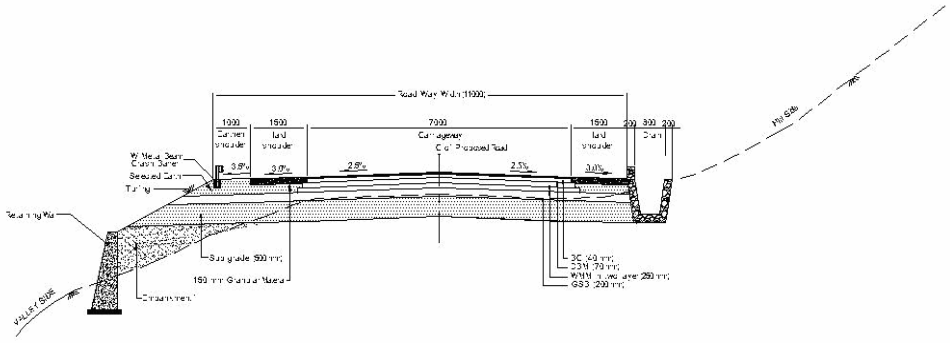
TCS-11 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE AND OPEN TRAPEZOIDAL DRAIN ON HILL SIDE (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-11A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



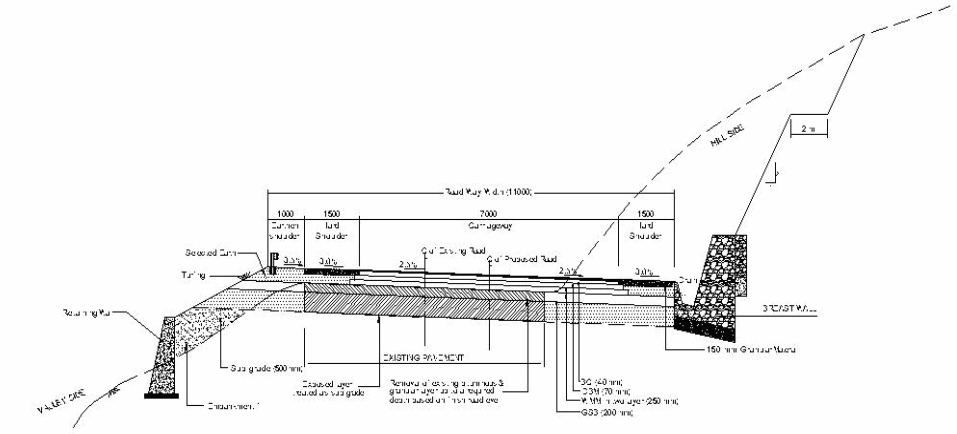
TCS-11A :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE AND OPEN TRAPEZOIDAL DRAIN ON HILL SIDE (NEW CONSTRUCTION)

Variable Declaration

TCS-12

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	525.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



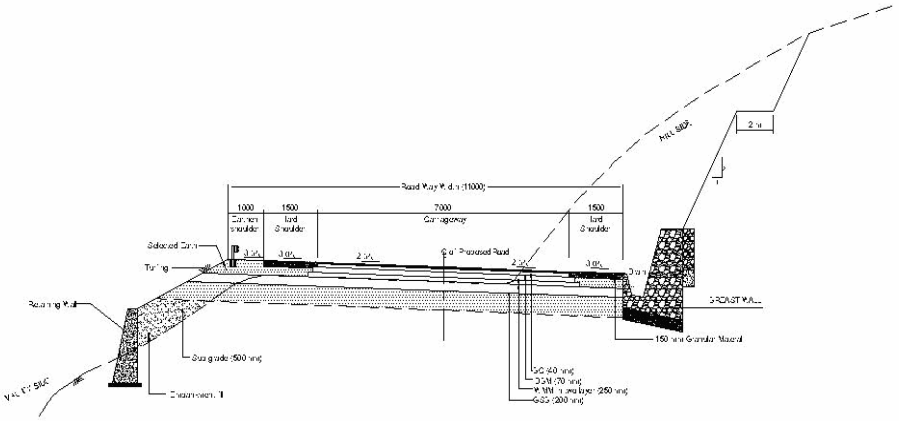
TCS-12 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE AND BREAST WALL ON HILL SIDE (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-12A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



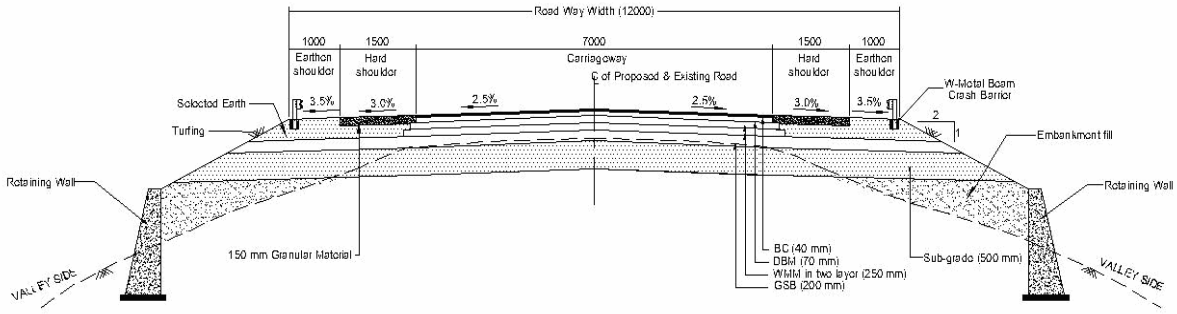
TCS-12A :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH RETAINING WALL ON VALLEY SIDE AND BREAST WALL ON HILL SIDE (NEW CONSTRUCTION)

Variable Declaration

TCS-13

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	247.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



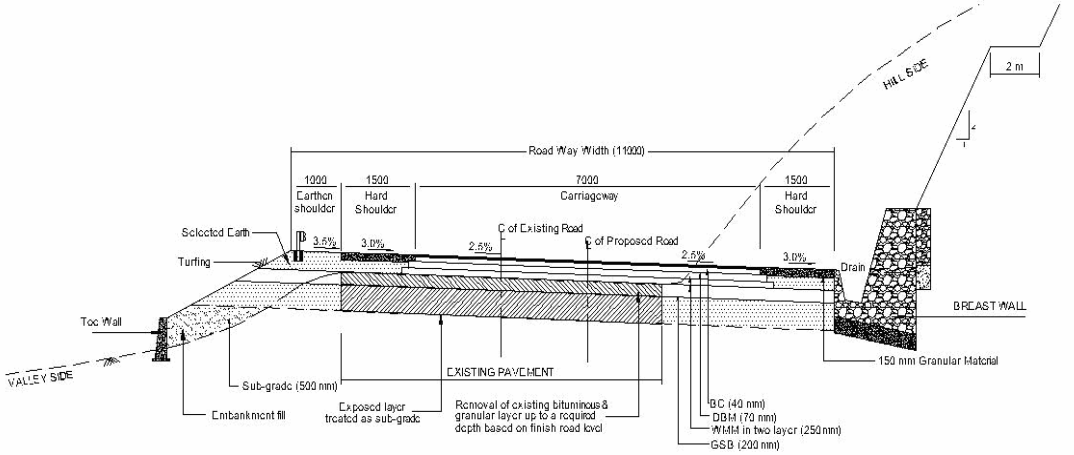
TCS-13 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH BOTH SIDE RETAINING WALL ON VALLEY SIDE (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-14

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	5.300	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	Earthen Shoulder	es	1.000	m
16	GSB Reuse	gsb_per	9.500	

Variable Declaration



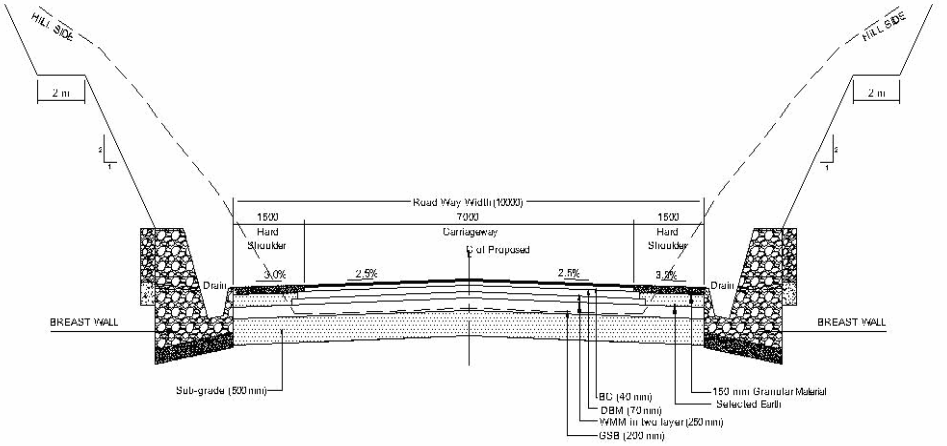
TCS-14 :-TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOULDER IN RURAL AREA WITH TOE WALL ON VALLEY SIDE AND BREAST WALL ON HILL SIDE (RECONSTRUCTION OF EXISTING PAVEMENT)

Variable Declaration

TCS-15A

Sl No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Hard Shoulder	hs	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.070	m
5	WMM Layer-I Thickness	wmm1	0.125	m
6	GSB Thickness	gsb	0.200	m
7	Subgrade Thickness	sg	0.500	m
8	Length	l	0.000	m
9	Existing Pavement Width	ext_pav	0.000	m
10	Length of each centreline marking	lc	3.000	m
11	Width of each centreline marking	wc	0.100	m
12	No of Lines for Carriageway Marking for 2 Lane	nc	2.000	nos.
13	Width of Carriageway Marking	wid_mar	0.150	m
14	WMM Layer-II Thickness	wmm2	0.125	m
15	GSB Reuse	gsb_per	9.500	

Variable Declaration



TCS-15A :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH HARD SHOILDER IN RURAL AREA WITH BOTH SIDE BREAST WALL (NEW CONSTRUCTION)

Site Clearance and Dismantling

A.Tree Cutting

Sl No	Girth Details			
1	Girth from 300 mm to 600 mm	150	Each	..... Bill No- 01, Sl. No- 1
2	Girth from 600 mm to 900 mm	13	Each	..... Bill No- 01, Sl. No- 2
3	Girth from 900 mm to 1800 mm	1	Each	..... Bill No- 01, Sl. No- 3

B.Clearing and grubbing

	Clearing and Grubbing Area	13.99	Ha	..... Bill No- 01, Sl. No- 4

C. Dismantling

Sl No A.Rubble stone masonry in cement mortar

1	Culvert =	1259	Cum	
	Total=	1259	cum	..... Bill No- 01, Sl. No- 6

Sl No B.Total Dismantling of Reinforced cement concrete

1	Culvert =	212	Cum	
	Total=	212	cum	..... Bill No- 01, Sl. No- 5

Sl No C.Total Dismantling Hume Pipe Culvert

1	up to 600 mm dia=	9	m	..... Bill No- 01, Sl. No- 7
2	600-900 mm dia=	19	m	..... Bill No- 01, Sl. No- 8
3	above 900 mm dia=	31	m	..... Bill No- 01, Sl. No- 9

Sl No D.Total Dismantling of Bituminous layer

1	Road =	42818	sqm	..... Bill No- 01, Sl. No- 11
	Total=	42818	sqm	

Sl No E.Total Dismantling of Granular Layer

1	Road =	68589	sqm	..... Bill No- 01, Sl. No- 10
	Refer backup calculation sheet			
	Total=	68589	sqm	

Site Clearance and Dismantling

(Tree Cutting List)

Sl No	CHAINAGE(KM)	**EASTING(M)**	**NORTHING(M)**	**GIRTH (M)**	SIDE
	14185	566314.079	2680944.105	0.3	RHS
	14193	566313.655	2680935.043	0.3	RHS
	14195	566312.236	2680933.014	0.3	RHS
	14210	566317.524	2680916.223	0.3	RHS
	14336	566427.312	2680844.261	0.3	LHS
	14378	566430.062	2680798.230	0.3	LHS
	14521	566369.762	2680665.957	0.6	RHS
	14687	566321.984	2680508.874	0.3	LHS
	14691	566319.611	2680506.462	0.3	LHS
	14699	566315.044	2680500.687	0.3	LHS
	14705	566311.282	2680495.721	0.3	LHS
	14720	566299.264	2680482.763	0.3	RHS
	14960	566411.519	2680301.114	0.3	RHS
	14965	566410.044	2680296.120	0.4	RHS
	14999	566397.939	2680267.869	0.3	RHS
	15001	566398.716	2680265.173	0.4	RHS
	15008	566391.737	2680262.532	0.5	RHS
	15012	566390.605	2680257.356	0.3	RHS
	15031	566374.088	2680252.741	0.4	RHS
	15031	566372.913	2680257.395	0.3	RHS
	15494	566430.930	2679994.756	0.3	RHS
	15830	566288.713	2679745.934	0.3	LHS
	17162	566008.666	2679049.252	0.3	RHS
	17173	566019.826	2679047.790	0.3	RHS
	17189	566039.379	2679056.872	0.4	LHS
	17196	566046.255	2679052.720	0.3	LHS
	17202	566053.161	2679049.186	0.3	LHS
	17648	565891.429	2678670.458	0.3	LHS
	17672	565885.977	2678647.093	0.3	LHS
	17679	565886.719	2678639.490	0.4	LHS
	18375	566298.261	2678222.957	0.3	RHS
	18958	566820.560	2678040.438	0.4	LHS
	19054	566798.830	2677944.085	0.5	LHS
	19067	566789.061	2677933.037	0.4	LHS
	19072	566774.061	2677940.625	0.4	RHS
	19076	566771.372	2677939.102	0.4	RHS
	19140	566716.781	2677921.972	0.3	RHS
	19500	566369.304	2677870.067	0.6	LHS
	19588	566285.541	2677909.298	0.4	LHS
	19624	566253.881	2677926.107	0.6	LHS
	19722	566176.634	2677952.297	0.6	RHS
	19725	566179.128	2677949.019	0.3	LHS
	19741	566188.582	2677939.034	0.4	LHS
	19982	566248.126	2677718.837	0.4	RHS
	19988	566247.710	2677713.234	0.6	RHS
	19993	566245.737	2677708.518	0.3	RHS
	19998	566244.336	2677704.677	0.4	RHS
	20005	566241.433	2677698.088	0.3	RHS
	20217	566055.167	2677651.781	0.3	LHS
	20285	565989.361	2677672.741	0.4	RHS
	20315	565959.762	2677656.802	0.3	LHS
	20325	565949.558	2677670.733	0.4	RHS
	20327	565947.141	2677671.001	0.4	RHS

	20336	565937.904	2677671.851	0.3	RHS
	20358	565916.132	2677658.602	0.5	LHS
	20367	565907.317	2677668.179	0.3	RHS
	20379	565894.665	2677658.006	0.5	LHS
	20388	565884.500	2677661.067	0.3	LHS
	20397	565875.122	2677663.015	0.3	LHS
	20408	565864.123	2677666.999	0.5	LHS
	20414	565858.254	2677669.955	0.4	LHS
	20450	565828.875	2677692.473	0.4	LHS
	24574	563588.576	2675561.074	0.4	LHS
	24583	563581.296	2675555.231	0.5	LHS
	24584	563580.334	2675555.466	0.3	LHS
	24609	563560.969	2675536.481	0.3	LHS
	24619	563551.683	2675531.809	0.4	LHS
	24629	563540.764	2675528.454	0.6	LHS
	25189	563426.929	2675042.668	0.3	RHS
	27237	562819.148	2673290.642	0.4	RHS
	27248	562815.302	2673281.250	0.6	RHS
	27251	562812.737	2673278.472	0.7	RHS
	27256	562825.996	2673268.885	0.4	LHS
	27260	562824.760	2673264.911	0.3	LHS
	27296	562805.759	2673230.650	0.9	RHS
	27298	562805.065	2673227.752	0.5	RHS
	27302	562806.644	2673224.019	0.6	RHS
	27499	562847.873	2673032.326	0.6	LHS
	27525	562840.653	2673007.498	0.4	LHS
	27617	562829.192	2672920.689	0.3	LHS
	27619	562814.629	2672915.263	0.4	RHS
	27628	562830.763	2672909.657	0.3	LHS
	27636	562820.295	2672898.653	0.3	RHS
	27644	562832.811	2672893.863	0.3	LHS
	27695	562848.184	2672844.225	0.4	LHS
	27724	562851.395	2672815.482	0.3	LHS
	27819	562862.043	2672721.166	0.4	LHS
	28099	562767.146	2672460.263	0.4	LHS
	28107	562751.431	2672460.365	0.3	RHS
	28107	562751.993	2672460.303	0.4	RHS
	28118	562746.021	2672450.415	0.4	RHS
	28124	562753.398	2672438.729	0.3	LHS
	28125	562741.111	2672445.698	0.3	RHS
	28168	562719.867	2672407.639	0.3	RHS
	28173	562717.749	2672403.092	0.3	RHS
	28229	562686.309	2672359.673	0.3	RHS
	28269	562656.948	2672336.215	0.3	RHS
	28313	562623.428	2672303.695	0.3	LHS
	28336	562604.118	2672292.939	0.4	LHS
	28338	562602.760	2672291.875	0.3	LHS
	29725	561544.936	2671651.446	0.3	RHS
	29742	561542.335	2671635.186	0.4	RHS
	29751	561542.341	2671625.773	0.4	RHS
	30045	561430.518	2671366.060	0.3	LHS
	30066	561427.707	2671345.310	0.35	LHS
	30109	561418.434	2671302.810	0.6	LHS
	30261	561284.338	2671296.691	0.5	LHS
	30369	561197.904	2671363.270	0.3	LHS
	30436	561144.611	2671398.545	0.5	LHS
	30443	561137.373	2671397.432	0.4	LHS
	30457	561125.819	2671406.174	0.34	LHS
	30476	561107.218	2671408.749	0.3	LHS
	30483	561101.320	2671411.485	0.35	LHS
	30638	560977.002	2671346.423	0.4	LHS

	30791	560860.263	2671380.880	0.35	RHS
	30796	560859.394	2671376.165	0.3	RHS
	30801	560854.656	2671372.191	0.3	RHS
	30807	560867.459	2671356.485	0.3	LHS
	30831	560850.168	2671339.305	0.3	LHS
	30837	560845.257	2671335.639	0.33	LHS
	30839	560842.881	2671334.465	0.35	LHS
	30875	560823.560	2671304.076	0.3	LHS
	30882	560823.179	2671296.441	0.36	LHS
	30889	560820.922	2671289.054	0.35	LHS
	30895	560819.001	2671283.683	0.3	LHS
	30932	560799.305	2671252.359	0.3	LHS
	30937	560797.735	2671246.430	0.3	LHS
	31006	560742.788	2671264.046	0.35	RHS
	31009	560725.431	2671259.140	0.7	LHS
	31013	560734.650	2671268.492	0.3	RHS
	31024	560732.207	2671279.286	0.35	RHS
	31034	560728.570	2671288.081	0.3	RHS
	31047	560724.896	2671300.611	0.34	RHS
	31054	560710.156	2671302.773	0.3	LHS
	31060	560708.222	2671309.291	0.6	LHS
	31084	560718.701	2671333.693	0.5	RHS
	31090	560703.847	2671340.296	0.3	LHS
	31110	560706.139	2671359.415	0.4	LHS
	31127	560708.260	2671375.108	0.4	LHS
	31143	560700.190	2671395.716	0.3	RHS
	31156	560687.895	2671377.794	0.4	LHS
	31156	560681.147	2671392.646	0.4	RHS
	31173	560680.329	2671369.694	0.3	LHS
	31289	560604.295	2671320.082	0.3	LHS
	31687	560354.853	2671278.414	0.3	RHS
	31691	560355.403	2671272.796	0.3	RHS
	31698	560364.249	2671265.636	0.4	LHS
	31708	560366.912	2671256.898	0.3	LHS
	31712	560368.494	2671253.242	0.3	LHS
	31715	560370.689	2671250.270	0.3	LHS
	31723	560375.536	2671244.136	0.4	LHS
	31972	560316.884	2671030.716	0.4	RHS
	31984	560309.823	2671021.271	0.3	RHS
	32008	560295.466	2671000.301	0.3	LHS
	32012	560292.968	2670996.989	0.3	LHS
	32015	560283.994	2671003.507	0.4	RHS
	32096	560221.336	2670951.856	0.3	LHS
	32112	560206.337	2670946.029	0.3	LHS
	32122	560196.959	2670942.334	0.4	LHS
	32318	560122.872	2670774.804	0.3	LHS
	32328	560112.734	2670771.281	0.3	LHS
	32345	560106.146	2670755.798	0.4	LHS
	32419	560065.636	2670693.962	0.5	RHS
	32477	560070.642	2670636.014	0.3	LHS

Summary Girth

Girth from 300 mm to 600 mm	150	Nos	.....	Bill No- 01, Sl. No- 1
Girth from 600 mm to 900 mm	13	Nos	.....	Bill No- 01, Sl. No- 2
Girth from 900 mm to 1800 mm	1	Nos	.....	Bill No- 01, Sl. No- 3

Clearing and Grubbing Road Land :

TCS Type	Net Length(m)	Existing Road Width (m)	Width of TCS (m)	Width to be cleared and grubbed (m)	Area to be cleared and grubbed (Ha)
TCS-1	1807.20	6.6	14	7.4	1.3
TCS-2	338.30	4.25	14	9.75	0.3
TCS-3	239.60	4.5	14	9.5	0.2
TCS-4	2295.90	4.8	14	9.2	2.1
TCS-4A	0.00	0	14	14	0.0
TCS-5	340.00	4.1	12	7.9	0.3
TCS-6	5558.18	3.845	10	6.155	3.4
TCS-6A	0.00	0	10	10	0.0
TCS-7	3558.00	3.9	12	8.1	2.9
TCS-8	495.00	4.025	12	7.975	0.4
TCS-9	2032.40	4.6	10	5.4	1.1
TCS-10	538.10	4.3	14	9.7	0.5
TCS-10A	0.00	0	14	14	0.0
TCS-11	877.60	3.5	12	8.5	0.7
TCS-12	524.80	4.125	12	7.875	0.4
TCS-13	247.40	4.2	14	9.8	0.2
			Total=		**14.0**

Total area of clearing & grubbing= **14.0 Ha** …… Bill No- 01, Sl. No- 4

Calculation of Quantities for Dismantling

Sl. No.	Brief Description	Unit	Design ch.	No.	L	B / H	T	Quantity	Total Quantity
A) Stone	Abutments for	cum	13.94	2	8.9	3.00	0.50	26.70	
A) Stone Masonry	Abutments for existing slab culvert H=h, Length=L, and thickness=t.	cum	14.311	2	5.7	3.00	0.50	17.10	
			14.513	2	7.0	3.00	0.50	21.00	
			14.539	2	8.3	3.00	0.50	24.90	
			14.688	2	7.3	3.00	0.50	21.90	
			14.887	2	8.3	3.00	0.50	24.90	
			15.079	2	8.0	3.00	0.50	24.00	
			15.248	2	8.0	3.00	0.50	24.00	
			15.336	2	8.4	3.00	0.50	25.20	
			15.447	2	7.2	3.00	0.50	21.60	
			15.805	2	7.0	3.00	0.50	21.00	
			15.865	2	10.0	3.00	0.50	30.00	
			16.111	2	8.4	3.00	0.50	25.20	
			16.196	2	8.0	3.00	0.50	24.00	
			16.496	2	7.0	3.00	0.50	21.00	
			16.73	2	7.0	3.00	0.50	21.00	
			16.96	2	8.0	3.00	0.50	24.00	
			17.272	2	8.0	3.00	0.50	24.00	
			17.381	2	6.5	3.00	0.50	19.50	
			17.511	2	5.5	3.00	0.50	16.50	
			17.617	2	8.1	3.00	0.50	24.30	
			18.064	2	8.5	3.00	0.50	25.50	
			18.298	2	8.0	3.00	0.50	24.00	
			18.411	2	8.2	3.00	0.50	24.60	
			18.54	2	12.0	3.00	0.50	36.00	
			16.69	2	9.2	3.00	0.50	27.60	
			18.959	2	9.2	3.00	0.50	27.60	
			19.239	2	4.8	3.00	0.50	14.40	
			19.582	2	5.0	3.00	0.50	15.00	
			19.752	2	4.5	3.00	0.50	13.50	
			19.998	2	4.5	3.00	0.50	13.50	
			20.033	2	4.5	3.00	0.50	13.50	
			20.308	2	4.6	3.00	0.50	13.80	
			20.434	2	5.0	3.00	0.50	15.00	
			20.625	2	4.5	3.00	0.50	13.50	
			20.91	2	4.5	3.00	0.50	13.50	
			21.093	2	4.0	3.00	0.50	12.00	
			21.447	2	5.5	3.00	0.50	16.50	
			21.703	2	5.3	3.00	0.50	15.90	
			21.89	2	4.7	3.00	0.50	14.10	
			22.021	2	4.5	3.00	0.50	13.50	
			22.627	2	5.3	3.00	0.50	15.90	
			22.768	2	4.4	3.00	0.50	13.20	
			22.99	2	4.4	3.00	0.50	13.20	
			23.426	2	4.5	3.00	0.50	13.50	
			23.458	2	5.0	3.00	0.50	15.00	
			23.782	2	4.5	3.00	0.50	13.50	
			23.91	2	5.7	3.00	0.50	17.10	
			24.225	2	5.0	3.00	0.50	15.00	
			24.463	2	4.5	3.00	0.50	13.50	
			24.812	2	4.2	3.00	0.50	12.60	
			25.53	2	4.0	3.00	0.50	12.00	
			26.122	2	3.8	3.00	0.50	11.40	

A) Stone Masonry	Abutments for existing slab culvert H=h, Length=L, and thickness=t.	cum	26.262	2	4.5	3.00	0.50	13.50	
			27.577	2	4.5	3.00	0.50	13.50	
			28.427	2	5.0	3.00	0.50	15.00	
			28.56	2	4.0	3.00	0.50	12.00	
			28.837	2	4.5	3.00	0.50	13.50	
			29.475	2	4.2	3.00	0.50	12.60	
			29.81	2	4.5	3.00	0.50	13.50	
			30.045	2	4.5	3.00	0.50	13.50	
			30.357	2	4.7	3.00	0.50	14.10	
			30.561	2	5.0	3.00	0.50	15.00	
			30.753	2	4.2	3.00	0.50	12.60	
			30.925	2	4.7	3.00	0.50	14.10	
			31.028	2	4.5	3.00	0.50	13.50	
			31.638	2	4.4	3.00	0.50	13.20	
			31.806	2	4.5	3.00	0.50	13.50	
			32.305	2	4.2	3.00	0.50	12.60	
			32.645	2	5.0	3.00	0.50	15.00	
			32.75	2	6.0	3.00	0.50	18.00	
								Total =	**1259.40**

B) RCC	For Slab culvert	Cum	13.94	1	8.9	1.00	0.3	2.67	
			14.311	1	5.7	0.70	0.3	1.20	
			14.513	1	7.0	1.00	0.3	2.10	
			14.539	1	8.3	0.60	0.3	1.49	
			14.688	1	7.3	2.00	0.3	4.38	
			14.887	1	8.3	1.60	0.3	3.98	
			15.079	1	8.0	2.50	0.3	6.00	
			15.248	1	8.0	0.76	0.3	1.82	
			15.336	1	8.4	2.20	0.3	5.54	
			15.447	1	7.2	1.00	0.3	2.16	
			15.805	1	7.0	0.90	0.3	1.89	
			15.865	1	10.0	3.80	0.3	11.40	
			16.111	1	8.4	1.20	0.3	3.02	
			16.196	1	8.0	4.20	0.3	10.08	
			16.496	1	7.0	1.30	0.3	2.73	
			16.73	1	7.0	1.00	0.3	2.10	
			16.96	1	8.0	4.00	0.3	9.60	
			17.272	1	8.0	4.20	0.3	10.08	
			17.381	1	6.5	1.00	0.3	1.95	
			17.511	1	5.5	0.80	0.3	1.32	
			17.617	1	8.1	2.40	0.3	5.83	
			18.064	1	8.5	1.00	0.3	2.55	
			18.298	1	8.0	1.00	0.3	2.40	
			18.411	1	8.2	1.00	0.3	2.46	
			18.54	1	12.0	3.20	0.3	11.52	
			16.69	1	9.2	1.80	0.3	4.97	
			18.959	1	9.2	1.10	0.3	3.04	
			19.239	1	4.8	1.10	0.3	1.58	
			19.582	1	5.0	1.20	0.3	1.80	
			19.752	1	4.5	3.30	0.3	4.46	
			19.998	1	4.5	1.50	0.3	2.03	
			20.033	1	4.5	1.20	0.3	1.62	

			20.308	1	4.6	1.90	0.3	2.62	
			20.434	1	5.0	2.00	0.3	3.00	
			20.625	1	4.5	1.00	0.3	1.35	
			20.91	1	4.5	5.00	0.3	6.75	
			21.093	1	4.0	1.20	0.3	1.44	
			21.447	1	5.5	1.70	0.3	2.81	
			21.703	1	5.3	1.00	0.3	1.59	
			21.89	1	4.7	1.00	0.3	1.41	
			22.021	1	4.5	1.80	0.3	2.43	
			22.627	1	5.3	1.00	0.3	1.59	
			22.768	1	4.4	0.90	0.3	1.19	
			22.99	1	4.4	0.90	0.3	1.19	
			23.426	1	4.5	2.00	0.3	2.70	
			23.458	1	5.0	1.00	0.3	1.50	
			23.782	1	4.5	1.30	0.3	1.76	
			23.91	1	5.7	2.50	0.3	4.28	
			24.225	1	5.0	1.00	0.3	1.50	
			24.463	1	4.5	1.20	0.3	1.62	
			24.812	1	4.2	1.10	0.3	1.39	
B) RCC	For Slab culvert	Cum	25.53	1	4.0	2.00	0.3	2.40	
			26.122	1	3.8	1.50	0.3	1.71	
			26.262	1	4.5	1.40	0.3	1.89	
			27.577	1	4.5	1.00	0.3	1.35	
			28.427	1	5.0	1.00	0.3	1.50	
			28.56	1	4.0	1.00	0.3	1.20	
			28.837	1	4.5	1.00	0.3	1.35	
			29.475	1	4.2	0.80	0.3	1.01	
			29.81	1	4.5	1.10	0.3	1.49	
			30.045	1	4.5	1.10	0.3	1.49	
			30.357	1	4.7	1.80	0.3	2.54	
			30.561	1	5.0	2.00	0.3	3.00	
			30.753	1	4.2	2.00	0.3	2.52	
			30.925	1	4.7	1.60	0.3	2.26	
			31.028	1	4.5	1.00	0.3	1.35	
			31.638	1	4.4	4.30	0.3	5.68	
			31.806	1	4.5	1.00	0.3	1.35	
			32.305	1	4.2	1.50	0.3	1.89	
			32.645	1	5.0	1.00	0.3	1.50	
			32.75	1	6.0	1.30	0.3	2.34	
								Total=	**211.67**
	Hume Pipe								
C) Hume Pipe	Dia upto 600 mm =	m		1	9.00				**9.00**
	Dia from 600-900 mm =	m		2	9.30				**18.60**
	Dia above 900mm=	m		3	10.20				**30.60**

Quantity Summary of Dismantling of Existing Culvert::

Total Dismantling of Rubble stone masonry in cement mortar=	**1259.40 cum**	.....	Bill No- 01, Sl. No- 6
Total Dismantling of Reinforced cement concrete=	**211.674 cum**	.....	Bill No- 01, Sl. No- 5
Total Dismantling of up to 600 mm dia Hume Pipe=	**9.00 m**	.....	Bill No- 01, Sl. No- 7
Total Dismantling of above 600 mm to 900 mm dia Hume Pipe=	**18.60 m**	.....	Bill No- 01, Sl. No- 8
Total Dismantling of above 900 mm dia Hume Pipe=	**30.60 m**	.....	Bill No- 01, Sl. No- 9

Quantity calculation for dismentling of Flexible Pavement

TCS	Net Length (m)	Avg. Width (m)	Thickness of Bituminous Layer (m)	Thickness of Base Layer/Sub Base Layer (m)	Quantity of Bituminous Layer (CUM)	Quantity of Base Layer for reuse (cum)
TCS-1	1807.2	6.6	0.035	0.260	417.463	3101
TCS-2	338.3	4.25	0.05		71.889	
TCS-3	239.6	4.5	0.04		43.128	
TCS-4	2295.9	4.8	0.025	0.200	275.508	2204
TCS-5	340.00	4.25	0.04		57.800	
TCS-6	5558.18	3.845	0.045		961.704	
TCS-7	3558	3.9	0.043	0.155	596.677	2151
TCS-8	495	4.025	0.043	0.14	85.672	271
TCS-9	2032.4	4.6	0.03	0.175	280.471	1636
TCS-10	538.1	4.3	0.035		80.984	
TCS-11	877.6	3.5	0.037	0.138	113.649	424
TCS-12	524.8	4.125	0.083	0.150	179.678	325
TCS-13	247.4	4.2	0.045	0.170	46.759	177
Total =					3211.382	**10288**

Total quantity for dismantling (Bituminous layer)=	3211.38	cum		
Quantity of Dismantelled Bituminous Material(sqm) (Assume avg thickness 75mm)	**42818**	**sqm**	.....	Bill No- 01, Sl. No- 11

Total quantity for dismantling (Granular Layer)=	10288.32	cum		
Quantity of Granular Material(sqm) (Assume avg thickness 150mm)	**68589**	**sqm**	.....	Bill No- 01, Sl. No- 10

Quantity of stone material for reuse (@ 60%) = 6173 cum

Earthwork
QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
13750	6.80	0	185.13	0.00
13775	6.39	0	164.88	0.00
13800	3.23	0.07	120.25	0.88
13825	2.21	1.99	68.00	25.75
13850	11.08	0	166.13	24.88
13875	7.09	0.47	227.13	5.88
13900	2.67	3.4	122.00	48.38
13925	4.64	1.42	91.38	60.25
13950	8.99	0	170.38	17.75
13975	5.86	2.07	185.63	25.88
14000	3.55	0.71	117.63	34.75
14025	3.49	0.23	88.00	11.75
14050	2.92	0.52	80.13	9.38
14075	2.80	2.09	71.50	32.63
14100	1.59	1.98	54.88	50.88
14125	0.00	5.18	19.88	89.50
14150	0.01	7.35	0.13	156.63
14175	0.05	8	0.75	191.88
14200	0.33	3.57	4.75	144.63
14225	0.00	130.7	4.13	1678.38
14250	2.15	1.34	26.88	1650.50
14275	6.73	0	111.00	16.75
14300	49.93	0	708.25	0.00
14325	55.33	0	1315.75	0.00
14350	23.26	0	982.38	0.00
14375	1.81	0.74	313.38	9.25
14400	25.12	2.85	336.63	44.88
14425	24.39	5.86	618.88	108.88
14450	0.00	32.9	304.88	484.50
14475	0.02	23.26	0.25	702.00
14500	0.00	18.52	0.25	522.25
14525	4.46	0	55.75	231.50
14550	10.61	0	188.38	0.00
14575	10.03	0.06	258.00	0.75
14600	20.18	0	377.63	0.75
14625	42.20	0.05	779.75	0.63
14650	33.91	0	951.38	0.63
14675	67.30	0	1265.13	0.00
14700	59.67	0	1587.13	0.00
14725	15.43	0.1	938.75	1.25
14750	1.36	4.54	209.88	58.00
14775	9.32	18.38	133.50	286.50
14800	1.01	27.98	129.13	579.50
14825	31.33	22.99	404.25	637.13
14850	10.67	17.96	525.00	511.88

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
14875	28.77	8.99	493.00	336.88
14900	13.42	4.78	527.38	172.13
14925	0.91	4.08	179.13	110.75
14950	14.18	0	188.63	51.00
14975	33.77	0	599.38	0.00
15000	28.36	0	776.63	0.00
15025	26.74	0	688.75	0.00
15050	10.19	0.41	461.63	5.13
15075	0.62	5.04	135.13	68.13
15100	0.38	3.14	12.50	102.25
15125	3.16	12.08	44.25	190.25
15150	0.00	41.82	39.50	673.75
15175	0.04	62.99	0.50	1310.13
15200	0.00	66.93	0.50	1624.00
15225	0.00	15.73	0.00	1033.25
15250	5.28	6.71	66.00	280.50
15275	23.13	0	355.13	83.88
15300	50.05	0.85	914.75	10.63
15325	17.07	9.62	839.00	130.88
15350	16.81	9.43	423.50	238.13
15375	0.00	12.08	210.13	268.88
15400	0.00	77.79	0.00	1123.38
15425	0.00	180.18	0.00	3224.63
15450	0.00	103.27	0.00	3543.13
15475	1.71	3.23	21.38	1331.25
15500	43.13	0.12	560.50	41.88
15525	21.09	0.01	802.75	1.63
15550	22.83	0	549.00	0.13
15575	5.67	7.81	356.25	97.63
15600	0.00	40.15	70.88	599.50
15625	4.54	11.32	56.75	643.38
15650	64.30	1.67	860.50	162.38
15675	15.09	0.02	992.38	21.13
15700	6.79	0	273.50	0.25
15725	31.87	0	483.25	0.00
15750	51.90	0	1047.13	0.00
15775	25.61	0	968.88	0.00
15800	27.52	0	664.13	0.00
15825	17.79	4.51	566.38	56.38
15850	0.00	84.05	222.38	1107.00
15875	0.02	88.87	0.25	2161.50
15900	0.00	14.52	0.25	1292.38
15925	17.94	0	224.25	181.50
15950	104.13	0	1525.88	0.00
15975	60.14	0	2053.38	0.00

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
16000	67.23	0	1592.13	0.00
16025	16.05	0.35	1041.00	4.38
16050	0.13	16.53	202.25	211.00
16075	0.00	47.15	1.63	796.00
16100	0.00	66.52	0.00	1420.88
16125	0.00	14.85	0.00	1017.13
16150	6.09	0	76.13	185.63
16175	49.90	0	699.88	0.00
16200	48.69	0	1232.38	0.00
16225	21.08	0	872.13	0.00
16250	9.96	0.04	388.00	0.50
16275	53.24	0	790.00	0.50
16300	37.97	0	1140.13	0.00
16325	4.30	54.75	528.38	684.38
16350	0.00	17.98	53.75	909.13
16375	1.75	30.06	21.88	600.50
16400	1.06	7.67	35.13	471.63
16425	41.32	0.92	529.75	107.38
16450	36.12	0.16	968.00	13.50
16475	35.50	0	895.25	2.00
16500	20.55	0	700.63	0.00
16525	58.71	0	990.75	0.00
16550	100.05	0	1984.50	0.00
16575	37.17	0.04	1715.25	0.50
16600	13.03	14.73	627.50	184.63
16625	47.71	0	759.25	184.13
16650	48.50	0	1202.63	0.00
16675	0.72	4.13	615.25	51.63
16700	0.88	2.97	20.00	88.75
16725	16.66	0.85	219.25	47.75
16750	18.12	6.39	434.75	90.50
16775	32.49	2.67	632.63	113.25
16800	4.95	64.27	468.00	836.75
16825	10.33	2.82	191.00	838.63
16850	29.90	0	502.88	35.25
16875	17.06	40.32	587.00	504.00
16900	88.97	0	1325.38	504.00
16925	111.35	0	2504.00	0.00
16950	29.57	0.21	1761.50	2.63
16975	10.80	4.72	504.63	61.63

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
17000	31.10	0	523.75	59.00
17025	0.00	26.16	388.75	327.00
17050	0.00	9.55	0.00	446.38
17075	3.60	1.81	45.00	142.00
17100	44.38	0	599.75	22.63
17125	26.44	0.01	885.25	0.13
17150	12.96	0	492.50	0.13
17175	4.95	0.23	223.88	2.88
17200	6.39	0	141.75	2.88
17225	37.14	0	544.13	0.00
17250	4.76	1.04	523.75	13.00
17275	0.00	117.72	59.50	1484.50
17300	0.00	44.53	0.00	2028.13
17325	38.41	0.03	480.13	557.00
17350	79.73	0	1476.75	0.38
17375	49.75	0	1618.50	0.00
17400	39.33	0	1113.50	0.00
17425	89.84	0	1614.63	0.00
17450	86.47	0	2203.88	0.00
17475	79.25	0.35	2071.50	4.38
17500	12.70	0	1149.38	4.38
17525	0.00	30.3	158.75	378.75
17550	12.96	24.7	162.00	687.50
17575	0.00	19.38	162.00	551.00
17600	10.96	0.6	137.00	249.75
17625	30.08	0	513.00	7.50
17650	9.58	0	495.75	0.00
17675	20.98	0.03	382.00	0.38
17700	35.33	0	703.88	0.38
17725	20.04	0	692.13	0.00
17750	12.10	0.27	401.75	3.38
17775	0.48	12.73	157.25	162.50
17800	23.39	10.68	298.38	292.63
17825	58.83	5.58	1027.75	203.25
17850	9.82	6.19	858.13	147.13
17875	50.17	1.19	749.88	92.25
17900	23.71	24.14	923.50	316.63
17925	0.95	86.87	308.25	1387.63
17950	4.06	41.66	62.63	1606.63
17975	16.62	48.53	258.50	1127.38

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
18000	1.64	23.31	228.25	898.00
18025	44.62	0	578.25	291.38
18050	8.92	0	669.25	0.00
18075	3.30	34.42	152.75	430.25
18100	29.04	0.3	404.25	434.00
18125	129.67	0.04	1983.88	4.25
18150	11.17	0	1760.50	0.50
18175	0.46	115.74	145.38	1446.75
18200	4.14	49.97	57.50	2071.38
18225	38.69	0	535.38	624.63
18250	26.34	0	812.88	0.00
18275	28.24	0.01	682.25	0.13
18300	75.17	0	1292.63	0.13
18325	87.84	0	2037.63	0.00
18350	108.62	0	2455.75	0.00
18375	29.15	0	1722.13	0.00
18400	3.57	0.67	409.00	8.38
18425	37.86	0	517.88	8.38
18450	140.15	0	2225.13	0.00
18475	67.89	0.04	2600.50	0.50
18500	12.67	0	1007.00	0.50
18525	144.91	0.03	1969.75	0.38
18550	37.24	0	2276.88	0.38
18575	6.80	0.02	550.50	0.25
18600	89.89	3.14	1208.63	39.50
18625	34.87	6.11	1559.50	115.63
18650	0.00	52.12	435.88	727.88
18675	0.33	9	4.13	764.00
18700	24.80	2.29	314.13	141.13
18725	11.79	1.36	457.38	45.63
18750	0.89	1.34	158.50	33.75
18775	11.07	1	149.50	29.25
18800	122.20	0.79	1665.88	22.38
18825	42.47	0.16	2058.38	11.88
18850	9.80	0	653.38	2.00
18875	0.00	24.84	122.50	310.50
18900	31.29	0	391.13	310.50
18925	4.41	1.71	446.25	21.38
18950	60.63	0	813.00	21.38
18975	39.63	0.09	1253.25	1.13

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
19000	77.61	0	1465.50	1.13
19025	52.22	0	1622.88	0.00
19050	23.02	0	940.50	0.00
19075	14.34	0	467.00	0.00
19100	5.34	0.01	246.00	0.13
19125	2.25	0.37	94.88	4.75
19150	0.14	4.68	29.88	63.13
19175	6.25	10.57	79.88	190.63
19200	27.77	0	425.25	132.13
19225	18.67	0.04	580.50	0.50
19250	8.24	0	336.38	0.50
19275	24.58	0	410.25	0.00
19300	32.00	0	707.25	0.00
19325	60.37	0	1154.63	0.00
19350	36.81	0	1214.75	0.00
19375	8.95	1.73	572.00	21.63
19400	11.38	4.31	254.13	75.50
19425	12.11	6.83	293.63	139.25
19450	4.48	16.07	207.38	286.25
19475	5.14	4.61	120.25	258.50
19500	24.97	0	376.38	57.63
19525	74.33	0	1241.25	0.00
19550	101.59	0	2199.00	0.00
19575	26.51	0.08	1601.25	1.00
19600	40.11	0	832.75	1.00
19625	23.23	0	791.75	0.00
19650	10.57	0	422.50	0.00
19675	9.18	0.86	246.88	10.75
19700	2.72	0	148.75	10.75
19725	0.14	21.73	35.75	271.63
19750	10.85	8.3	137.38	375.38
19775	17.87	3.36	359.00	145.75
19800	72.77	0.07	1133.00	42.88
19825	56.11	0	1611.00	0.88
19850	22.03	0	976.75	0.00
19875	3.66	5.54	321.13	69.25
19900	9.38	1.03	163.00	82.13
19925	4.16	13.99	169.25	187.75
19950	2.53	2.32	83.63	203.88
19975	7.16	0.16	121.13	31.00

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
20000	15.70	0	285.75	2.00
20025	14.77	0.02	380.88	0.25
20050	8.11	0	286.00	0.25
20075	1.38	0.05	118.63	0.63
20100	11.65	0.07	162.88	1.50
20125	11.77	0.06	292.75	1.63
20150	17.39	0	364.50	0.75
20175	37.77	0	689.50	0.00
20200	1.12	2.05	486.13	25.63
20225	0.00	7.13	14.00	114.75
20250	0.00	3.73	0.00	135.75
20275	0.75	0.13	9.38	48.25
20300	3.45	0	52.50	1.63
20325	4.49	1.27	99.25	15.88
20350	5.60	0.58	126.13	23.13
20375	16.24	0.01	273.00	7.38
20400	14.71	0	386.88	0.13
20425	3.13	1.23	223.00	15.38
20450	0.00	7.22	39.13	105.63
20475	0.01	20.32	0.13	344.25
20500	0.00	19.93	0.13	503.13
20525	0.08	5.87	1.00	322.50
20550	3.49	0	44.63	73.38
20575	0.05	8.82	44.25	110.25
20600	0.00	36.43	0.63	565.63
20625	0.00	11.78	0.00	602.63
20650	0.00	8.57	0.00	254.38
20675	16.79	18.41	209.88	337.25
20700	5.44	14.25	277.88	408.25
20725	13.40	5.88	235.50	251.63
20750	42.63	0.06	700.38	74.25
20775	7.32	8.57	624.38	107.88
20800	61.56	0	861.00	107.13
20825	0.07	60.89	770.38	761.13
20850	0.00	48.25	0.88	1364.25
20875	0.03	7.21	0.38	693.25
20900	5.54	0.44	69.63	95.63
20925	13.53	0	238.38	5.50
20950	27.20	0	509.13	0.00
20975	24.82	0	650.25	0.00

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
21000	15.48	0	503.75	0.00
21025	3.43	0.42	236.38	5.25
21050	0.18	18.36	45.13	234.75
21075	0.00	41	2.25	742.00
21100	0.00	74.4	0.00	1442.50
21125	0.15	69.47	1.88	1798.38
21150	0.00	77.45	1.88	1836.50
21175	0.01	75.97	0.13	1917.75
21200	0.00	69.58	0.13	1819.38
21225	0.37	66.87	4.63	1705.63
21250	0.00	76.88	4.63	1796.88
21275	0.01	118.84	0.13	2446.50
21300	0.00	155.06	0.13	3423.75
21325	0.04	152.22	0.50	3841.00
21350	0.00	121.33	0.50	3419.38
21375	0.06	111.17	0.75	2906.25
21400	0.00	67.46	0.75	2232.88
21425	46.33	1.93	579.13	867.38
21450	92.50	0	1735.38	24.13
21475	58.79	0	1891.13	0.00
21500	23.32	0	1026.38	0.00
21525	0.00	16.75	291.50	209.38
21550	27.79	0	347.38	209.38
21575	110.26	0	1725.63	0.00
21600	173.73	0	3549.88	0.00
21625	173.26	0	4337.38	0.00
21650	96.33	0	3369.88	0.00
21675	42.44	0	1734.63	0.00
21700	7.08	0	619.00	0.00
21725	6.94	0	175.25	0.00
21750	37.64	1.88	557.25	23.50
21775	54.71	3.87	1154.38	71.88
21800	13.33	31.23	850.50	438.75
21825	33.61	3.57	586.75	435.00
21850	23.55	1.31	714.50	61.00
21875	1.88	4.22	317.88	69.13
21900	34.28	0	452.00	52.75
21925	36.12	0.09	880.00	1.13
21950	25.00	94.79	764.00	1186.00
21975	42.00	36.57	837.50	1642.00

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
22000	44.52	0.7	1081.50	465.88
22025	75.16	25.28	1496.00	324.75
22050	31.04	17.84	1327.50	539.00
22075	45.01	5.66	950.63	293.75
22100	73.84	0	1485.63	70.75
22125	14.35	1.01	1102.38	12.63
22150	7.30	0	270.63	12.63
22175	10.92	0	227.75	0.00
22200	32.31	0	540.38	0.00
22225	21.56	0.03	673.38	0.38
22250	30.72	5.14	653.50	64.63
22275	9.60	25.05	504.00	377.38
22300	7.88	14.37	218.50	492.75
22325	25.06	5.54	411.75	248.88
22350	29.17	0	677.88	69.25
22375	45.08	1.44	928.13	18.00
22400	36.47	0	1019.38	18.00
22425	13.15	0.07	620.25	0.88
22450	0.00	18.79	164.38	235.75
22475	24.95	22.65	311.88	518.00
22500	88.81	0	1422.00	283.13
22525	0.00	58.31	1110.13	728.88
22550	0.00	88.35	0.00	1833.25
22575	0.00	75.09	0.00	2043.00
22600	0.33	68.51	4.13	1795.00
22625	14.36	11.5	183.63	1000.13
22650	7.32	2.86	271.00	179.50
22675	11.84	1.97	239.50	60.38
22700	79.53	0	1142.13	24.63
22725	26.53	39.86	1325.75	498.25
22750	84.69	0	1390.25	498.25
22775	91.80	0	2206.13	0.00
22800	109.39	0	2514.88	0.00
22825	93.80	0	2539.88	0.00
22850	169.70	0	3293.75	0.00
22875	197.27	0	4587.13	0.00
22900	121.55	0	3985.25	0.00
22925	194.11	0	3945.75	0.00
22950	222.06	0	5202.13	0.00
22975	142.36	0.01	4555.25	0.13

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
23000	105.35	0	3096.38	0.13
23025	67.44	0.07	2159.88	0.88
23050	53.21	0	1508.13	0.88
23075	56.79	0.08	1375.00	1.00
23100	56.38	0	1414.63	1.00
23125	54.84	0	1390.25	0.00
23150	54.54	67.27	1367.25	840.88
23175	20.59	66.78	939.13	1675.63
23200	3.89	62.02	306.00	1610.00
23225	4.59	1.62	106.00	795.50
23250	11.73	0.04	204.00	20.75
23275	23.46	0.01	439.88	0.63
23300	79.70	0	1289.50	0.13
23325	53.07	0	1659.63	0.00
23350	24.89	0	974.50	0.00
23375	33.71	0	732.50	0.00
23400	0.74	6.22	430.63	77.75
23425	0.14	19.88	11.00	326.25
23450	29.69	5.98	372.88	323.25
23475	15.85	4.35	569.25	129.13
23500	12.28	0.17	351.63	56.50
23525	68.01	0.26	1003.63	5.38
23550	38.79	0	1335.00	3.25
23575	33.32	0.01	901.38	0.13
23600	65.42	0	1234.25	0.13
23625	61.24	0.02	1583.25	0.25
23650	31.22	0	1155.75	0.25
23675	4.96	0.39	452.25	4.88
23700	3.48	3.88	105.50	53.38
23725	3.96	1.46	93.00	66.75
23750	4.50	0.04	105.75	18.75
23775	24.90	0	367.50	0.50
23800	90.29	0	1439.88	0.00
23825	72.17	0.05	2030.75	0.63
23850	75.11	0	1841.00	0.63
23875	69.60	0.03	1808.88	0.38
23900	40.08	0	1371.00	0.38
23925	53.06	0	1164.25	0.00
23950	8.14	26.16	765.00	327.00
23975	0.00	29.39	101.75	694.38

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
24000	0.00	45.01	0.00	930.00
24025	1.22	8.91	15.25	674.00
24050	24.31	9.15	319.13	225.75
24075	0.12	23.42	305.38	407.13
24100	0.00	127.15	1.50	1882.13
24125	0.00	159.42	0.00	3582.13
24150	0.00	68.62	0.00	2850.50
24175	3.04	18.97	38.00	1094.88
24200	33.74	7.35	459.75	329.00
24225	7.03	11.77	509.63	239.00
24250	0.00	29.73	87.88	518.75
24275	0.68	7.69	8.50	467.75
24300	1.16	19.67	23.00	342.00
24325	0.13	8.72	16.13	354.88
24350	0.00	29.15	1.63	473.38
24375	0.00	44.48	0.00	920.38
24400	0.00	41.77	0.00	1078.13
24425	0.00	16.27	0.00	725.50
24450	9.70	0.2	121.25	205.88
24475	41.02	0	634.00	2.50
24500	17.23	0	728.13	0.00
24525	3.70	0.94	261.63	11.75
24550	5.37	0	113.38	11.75
24575	4.70	0.52	125.88	6.50
24600	5.32	0.14	125.25	8.25
24625	19.29	0	307.63	1.75
24650	4.03	0.01	291.50	0.13
24675	0.00	36.72	50.38	459.13
24700	22.44	14.35	280.50	638.38
24725	54.76	0	965.00	179.38
24750	88.26	0	1787.75	0.00
24775	65.11	5.15	1917.13	64.38
24800	41.10	67.94	1327.63	913.63
24825	44.49	55.82	1069.88	1547.00
24850	34.35	12.76	985.50	857.25
24875	15.77	0.59	626.50	166.88
24900	12.57	0.5	354.25	13.63
24925	15.83	0.33	355.00	10.38
24950	9.18	0.58	312.63	11.38
24975	7.72	0.09	211.25	8.38

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
25000	6.95	0	183.38	1.13
25025	8.67	0.03	195.25	0.38
25050	14.19	0	285.75	0.38
25075	13.39	0.01	344.75	0.13
25100	6.23	0	245.25	0.13
25125	0.14	5.1	79.63	63.75
25150	0.00	8.92	1.75	175.25
25175	0.01	12.17	0.13	263.63
25200	0.00	5.1	0.13	215.88
25225	0.27	1.47	3.38	82.13
25250	0.45	1.37	9.00	35.50
25275	0.24	0.55	8.63	24.00
25300	1.22	0.68	18.25	15.38
25325	7.32	0	106.75	8.50
25350	5.53	18.17	160.63	227.13
25375	0.39	4.31	74.00	281.00
25400	0.00	8.69	4.88	162.50
25425	2.33	5.68	29.13	179.63
25450	19.34	0	270.88	71.00
25475	14.80	0	426.75	0.00
25500	10.63	0	317.88	0.00
25525	2.94	0	169.63	0.00
25550	10.48	0	167.75	0.00
25575	15.97	0	330.63	0.00
25600	2.29	3.74	228.25	46.75
25625	0.00	35.35	28.63	488.63
25650	0.00	56.84	0.00	1152.38
25675	0.00	41.72	0.00	1232.00
25700	29.13	0	364.13	521.50
25725	34.95	0.28	801.00	3.50
25750	45.29	0	1003.00	3.50
25775	37.20	0	1031.13	0.00
25800	32.79	0	874.88	0.00
25825	72.97	0.12	1322.00	1.50
25850	89.52	0	2031.13	1.50
25875	65.09	0	1932.63	0.00
25900	64.95	0	1625.50	0.00
25925	52.43	0	1467.25	0.00
25950	37.41	0	1123.00	0.00
25975	58.69	0	1201.25	0.00

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
26000	7.29	0.65	824.75	8.13
26025	58.41	2.42	821.25	38.38
26050	59.30	0	1471.38	30.25
26075	0.00	32.32	741.25	404.00
26100	0.00	109.75	0.00	1775.88
26125	0.00	196.92	0.00	3833.38
26150	0.00	204.2	0.00	5014.00
26175	0.00	84.21	0.00	3605.13
26200	19.01	0	237.63	1052.63
26225	110.50	0	1618.88	0.00
26250	96.47	0	2587.13	0.00
26275	122.96	0	2742.88	0.00
26300	143.60	0	3332.00	0.00
26325	100.12	0	3046.50	0.00
26350	22.84	0	1537.00	0.00
26375	0.19	0.96	287.88	12.00
26400	0.29	11.77	6.00	159.13
26425	0.01	19.65	3.75	392.75
26450	6.22	0	77.88	245.63
26475	9.88	0.33	201.25	4.13
26500	12.80	0.57	283.50	11.25
26525	7.86	10.28	258.25	135.63
26550	10.79	0	233.13	128.50
26575	31.65	66.37	530.50	829.63
26600	15.46	55.58	588.88	1524.38
26625	7.91	12.17	292.13	846.88
26650	2.69	4.35	132.50	206.50
26675	0.01	7.92	33.75	153.38
26700	9.04	0	113.13	99.00
26725	2.10	6.07	139.25	75.88
26750	0.00	4.93	26.25	137.50
26775	35.36	0	442.00	61.63
26800	126.08	0	2018.00	0.00
26825	110.70	0	2959.75	0.00
26850	54.06	0	2059.50	0.00
26875	28.66	0.01	1034.00	0.13
26900	10.44	9.16	488.75	114.63
26925	21.66	0	401.25	114.50
26950	17.11	0.6	484.63	7.50
26975	20.42	0	469.13	7.50

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
27000	18.06	0	481.00	0.00
27025	11.82	1.65	373.50	20.63
27050	0.51	4.7	154.13	79.38
27075	0.07	12.09	7.25	209.88
27100	0.94	12.45	12.63	306.75
27125	0.02	12.45	12.00	311.25
27150	0.81	11.68	10.38	301.63
27175	5.83	3.88	83.00	194.50
27200	1.26	1.21	88.63	63.63
27225	1.60	0	35.75	15.13
27250	2.51	0	51.38	0.00
27275	2.04	3.2	56.88	40.00
27300	4.65	0	83.63	40.00
27325	0.76	2.87	67.63	35.88
27350	7.80	0	107.00	35.88
27375	11.93	0.03	246.63	0.38
27400	19.01	0	386.75	0.38
27425	33.34	0	654.38	0.00
27450	39.27	0	907.63	0.00
27475	60.20	0.01	1243.38	0.13
27500	100.45	0	2008.13	0.13
27525	129.76	0	2877.63	0.00
27550	172.09	0	3773.13	0.00
27575	133.89	0.04	3824.75	0.50
27600	79.89	0	2672.25	0.50
27625	28.56	0.05	1355.63	0.63
27650	4.25	0.12	410.13	2.13
27675	0.00	30.46	53.13	382.25
27700	0.00	30.86	0.00	766.50
27725	1.12	10.06	14.00	511.50
27750	10.67	0.32	147.38	129.75
27775	5.27	0.01	199.25	4.13
27800	5.02	1.31	128.63	16.50
27825	10.05	0	188.38	16.38
27850	10.62	0	258.38	0.00
27875	9.48	0.21	251.25	2.63
27900	12.39	0	273.38	2.63
27925	1.22	1.81	170.13	22.63
27950	0.37	7.37	19.88	114.75
27975	0.72	6.4	13.63	172.13

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
28000	13.31	0	175.38	80.00
28025	15.88	0.22	364.88	2.75
28050	10.78	0	333.25	2.75
28075	0.46	2.27	140.50	28.38
28100	0.09	6.15	6.88	105.25
28125	0.35	6.27	5.50	155.25
28150	0.00	7.48	4.38	171.88
28175	2.72	2.06	34.00	119.25
28200	4.82	0	94.25	25.75
28225	8.78	0.14	170.00	1.75
28250	19.66	0	355.50	1.75
28275	18.98	0	483.00	0.00
28300	36.15	0	689.13	0.00
28325	61.38	0.01	1219.13	0.13
28350	84.50	0	1823.50	0.13
28375	68.42	0.01	1911.50	0.13
28400	43.00	0	1392.75	0.13
28425	1.81	3.5	560.13	43.75
28450	11.37	0	164.75	43.75
28475	0.01	12.79	142.25	159.88
28500	0.45	3.6	5.75	204.88
28525	27.91	0.04	354.50	45.50
28550	18.99	1.62	586.25	20.75
28575	0.35	8.7	241.75	129.00
28600	0.24	2.84	7.38	144.25
28625	3.37	0.08	45.13	36.50
28650	47.59	0	637.00	1.00
28675	18.91	0	831.25	0.00
28700	0.02	8.76	236.63	109.50
28725	9.19	0	115.13	109.50
28750	0.00	18.92	114.88	236.50
28775	0.39	4.06	4.88	287.25
28800	0.00	4.77	4.88	110.38
28825	0.23	8.13	2.88	161.25
28850	122.13	0	1529.50	101.63
28875	211.66	0	4172.38	0.00
28900	4.70	0	2704.50	0.00
28925	6.19	0	136.13	0.00
28950	29.37	0	444.50	0.00
28975	78.62	0	1349.88	0.00

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
29000	22.74	0	1267.00	0.00
29025	19.42	0.28	527.00	3.50
29050	14.51	0	424.13	3.50
29075	0.00	9.26	181.38	115.75
29100	0.00	9.63	0.00	236.13
29125	4.08	7.33	51.00	212.00
29150	1.70	5.9	72.25	165.38
29175	1.30	0.12	37.50	75.25
29200	0.50	2.8	22.50	36.50
29225	7.18	0.13	96.00	36.63
29250	65.06	0	903.00	1.63
29275	3.13	0.91	852.38	11.38
29300	6.62	0	121.88	11.38
29325	0.42	2.99	88.00	37.38
29350	0.08	1.51	6.25	56.25
29375	6.75	0	85.38	18.88
29400	3.35	0.13	126.25	1.63
29425	1.23	3.84	57.25	49.63
29450	0.00	13.57	15.38	217.63
29475	0.01	8.5	0.13	275.88
29500	4.34	0	54.38	106.25
29525	19.94	0	303.50	0.00
29550	56.11	0	950.63	0.00
29575	66.67	0.08	1534.75	1.00
29600	99.50	0	2077.13	1.00
29625	90.69	0.01	2377.38	0.13
29650	88.16	0	2235.63	0.13
29675	97.78	0	2324.25	0.00
29700	41.46	0	1740.50	0.00
29725	40.25	0.19	1021.38	2.38
29750	8.82	0	613.38	2.38
29775	0.00	29.95	110.25	374.38
29800	0.00	43.27	0.00	915.25
29825	0.00	44.95	0.00	1102.75
29850	0.00	43.14	0.00	1101.13
29875	0.00	52.18	0.00	1191.50
29900	3.80	64.31	47.50	1456.13
29925	2.56	60.6	79.50	1561.38
29950	10.76	40.76	166.50	1267.00
29975	6.93	63.21	221.13	1299.63

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
30000	0.00	62.26	86.63	1568.38
30025	0.00	51.74	0.00	1425.00
30050	27.54	0	344.25	646.75
30075	0.00	15.28	344.25	191.00
30100	17.50	0.54	218.75	197.75
30125	58.39	0.14	948.63	8.50
30150	196.92	0	3191.38	1.75
30175	301.23	0	6226.88	0.00
30200	204.75	0	6324.75	0.00
30225	145.55	0.17	4378.75	2.13
30250	282.54	0	5351.13	2.13
30275	188.08	0.09	5882.75	1.13
30300	160.89	0	4362.13	1.13
30325	184.46	0	4316.88	0.00
30350	206.79	0	4890.63	0.00
30375	173.21	0.53	4750.00	6.63
30400	140.55	0	3922.00	6.63
30425	132.37	0	3411.50	0.00
30450	113.07	0	3068.00	0.00
30475	110.49	0.03	2794.50	0.38
30500	105.58	0	2700.88	0.38
30525	127.04	0	2907.75	0.00
30550	118.52	0	3069.50	0.00
30575	81.27	1.56	2497.38	19.50
30600	106.71	0	2349.75	19.50
30625	99.08	0.11	2572.38	1.38
30650	79.89	0	2237.13	1.38
30675	80.47	0	2004.50	0.00
30700	76.41	0	1961.00	0.00
30725	12.92	0.05	1116.63	0.63
30750	0.00	5.88	161.50	74.13
30775	0.90	1.85	11.25	96.63
30800	3.95	0	60.63	23.13
30825	8.23	0.01	152.25	0.13
30850	7.94	0.14	202.13	1.88
30875	7.43	0.03	192.13	2.13
30900	17.43	0	310.75	0.38
30925	15.91	0.18	416.75	2.25
30950	6.92	0.39	285.38	7.13
30975	8.45	0.01	192.13	5.00

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
31000	5.36	0	172.63	0.13
31025	10.87	0	202.88	0.00
31050	9.57	0	255.50	0.00
31075	8.50	0.07	225.88	0.88
31100	5.13	3.06	170.38	39.13
31125	0.00	19.36	64.13	280.25
31150	0.00	30.25	0.00	620.13
31175	11.77	14.69	147.13	561.75
31200	0.22	17.2	149.88	398.63
31225	0.01	16.72	2.88	424.00
31250	12.46	2.8	155.88	244.00
31275	28.12	0.01	507.25	35.13
31300	32.81	0	761.63	0.13
31325	31.33	0.2	801.75	2.50
31350	34.20	0	819.13	2.50
31375	29.27	0.01	793.38	0.13
31400	53.79	0	1038.25	0.13
31425	74.20	0	1599.88	0.00
31450	54.18	0	1604.75	0.00
31475	55.82	0	1375.00	0.00
31500	63.69	0	1493.88	0.00
31525	61.68	0.08	1567.13	1.00
31550	31.88	0	1169.50	1.00
31575	49.78	0.01	1020.75	0.13
31600	69.65	0	1492.88	0.13
31625	178.74	0	3104.88	0.00
31650	100.19	0	3486.63	0.00
31675	20.38	0	1507.13	0.00
31700	12.04	0	405.25	0.00
31725	58.32	0	879.50	0.00
31750	87.34	0	1820.75	0.00
31775	73.32	26.56	2008.25	332.00
31800	49.56	0	1536.00	332.00
31825	14.70	2.78	803.25	34.75
31850	2.93	20.11	220.38	286.13
31875	3.50	1	80.38	263.88
31900	5.28	0.05	109.75	13.13
31925	7.65	20.5	161.63	256.88
31950	6.12	0	172.13	256.25
31975	10.36	3.06	206.00	38.25

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
32000	9.89	1.36	253.13	55.25
32025	2.45	4.49	154.25	73.13
32050	4.08	0.24	81.63	59.13
32075	10.56	0	183.00	3.00
32100	5.41	0	199.63	0.00
32125	1.29	2.97	83.75	37.13
32150	3.33	0	57.75	37.13
32175	5.59	3.2	111.50	40.00
32200	16.37	0	274.50	40.00
32225	40.91	0.74	716.00	9.25
32250	23.41	0	804.00	9.25
32275	35.26	0.23	733.38	2.88
32300	28.00	0	790.75	2.88
32325	0.62	1.22	357.75	15.25
32350	7.40	0.27	100.25	18.63
32375	34.24	0.04	520.50	3.88
32400	18.20	0	655.50	0.50
32425	61.08	0.01	991.00	0.13
32450	58.90	0	1499.75	0.13
32475	62.78	0.05	1521.00	0.63
32500	53.44	0	1452.75	0.63
32525	85.03	0.15	1730.88	1.88
32550	111.81	0	2460.50	1.88
32575	49.60	0	2017.63	0.00
32600	18.61	13.98	852.63	174.75
32625	32.07	0	633.50	174.75
32650	38.78	0	885.63	0.00
32675	32.75	4.41	894.13	55.13
32700	44.91	0	970.75	55.13
32725	42.22	0	1089.13	0.00
32750	12.15	0	679.63	0.00
32775	27.62	0.52	497.13	6.50
32800	21.12	4.78	609.25	66.25
32825	24.25	1.21	567.13	74.88
32835	23.74	14.47	239.95	78.40
		Total =	**566877**	**205316**

Total Earthwork in cutting = 566877 cum

Assume 20% total cutting Volume for Ordinary Rock Cutting= 113375 cum Bill No- 02, Sl. No- 7

Total earthwork in soil= 453502 cum Bill No- 02, Sl. No- 6

Total Earthwork in filling = 205316 cum Bill No- 02, Sl. No- 2

Using 60% of cutting material for fiiling earthworks in embankment
Earthwork used from Roadway Cutting Material= 272100.94 cum
So no Earthwork required for embankment const from borrowpit ::

Variable Declaration

Earthwork

Sl No	Variable Description	Variable	Dimension	Unit
1	Total Earthwork In Cutting	tot_cut	566877.000	cum
2	Total Earthwork In Filling (Consider Only Embankment)	tot_fill	205316.000	cum
3	Percentage of Rock	per_rock	20.000	percent

Calculation of Extra Widening on Flexible Pavement

For 0.6m EXTRA WIDENING

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Straight	14408.379	14486.725	0	0.00	
85	Arc	14486.725	14524.316	37.591	37.59	300.00
	Straight	14524.316	14595.258	0	0.00	
	Straight	15275.553	15307.060	0	0.00	
91	Arc	15307.060	15367.251	60.191	60.19	300.00
	Straight	15367.251	15490.173	0	0.00	
	Transition	15712.139	15727.139	15	7.50	
93	Arc	15727.139	15817.306	90.167	90.17	125.00
	Transition	15817.306	15832.306	15	7.50	
	Transition	16854.085	16869.085	15	7.50	
101	Arc	16869.085	16891.750	22.665	22.67	200.00
	Transition	16891.750	16906.750	15	7.50	
	Transition	17376.060	17391.060	15	7.50	
104	Arc	17391.060	17421.626	30.566	30.57	200.00
	Transition	17421.626	17436.626	15	7.50	
	Straight	17866.432	17993.896	0	0.00	
108	Arc	17993.896	18050.758	56.862	56.86	300.00
	Straight	18050.758	18067.200	0	0.00	
	Transition	18179.126	18194.126	15	7.50	
110	Arc	18194.126	18230.867	36.741	36.74	125.00
	Transition	18230.867	18245.867	15	7.50	
	Transition	18331.385	18346.385	15	7.50	
111	Arc	18346.385	18407.191	60.805	60.81	150.00
	Transition	18407.191	18422.191	15	7.50	
	Transition	18798.079	18813.079	15	7.50	
114	Arc	18813.079	18847.277	34.198	34.20	125.00
	Transition	18847.277	18862.277	15	7.50	
	Straight	19129.649	19233.875	0	0.00	
117	Arc	19233.875	19326.600	92.725	92.73	300.00
	Straight	19326.600	19379.012	0	0.00	
	Transition	19776.019	19791.019	15	7.50	
121	Arc	19791.019	19836.887	45.868	45.87	125.00
	Transition	19836.887	19851.887	15	7.50	
	Transition	19903.723	19923.723	20	10.00	
122	Arc	19923.723	20143.495	219.773	219.77	115.00
	Transition	20143.495	20163.495	20	10.00	
	Transition	20207.866	20222.866	15	7.50	
123	Arc	20222.866	20257.634	34.768	34.77	200.00
	Transition	20257.634	20272.634	15	7.50	
	Transition	20924.393	20939.393	15	7.50	
129	Arc	20939.393	20978.410	39.017	39.02	150.00
	Transition	20978.410	20993.410	15	7.50	
	Straight	20993.410	21117.686	0	0.00	
130	Arc	21117.686	21183.725	66.038	66.04	300.00
	Straight	21183.725	21206.998	0	0.00	
	Transition	23213.124	23228.124	15	7.50	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
148	Arc	23228.124	23243.816	15.692	15.69	125.00
	Transition	23243.816	23258.816	15	7.50	
	Transition	23646.231	23681.231	35	17.50	
151	Arc	23681.231	23718.863	37.631	37.63	150.00
	Transition	23718.863	23753.863	35	17.50	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	23754.339	23789.339	35	17.50	
152	Arc	23789.339	23815.153	25.814	25.81	150.00
	Transition	23815.153	23850.153	35	17.50	
	Transition	24074.187	24089.187	15	7.50	
154	Arc	24089.187	24120.338	31.151	31.15	300.00
	Transition	24120.338	24135.338	15	7.50	
	Transition	24659.839	24674.839	15	7.50	
158	Arc	24674.839	24787.058	112.219	112.22	125.00
	Transition	24787.058	24802.058	15	7.50	
	Transition	24864.729	24879.729	15	7.50	
159	Arc	24879.729	24944.507	64.778	64.78	170.00
	Transition	24944.507	24959.507	15	7.50	
	Transition	24992.402	25007.402	15	7.50	
160	Arc	25007.402	25040.959	33.557	33.56	200.00
	Transition	25040.959	25055.959	15	7.50	
	Straight	25055.959	25079.108	0	0.00	
161	Arc	25079.108	25124.505	45.397	45.40	300.00
	Straight	25124.505	25135.051	0	0.00	
	Transition	25135.051	25150.051	15	7.50	
162	Arc	25150.051	25280.159	130.107	130.11	125.00
	Transition	25280.159	25295.159	15	7.50	
	Transition	25491.179	25506.179	15	7.50	
164	Arc	25506.179	25578.828	72.649	72.65	125.00
	Transition	25578.828	25593.828	15	7.50	
	Transition	27524.288	27559.288	35	17.50	
179	Arc	27559.288	27612.658	53.37	53.37	150.00
	Transition	27612.658	27647.658	35	17.50	
	Transition	27664.694	27679.694	15	7.50	
180	Arc	27679.694	27709.630	29.936	29.94	300.00
	Transition	27709.630	27724.630	15	7.50	
	Transition	27826.643	27861.643	35	17.50	
181	Arc	27861.643	27909.363	47.72	47.72	150.00
	Transition	27909.363	27944.363	35	17.50	
	Transition	28191.633	28206.633	15	7.50	
183	Arc	28206.633	28287.326	80.693	80.69	150.00
	Transition	28287.326	28302.326	15	7.50	
	Transition	28316.942	28331.942	15	7.50	
184	Arc	28331.942	28379.195	47.253	47.25	125.00
	Transition	28379.195	28394.195	15	7.50	
	Transition	29436.332	29451.332	15	7.50	
193	Arc	29451.332	29483.178	31.846	31.85	150.00
	Transition	29483.178	29498.178	15	7.50	
	Transition	30310.085	30325.085	15	7.50	
200	Arc	30325.085	30335.812	10.727	10.73	200.00
	Transition	30335.812	30350.812	15	7.50	
	Transition	32055.747	32070.747	15	7.50	
217	Arc	32070.747	32081.308	10.561	10.56	125.00
	Transition	32081.308	32096.308	15	7.50	
Total Length of 0.6m Extra Widening=					**2299**	**m**

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
For 0.9m EXTRA WIDENING						
	Transition	2208.068	2233.068	25	12.50	
9	Arc	2233.068	2260.589	27.521	27.52	80.00
	Transition	2260.589	2285.589	25	12.50	
	Transition	2441.387	2461.387	20	10.00	
12	Arc	2461.387	2475.063	13.676	13.68	100.00
	Transition	2475.063	2495.063	20	10.00	
	Transition	2535.580	2560.580	25	12.50	
13	Arc	2560.580	2575.642	15.062	15.06	80.00
	Transition	2575.642	2600.642	25	12.50	
	Transition	3739.659	3764.659	25	12.50	
19	Arc	3764.659	3790.317	25.659	25.66	80.00
	Transition	3790.317	3815.317	25	12.50	
	Transition	5083.272	5103.272	20	10.00	
26	Arc	5103.272	5124.631	21.359	21.36	100.00
	Transition	5124.631	5144.631	20	10.00	
	Transition	6361.306	6406.306	45	22.50	
35	Arc	6406.306	6416.121	9.815	9.82	100.00
	Transition	6416.121	6461.121	45	22.50	
	Transition	8619.890	8644.890	25	12.50	
45	Arc	8644.890	8726.367	81.477	81.48	80.00
	Transition	8726.367	8751.367	25	12.50	
	Transition	10193.526	10218.526	25	12.50	
54	Arc	10218.526	10242.501	23.976	23.98	80.00
	Transition	10242.501	10267.501	25	12.50	
	Transition	10468.665	10488.665	20	10.00	
56	Arc	10488.665	10507.838	19.173	19.17	100.00
	Transition	10507.838	10527.838	20	10.00	
	Transition	10566.874	10591.874	25	12.50	
57	Arc	10591.874	10656.734	64.86	64.86	80.00
	Transition	10656.734	10681.734	25	12.50	
	Transition	10936.389	10961.389	25	12.50	
59	Arc	10961.389	11064.850	103.461	103.46	80.00
	Transition	11064.850	11089.850	25	12.50	
	Transition	12048.989	12068.989	20	10.00	
67	Arc	12068.989	12086.736	17.747	17.75	100.00
	Transition	12086.736	12106.736	20	10.00	
	Transition	12130.751	12160.751	30	15.00	
68	Arc	12160.751	12172.576	11.825	11.83	70.00
	Transition	12172.576	12202.576	30	15.00	
	Transition	12355.913	12385.913	30	15.00	
70	Arc	12385.913	12394.109	8.196	8.20	70.00
	Transition	12394.109	12424.109	30	15.00	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	12758.091	12788.091	30	15.00	
73	Arc	12788.091	12805.167	17.076	17.08	70.00
	Transition	12805.167	12835.167	30	15.00	
	Transition	13504.632	13524.632	20	10.00	
79	Arc	13524.632	13564.023	39.391	39.39	100.00
	Transition	13564.023	13584.023	20	10.00	
	Transition	13725.116	13745.116	20	10.00	
80	Arc	13745.116	13781.635	36.519	36.52	100.00
	Transition	13781.635	13801.635	20	10.00	
	Transition	13823.093	13843.093	20	10.00	
81	Arc	13843.093	13872.277	29.184	29.18	100.00
	Transition	13872.277	13892.277	20	10.00	
	Transition	13988.844	14008.844	20	10.00	
82	Arc	14008.844	14035.479	26.635	26.64	100.00
	Transition	14035.479	14055.479	20	10.00	
	Transition	14595.258	14620.258	25	12.50	
83	Arc	14620.258	14629.730	9.472	9.47	80.00
	Transition	14629.730	14654.730	25	12.50	
	Transition	18643.117	18668.117	25	12.50	
113	Arc	18668.117	18689.690	21.573	21.57	80.00
	Transition	18689.690	18714.690	25	12.50	
	Transition	19379.012	19404.012	25	12.50	
118	Arc	19404.012	19435.086	31.074	31.07	80.00
	Transition	19435.086	19460.086	25	12.50	
	Transition	20352.860	20372.860	20	10.00	
124	Arc	20372.860	20422.287	49.427	49.43	100.00
	Transition	20422.287	20442.287	20	10.00	
	Transition	20552.191	20572.191	20	10.00	
126	Arc	20572.191	20626.200	54.009	54.01	100.00
	Transition	20626.200	20646.200	20	10.00	
	Transition	20685.246	20715.246	30	15.00	
127	Arc	20715.246	20768.044	52.798	52.80	70.00
	Transition	20768.044	20798.044	30	15.00	
	Transition	20819.014	20844.014	25	12.50	
128	Arc	20844.014	20862.105	18.091	18.09	80.00
	Transition	20862.105	20887.105	25	12.50	
	Transition	21206.998	21231.998	25	12.50	
131	Arc	21231.998	21265.383	33.385	33.39	80.00
	Transition	21265.383	21290.383	25	12.50	
	Transition	21549.797	21569.797	20	10.00	
133	Arc	21569.797	21606.474	36.677	36.68	100.00
	Transition	21606.474	21626.474	20	10.00	
	Transition	21832.256	21847.256	15	7.50	
136	Arc	21847.256	21921.672	74.416	74.42	75.00
	Transition	21921.672	21936.672	15	7.50	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	22192.476	22207.476	15	7.50	
138	Arc	22207.476	22223.107	15.631	15.63	80.00
	Transition	22223.107	22238.107	15	7.50	
	Transition	22991.541	23016.541	25	12.50	
146	Arc	23016.541	23048.435	31.895	31.90	80.00
	Transition	23048.435	23073.435	25	12.50	
	Transition	23082.496	23102.496	20	10.00	
147	Arc	23102.496	23110.869	8.373	8.37	100.00
	Transition	23110.869	23130.869	20	10.00	
	Transition	23490.794	23540.794	50	25.00	
150	Arc	23540.794	23557.007	16.213	16.21	90.00
	Transition	23557.007	23607.007	50	25.00	
	Transition	23923.940	23978.940	55	27.50	
153	Arc	23978.940	23987.113	8.173	8.17	80.00
	Transition	23987.113	24042.113	55	27.50	
	Transition	24414.747	24444.747	30	15.00	
155	Arc	24444.747	24450.401	5.655	5.66	75.00
	Transition	24450.401	24480.401	30	15.00	
	Transition	24488.854	24518.854	30	15.00	
156	Arc	24518.854	24538.275	19.421	19.42	75.00
	Transition	24538.275	24568.275	30	15.00	
	Transition	24571.717	24596.717	25	12.50	
157	Arc	24596.717	24613.440	16.723	16.72	80.00
	Transition	24613.440	24638.440	25	12.50	
	Transition	25332.452	25352.452	20	10.00	
163	Arc	25352.452	25367.468	15.016	15.02	100.00
	Transition	25367.468	25387.468	20	10.00	
	Transition	25634.031	25664.031	30	15.00	
165	Arc	25664.031	25676.491	12.46	12.46	70.00
	Transition	25676.491	25706.491	30	15.00	
	Transition	25908.911	25928.911	20	10.00	
167	Arc	25928.911	25965.512	36.602	36.60	100.00
	Transition	25965.512	25985.512	20	10.00	
	Transition	26062.208	26092.208	30	15.00	
168	Arc	26092.208	26115.696	23.488	23.49	70.00
	Transition	26115.696	26145.696	30	15.00	
	Transition	26840.929	26865.929	25	12.50	
173	Arc	26865.929	26888.802	22.873	22.87	80.00
	Transition	26888.802	26913.802	25	12.50	
	Transition	27247.813	27272.813	25	12.50	
177	Arc	27272.813	27297.153	24.34	24.34	80.00
	Transition	27297.153	27322.153	25	12.50	
	Transition	27423.650	27453.650	30	15.00	
178	Arc	27453.650	27465.048	11.398	11.40	70.00
	Transition	27465.048	27495.048	30	15.00	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	29625.487	29650.487	25	12.50	
194	Arc	29650.487	29686.904	36.418	36.42	80.00
	Transition	29686.904	29711.904	25	12.50	
	Transition	29755.038	29780.038	25	12.50	
195	Arc	29780.038	29802.717	22.678	22.68	80.00
	Transition	29802.717	29827.717	25	12.50	
	Transition	29923.777	29953.777	30	15.00	
197	Arc	29953.777	29961.106	7.329	7.33	70.00
	Transition	29961.106	30001.106	40	20.00	
	Transition	30002.647	30032.647	30	15.00	
198	Arc	30032.647	30040.314	7.668	7.67	70.00
	Transition	30040.314	30070.314	30	15.00	
	Transition	30377.070	30397.070	20	10.00	
201	Arc	30397.070	30414.755	17.685	17.69	100.00
	Transition	30414.755	30434.755	20	10.00	
	Transition	31034.651	31049.651	15	7.50	
207	Arc	31049.651	31071.631	21.98	21.98	80.00
	Transition	31071.631	31086.631	15	7.50	
	Transition	32189.995	32209.995	20	10.00	
219	Arc	32209.995	32219.705	9.71	9.71	90.00
	Transition	32219.705	32239.705	20	10.00	
	Transition	32309.190	32334.190	25	12.50	
221	Arc	32334.190	32341.823	7.633	7.63	80.00
	Transition	32341.823	32366.823	25	12.50	
	Transition	32398.566	32418.566	20	10.00	
222	Arc	32418.566	32442.934	24.368	24.37	100.00
	Transition	32442.934	32462.934	20	10.00	
	Transition	32512.047	32532.047	20	10.00	
223	Arc	32532.047	32553.730	21.684	21.68	100.00
	Transition	32553.730	32573.730	20	10.00	
Total Length of 0.9m Extra Widening=					**2784**	**m**

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
For 1.2m EXTRA WIDENING						
	Transition	8221.979	8256.979	35	17.50	
42	Arc	8256.979	8277.553	20.574	20.57	60.00
	Transition	8277.553	8312.553	35	17.50	
	Transition	8327.365	8362.365	35	17.50	
43	Arc	8362.365	8387.202	24.837	24.84	60.00
	Transition	8387.202	8422.202	35	17.50	
	Transition	8514.746	8549.746	35	17.50	
44	Arc	8549.746	8568.042	18.297	18.30	60.00
	Transition	8568.042	8603.042	35	17.50	
	Transition	10298.086	10338.086	40	20.00	
55	Arc	10338.086	10412.767	74.681	74.68	55.00
	Transition	10412.767	10452.767	40	20.00	
	Transition	10684.953	10724.953	40	20.00	
58	Arc	10724.953	10749.824	24.872	24.87	50.00
	Transition	10749.824	10789.824	40	20.00	
	Transition	11201.297	11221.297	20	10.00	
60	Arc	11221.297	11272.874	51.577	51.58	50.00
	Transition	11272.874	11292.874	20	10.00	
	Transition	11304.311	11324.311	20	10.00	
61	Arc	11324.311	11335.796	11.485	11.49	50.00
	Transition	11335.796	11355.796	20	10.00	
	Transition	11364.169	11384.169	20	10.00	
62	Arc	11384.169	11417.070	32.901	32.90	50.00
	Transition	11417.070	11437.070	20	10.00	
	Transition	11475.307	11515.307	40	20.00	
63	Arc	11515.307	11540.990	25.684	25.68	50.00
	Transition	11540.990	11580.990	40	20.00	
	Transition	11652.679	11687.679	35	17.50	
64	Arc	11687.679	11706.660	18.98	18.98	60.00
	Transition	11706.660	11741.660	35	17.50	
	Transition	11803.391	11843.391	40	20.00	
65	Arc	11843.391	11873.686	30.294	30.29	50.00
	Transition	11873.686	11913.686	40	20.00	
	Transition	12247.174	12287.174	40	20.00	
69	Arc	12287.174	12300.806	13.632	13.63	50.00
	Transition	12300.806	12340.806	40	20.00	
	Transition	12461.085	12501.085	40	20.00	
71	Arc	12501.085	12515.370	14.285	14.29	50.00
	Transition	12515.370	12555.370	40	20.00	
	Transition	12629.081	12664.081	35	17.50	
72	Arc	12664.081	12703.479	39.398	39.40	60.00
	Transition	12703.479	12738.479	35	17.50	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	12869.585	12904.585	35	17.50	
74	Arc	12904.585	12930.378	25.793	25.79	60.00
	Transition	12930.378	12965.378	35	17.50	
	Transition	13024.402	13059.402	35	17.50	
75	Arc	13059.402	13069.946	10.544	10.54	60.00
	Transition	13069.946	13104.946	35	17.50	
	Transition	13319.210	13339.210	20	10.00	
77	Arc	13339.210	13373.656	34.446	34.45	50.00
	Transition	13373.656	13393.656	20	10.00	
	Transition	14156.766	14191.766	35	17.50	
83	Arc	14191.766	14227.506	35.741	35.74	60.00
	Transition	14227.506	14262.506	35	17.50	
	Transition	14291.222	14326.222	35	17.50	
84	Arc	14326.222	14373.379	47.157	47.16	60.00
	Transition	14373.379	14408.379	35	17.50	
	Transition	14668.136	14708.136	40	20.00	
87	Arc	14708.136	14754.898	46.762	46.76	50.00
	Transition	14754.898	14794.898	40	20.00	
	Transition	14833.527	14873.527	40	20.00	
88	Arc	14873.527	14894.458	20.931	20.93	50.00
	Transition	14894.458	14934.458	40	20.00	
	Transition	14950.414	14990.414	40	20.00	
89	Arc	14990.414	15020.956	30.543	30.54	50.00
	Transition	15020.956	15060.956	40	20.00	
	Transition	15106.170	15146.170	40	20.00	
90	Arc	15146.170	15235.553	89.383	89.38	50.00
	Transition	15235.553	15275.553	40	20.00	
	Transition	15490.173	15530.173	40	20.00	
92	Arc	15530.173	15560.608	30.436	30.44	50.00
	Transition	15560.608	15600.608	40	20.00	
	Transition	15919.736	15954.736	35	17.50	
94	Arc	15954.736	15959.426	4.69	4.69	60.00
	Transition	15959.426	15994.426	35	17.50	
	Transition	16001.319	16041.319	40	20.00	
95	Arc	16041.319	16120.813	79.495	79.50	50.00
	Transition	16120.813	16160.813	40	20.00	
	Transition	17482.081	17502.081	20	10.00	
105	Arc	17502.081	17544.850	42.769	42.77	50.00
	Transition	17544.850	17564.850	20	10.00	
	Transition	17575.435	17590.435	15	7.50	
106	Arc	17590.435	17618.767	28.331	28.33	60.00
	Transition	17618.767	17633.767	15	7.50	
	Transition	17760.674	17795.674	35	17.50	
107	Arc	17795.674	17831.432	35.758	35.76	60.00
	Transition	17831.432	17866.432	35	17.50	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	18067.200	18102.200	35	17.50	
109	Arc	18102.200	18121.505	19.305	19.31	60.00
	Transition	18121.505	18156.505	35	17.50	
	Transition	18550.245	18590.245	40	20.00	
112	Arc	18590.245	18598.966	8.721	8.72	50.00
	Transition	18598.966	18638.966	40	20.00	
	Transition	18914.641	18949.641	35	17.50	
115	Arc	18949.641	18995.943	46.302	46.30	60.00
	Transition	18995.943	19030.943	35	17.50	
	Transition	19038.134	19073.134	35	17.50	
116	Arc	19073.134	19094.649	21.515	21.52	60.00
	Transition	19094.649	19129.649	35	17.50	
	Transition	20455.975	20490.975	35	17.50	
125	Arc	20490.975	20500.016	9.04	9.04	60.00
	Transition	20500.016	20535.016	35	17.50	
	Transition	21298.851	21338.851	40	20.00	
132	Arc	21338.851	21357.155	18.303	18.30	50.00
	Transition	21357.155	21397.155	40	20.00	
	Transition	23264.415	23279.415	15	7.50	
149	Arc	23279.415	23309.954	30.539	30.54	60.00
	Transition	23309.954	23324.954	15	7.50	
	Transition	25708.833	25748.833	40	20.00	
166	Arc	25748.833	25751.626	2.792	2.79	52.00
	Transition	25751.626	25791.626	40	20.00	
	Transition	26397.634	26412.634	15	7.50	
169	Arc	26412.634	26438.422	25.788	25.79	60.00
	Transition	26438.422	26453.422	15	7.50	
	Transition	26596.002	26631.002	35	17.50	
171	Arc	26631.002	26653.115	22.113	22.11	60.00
	Transition	26653.115	26688.115	35	17.50	
	Transition	26694.313	26729.313	35	17.50	
172	Arc	26729.313	26741.207	11.893	11.89	60.00
	Transition	26741.207	26776.207	35	17.50	
	Transition	26923.910	26963.910	40	20.00	
174	Arc	26963.910	26968.762	4.852	4.85	50.00
	Transition	26968.762	27008.762	40	20.00	
	Transition	27030.387	27065.387	35	17.50	
175	Arc	27065.387	27083.132	17.745	17.75	60.00
	Transition	27083.132	27118.132	35	17.50	
	Transition	27136.625	27171.625	35	17.50	
176	Arc	27171.625	27181.549	9.924	9.92	60.00
	Transition	27181.549	27216.549	35	17.50	
	Transition	28421.395	28461.395	40	20.00	
185	Arc	28461.395	28464.696	3.301	3.30	50.00
	Transition	28464.696	28504.696	40	20.00	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	28595.679	28635.679	40	20.00	
186	Arc	28635.679	28654.364	18.685	18.69	50.00
	Transition	28654.364	28694.364	40	20.00	
	Transition	28699.089	28739.089	40	20.00	
187	Arc	28739.089	28757.160	18.071	18.07	50.00
	Transition	28757.160	28797.160	40	20.00	
	Transition	29240.040	29280.040	40	20.00	
191	Arc	29280.040	29299.045	19.005	19.01	50.00
	Transition	29299.045	29339.045	40	20.00	
	Transition	29347.264	29387.264	40	20.00	
192	Arc	29387.264	29391.468	4.204	4.20	50.00
	Transition	29391.468	29431.468	40	20.00	
	Transition	29830.767	29870.767	40	20.00	
196	Arc	29870.767	29875.750	4.983	4.98	54.00
	Transition	29875.750	29915.750	40	20.00	
	Transition	30079.570	30119.570	40	20.00	
199	Arc	30119.570	30183.371	63.8	63.80	50.00
	Transition	30183.371	30223.371	40	20.00	
	Transition	30454.656	30489.656	35	17.50	
202	Arc	30489.656	30497.765	8.109	8.11	60.00
	Transition	30497.765	30532.765	35	17.50	
	Transition	30566.882	30586.882	20	10.00	
203	Arc	30586.882	30592.911	6.029	6.03	50.00
	Transition	30592.911	30612.911	20	10.00	
	Transition	31579.576	31599.576	20	10.00	
212	Arc	31599.576	31610.107	10.531	10.53	50.00
	Transition	31610.107	31630.107	20	10.00	
	Transition	31829.967	31849.967	20	10.00	
215	Arc	31849.967	31890.353	40.386	40.39	50.00
	Transition	31890.353	31910.353	20	10.00	
	Transition	32251.868	32266.868	15	7.50	
220	Arc	32266.868	32285.923	19.055	19.06	60.00
	Transition	32285.923	32300.923	15	7.50	
	Transition	32643.314	32683.314	40	20.00	
224	Arc	32683.314	32733.207	49.892	49.89	50.00
	Transition	32733.207	32773.207	40	20.00	
Total Length of 1.2m Extra Widening=					**3359**	**m**

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
For 1.5m EXTRA WIDENING						
	Transition	8828.104	8853.104	25	12.50	
46	Arc	8853.104	8901.606	48.503	48.50	40.00
	Transition	8901.606	8926.606	25	12.50	
	Transition	8979.348	9004.348	25	12.50	
47	Arc	9004.348	9059.476	55.128	55.13	30.00
	Transition	9059.476	9084.476	25	12.50	
	Transition	13401.334	13426.334	25	12.50	
78	Arc	13426.334	13460.884	34.549	34.55	40.00
	Transition	13460.884	13485.884	25	12.50	
	Transition	16241.774	16266.774	25	12.50	
96	Arc	16266.774	16292.483	25.709	25.71	35.00
	Transition	16292.483	16317.483	25	12.50	
	Transition	16318.567	16343.567	25	12.50	
97	Arc	16343.567	16401.586	58.019	58.02	35.00
	Transition	16401.586	16426.586	25	12.50	
	Transition	16473.201	16498.201	25	12.50	
98	Arc	16498.201	16583.266	85.066	85.07	40.00
	Transition	16583.266	16608.266	25	12.50	
	Transition	16638.300	16663.300	25	12.50	
99	Arc	16663.300	16697.216	33.916	33.92	25.00
	Transition	16697.216	16722.216	25	12.50	
	Transition	16724.259	16749.259	25	12.50	
100	Arc	16749.259	16780.240	30.981	30.98	35.00
	Transition	16780.240	16805.240	25	12.50	
	Transition	16954.437	16979.437	25	12.50	
102	Arc	16979.437	17049.095	69.658	69.66	40.00
	Transition	17049.095	17074.095	25	12.50	
	Transition	17165.220	17190.220	25	12.50	
103	Arc	17190.220	17247.204	56.984	56.98	40.00
	Transition	17247.204	17272.204	25	12.50	
	Transition	19470.584	19495.584	25	12.50	
119	Arc	19495.584	19513.392	17.809	17.81	40.00
	Transition	19513.392	19538.392	25	12.50	
	Transition	19673.937	19693.937	20	10.00	
120	Arc	19693.937	19731.246	37.308	37.31	20.00
	Transition	19731.246	19751.246	20	10.00	
	Transition	21652.997	21667.997	15	7.50	
134	Arc	21667.997	21725.172	57.176	57.18	35.00
	Transition	21725.172	21740.172	15	7.50	
	Transition	21747.344	21762.344	15	7.50	
135	Arc	21762.344	21804.742	42.398	42.40	35.00
	Transition	21804.742	21819.742	15	7.50	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	22108.629	22128.629	20	10.00	
137	Arc	22128.629	22169.618	40.989	40.99	25.00
	Transition	22169.618	22189.618	20	10.00	
	Transition	22263.504	22288.504	25	12.50	
139	Arc	22288.504	22364.473	75.969	75.97	37.00
	Transition	22364.473	22389.473	25	12.50	
	Transition	22400.880	22425.880	25	12.50	
140	Arc	22425.880	22444.352	18.472	18.47	30.00
	Transition	22444.352	22469.352	25	12.50	
	Transition	22531.504	22546.504	15	7.50	
141	Arc	22546.504	22574.393	27.889	27.89	30.00
	Transition	22574.393	22589.393	15	7.50	
	Transition	22595.471	22610.471	15	7.50	
142	Arc	22610.471	22642.821	32.35	32.35	30.00
	Transition	22642.821	22657.821	15	7.50	
	Transition	22668.673	22683.673	15	7.50	
143	Arc	22683.673	22701.067	17.395	17.40	40.00
	Transition	22701.067	22716.067	15	7.50	
	Transition	22754.067	22769.067	15	7.50	
144	Arc	22769.067	22784.668	15.601	15.60	35.00
	Transition	22784.668	22799.668	15	7.50	
	Transition	22807.903	22827.903	20	10.00	
145	Arc	22827.903	22850.874	22.971	22.97	25.00
	Transition	22850.874	22870.874	20	10.00	
	Transition	26461.961	26486.961	25	12.50	
170	Arc	26486.961	26518.489	31.528	31.53	40.00
	Transition	26518.489	26543.489	25	12.50	
	Transition	28924.378	28949.378	25	12.50	
188	Arc	28949.378	28980.250	30.872	30.87	35.00
	Transition	28980.250	29005.250	25	12.50	
	Transition	29028.662	29053.662	25	12.50	
189	Arc	29053.662	29078.423	24.761	24.76	25.00
	Transition	29078.423	29103.423	25	12.50	
	Transition	29115.330	29140.330	25	12.50	
190	Arc	29140.330	29160.978	20.648	20.65	30.00
	Transition	29160.978	29185.978	25	12.50	
	Transition	30636.466	30656.466	20	10.00	
204	Arc	30656.466	30678.265	21.799	21.80	20.00
	Transition	30678.265	30698.265	20	10.00	
	Transition	30718.778	30738.778	20	10.00	
205	Arc	30738.778	30762.353	23.575	23.58	20.00
	Transition	30762.353	30782.353	20	10.00	
	Transition	30931.686	30946.686	15	7.50	
206	Arc	30946.686	30995.974	49.288	50.00	30.00
	Transition	30995.974	31010.974	15	7.50	

HIP/CURVE NO.	ELEMENT	START	END	CHORD LENGTH (m)	LENGTH OF EXTRA WIDENING (m)	RADIUS (m)
		CHAINAGE (m)	CHAINAGE (m)			
	Transition	31106.153	31126.153	20	10.00	
208	Arc	31126.153	31163.791	37.638	37.64	20.00
	Transition	31163.791	31183.791	20	10.00	
	Transition	31220.327	31240.327	20	10.00	
209	Arc	31240.327	31263.024	22.697	22.70	20.00
	Transition	31263.024	31283.024	20	10.00	
	Transition	31341.472	31361.472	20	10.00	
210	Arc	31361.472	31397.298	35.826	35.83	20.00
	Transition	31397.298	31417.298	20	10.00	
	Transition	31437.549	31462.549	25	12.50	
211	Arc	31462.549	31514.452	51.903	51.90	40.00
	Transition	31514.452	31539.452	25	12.50	
	Transition	31642.183	31662.183	20	10.00	
213	Arc	31662.183	31693.008	30.825	30.83	20.00
	Transition	31693.008	31713.008	20	10.00	
	Transition	31767.671	31787.671	20	10.00	
214	Arc	31787.671	31802.996	15.324	15.32	25.00
	Transition	31802.996	31822.996	20	10.00	
	Transition	31925.666	31950.666	25	12.50	
216	Arc	31950.666	31964.401	13.736	13.74	35.00
	Transition	31964.401	31989.401	25	12.50	
	Transition	32121.004	32146.004	25	12.50	
218	Arc	32146.004	32157.039	11.035	11.04	30.00
	Transition	32157.039	32182.039	25	12.50	
Total Length of 1.5m Extra Widening=					**2132**	**m**

Total Length of 0.6m Extra Widening=	2299	m
Total Length of 0.9m Extra Widening=	2784	m
Total Length of 1.2m Extra Widening=	3359	m
Total Length of 1.5m Extra Widening=	2132	m
Total Area of Extra Widening=	**11114**	**Sqm**

Variable Declaration

Extra Widening on Flexible Pavement

Sl No	Variable Description	Variable	Dimension	Unit
1	Total Area of Extra Widening	ew_area	11114.000	Sqm
2	BC	bc	0.040	m
3	DBM	dbm	0.070	m
4	WMM-I	wmm1	0.125	m
5	WMM-II	wmm2	0.125	m
6	GSB	gsb	0.200	m
7	GSB percentage Re-use	gsb_per	9.500	percentage

RCC Cover Drain

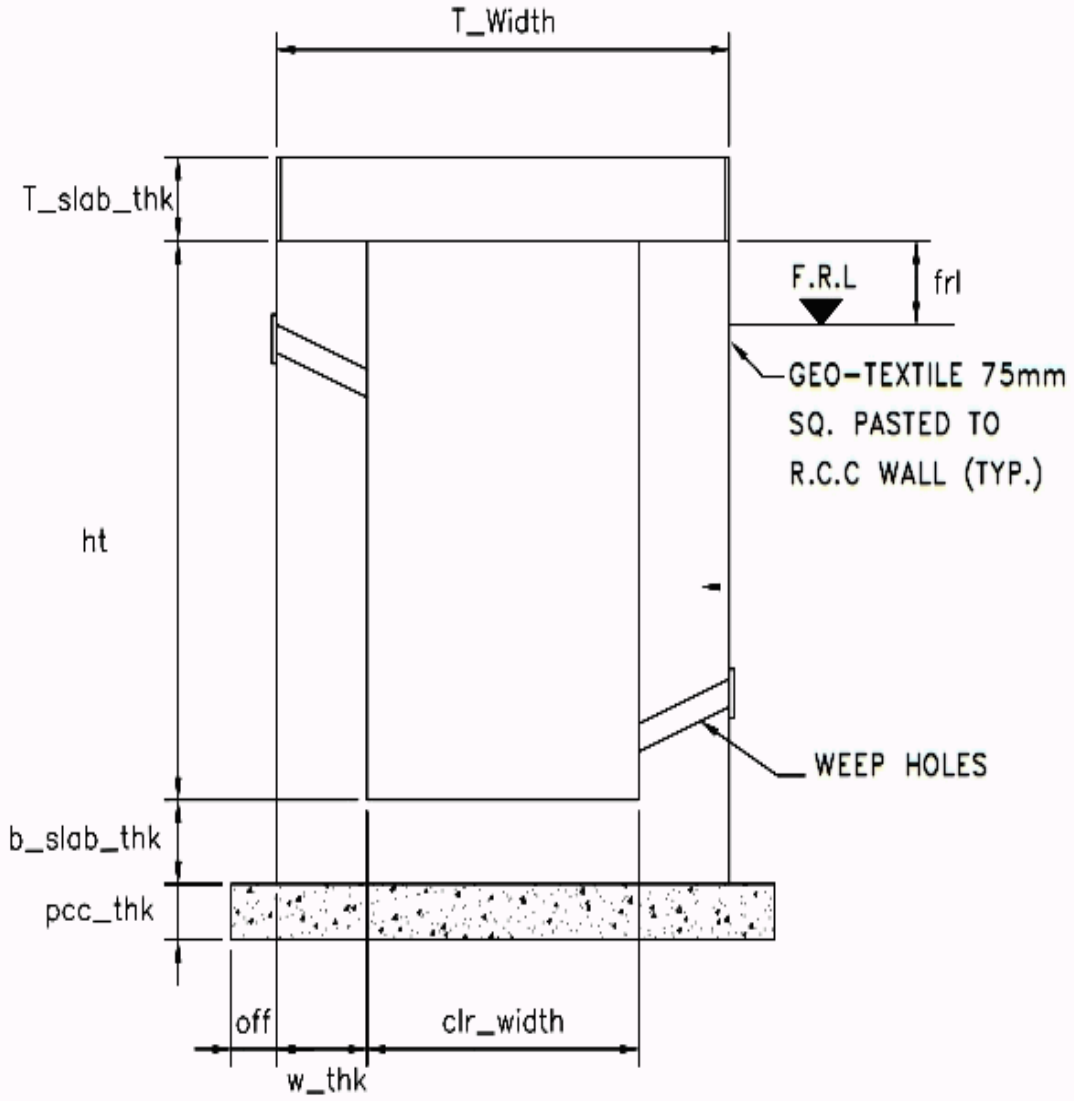
RCC Cover Drain			
TCS Type	**Length(m)**	**Side**	**Net Length (m)**
TCS-1	1807.2	Both side	3614
		Total Length=	3614

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	3614.000	m
9	Reinforcement Per Cum RCC	s	0.050	MT/Cum RCC
10	Finished Road Level	frl	0.300	m

Variable Declaration



RR Masonary Trapezoidal Drain :-

TCS Type	Length(km)	Side	Net Length (m)
TCS-5	340	Single side	340
TCS-6	5558.18	Both side	11116
TCS-6A	0	Both side	0
TCS-7	3558	Single side	3558
TCS-9	2032.4	Single side	2032
TCS-11	877.6	Single side	878
		Total length =	**17924**

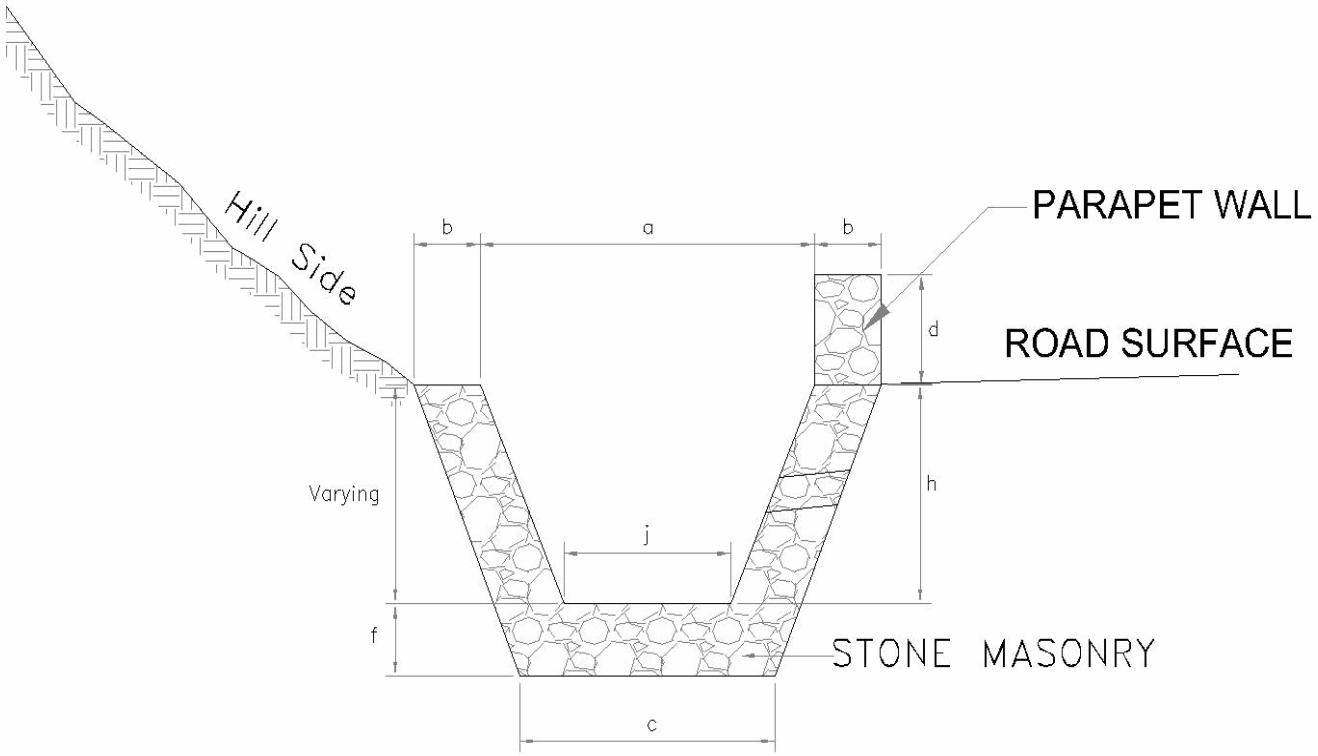
Length of Side Drain	**17924**	**m**
Length of catch water Drain=	**1792.436**	**m**
Length of Outlet=	**1792.436**	**m**
Total Length of Drain=	**21509**	**m**

Variable Declaration

RR Masonry Trapezoidal Drain

Sl No	Variable Description	Variable	Dimension	Unit
1	Ref Drawing	a	0.800	m
2	Ref Drawing	b	0.200	m
3	Ref Drawing	d	0.300	m
4	Ref Drawing	h	0.850	m
5	Ref Drawing	c	0.835	m
6	Ref Drawing	j	0.500	m
7	Ref Drawing	f	0.200	m
8	Length	l	21509.000	m

Variable Declaration



SECTION OF STONE MASONRY
TRAPEZOIDAL DRAIN

Breast Wall

TCS Type	Length	Side	Net Length
TCS-8	495.00	Single	495.00
TCS-9	2032.40	Single	2032.40
TCS-12	524.80	Single	524.80
		Total=	**3052**

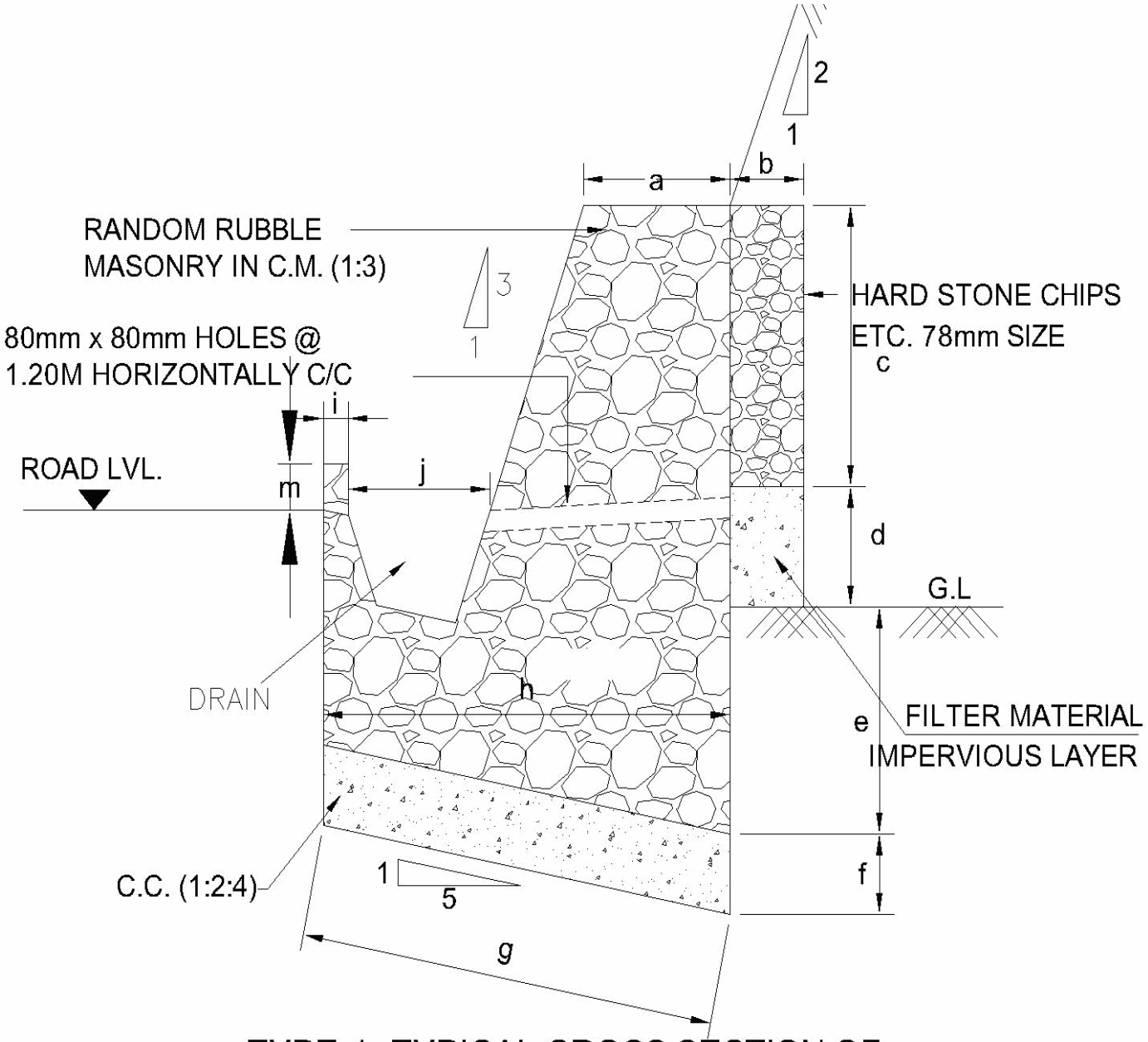
Total Length of Breast Wall= 3052 m

Variable Declaration

Breast Wall

Sl No	Variable Description	Variable	Dimension	Unit
1	From Diagram	a	0.600	m
2	From Diagram	b	0.300	m
3	From Diagram	c	1.050	m
4	From Diagram	d	0.450	m
5	From Diagram	e	0.850	m
6	From Diagram	f	0.300	m
7	PCC Width g= sqrt(h^2 + (h/5)^5)	g	2.200	m
8	From Diagram	h	2.160	m
9	From Diagram	i	0.200	m
10	From Diagram	j	1.000	m
11	length	l	3052.000	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

RETAINING WALL

Chainage		Side	Avg. Height	CD Length	Length	Net Length	TCS
From	To						
15120	15220	single	1.50	2.7	100	97.3	TCS-2
15370	15470	single	3.00	9	100	91	TCS-2
15570	15620	single	2.00	2.6	50	47.4	TCS-10
15820	15870	single	4.00		50	50	TCS-10
16080	16130	single	2.00	5	50	45	TCS-10
16780	16870	single	2.00	2.6	90	87.4	TCS-11
17270	17320	single	2.00	2.6	50	47.4	TCS-10
17820	18020	single	2.50	14.5	200	185.5	TCS-11
18170	18220	single	2.50	2.6	50	47.4	TCS-10
20570	20620	single	3.00		50	50	TCS-10
21070	21120	single	2.00		50	50	TCS-10
21120	21270	single	2.00		150	150	TCS-2
21270	21370	both	4.00		200	200	TCS-13
21370	21520	single	1.50	5.3	150	144.7	TCS-11
21770	22070	single	3.00		300	300	TCS-12
22520	22570	both	2.00	2.6	100	94.8	TCS-13
22570	22620	single	3.00		50	50	TCS-11
23120	23230	single	3.00		110	110	TCS-11
23920	24070	single	2.50		150	150	TCS-11
24070	24170	single	4.00	6.4	100	93.6	TCS-10
24620	24850	single	1.50	5.2	230	224.8	TCS-12
25610	25720	single	1.50	2.7	110	107.3	TCS-10
26070	26170	single	2.00		100	100	TCS-13
26070	26170	Left	6.00		100	100	
26570	26620	single	3.00		50	50	TCS-11
29870	29970	single	2.00		100	100	TCS-11

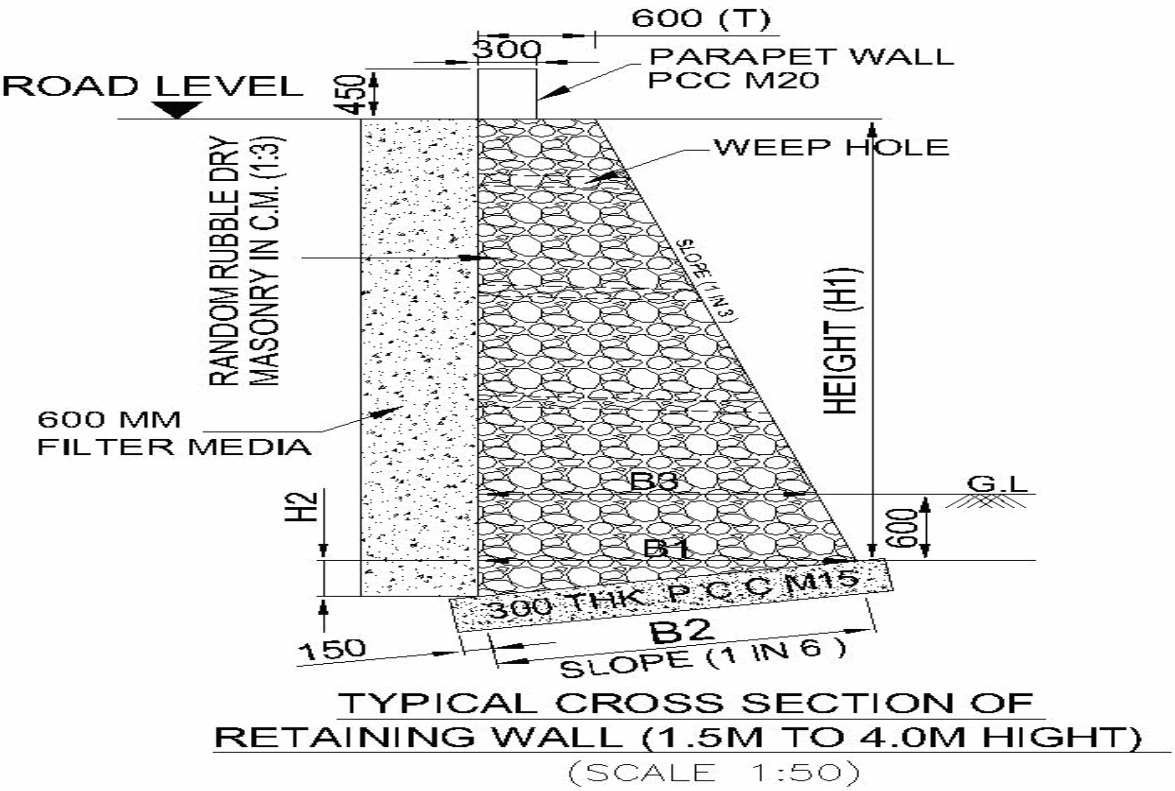
Length of 1.5m Retaining Wall= 574 m
Length of 2.0m Retaining Wall= 722 m
Length of 2.5m Retaining Wall= 383 m
Length of 3.0m Retaining Wall= 651 m
Length of 4.0m Retaining Wall= 344 m
Length of 6.0m Retaining Wall= 100 m

Variable Declaration

Retaining Wall 1.5m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height	H1	1.500	m
3	Slope at Base(1 In 6)	Z	9.462	degree
4	B1 = (T+H1/3)	B1	1.100	m
5	B2 = B1/CosZ	B2	1.115	m
6	H2 = B1.TanZ	H2	0.183	m
7	EGL to PCC top Height	d	0.600	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	B3 = T+ (H1-d)TanY	e	0.900	m
10	Thickness PCC	pcc_thk	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	574.000	m
14	No of weephole along slope of 1m gap m= ((H1 - d) / COSY) / 1	n	2.000	nos
15	Avg Length of Weephole q = (B3 + T) / 2	weep_len	0.750	m
16	percentage of Rock cutting	p_c	0.200	
17	Width of parapet wall	para_w	0.300	m
18	Height of parapet wall	para_ht	0.450	m
19	Taking gap every 10m length	gap	0.300	m

Variable Declaration



TYPICAL CROSS SECTION OF RETAINING WALL (1.5M TO 4.0M HIGHT)

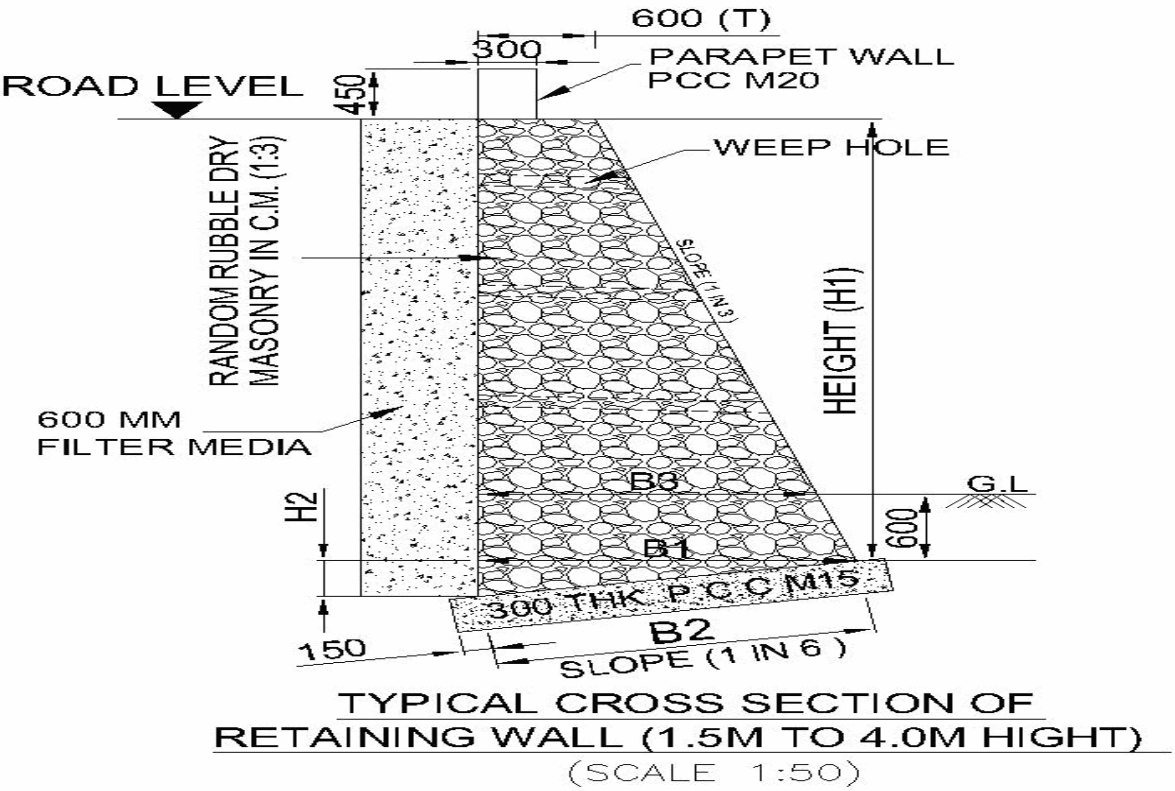
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Variable Declaration

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/CosZ	B2	1.284	m
6	H2 = B1.TanZ	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)TanY	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	722.000	m
14	No of weephole along slope of 1m gap m= ((H1 - d) / COSY) / 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)

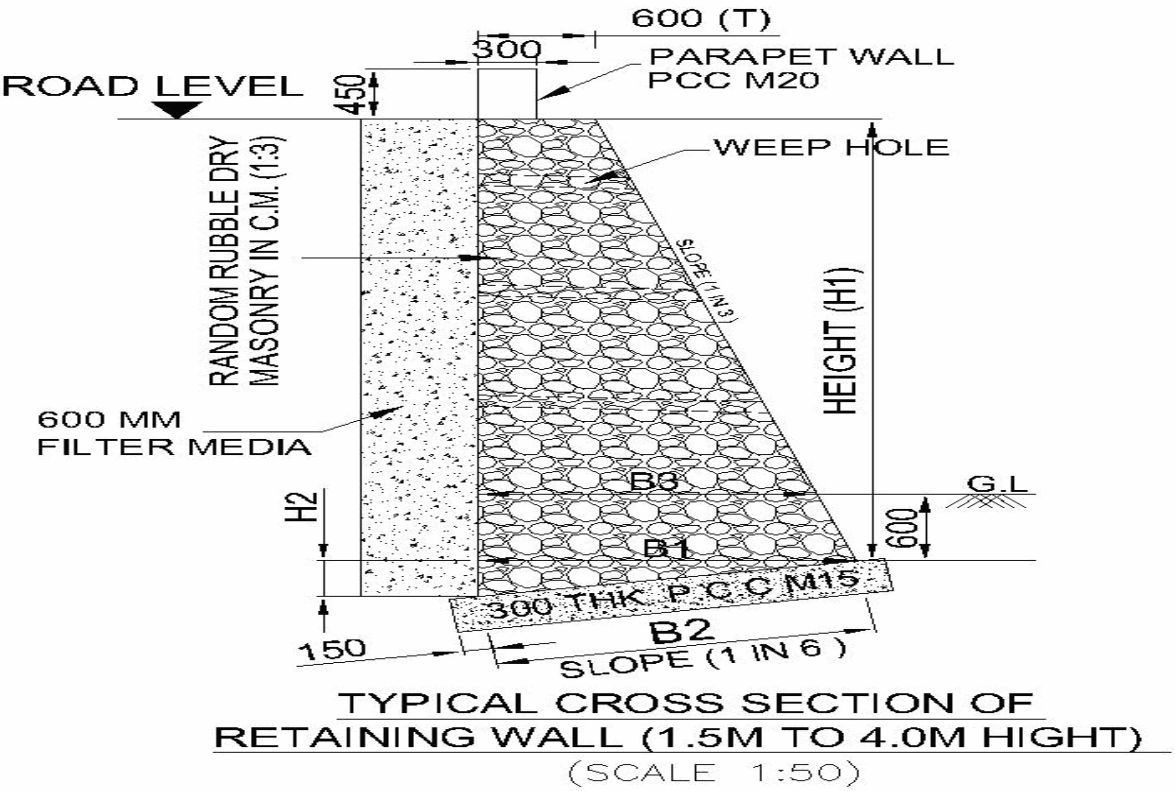
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Variable Declaration

Retaining Wall 2.5m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width (T)	T	0.600	m
2	Height (H1)	H1	2.500	m
3	Slope at Base(1 In 6)	Z	9.462	degree
4	B1 = (T+H1/3)	B1	1.430	m
5	B2 = B1/CosZ	B2	1.453	m
6	H2 = B1.TanZ	H2	0.239	m
7	EGL to PCC top Height	d	0.600	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	B3 = T+ (H1-d)TanY	B3	1.230	m
10	Thickness PCC	pcc_tH1k	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	383.000	m
14	No of weephole along slope of 1m gap m= ((H1 - d) / COSY) / 1	n	3.000	nos
15	Avg Length of Weephole q = (B3 + T) / 2	weep_len	0.915	m
16	percentage of rock cutting	p_c	0.200	
17	width of parapet wall	para_w	0.300	m
18	Height of parapet wall	para_ht	0.450	m
19	Taking gap every 10m length	gap	0.300	m

Variable Declaration



TYPICAL CROSS SECTION OF RETAINING WALL (1.5M TO 4.0M HIGHT)

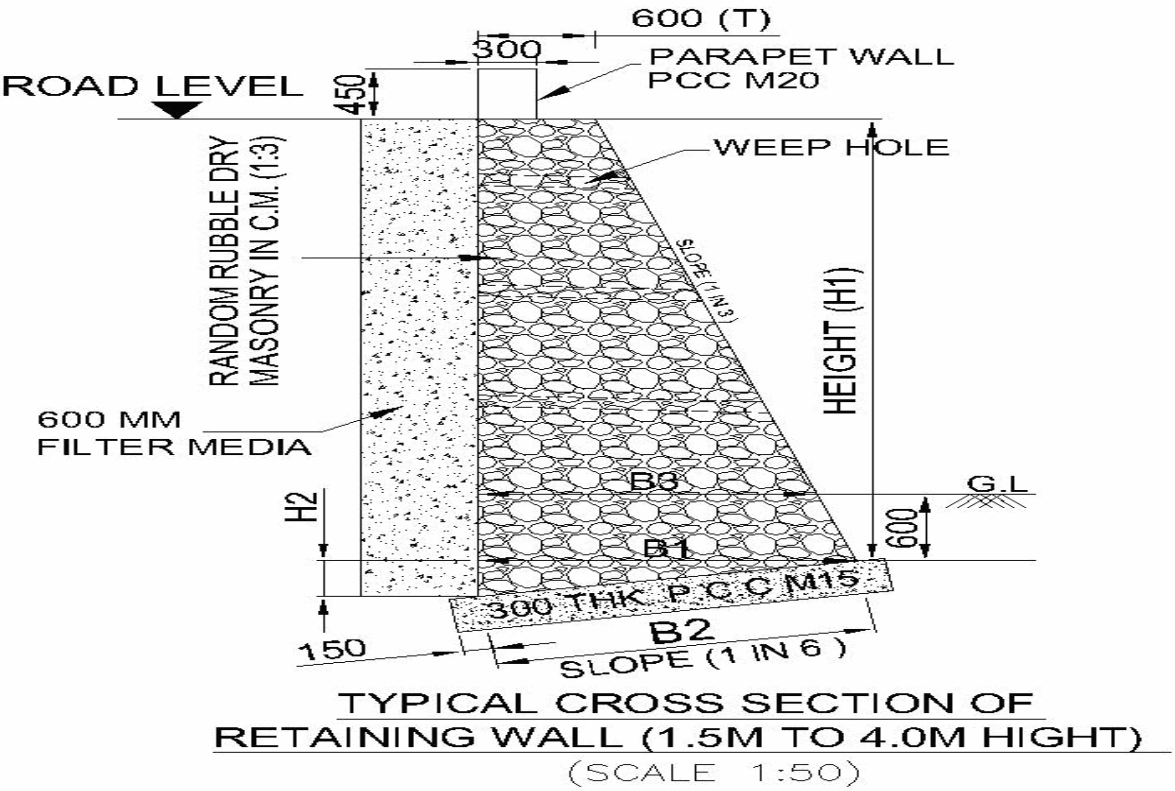
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Variable Declaration

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/CosZ	B2	1.622	m
6	H2 = B1.TanZ	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)TanY	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	651.000	m
14	No of weephole along slope of 1m gap m= ((H1 - d) / COSY) / 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)

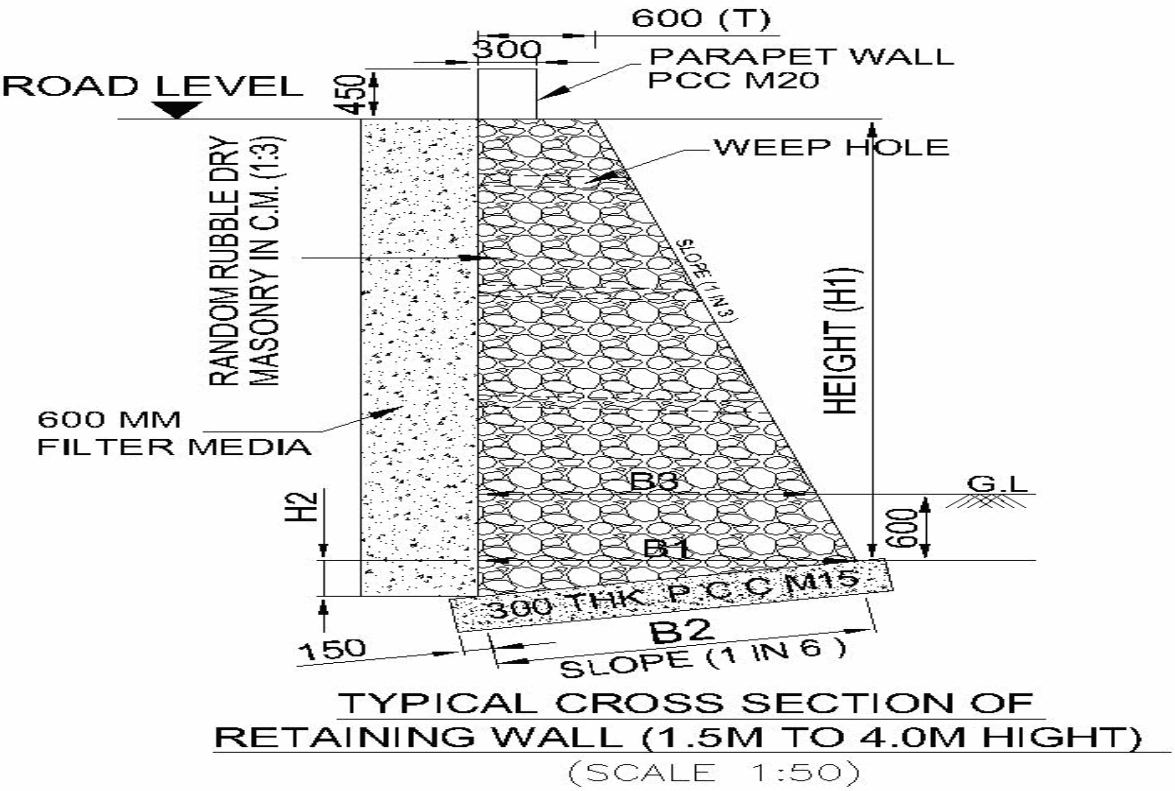
(SCALE 1:50)

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/CosZ	B2	1.960	m
6	H2 = B1.TanZ	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)TanY	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	344.000	m
14	No of weephole along slope of 1m gap m= ((H1 - d) / COSY) / 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)

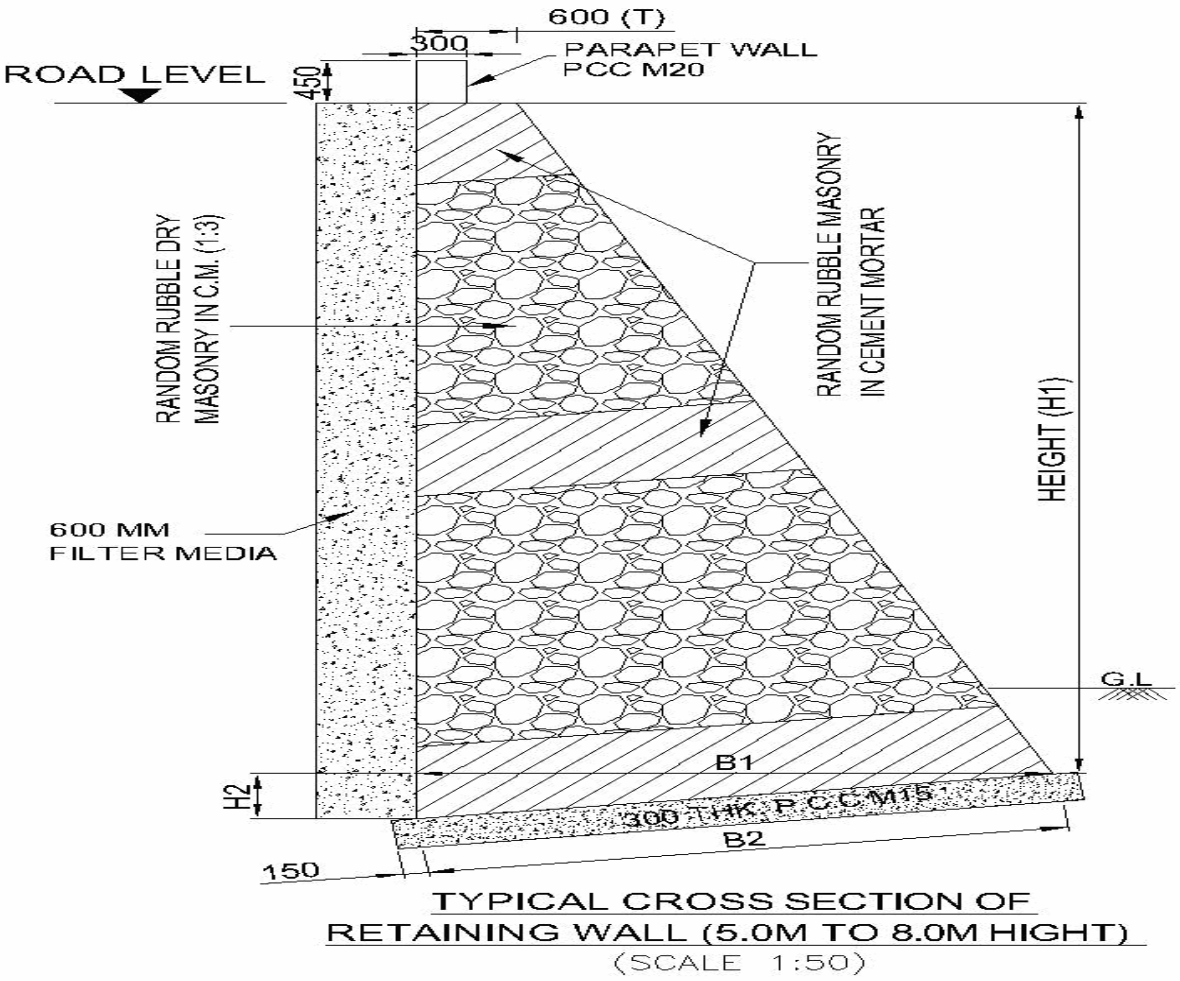
(SCALE 1:50)

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	2.700	m
5	B2 = B1/CosZ	B2	2.740	m
6	H2 = B1.TanZ	H2	0.450	m
7	EGL to PCC top Height	d	0.900	m
8	Slope of Wall(1 in 3)	Y	18.435	degree
9	B3 = T+ (H1-d)TanY	B3	2.298	m
10	Thickness PCC	pcc_tH1k	0.300	m
11	Offset at PCC	o	0.150	m
12	Filter Media Width	mw	0.600	m
13	length	l	100.000	m
14	No of weephole along slope of 1m gap m= ((H1 - d) / COSY) / 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)

Toe Wall

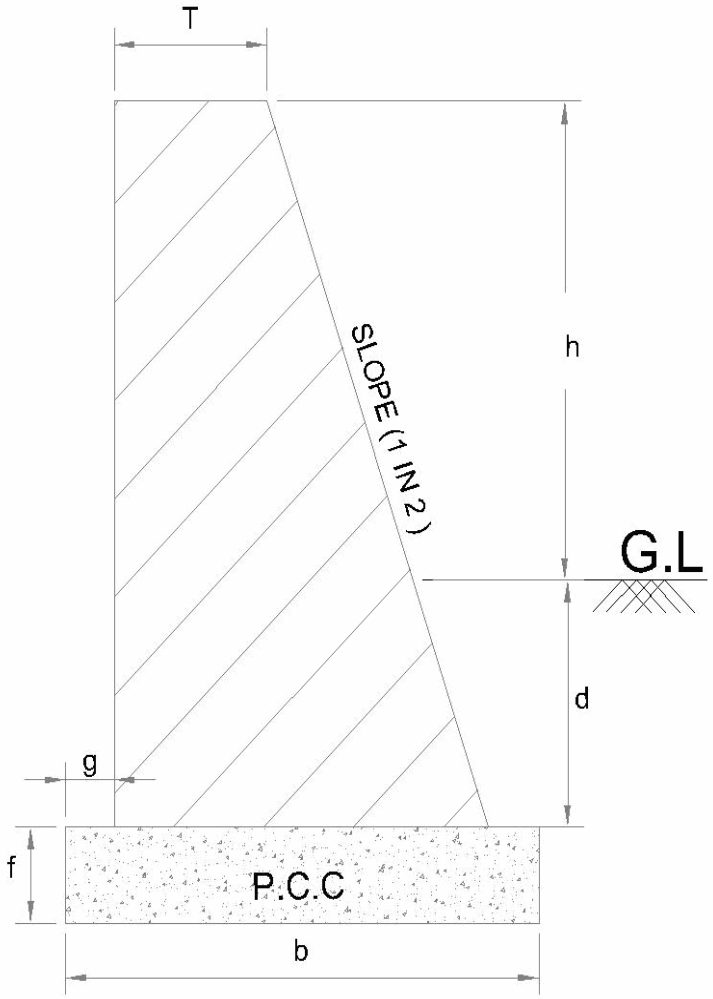
TCS Type	Length (m)	Side	Net Length (m)
TCS-2	338.3	Single	338.3
TCS-3	239.6	Single	239.6
TCS-5	340	Single	340
Total Length=			918

Variable Declaration

Toe Wall 1m

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width	T	0.200	m
2	Bottom Width	b	0.750	m
3	Offset	g	0.100	m
4	Height above Ground	h	1.000	m
5	Height Below Ground	d	0.600	m
6	Foundation Thickness	f	0.100	m
7	Length	l	918.000	m
8	Width At GL (c= b - 2.g - h/2)	c	0.550	m

Variable Declaration



TYPICAL CROSS SECTION OF TOE WALL

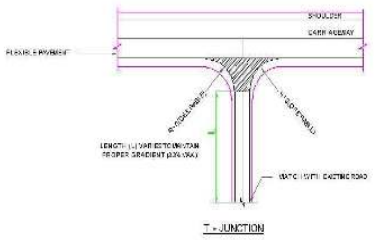
Major Junction

Calculation of Each Major junction Area=

(5.5 x 7.5)+ 2 x (0.5 x 7.5 x 7.5) = 97.50 sqm

25 x 5.5 = 137.5 sqm

Total A **235 sqm**



Chainage	Total Area(Sqm)	Unit
32.155	235.00	sqm
Total Area	**235.00**	**sqm**

Bill No - 05

Lane Marking for junction location:

Items	No	Length (m)	Width (m)	Area (sqm)	Remarks
3-legged Major Junction	1	50	0.15	6	@6m Marking per 9m Length
Considering 20% extra for painting on side road at junction				1	
For Lettering(assume 10% additional area)				1	
			Sub total=	**7**	

Bill No - 05

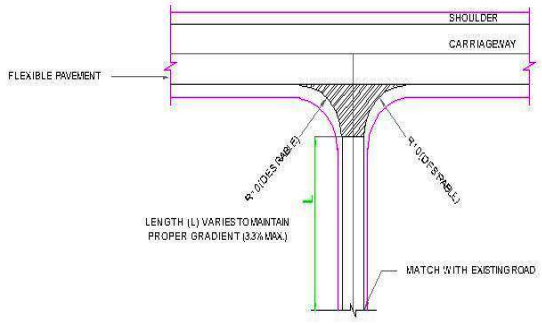
Variable Declaration

Major Junction

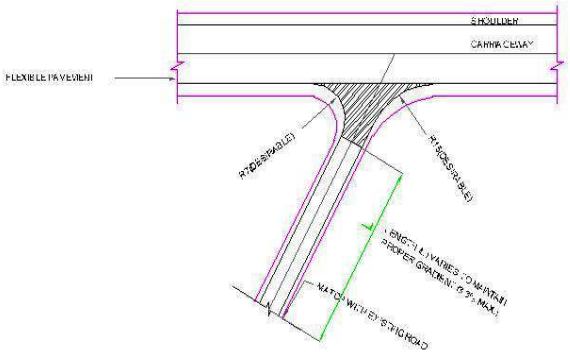
Sl No	Variable Description	Variable	Dimension	Unit
1	Net Area of Major Junction	net_area	235.000	sqm
2	BC	bc	0.040	m
3	DBM	dbm	0.070	m
4	WMM-I	wmm1	0.125	m
5	WMM-II	wmm2	0.125	m
6	GSB	gsb	0.200	m
7	Area of Single Marking(0.3m x 0.15m)	mark_area	0.045	sqm
8	Area of Island	area_is	286.620	sqm
9	Kerb Perimeter	peri_kerb	270.290	m
10	Width of Kerb	width_kerb	0.150	m
11	Height of Median Earthwork	ht_med	0.540	m
12	Total Area of Major Junction	tot_area	0.000	sqm
13	GSB Reuse	gsb_per	9.500	
14	Total Painting Area	tot_paint	7.000	sqm

Minor Junction

Minor Junction				
Sl No	Design Chainage (km)	Junction Type	Type	
1	13+750	X	4-Legged	
2	13+850	T	3-Legged	
3	13+895	T	3-Legged	
4	14+630	T	3-Legged	
5	14+870	Y	3-Legged	
6	14+990	T	3-Legged	
7	15+735	Y	3-Legged	
8	19+330	Y	3-Legged	
9	19+980	T	3-Legged	
10	20+030	T	3-Legged	
11	20+135	Y	3-Legged	
12	20+270	T	3-Legged	
13	20+320	T	3-Legged	
14	28+060	Y	3-Legged	
15	28+200	Y	3-Legged	
16	28+465	Y	3-Legged	
17	29+575	T	3-Legged	
18	31+850	Y	3-Legged	
19	32+025	T	3-Legged	
20	32+650	Y	3-Legged	
21	32+800	Y	3-Legged	



T - JUNCTION



Y - JUNCTION

Junction Type-1

Hatch Area=	(3.5 x 5)+2 x (0.5 x 5 x 5) =	42.50 sqm
Existing Road Area=	10 x 3.75	37.5 sqm
Total Area=		80.00 sqm
(Note: L=10m)		

Junction Type-2

Hatch Area=	(3.5 x 5)+(0.5 x 5 x 5)+ (0.5 x 7.5 x 7.5) =	58.13 sqm
Existing Road Area=	10 x 3.75	37.5 sqm
Total Area=		96 sqm
(Note: L=10m)		

Quantity Calculation for Minor Junction

Junction-Type	***Total No.***	***Each Junction area (sqm)***	***Total area (sqm)***
Y-Type	*10*	*96*	*956*
X-Type	*1*	*160*	*160*
T-Type	*10*	*80*	*800*
Total	***21***		***1916***

Variable Declaration

Minor Junction

Sl No	Variable Description	Variable	Dimension	Unit
1	Total_area	tot_area	1916.000	area
2	BC	bc	0.040	m
3	DBM	dbm	0.070	m
4	WMM-I	wmm1	0.125	m
5	WMM-II	wmm2	0.125	m
6	GSB	gsb	0.200	m
7	GSB percentage Re-use	gsb_per	9.500	percentage

PASSENGER SHELTER

Chainage of Passenger Shelter

Chainage	*Name of the Place*	*Side*
15+650	Panglian Village	both
16+620	S.Munhaihull Village	both
19+170	Geetal Village	both
21+420	L.Phaimol village	both
23+630	Muollum Village	both
31+750	Singngat Village	both
32+500	Singngat Vaiilage	both

Total Number of Bus Bay = **14 No**

Variable Declaration

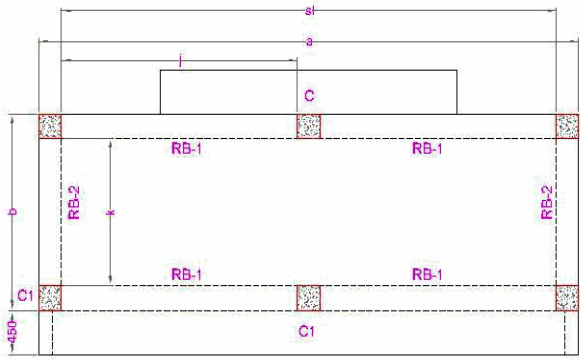
Passenger Shelter

Sl No	Variable Description	Variable	Dimension	Unit
1	No of Passenger Shelter	n	14.000	nos
2	Foundation Length for column	a	0.750	m
3	Foundation Width for column	b	0.750	m
4	Foundation Depth for column	df	0.750	m
5	Nos of column	col_n	6.000	Nos
6	Foundation length for Brick work	l	13.500	m
7	Foundation width for Brick work	w	0.500	m
8	Foundation depth for Brick work	db	0.300	m
9	Each column length	col_l	0.250	m
10	Each column width	col_w	0.250	m
11	Thickness of foundation at bottom	btm_thk	0.100	m
12	Thickness of foundation at top	top_thk	0.100	m
13	Foundation reinforcement	rf	120.000	kg/cum
14	Width of brick wall	w_wall	0.125	m
15	Thickness of pcc	pcc_thk	0.100	m
16	Length of Passenger shelter	l_pass	6.000	m
17	Width of Passenger shelter	w_pass	2.000	m
18	Foundation brick wall top thickness	wtop_thk	0.150	m
19	Foundation brick wall btm thickness	wbtm_thk	0.150	m
20	Side wall & back wall lower portion height	wall_h	0.550	m
21	Side wall upper portion length	sw_l	1.500	m
22	Side wall upper portion height	sw_h	2.130	m
23	Back wall upper portion Length	bw_l	2.650	m
24	Back wall upper portion height	bw_h	0.950	m
25	Seating bench length	bch_l	5.000	m
26	Seating bench width	bch_w	0.500	m
27	Seating bench thickness	bch_thk	0.075	m
28	Nos of window	win_n	2.000	nos
29	Length of window	win_l	1.250	m
30	Height of window	win_h	0.900	m
31	Front column height	fcol_h	2.650	m
32	Back column height	bcol_h	2.100	m
33	Side beam length (RB2)	sb_l	1.530	m
34	Side beam width	sb_w	0.250	m
35	Side beam thickness	sb_thk	0.350	m
36	Side beam length (RB1)	sb_a	3.000	m
37	Thickness of Roof slab	roof_thk	0.110	m

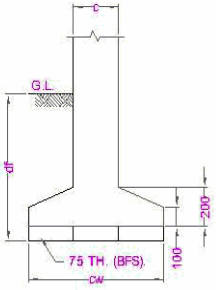
Variable Declaration

38	Width of front Chajja	fchj_w	0.680	m
39	Width of back Chajja	bchj_w	0.450	m
40	Length of railing	rail_l	9.500	m
41	Height of railing	rail_h	0.450	m
42	Width of roof slab	roof_w	1.530	m
43	Superstructure reinforcement	srf	100.000	kg/cum
44	Side wall inner side length	sw_in	1.875	m
45	Back wall inner side length	bw_in	5.800	m
46	Side wall height (plastering &painting)	sw_ht	3.830	m
47	Back wall height (plastering &painting)	bw_ht	2.350	m
48	top width of wall in foundation	fw_wall	0.250	m

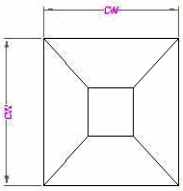
Variable Declaration



STRUCTURAL ARRANGEMENT PLAN

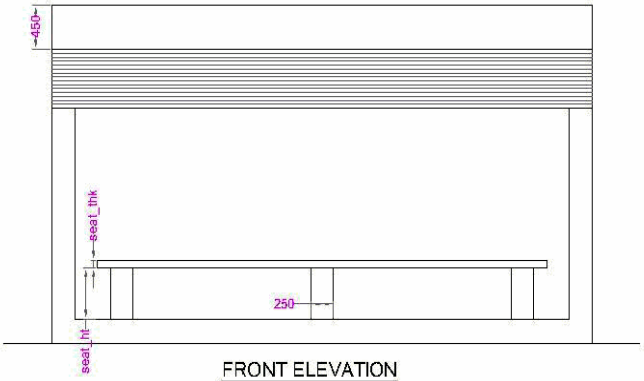


SECTION

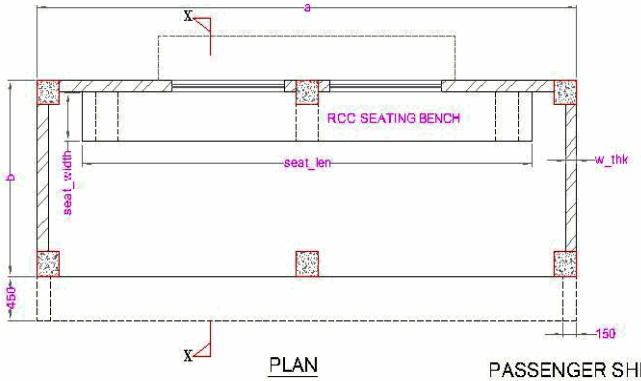


PLAN

COLUMN FOUNDATION DETAILS

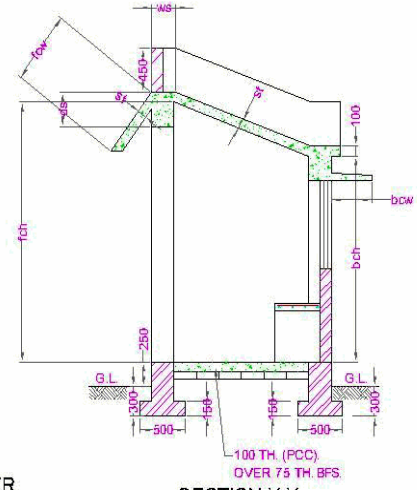


FRONT ELEVATION



PLAN

PASSENGER SHELTER



SECTION X-X

OVERHEAD SIGN

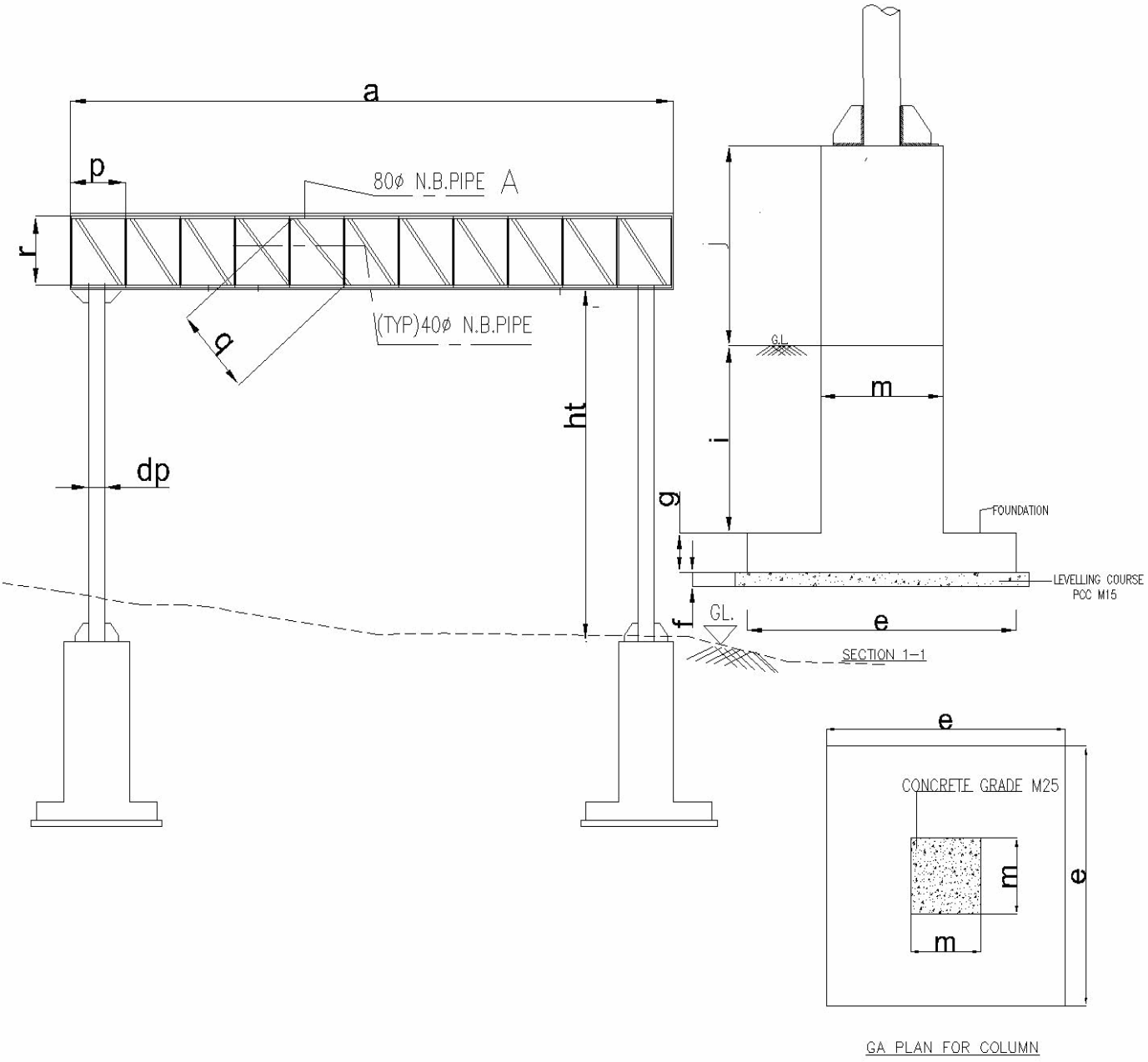
Chainage Details:		
Location	**Ch. Km**	**Nos**
Start & End Road	32+835 km	1
	Total	**1**

Variable Declaration

Overhead Signs

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

Variable Declaration



GA PLAN FOR COLUMN

Metal Beam Crash Barrier

TCS Type	Length (m)	Side	Net Length (m)
TCS-2	338.30	Both	677
TCS-3	239.60	Single	240
TCS-5	340.00	Single	340
TCS-10	538.10	Single	538
TCS-10A	0.00	Single	0
TCS-11	877.60	Single	878
TCS-12	524.80	Single	525
TCS-13	247.40	Both	495
		Total=	**3692**

Total length of crash barrier = **3692 m**

Variable Declaration

Crash Barrier

Sl No	Variable Description	Variable	Dimension	Unit
1	No of Location of Crash Barrier	n	17.000	nos
2	Each side of Crash Barrier Length	cl	25.000	m
3	Total Length of Crash Barrier	tot_len	3692.000	m

Traffic Signs and Other Appurtenance

Summary Of Traffic Signs			
Total No of Street Light=	309	Nos	Bill No- 06, Sl. No- 15
Kilometer stones=	16	Nos	Bill No- 06, Sl. No- 2
5th Kilometer stones=	4	Nos	Bill No- 06, Sl. No- 1
Boundary Stones=	193	Nos	Bill No- 06, Sl. No- 3
Delineators (100 cm long and circular shaped)+H	1608	Nos	Bill No- 06, Sl. No- 12
Road Stud=	9570	Nos	Bill No- 06, Sl. No- 14
900 mm Octagonal	8	Nos	Bill No- 06, Sl. No- 8
600 mm circular	5	Nos	Bill No- 06, Sl. No- 5
900 mm Tringular	339	Nos	Bill No- 06, Sl. No- 5
800 mm x 600 mm rectangular	16	Nos	Bill No- 06, Sl. No- 7
Direction Sign < 0.9 sqm	16.2	sqm	Bill No- 06, Sl. No- 9
Direction Sign > 0.9 sqm	9	sqm	Bill No- 06, Sl. No- 10
Convex Mirror for Blind Curve	30	Nos	Bill No- 06, Sl. No- 16

Traffic Signs and Other Appurtenance

Sl No	Type	IRC-67 2012 Specification	Dimension	Chainage / Location	No	Remarks
1	Right Hand Side Curve	fig 15.02	900 mm Tringular	13.763, 14.022, 14.21, 14.506, 14.732, 15.191, 16.081, 16.373, 16.68, 17.014, 17.523, 17.814, 18.112, 18.377, 18.679, 19.42, 19.713, 20.24, 20.495, 20.742, 20.959, 21.151, 21.348, 21.697, 22.149, 22.215, 22.435, 22.56, 22.839, 23.032, 23.236, 23.549, 23.802, 24.529, 24.731, 24.912, 25.102, 25.36, 25.543, 25.67, 26.104, 26.426, 26.642, 26.966, 27.177, 27.285, 27.586, 28.356, 28.645, 28.965, 29.151, 29.389, 29.669, 29.873, 30.036, 30.406, 30.494, 30.59, 30.751, 31.145, 31.379, 31.678, 31.87, 32.152, 32.338, 32.431	**132**	@ 2per location
2	Left Hand Side Curve	fig 15.01	900 mm Tringular	13.858, 14.35, 14.625, 14.884, 15.006, 15.337, 15.545, 15.772, 15.957, 16.28, 16.541, 16.765, 16.88, 17.219, 17.406, 17.605, 18.022, 18.212, 18.595, 18.83, 18.973, 19.084, 19.28, 19.504, 19.814, 20.034, 20.398, 20.599, 20.853, 21.249, 21.588, 21.784, 21.884, 22.326, 22.627, 22.692, 22.777, 23.107, 23.295, 23.7, 23.983, 24.105, 24.448, 24.605, 25.024, 25.215, 25.75, 25.947, 26.503, 26.735, 26.877, 27.074, 27.459, 27.695, 27.886, 28.017, 28.247, 28.463, 28.748, 29.066, 29.29, 29.467, 29.791, 29.957, 30.151, 30.33, 30.667, 30.971, 31.061, 31.252, 31.489, 31.605, 31.795, 31.958, 32.076, 32.215, 32.276, 32.543, 32.708,	**160**	@ 2per location
3	Built-up area	fig 15.35	900 mm Tringular		**0**	@ 2per location
4	School	fig 15.34	900 mm Tringular		**0**	@ 2per location
6	Police station	fig 17.13	800x600 rectangular	32.8	**2**	@ 2per location
6	Side road	fig 15.09 & 15.10	900 mm Tringular	19.095, 19.325, 20.03, 20.138, 20.273, 28.47, 32.64	**14**	@ 2per location
7	Cross Road	fig 15.14	900 mm Tringular		**0**	@ 2per location
9	Pedestain Crossing		900 mm Tringular	15.65, 16.62, 19.095, 19.17, 19.325, 20.03, 20.138, 20.273, 21.42, 23.63, 28.47, 31.75, 32.5, 32.64	**28**	@ 2per location
9	Bus Stop	fig 17.35	800x600 rectangular	15.65, 16.62, 19.17, 21.42, 23.63, 31.75, 32.5	**14**	@ 2per location
10	Direction Sign		<.0.9 sqm	19.095, 19.325, 20.03, 20.138, 20.273, 28.47, 32.64	**14**	

11	Direction Sign		>0.9 sqm	14.223, 17.017, 21.104	**6**	@ 2per location
12	Hazard Marker	fig 15.76 & fig 15.77	900x300 mm rectangular	Bidge : 14.223, 17.017, 21.104, Culvert:13.861, 14.06, 14.087, 14.489, 14.824, 15.182, 15.242, 15.39, 15.42, 15.6, 15.898, 16.09, 16.214, 16.367, 16.592, 16.68, 16.79, 17.065, 17.29, 17.515, 17.658, 17.845, 17.918, 18.171, 18.402, 18.495, 18.65, 18.89, 19.13, 19.264, 19.455, 19.715, 20.236, 20.488, 20.674, 20.802, 21.38, 21.52, 21.712, 22.135, 22.45, 22.55, 23.245, 23.425, 24.11, 24.368, 24.666, 24.805, 25.638, 26.065, 26.902, 27.031, 27.305, 28.22, 28.486, 28.56, 28.76, 29.081, 29.212, 29.28, 29.446, 29.855, 30.005, 30.746, 30.852, 31.137, 31.378, 31.906, 31.975, 32.135	**292**	@ 4 per structure
13	Stop Sign	fig 14.01	900 mm Octagonal	19.095, 19.325, 20.03, 20.138, 20.273, 28.47, 32.64	**7**	@ 1per location
14	Speed limit	fig 14.37	600mm Cicular		**2**	@ 2per location
15	Horn prohibited	fig 14.18	600mm Cicular		**2**	@ 2per location
16	Convex Mirror for Blind Curve			14.775, 15, 15.2, 16.075, 16.4, 16.6, 16.75, 17, 17.23, 19.7, 22.15, 30.75, 31.15, 31.375, 31.675	**30**	@ 2per location

Junction Part						
3-Legged Junction (Chainage ::,0+000)						
No Of 3 legged Major Junction			**1**	**nos**		
1	Right Hand Side Curve	fig 15.02	900 mm Tringular	nosx1	**1**	
2	Left Hand Side Curve	fig 15.01	900 Tringular	nosx1	**1**	
5	Pedestain Crossing	fig 15.33	900 Tringular	nosx3	**3**	
6	Stop Sign	fig 14.01	900 mm Octagonal	nosx1	**1**	
7	Speed limit	fig 14.37	600mm Cicular	nosx1	**1**	
9	Rumble strip	fig 15.50	900 Tringular	nosx3		
10	Object Marker (one way)	fig 15.76 & fig 15.77	900x300 mm rectangular	nosx4	**4**	
11	Object Marker (Two way)	fig 15.78	900x450 mm rectangular	nosx1	**1**	
12	Direction Sign		<.0.9 sqm	nosx4	**4**	
13	Direction Sign		>0.9 sqm	nosx3	**3**	

4-Legged Junction (Chainage ::)						
No Of 4 legged Major Junction			**0**	**nos**		
1	Right Hand Side Curve	fig 15.02	900 mm Tringular	nos x 2	**0**	
2	Left Hand Side Curve	fig 15.01	900 Tringular	nos x 2	**0**	
5	Pedestain Crossing	fig 15.33	900 Tringular	nos x 4	**0**	
6	Stop Sign	fig 14.01	900 mm Octagonal	nos x 1	**0**	
7	Speed limit	fig 14.37	600mm Cicular	nos x 1	**0**	
9	Object Marker (one way)	fig 15.76 & fig 15.77	900x300 mm rectangular	nos x 6	**0**	
10	Object Marker (Two way)	fig 15.78	900x450 mm rectangular	nos x 2	**0**	
11	Direction Sign		<.0.9 sqm	nos x 6	**0**	
12	Direction Sign		>0.9 sqm	nos x 4	**0**	

SUMMARY				
90 cm equilateral triangle		**339**	nos	...Bill No- 06, Sl. No- 5
Stop Sign (90 cm high octagon)		**8**	nos	...Bill No- 06, Sl. No- 8
60 cm circular		**5**	nos	...Bill No- 06, Sl. No- 6
80 cm x 60 cm rectangular		**16**	nos	...Bill No- 06, Sl. No- 7
Direction Sign	<.0.9 sqm	**16.2**	nos	...Bill No- 06, Sl. No- 9
Direction Sign	>0.9 sqm	**9**	nos	...Bill No- 06, Sl. No- 10
Object Marker (one way) & (two way)		**5**	nos	...Bill No- 06, Sl. No- 12
Hazard Marker		**292**	nos	...Bill No- 06, Sl. No- 12
Convex Mirror for Blind Curve		**30**	nos	...Bill No- 06, Sl. No- 16

Calculation of km Stone, Hectometer Stone and Boundary Stone

Item	Remarks	Nos	
Kilometer stones	Total KM Stone- No. of 5th KM stone	**16**	...Bill No- 06, Sl. No- 2
5th Kilometer stones	(km stone 5th, 10th , 15th, 20th etc)	**4**	...Bill No- 06, Sl. No- 1
Boundary stones	(Total Lengthx5x2) + 2x1	**193**	...Bill No- 06, Sl. No- 3

Traffic Signs and Other Appurtenance

CALCULATION FOR STREET LIGHTING

Street light in Built Up Location:

TCS Type	Length	Length (m)
TCS-1	1807.2	3614.40
	Total =	**3614.4**

Total length = **3614 m**

Assuming , street lights @= 50m interval

for	3614 m	73	nos
Add for Major Junction = (@ 4nos per junction)		20	nos
At Busbay location= (@ 5 nos per Busbay)		120	nos
At Bridge Portion = (@ 4 nos per Bridge)		48	nos
At Bridge Apprach= (@ 4 nos per Approach)		48	nos
Total nos of street light=		**309**	**nos**

Bill No- 06, Sl. No- 15

CALCULATION FOR DELINEATOR

HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S) as per IRC:79-1981	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
81	13843.093	13872.277	100	12	29.184	3	2	1	1	1	1	1	0
82	14008.844	14035.479	100	12	26.635	3	2	1	1	1	1	1	0
83	14191.766	14227.506	60	8	35.740	5	3	1	1	1	1	1	0
84	14326.222	14373.379	60	8	47.157	6	3	1	1	1	1	1	0
85	14486.725	14524.316	300	25	37.591	2	1	1	1	1	0	1	0
86	14620.258	14629.730	80	8	9.472	2	1	1	1	1	1	1	0
87	14708.136	14754.898	50	8	46.762	6	3	1	1	1	1	1	0
88	14873.527	14894.458	50	8	20.931	3	2	1	1	1	1	1	0
89	14990.414	15020.956	50	8	30.542	4	2	1	1	1	1	1	0
90	15146.170	15235.553	50	8	89.383	12	6	1	1	1	0	1	0
91	15307.060	15367.251	300	25	60.191	3	2	0	1	1	0	1	0
92	15530.173	15560.608	50	8	30.435	4	2	1	1	1	1	1	0
93	15727.139	15817.306	125	12	90.167	8	4	1	1	1	1	1	0
94	15954.736	15959.426	60	8	4.690	1	1	1	1	1	1	1	0
95	16041.319	16120.813	50	8	79.494	10	5	1	1	1	1	1	0
96	16266.774	16292.483	35	6	25.709	5	3	1	1	1	0	1	0
97	16343.567	16401.586	35	6	58.019	10	5	1	1	1	1	1	0
98	16498.201	16583.266	40	6	85.065	15	8	1	1	1	1	1	0

HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S) as per IRC:79-1981	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
99	16663.300	16697.216	25	8	33.916	5	3	1	1	1	0	1	0
100	16749.259	16780.240	35	6	30.981	6	3	1	1	1	1	1	0
101	16869.085	16891.750	200	20	22.665	2	1	1	1	1	0	1	0
102	16979.437	17049.095	40	6	69.658	12	6	1	1	1	1	1	1
103	17190.220	17247.204	40	6	56.984	10	5	1	1	1	1	1	1
104	17391.060	17421.626	200	20	30.566	2	1	1	1	1	0	1	0
105	17502.081	17544.850	50	8	42.769	6	3	1	1	1	0	1	0
106	17590.435	17618.767	60	8	28.332	4	2	1	1	1	1	1	1
107	17795.674	17831.432	60	8	35.758	5	3	1	1	1	1	1	0
108	17993.896	18050.758	300	25	56.862	3	2	1	0	1	0	1	0
109	18102.200	18121.505	60	8	19.305	3	2	1	1	1	0	1	0
110	18194.126	18230.867	125	12	36.741	4	2	1	1	1	1	1	0
111	18346.385	18407.191	150	12	60.806	6	3	1	1	1	1	1	0
112	18590.245	18598.966	50	8	8.721	2	1	1	1	1	0	1	0
113	18668.117	18689.690	80	8	21.573	3	2	1	1	1	1	1	0
114	18813.079	18847.277	125	12	34.198	3	2	1	1	1	0	1	0
115	18949.641	18995.943	60	8	46.302	6	3	1	1	1	1	1	0
116	19073.134	19094.649	60	8	21.515	3	2	1	1	1	1	1	0
117	19233.875	19326.600	300	25	92.725	4	2	1	0	1	0	1	0
118	19404.012	19435.086	80	8	31.074	4	2	1	1	1	0	1	0
119	19495.584	19513.392	40	6	17.808	3	2	1	1	1	1	1	1
120	19693.937	19731.246	20	6	37.309	7	4	1	1	1	1	1	0
121	19791.019	19836.887	125	12	45.868	4	2	1	1	1	0	1	0
122	19923.723	20143.495	115	12	219.772	19	10	1	1	1	0	1	0
123	20222.866	20257.634	200	20	34.768	2	1	1	1	1	0	1	0
124	20372.860	20422.287	100	12	49.427	5	3	1	1	1	0	1	0
125	20490.975	20500.016	60	8	9.041	2	1	1	1	1	0	1	0
126	20572.191	20626.200	100	12	54.009	5	3	1	1	1	0	1	0
127	20715.246	20768.044	70	8	52.798	7	4	1	1	1	0	1	0
128	20844.014	20862.105	80	8	18.091	3	2	1	1	1	1	1	0
129	20939.393	20978.410	150	12	39.017	4	2	1	1	1	1	1	0
130	21117.686	21183.725	300	25	66.039	3	2	1	0	1	0	1	0

HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S) as per IRC:79-1981	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
131	21231.998	21265.383	80	8	33.385	5	3	1	1	1	0	1	0
132	21338.851	21357.155	50	8	18.304	3	2	1	1	1	1	1	1
133	21569.797	21606.474	100	12	36.677	4	2	1	1	1	0	1	0
134	21667.997	21725.172	35	6	57.175	10	5	1	1	1	0	1	0
135	21762.344	21804.742	35	6	42.398	8	4	1	1	1	0	1	0
136	21847.256	21921.672	75	8	74.416	10	5	1	1	1	1	1	1
137	22128.629	22169.618	25	8	40.989	6	3	1	1	1	0	1	0
138	22207.476	22223.107	80	8	15.631	2	1	1	1	1	0	1	0
139	22288.504	22364.473	37	6	75.969	13	7	1	1	1	1	1	0
140	22425.880	22444.352	30	6	18.472	4	2	1	1	1	1	1	0
141	22546.504	22574.393	30	6	27.889	5	3	1	1	1	0	1	0
142	22610.471	22642.821	30	6	32.350	6	3	1	1	1	0	1	0
143	22683.673	22701.067	40	6	17.394	3	2	1	1	1	1	1	0
144	22769.067	22784.668	35	6	15.601	3	2	1	1	1	0	1	0
145	22827.903	22850.874	25	8	22.971	3	2	1	1	1	1	1	0
146	23016.541	23048.435	80	8	31.894	4	2	1	1	1	0	1	0
147	23102.496	23110.869	100	12	8.373	1	1	1	1	1	1	1	0
148	23228.124	23243.816	125	12	15.692	2	1	1	0	1	0	1	0
149	23279.415	23309.954	60	8	30.539	4	2	1	1	1	1	1	1
150	23540.794	23557.007	90	8	16.213	3	2	1	1	1	1	1	0
151	23681.231	23718.863	150	12	37.632	4	2	1	1	1	0	1	0
152	23789.339	23815.153	150	12	25.814	3	2	1	1	1	1	1	0
153	23978.940	23987.113	80	8	8.173	2	1	1	1	1	1	1	0
154	24089.187	24120.338	300	25	31.151	2	1	1	1	1	1	1	0
155	24444.747	24450.401	75	8	5.654	1	1	1	1	1	0	1	0
156	24518.854	24538.275	75	8	19.421	3	2	1	1	1	0	1	0
157	24596.717	24613.440	80	8	16.723	3	2	1	1	1	0	1	0
158	24674.839	24787.058	125	12	112.219	10	5	1	1	1	0	1	0
159	24879.729	24944.507	170	12	64.778	6	3	1	1	1	0	1	0
160	25007.402	25040.959	200	20	33.557	2	1	0	0	1	0	1	0
161	25079.108	25124.505	300	25	45.397	2	1	0	0	1	0	1	0
162	25150.051	25280.159	125	12	130.108	11	6	0	1	1	0	1	0

HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S) as per IRC:79-1981	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
163	25352.452	25367.468	100	12	15.016	2	1	1	1	1	1	1	0
164	25506.179	25578.828	125	12	72.649	7	4	1	1	1	0	1	0
165	25664.031	25676.491	70	8	12.460	2	1	1	1	1	0	1	0
166	25748.833	25751.626	52	8	2.793	1	1	1	1	1	1	1	1
167	25928.911	25965.512	100	12	36.601	4	2	1	1	1	1	1	0
168	26092.208	26115.696	70	8	23.488	3	2	1	1	1	1	1	1
169	26412.634	26438.422	60	8	25.788	4	2	1	1	1	0	1	0
170	26486.961	26518.489	40	6	31.528	6	3	1	1	1	1	1	0
171	26631.002	26653.115	60	8	22.113	3	2	1	1	1	0	1	0
172	26729.313	26741.207	60	8	11.894	2	1	1	1	1	1	1	0
173	26865.929	26888.802	80	8	22.873	3	2	1	1	1	0	1	0
174	26963.910	26968.762	50	8	4.852	1	1	1	1	1	1	1	0
175	27065.387	27083.132	60	8	17.745	3	2	1	1	1	1	1	0
176	27171.625	27181.549	60	8	9.924	2	1	1	1	1	1	1	0
177	27272.813	27297.153	80	8	24.340	4	2	1	1	1	1	1	0
178	27453.650	27465.048	70	8	11.398	2	1	1	1	1	1	1	0
179	27559.288	27612.658	150	12	53.370	5	3	1	1	1	0	1	0
180	27679.694	27709.630	300	25	29.936	2	1	0	1	1	0	1	0
181	27861.643	27909.363	150	12	47.720	4	2	1	1	1	0	1	0
182	27990.768	28042.936	500	35	52.168	2	1	0	1	1	0	1	0
183	28206.633	28287.326	150	12	80.693	7	4	1	1	1	0	1	0
184	28331.942	28379.195	125	12	47.253	4	2	1	1	1	0	1	0
185	28461.395	28464.696	50	8	3.301	1	1	1	1	1	1	1	0
186	28635.679	28654.364	50	8	18.685	3	2	1	1	1	1	1	0
187	28739.089	28757.160	50	8	18.071	3	2	1	1	1	1	1	1
188	28949.378	28980.250	35	6	30.872	6	3	1	1	1	1	1	0
189	29053.662	29078.423	25	8	24.761	4	2	1	1	1	0	1	0
190	29140.330	29160.978	30	6	20.648	4	2	1	1	1	1	1	0
191	29280.040	29299.045	50	8	19.005	3	2	1	1	1	1	1	0
192	29387.264	29391.468	50	8	4.204	1	1	1	1	1	0	1	0
193	29451.332	29483.178	150	12	31.846	3	2	1	1	1	1	1	0
194	29650.487	29686.904	80	8	36.417	5	3	1	1	1	1	1	0

HIP / CURVE NO.	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S) as per IRC:79-1981	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
195	29780.038	29802.717	80	8	22.679	3	2	1	1	1	0	1	0
196	29870.767	29875.750	54	8	4.983	1	1	1	1	1	1	1	0
197	29953.777	29961.106	70	8	7.329	1	1	1	1	1	0	1	0
198	30032.647	30040.314	70	8	7.667	1	1	1	1	1	1	1	0
199	30119.570	30183.371	50	8	63.801	8	4	1	1	1	1	1	0
200	30325.085	30335.812	200	20	10.727	1	1	1	0	1	0	1	0
201	30397.070	30414.755	100	12	17.685	2	1	1	1	1	0	1	0
202	30489.656	30497.765	60	8	8.109	2	1	1	1	1	1	1	0
203	30586.882	30592.911	50	8	6.029	1	1	1	1	1	0	1	0
204	30656.466	30678.265	20	6	21.799	4	2	1	1	1	1	1	0
205	30738.778	30762.353	20	6	23.575	4	2	1	1	1	1	1	1
206	30946.686	30995.974	30	6	49.288	9	5	1	1	1	0	1	0
207	31049.651	31071.631	80	8	21.980	3	2	1	1	1	0	1	0
208	31126.153	31163.791	20	6	37.638	7	4	1	1	1	1	1	0
209	31240.327	31263.024	20	6	22.697	4	2	1	1	1	1	1	0
210	31361.472	31397.298	20	6	35.826	6	3	1	1	1	1	1	0
211	31462.549	31514.452	40	6	51.903	9	5	1	1	1	1	1	0
212	31599.576	31610.107	50	8	10.531	2	1	1	1	1	0	1	0
213	31662.183	31693.008	20	6	30.825	6	3	1	1	1	1	1	0
214	31787.671	31802.996	25	8	15.325	2	1	1	1	1	0	1	0
215	31849.967	31890.353	50	8	40.386	6	3	1	1	1	0	1	0
216	31950.666	31964.401	35	6	13.735	3	2	1	1	1	1	1	0
217	32070.747	32081.308	125	12	10.561	1	1	1	1	1	0	1	0
218	32146.004	32157.039	30	6	11.035	2	1	1	1	1	0	1	0
219	32209.995	32219.705	90	8	9.710	2	1	1	1	1	0	1	0
220	32266.868	32285.923	60	8	19.055	3	2	1	1	1	0	1	0
221	32334.190	32341.823	80	8	7.633	1	1	1	1	1	0	1	0
222	32418.566	32442.934	100	12	24.368	3	2	1	1	1	0	1	0
223	32532.047	32553.730	100	12	21.683	2	1	1	1	1	1	1	0
224	32683.314	32733.207	50	8	49.893	7	4	1	0	1	0	1	0
				TOTAL	**=**	**619**	**344**	**138**	**136**	**144**	**72**	**144**	**11**

Total No of Road Delineators = **1608 nos.** Bill No- 06, Sl. No- 12

Quantity Calculation for Road Stud

SL. No.	Description of section	START CHAINAGE	END CHAINAGE	Transition length	START CH. Road Stud	END CH. Road stud	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
1	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	13843.093	13872.277	20	13803.093	13912.277	109.18	100	6	19	38
		14008.844	14035.479	20	13968.844	14075.479	106.64	100	6	18	36
		14191.766	14227.506	35	14136.766	14282.506	145.74	60	6	25	50
		14326.222	14373.379	35	14271.222	14428.379	157.16	60	6	27	54
		14486.725	14524.316		14466.725	14544.316	77.59	300	6	13	26
		14620.258	14629.730	25	14575.258	14674.73	99.47	80	6	17	34
		14708.136	14754.898	40	14648.136	14814.898	166.76	50	6	28	56
		14873.527	14894.458	40	14813.527	14954.458	140.93	50	6	24	48
		14990.414	15020.956	40	14930.414	15080.956	150.54	50	6	26	52
		15146.170	15235.553	40	15086.17	15295.553	209.38	50	6	35	70
		15307.060	15367.251		15287.06	15387.251	100.19	300	6	17	34
		15530.173	15560.608	40	15470.173	15620.608	150.43	50	6	26	52
		15727.139	15817.306	15	15692.139	15852.306	160.17	125	6	27	54
		15954.736	15959.426	35	15899.736	16014.426	114.69	60	6	20	40

SL. No.	Description of section	START CHAINAGE	END CHAINAGE	Transition length	START CH. Road Stud	END CH. Road stud	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	16041.319	16120.813	40	15981.319	16180.813	199.49	50	6	34	68
		16266.774	16292.483	25	16221.774	16337.483	115.71	35	6	20	40
		16343.567	16401.586	25	16298.567	16446.586	148.02	35	6	25	50
		16498.201	16583.266	25	16453.201	16628.266	175.06	40	6	30	60
		16663.300	16697.216	25	16618.3	16742.216	123.92	25	6	21	42
		16749.259	16780.240	25	16704.259	16825.24	120.98	35	6	21	42
		16869.085	16891.750	15	16834.085	16926.75	92.67	200	6	16	32
		16979.437	17049.095	25	16934.437	17094.095	159.66	40	6	27	54
		17190.220	17247.204	25	17145.22	17292.204	146.98	40	6	25	50
		17391.060	17421.626	15	17356.06	17456.626	100.57	200	6	17	34
		17502.081	17544.850	20	17462.081	17584.85	122.77	50	6	21	42
		17590.435	17618.767	15	17555.435	17653.767	98.33	60	6	17	34
		17795.674	17831.432	35	17740.674	17886.432	145.76	60	6	25	50
		17993.896	18050.758		17973.896	18070.758	96.86	300	6	17	34
		18102.200	18121.505	35	18047.2	18176.505	129.31	60	6	22	44
		18194.126	18230.867	15	18159.126	18265.867	106.74	125	6	18	36
		18346.385	18407.191	15	18311.385	18442.191	130.81	150	6	22	44
		18590.245	18598.966	40	18530.245	18658.966	128.72	50	6	22	44
		18668.117	18689.690	25	18623.117	18734.69	111.57	80	6	19	38
		18813.079	18847.277	15	18778.079	18882.277	104.20	125	6	18	36
		18949.641	18995.943	35	18894.641	19050.943	156.30	60	6	27	54
		19073.134	19094.649	35	19018.134	19149.649	131.52	60	6	22	44
		19233.875	19326.600		19213.875	19346.6	132.72	300	6	23	46
		19404.012	19435.086	25	19359.012	19480.086	121.07	80	6	21	42
		19495.584	19513.392	25	19450.584	19558.392	107.81	40	6	18	36
		19693.937	19731.246	20	19653.937	19771.246	117.31	20	6	20	40
		19791.019	19836.887	15	19756.019	19871.887	115.87	125	6	20	40
		19923.723	20143.495	20	19883.723	20183.495	299.77	115	6	50	100
		20222.866	20257.634	15	20187.866	20292.634	104.77	200	6	18	36
		20372.860	20422.287	20	20332.86	20462.287	129.43	100	6	22	44
		20490.975	20500.016	35	20435.975	20555.016	119.04	60	6	20	40

SL. No.	Description of section	START CHAINAGE	END CHAINAGE	Transition length	START CH. Road Stud	END CH. Road stud	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	20572.191	20626.200	20	20532.191	20666.2	134.01	100	6	23	46
		20715.246	20768.044	30	20665.246	20818.044	152.80	70	6	26	52
		20844.014	20862.105	25	20799.014	20907.105	108.09	80	6	19	38
		20939.393	20978.410	15	20904.393	21013.41	109.02	150	6	19	38
		21117.686	21183.725		21097.686	21203.725	106.04	300	6	18	36
		21231.998	21265.383	25	21186.998	21310.383	123.39	80	6	21	42
		21338.851	21357.155	40	21278.851	21417.155	138.30	50	6	24	48
		21569.797	21606.474	20	21529.797	21646.474	116.68	100	6	20	40
		21667.997	21725.172	15	21632.997	21760.172	127.17	35	6	22	44
		21762.344	21804.742	15	21727.344	21839.742	112.40	35	6	19	38
		21847.256	21921.672	15	21812.256	21956.672	144.42	75	6	25	50
		22128.629	22169.618	20	22088.629	22209.618	120.99	25	6	21	42
		22207.476	22223.107	15	22172.476	22258.107	85.63	80	6	15	30
		22288.504	22364.473	25	22243.504	22409.473	165.97	37	6	28	56
		22425.880	22444.352	25	22380.88	22489.352	108.47	30	6	19	38
		22546.504	22574.393	15	22511.504	22609.393	97.89	30	6	17	34
		22610.471	22642.821	15	22575.471	22677.821	102.35	30	6	18	36
		22683.673	22701.067	15	22648.673	22736.067	87.39	40	6	15	30
		22769.067	22784.668	15	22734.067	22819.668	85.60	35	6	15	30
		22827.903	22850.874	20	22787.903	22890.874	102.97	25	6	18	36
		23016.541	23048.435	25	22971.541	23093.435	121.89	80	6	21	42
		23102.496	23110.869	20	23062.496	23150.869	88.37	100	6	15	30
		23228.124	23243.816	15	23193.124	23278.816	85.69	125	6	15	30
		23279.415	23309.954	15	23244.415	23344.954	100.54	60	6	17	34
		23540.794	23557.007	50	23470.794	23627.007	156.21	90	6	27	54
		23681.231	23718.863	35	23626.231	23773.863	147.63	150	6	25	50
		23789.339	23815.153	35	23734.339	23870.153	135.81	150	6	23	46
		23978.940	23987.113	55	23903.94	24062.113	158.17	80	6	27	54
		24089.187	24120.338	15	24054.187	24155.338	101.15	300	6	17	34
		24444.747	24450.401	30	24394.747	24500.401	105.65	75	6	18	36
		24518.854	24538.275	30	24468.854	24588.275	119.42	75	6	20	40

SL. No.	Description of section	START CHAINAGE	END CHAINAGE	Transition length	START CH. Road Stud	END CH. Road stud	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	24596.717	24613.440	25	24551.717	24658.44	106.72	80	6	18	36
		24674.839	24787.058	15	24639.839	24822.058	182.22	125	6	31	62
		24879.729	24944.507	15	24844.729	24979.507	134.78	170	6	23	46
		25007.402	25040.959	15	24972.402	25075.959	103.56	200	6	18	36
		25079.108	25124.505		25059.108	25144.505	85.40	300	6	15	30
		25150.051	25280.159	15	25115.051	25315.159	200.11	125	6	34	68
		25352.452	25367.468	20	25312.452	25407.468	95.02	100	6	16	32
		25506.179	25578.828	15	25471.179	25613.828	142.65	125	6	24	48
		25664.031	25676.491	30	25614.031	25726.491	112.46	70	6	19	38
		25748.833	25751.626	40	25688.833	25811.626	122.79	52	6	21	42
		25928.911	25965.512	20	25888.911	26005.512	116.60	100	6	20	40
		26092.208	26115.696	30	26042.208	26165.696	123.49	70	6	21	42
		26412.634	26438.422	15	26377.634	26473.422	95.79	60	6	16	32
		26486.961	26518.489	25	26441.961	26563.489	121.53	40	6	21	42
		26631.002	26653.115	35	26576.002	26708.115	132.11	60	6	23	46
		26729.313	26741.207	35	26674.313	26796.207	121.89	60	6	21	42
		26865.929	26888.802	25	26820.929	26933.802	112.87	80	6	19	38
		26963.910	26968.762	40	26903.91	27028.762	124.85	50	6	21	42
		27065.387	27083.132	35	27010.387	27138.132	127.75	60	6	22	44
		27171.625	27181.549	35	27116.625	27236.549	119.92	60	6	20	40
		27272.813	27297.153	25	27227.813	27342.153	114.34	80	6	20	40
		27453.650	27465.048	30	27403.65	27515.048	111.40	70	6	19	38
		27559.288	27612.658	35	27504.288	27667.658	163.37	150	6	28	56
		27679.694	27709.630	15	27644.694	27744.63	99.94	300	6	17	34
		27861.643	27909.363	35	27806.643	27964.363	157.72	150	6	27	54
		27990.768	28042.936		27970.768	28062.936	92.17	500	9	11	22
		28206.633	28287.326	15	28171.633	28322.326	150.69	150	6	26	52
		28331.942	28379.195	15	28296.942	28414.195	117.25	125	6	20	40
		28461.395	28464.696	40	28401.395	28524.696	123.30	50	6	21	42
		28635.679	28654.364	40	28575.679	28714.364	138.69	50	6	24	48
		28739.089	28757.160	40	28679.089	28817.16	138.07	50	6	24	48

SL. No.	Description of section	START CHAINAGE	END CHAINAGE	Transition length	START CH. Road Stud	END CH. Road stud	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	28949.378	28980.250	25	28904.378	29025.25	120.87	35	6	21	42
		29053.662	29078.423	25	29008.662	29123.423	114.76	25	6	20	40
		29140.330	29160.978	25	29095.33	29205.978	110.65	30	6	19	38
		29280.040	29299.045	40	29220.04	29359.045	139.00	50	6	24	48
		29387.264	29391.468	40	29327.264	29451.468	124.20	50	6	21	42
		29451.332	29483.178	15	29416.332	29518.178	101.85	150	6	17	34
		29650.487	29686.904	25	29605.487	29731.904	126.42	80	6	22	44
		29780.038	29802.717	25	29735.038	29847.717	112.68	80	6	19	38
		29870.767	29875.750	40	29810.767	29935.75	124.98	54	6	21	42
		29953.777	29961.106	30	29903.777	30011.106	107.33	70	6	18	36
		30032.647	30040.314	30	29982.647	30090.314	107.67	70	6	18	36
		30119.570	30183.371	40	30059.57	30243.371	183.80	50	6	31	62
		30325.085	30335.812	15	30290.085	30370.812	80.73	200	6	14	28
		30397.070	30414.755	20	30357.07	30454.755	97.69	100	6	17	34
		30489.656	30497.765	35	30434.656	30552.765	118.11	60	6	20	40
		30586.882	30592.911	20	30546.882	30632.911	86.03	50	6	15	30
		30656.466	30678.265	20	30616.466	30718.265	101.80	20	6	17	34
		30738.778	30762.353	20	30698.778	30802.353	103.58	20	6	18	36
		30946.686	30995.974	15	30911.686	31030.974	119.29	30	6	20	40
		31049.651	31071.631	15	31014.651	31106.631	91.98	80	6	16	32
		31126.153	31163.791	20	31086.153	31203.791	117.64	20	6	20	40
		31240.327	31263.024	20	31200.327	31303.024	102.70	20	6	18	36
		31361.472	31397.298	20	31321.472	31437.298	115.83	20	6	20	40
		31462.549	31514.452	25	31417.549	31559.452	141.90	40	6	24	48
		31599.576	31610.107	20	31559.576	31650.107	90.53	50	6	16	32
		31662.183	31693.008	20	31622.183	31733.008	110.83	20	6	19	38
		31787.671	31802.996	20	31747.671	31842.996	95.33	25	6	16	32

SL. No.	Description of section	START CHAINAGE	END CHAINAGE	Transition length	START CH. Road Stud	END CH. Road stud	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
	Horizontal curve :: Curve radii upto 450 , spacing =6m. Curve radii 451 to 750 , spacing =9m. Curve radii 751 to 2000m & critical sections, spacing =18m	31849.967	31890.353	20	31809.967	31930.353	120.39	50	6	21	42
		31950.666	31964.401	25	31905.666	32009.401	103.74	35	6	18	36
		32070.747	32081.308	15	32035.747	32116.308	80.56	125	6	14	28
		32146.004	32157.039	25	32101.004	32202.039	101.04	30	6	17	34
		32209.995	32219.705	20	32169.995	32259.705	89.71	90	6	15	30
		32266.868	32285.923	15	32231.868	32320.923	89.06	60	6	15	30
		32334.190	32341.823	25	32289.19	32386.823	97.63	80	6	17	34
		32418.566	32442.934	20	32378.566	32482.934	104.37	100	6	18	36
		32532.047	32553.730	20	32492.047	32593.73	101.68	100	6	17	34
		32683.314	32733.207	40	32623.314	32793.207	169.89	50	6	29	58
2	Major/Minor Bridge	structure					540.00		9	60	120
3	Builtup sections						1807		18	101	202
4	junctions	Junction = 1 no					180.00		9	20	40
										3190	**6380**

Total no. of Road stud = 9570 no.

Bill No- 06, Sl. No- 14

Busbay

Chainage of Busbay

Chainage	*Name of the Place*	*Side*
15+650	Panglian Village	both
16+620	S.Munhaihull Village	both
19+170	Geetal Village	both
21+420	L.Phaimol village	both
23+630	Muollum Village	both
31+750	Singngat Village	both
32+500	Singngat Vaiilage	both

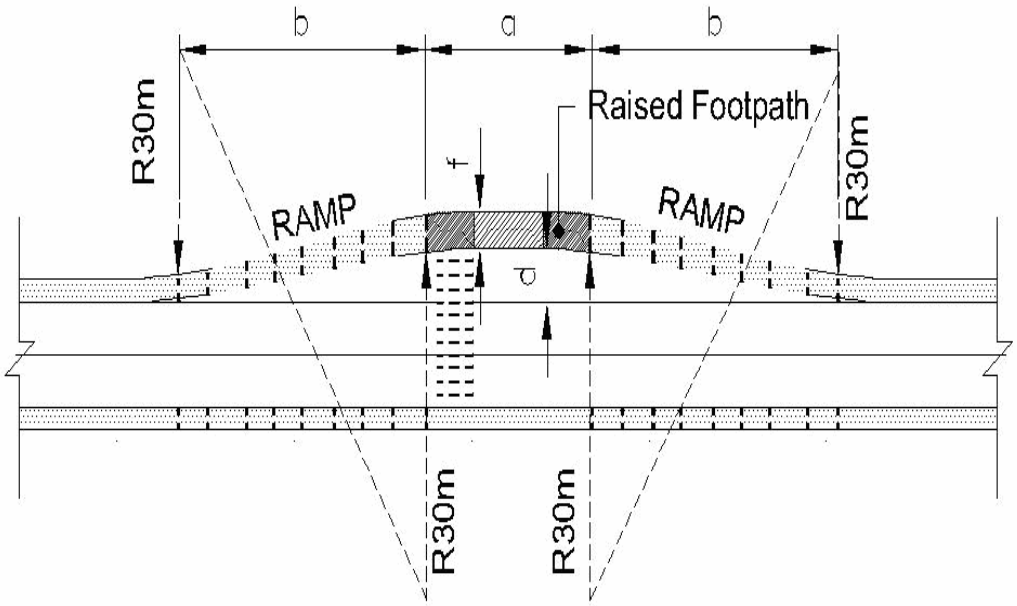
Total Number of Bus Bay = **14 No**

Variable Declaration

Busbay (2 Lane) at Hill

Sl No	Variable Description	Variable	Dimension	Unit
1	BC Thickness	bc	0.040	m
2	DBM Thickness	dbm	0.070	m
3	WMM-I Thickness	wmm1	0.125	m
4	WMM-II Thickness	wmm2	0.125	m
5	GSB Thickness	gsb	0.200	m
6	SG Thickness	sg	0.500	m
7	Nos of Bus Bay	n	14.000	nos
8	Width Foothpath	f	2.500	m
9	Ref Drawing	a	15.000	m
10	Ref Drawing	b	22.000	m
11	Ref Drawing	d	3.500	m
12	GSB percentage Re-use	gsb_per	9.500	percentage
13	Eech Pedestrain Marking Area for Each Busbay(1.5m x 20m)	ped_mar	30.000	sqm

Variable Declaration



TYPICAL LAYOUT OF PICK-UP BUS STOP ON HILLY AREA

Errosion Control

A. QUANTITY CALCULATION OF TURFING

Turfing with Sods ::

Turfing is provided on TCS 2,TCS 3, TCS 5, TCS 10, TCS 10A, TCS 11, TCS 12, TCS 13

Length of Turfing for TCS 2(both side) =	676.60	m
Length of Turfing for TCS 3(single side) =	239.60	m
Length of Turfing for TCS 5(Single side)=	340.00	m
Length of Turfing for TCS 10(single side)=	538.10	m
Length of Turfing for TCS 10A(single side)=	0.00	m
Length of Turfing for TCS 11(Single side)=	877.60	m
Length of Turfing for TCS 12(Single side)=	524.80	m
Length of Turfing for TCS 13(Both side)=	494.80	m

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

Quantity of Turfing = 16509 sqm

B . Quantity Calculation For Hydro Seeding

TCS Type	Length (m)	side	Length
TCS-8	495.00	Single	495
TCS-9	2032.40	Single	2032.4
TCS-12	524.80	Single	524.8
		Total =	**3052.2**

Avg Width of Hydro Seeding = 8.00 **m**

Total Area of Hydro Seedin 24418 sqm

Summary

Turfing=	16509	sqm	Bill No- 02, Sl. No- 5
Hydroseeding=	24418	sqm	Bill No- 02, Sl. No- 1

GSB Reuse Calculation

	Required GSB Qty	Reusable GSB Quantity	
TCS-01	5396.154	512.635	Cum
TCS-03	901.02	85.597	Cum
TCS-04	8619.758	818.877	Cum
TCS-05	1145.885	108.859	Cum
TCS-06	16597.58	1576.770	Cum
TCS-07	11991.35	1139.178	Cum
TCS-08	1668.274	158.486	Cum
TCS-09	6068.06	576.466	Cum
TCS-10	2019.787	191.880	Cum
TCS-11	2959.08	281.113	Cum
TCS-12	1769.381	168.091	Cum
TCS-13	927.3	88.094	Cum
TCS-02	1268.937	120.549	Cum
Busbay (2 Lane) at Hill	991.2	94.164	Cum
Extra Widening on Flexible Pavement	2222.6	211.147	Cum
Major Junction	47	4.465	Cum
Minor Junction	383.2	36.404	Cum
Total=	**64977**	**6173**	

Reuseable GSB Quantity= **9.50%**

Total Dismantle Granular Quantity(cum)= **10288** Refer backup calculation sheet

use 60% of Total Dismantle Granular Quantity for GSB (cum)= **6173** ≅

Total Required GSB Qty (Cum)= **64977**

9.5 % of this required quantity will be bought from dismantle material i.e 6173

Re Useable Quantity of GSB Material(cum)= **6173**

Remaining Quantity of GSB(cum) = **58804**

BILL OF QUANTITY

(ROAD PART)

Bill No : 01. Site Clearance and Dismantling

Sl 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	150.00		
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	13.00		
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	1.00		
4	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	13.99		
5	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	212.00		
6	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	1,259.00		
7	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	9.00		

Bill No : 01. Site Clearance and Dismantling

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
8	02.04/vii /b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	19.00		
9	02.04/vii /c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	31.00		
10	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	68,589.00		
11	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	42,818.00		
		Total of Bill 01. Site Clearance and Dismantling				

Quantity Backup Calculation For Bill : 01. Site Clearance and Dismantling

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	02.01/i	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth from 300 mm to 600 mm			
		Refer: Site Clearance and Dismantling **Formula:** 150	150	150.00	Each
			Total :	**150.00**	**Each**
2	02.01/ii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 600 mm to 900 mm			
		Refer: Site Clearance and Dismantling **Formula:** 13	13	13.00	Each
			Total :	**13.00**	**Each**
3	02.01/iii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 900 mm to 1800 mm			
		Refer: Site Clearance and Dismantling **Formula:** 1	1	1.00	Each
			Total :	**1.00**	**Each**
4	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)			
		Refer: Site Clearance and Dismantling **Formula:** 13.99	13.99	13.99	Ha

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	**13.99**	**Ha**
5	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above			
		Refer: Site Clearance and Dismantling **Formula:** 212	212	212.00	cum
			Total :	**212.00**	**cum**
6	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar			
		Refer: Site Clearance and Dismantling **Formula:** 1259	1259	1,259.00	Cum
			Total :	**1,259.00**	**Cum**
7	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia			
		Refer: Site Clearance and Dismantling **Formula:** 9	9	9.00	rm
			Total :	**9.00**	**rm**
8	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia			
		Refer: Site Clearance and Dismantling **Formula:** 19	19	19.00	rm
			Total :	**19.00**	**rm**

Quantity Backup Calculation For Bill : 01. Site Clearance and Dismantling

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
9	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia			
		Refer: Site Clearance and Dismantling **Formula:** 31	31	31.00	rm
			Total :	**31.00**	**rm**
10	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier			
		Refer: Site Clearance and Dismantling **Formula:** 68589	68589	68,589.00	sqm
			Total :	**68,589.00**	**sqm**
11	)2.04/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 attatched with scarifier			
		Refer: Site Clearance and Dismantling **Formula:** 42818	42818	42,818.00	sqm
			Total :	**42,818.00**	**sqm**

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface	sqm	24,418.00		
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	205,316.00		
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	88,916.66		
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	30,393.06		
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	16,509.00		
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	453,501.60		

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

Sl 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	113,375.40		
		Total of Bill 02. Earth work,Subgrade and Erosion control				

Quantity Backup Calculation For Bill : 02. Earth work,Subgrade and Erosion control

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	02/nsc/1	Supplying and laying Hydro Seeding on cutting Surface			
		Refer: Errosion Control **Formula:** 24418	24418	24,418.00	sqm
			Total :	**24,418.00**	**sqm**
2	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2			
		Refer: Earthwork **Formula:** tot_fill	205316.000	205,316.00	cum
			Total :	**205,316.00**	**cum**
3	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2			
		Refer: TCS-01 **Formula:** (cw-ext_pav+2*hs)*sg*l	(7.000-5.300+2*1.500)*0.500*1807.000	4,246.45	cum
		Refer: TCS-02 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*2*l+ (cw+2*hs+2*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*2) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *2*338.000+ (7.000+2*1.500+2*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*2)*0.500*338.000	2,010.83	cum
		Refer: TCS-03 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*2*l+ (cw+2*hs+2*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*2) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *2*240.000+ (7.000+2*1.500+2*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*2)*0.500*240.000	1,427.81	cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-04 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*2*l+ (cw+2*hs+2*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*2) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *2*2296.000+ (7.000+2*1.500+2*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*2)*0.500*2296.000	13,659.36	cum
		Refer: TCS-05 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*1*l+ (cw+2*hs+1*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*1) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *1*340.000+ (7.000+2*1.500+1*1.000-0.000+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*1)*0.500*340.000	2,311.86	cum
		Refer: TCS-06 **Formula:** (cw+2*hs)*sg*l	(7.000+2*1.500)*0.500*5558.000	27,790.00	cum
		Refer: TCS-07 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*1*l+ (cw+2*hs+1*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*1) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *1*3558.000+ (7.000+2*1.500+1*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*1)*0.500*3558.000	14,764.28	cum
		Refer: TCS-08 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*1*l+ (cw+2*hs+1*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*1) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *1*495.000+ (7.000+2*1.500+1*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*1)*0.500*495.000	2,054.05	cum
		Refer: TCS-09 **Formula:** (cw+2*hs-ext_pav)*sg*l	(7.000+2*1.500-0.000)*0.500*2032.000	10,160.00	cum
		Refer: TCS-10 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*2*l+ (cw+2*hs+2*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*2) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *2*538.000+ (7.000+2*1.500+2*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*2)*0.500*538.000	3,200.67	cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-11 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*1*l+ (cw+2*hs+1*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*1) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *1*878.000+ (7.000+2*1.500+1*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*1)*0.500*878.000	3,643.35	cum
		Refer: TCS-12 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*1*l+ (cw+2*hs+1*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*1) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *1*525.000+ (7.000+2*1.500+1*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*1)*0.500*525.000	2,178.54	cum
		Refer: TCS-13 **Formula:** (0.5*(es+es+(bc+dbm+wmm1+wmm2)*2)* (bc+dbm+wmm1+wmm2))*2*l+ (cw+2*hs+2*es-ext_pav+2* (bc+dbm+wmm1+wmm2+gsb+0.5*sg)*2) *sg*l	(0.5*(1.000+1.000+ (0.040+0.070+0.125+0.125)*2)* (0.040+0.070+0.125+0.125)) *2*247.000+ (7.000+2*1.500+2*1.000-5.300+2* (0.040+0.070+0.125+0.125+0.200+0.5*0 .500)*2)*0.500*247.000	1,469.45	cum
			Total :	**88,916.66**	**cum**
4	03.15	Compacting original ground supporting subgrade Loosening of the ground upto a level of 500 mm below the subgrade level, watered, graded and compacted in layers to meet requirement of table 300-2 for subgrade construction.			
		Refer: TCS-01 **Formula:** (cw-ext_pav+2*hs)*sg*l	(7.000-5.300+2*1.500)*0.500*1807.000	4,246.45	cum
		Refer: TCS-02 **Formula:** ((cw-ext_pav+2*hs+2*es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb) *2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2)*2)*l)	((7.000-5.300+2*1.500+2*1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2*2)*0.500*338.000))+ (1.000* (0.040+0.070+0.125+0.125+0.200)*2)+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2) *2)*338.000)	767.37	cum

Quantity Backup Calculation For Bill : 02. Earth work,Subgrade and Erosion control

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-03 **Formula:** ((cw-ext_pav+2*hs+2*es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb) *2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2)*2)*l)	((7.000-5.300+2*1.500+2*1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2*2)*0.500*240.000))+ (1.000* (0.040+0.070+0.125+0.125+0.200)*2)+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2) *2)*240.000)	547.15	cum
		Refer: TCS-04 **Formula:** ((cw-ext_pav+2*hs+2*es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb) *2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2)*2)*l)	((7.000-5.300+2*1.500+2*1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2*2)*0.500*2296.000))+ (1.000* (0.040+0.070+0.125+0.125+0.200)*2)+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2) *2)*2296.000)	5,167.39	cum
		Refer: TCS-04A **Formula:** ((cw-ext_pav+2*hs+2*es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb) *2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2)*2)*l)	((7.000-0.000+2*1.500+2*1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2*2)*0.500*0.000))+(1.000* (0.040+0.070+0.125+0.125+0.200)*2)+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2) *2)*0.000)	13.12	cum
		Refer: TCS-05 **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-0.000+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*340.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *340.000)	393.58	cum
		Refer: TCS-07 **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-5.300+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*3558.000))+ (1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *3558.000)	4,004.03	cum
		Refer: TCS-07A **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-0.000+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*0.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *0.000)	11.56	cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-08 **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-5.300+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*495.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *495.000)	562.44	cum
		Refer: TCS-08A **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-0.000+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*0.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *0.000)	11.56	cum
		Refer: TCS-09 **Formula:** ((cw-ext_pav+2*hs)+(hs* (bc+dbm+wmm1+wmm2)*2)-ext_pav)*sg*l	((7.000-0.000+2*1.500)+(1.500* (0.040+0.070+0.125+0.125)*2)-0.000) *0.500*2032.000	11,257.28	cum
		Refer: TCS-10 **Formula:** ((cw-ext_pav+2*hs+2*es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb) *2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2)*2)*l)	((7.000-5.300+2*1.500+2*1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2*2)*0.500*538.000))+ (1.000* (0.040+0.070+0.125+0.125+0.200)*2)+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2) *2)*538.000)	1,216.81	cum
		Refer: TCS-10A **Formula:** ((cw-ext_pav+2*hs+2*es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb) *2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2)*2)*l)	((7.000-0.000+2*1.500+2*1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2*2)*0.500*0.000))+(1.000* (0.040+0.070+0.125+0.125+0.200)*2)+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2) *2)*0.000)	13.12	cum
		Refer: TCS-11 **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-5.300+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*878.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *878.000)	992.78	cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-11A **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-0.000+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*0.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *0.000)	11.56	cum
		Refer: TCS-12 **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-5.300+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*525.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *525.000)	596.15	cum
		Refer: TCS-12A **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-0.000+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*0.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *0.000)	11.56	cum
		Refer: TCS-13 **Formula:** ((cw-ext_pav+2*hs+2*es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb) *2)+((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2)*2)*l)	((7.000-5.300+2*1.500+2*1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2*2)*0.500*247.000))+ (1.000* (0.040+0.070+0.125+0.125+0.200)*2)+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2) *2)*247.000)	562.88	cum
		Refer: TCS-14 **Formula:** ((cw-ext_pav+2*hs+es+ ((bc+dbm+wmm1+wmm2+gsb+(sg/2))*2) *sg*l))+(es*(bc+dbm+wmm1+wmm2+gsb))+ ((0.5*(bc+dbm+wmm1+wmm2+gsb)* ((bc+dbm+wmm1+wmm2+gsb)*2))*l)	((7.000-5.300+2*1.500+1.000+ ((0.040+0.070+0.125+0.125+0.200+ (0.500/2))*2)*0.500*0.000))+(1.000* (0.040+0.070+0.125+0.125+0.200))+ ((0.5*(0.040+0.070+0.125+0.125+0.200) *((0.040+0.070+0.125+0.125+0.200)*2)) *0.000)	6.26	cum
			Total :	**30,393.06**	**cum**
5	03.19	Turfing with Sods Furnishing and laying of the live sods of perennial turf forming grass on embankment slope, verges or other locations shown on the drawing or as directed by the engineer including preparation of ground, fetching of sods and watering			

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Errosion Control **Formula:** 16509	16509	16,509.00	sqm
			Total :	**16,509.00**	**sqm**
6	03.31	Excavation in Hill Area in Soil by Mechanical Means Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with all lifts and lead upto 1000 metres			
		Refer: Earthwork **Formula:** tot_cut*(1-per_rock/100)	566877.000*(1-20.000/100)	453,501.60	cum
			Total :	**453,501.60**	**cum**
7	03.32	Excavation in Hilly Area in Ordinary Rock by Mechanical Means not Requiring Blasting. Excavation in hilly area in ordinary rock not requiring ballasting by mechanical means including cutting and trimming of slopes and disposal of cut material with all lift and lead upto 1000 metres			
		Refer: Earthwork **Formula:** tot_cut*(per_rock/100)	566877.000*(20.000/100)	113,375.40	cum
			Total :	**113,375.40**	**cum**

Bill No : 03. Sub-Base & Base Courses

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Nsc1	Sub-base with Close Graded Material (Table:-400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	57,517.60		
2	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401	Cum	9,012.25		
3	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	37,536.88		
		Total of Bill 03. Sub-Base & Base Courses				

Quantity Backup Calculation For Bill : 03. Sub-Base & Base Courses

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	04.01/Nsc1	Sub-base with Close Graded Material (Table: - 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material			
		Refer: Extra Widening on Flexible **Formula:**Pavement (ew_area*gsb)*(1-gsb_per/100)	(11114.000*0.200)*(1-9.500/100)	2,011.63	Cum
		Refer: TCS-01 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs)*gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *1807.000*2+(7.000+2*1.500) *0.200*1807.000)*(1-9.500/100)	4,883.52	Cum
		Refer: TCS-02 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *338.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*338.000)*(1-9.500/100)	1,148.39	Cum
		Refer: TCS-03 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *240.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*240.000)*(1-9.500/100)	815.42	Cum
		Refer: TCS-04 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *2296.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*2296.000)*(1-9.500/100)	7,800.88	Cum
		Refer: TCS-05 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *340.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*340.000)*(1-9.500/100)	1,037.03	Cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-06 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs)*gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *5558.000*2+(7.000+2*1.500) *0.200*5558.000)*(1-9.500/100)	15,020.81	Cum
		Refer: TCS-07 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *3558.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*3558.000)*(1-9.500/100)	10,852.17	Cum
		Refer: TCS-08 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *495.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*495.000)*(1-9.500/100)	1,509.79	Cum
		Refer: TCS-09 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs)*gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *2032.000*2+(7.000+2*1.500) *0.200*2032.000)*(1-9.500/100)	5,491.59	Cum
		Refer: TCS-10 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *538.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*538.000)*(1-9.500/100)	1,827.91	Cum
		Refer: TCS-11 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *878.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*878.000)*(1-9.500/100)	2,677.97	Cum
		Refer: TCS-12 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *525.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*525.000)*(1-9.500/100)	1,601.29	Cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-13 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(1-gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *247.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*247.000)*(1-9.500/100)	839.21	Cum
			Total :	**57,517.60**	**Cum**
2	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401			
		Refer: Extra Widening on Flexible **Formula:**Pavement (ew_area*gsb)*(gsb_per/100)	(11114.000*0.200)*(9.500/100)	211.17	Cum
		Refer: TCS-01 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs)*gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *1807.000*2+(7.000+2*1.500) *0.200*1807.000)*(9.500/100)	512.64	Cum
		Refer: TCS-02 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *338.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*338.000)*(9.500/100)	120.55	Cum
		Refer: TCS-03 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *240.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*240.000)*(9.500/100)	85.60	Cum
		Refer: TCS-04 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *2296.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*2296.000)*(9.500/100)	818.88	Cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-05 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *340.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*340.000)*(9.500/100)	108.86	Cum
		Refer: TCS-06 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs)*gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *5558.000*2+(7.000+2*1.500) *0.200*5558.000)*(9.500/100)	1,576.77	Cum
		Refer: TCS-07 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*gsb*1) *l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *3558.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *0.200*1)*3558.000)*(9.500/100)	4,113.67	Cum
		Refer: TCS-08 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *495.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*495.000)*(9.500/100)	158.49	Cum
		Refer: TCS-09 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs)*gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *2032.000*2+(7.000+2*1.500) *0.200*2032.000)*(9.500/100)	576.47	Cum
		Refer: TCS-10 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *538.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*538.000)*(9.500/100)	191.88	Cum
		Refer: TCS-11 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *878.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*878.000)*(9.500/100)	281.11	Cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-12 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+1*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*1) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *525.000*2+ (7.000+2*1.500+1*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *1)*0.200*525.000)*(9.500/100)	168.09	Cum
		Refer: TCS-13 **Formula:** ((hs*(bc+dbm+wmm1+wmm2)- (wmm1*0.125)-(wmm2*0.250))*l*2+ (cw+2*hs+2*es+2* (bc+dbm+wmm1+wmm2+0.5*gsb)*2) *gsb*l)*(gsb_per/100)	((1.500*(0.040+0.070+0.125+0.125)- (0.125*0.125)-(0.125*0.250)) *247.000*2+ (7.000+2*1.500+2*1.000+2* (0.040+0.070+0.125+0.125+0.5*0.200) *2)*0.200*247.000)*(9.500/100)	88.09	Cum
			Total :	**9,012.25**	**Cum**
3	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)			
		Refer: Extra Widening on Flexible **Formula:**Pavement ew_area*(wmm1+wmm2)	11114.000*(0.125+0.125)	2,778.50	Cum
		Refer: TCS-01 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*1807.000)	3,331.66	Cum
		Refer: TCS-02 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*338.000)	623.19	Cum
		Refer: TCS-03 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*240.000)	442.50	Cum
		Refer: TCS-04 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*2296.000)	4,233.25	Cum

Quantity Backup Calculation For Bill : 03. Sub-Base & Base Courses

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-05 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*340.000)	626.88	Cum
		Refer: TCS-06 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*5558.000)	10,247.56	Cum
		Refer: TCS-07 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*3558.000)	6,560.06	Cum
		Refer: TCS-08 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*495.000)	912.66	Cum
		Refer: TCS-09 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*2032.000)	3,746.50	Cum
		Refer: TCS-10 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*538.000)	991.94	Cum
		Refer: TCS-11 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*878.000)	1,618.81	Cum
		Refer: TCS-12 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*525.000)	967.97	Cum
		Refer: TCS-13 **Formula:** ((((cw+0.125*2)*wmm1)+((cw+0.250*2) *wmm2))*l)	((((7.000+0.125*2)*0.125)+ ((7.000+0.250*2)*0.125))*247.000)	455.41	Cum
			Total :	**37,536.88**	**Cum**

Bill No : 04. Bituminous Courses

Sl 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	143,078.00		
2	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	11,114.00		
3	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	131,964.00		
4	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	10,015.46		

Bill No : 04. Bituminous Courses

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	5,723.12		
		Total of Bill 04. Bituminous Courses				

Quantity Backup Calculation For Bill : 04. Bituminous Courses

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm			
		Refer: Extra Widening on Flexible **Formula:**Pavement ew_area	11114.000	11,114.00	sqm
		Refer: TCS-01 **Formula:** cw*l	7.000*1807.000	12,649.00	sqm
		Refer: TCS-02 **Formula:** cw*l	7.000*338.000	2,366.00	sqm
		Refer: TCS-03 **Formula:** cw*l	7.000*240.000	1,680.00	sqm
		Refer: TCS-04 **Formula:** cw*l	7.000*2296.000	16,072.00	sqm
		Refer: TCS-05 **Formula:** cw*l	7.000*340.000	2,380.00	sqm
		Refer: TCS-06 **Formula:** cw*l	7.000*5558.000	38,906.00	sqm
		Refer: TCS-07 **Formula:** cw*l	7.000*3558.000	24,906.00	sqm
		Refer: TCS-08 **Formula:** cw*l	7.000*495.000	3,465.00	sqm
		Refer: TCS-09 **Formula:** cw*l	7.000*2032.000	14,224.00	sqm
		Refer: TCS-10 **Formula:** cw*l	7.000*538.000	3,766.00	sqm
		Refer: TCS-11 **Formula:** cw*l	7.000*878.000	6,146.00	sqm

Quantity Backup Calculation For Bill : 04. Bituminous Courses

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-12 **Formula:** cw*l	7.000*525.000	3,675.00	sqm
		Refer: TCS-13 **Formula:** cw*l	7.000*247.000	1,729.00	sqm
			Total :	**143,078.00**	**sqm**
2	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminious Surface @ 0.20 - 0.30 kg/sqm			
		Refer: Extra Widening on Flexible **Formula:**Pavement ew_area	11114.000	11,114.00	sqm
			Total :	**11,114.00**	**sqm**
3	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm			
		Refer: TCS-01 **Formula:** cw*l	7.000*1807.000	12,649.00	sqm
		Refer: TCS-02 **Formula:** cw*l	7.000*338.000	2,366.00	sqm
		Refer: TCS-03 **Formula:** cw*l	7.000*240.000	1,680.00	sqm
		Refer: TCS-04 **Formula:** cw*l	7.000*2296.000	16,072.00	sqm
		Refer: TCS-05 **Formula:** cw*l	7.000*340.000	2,380.00	sqm
		Refer: TCS-06 **Formula:** cw*l	7.000*5558.000	38,906.00	sqm

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-07 **Formula:** cw*l	7.000*3558.000	24,906.00	sqm
		Refer: TCS-08 **Formula:** cw*l	7.000*495.000	3,465.00	sqm
		Refer: TCS-09 **Formula:** cw*l	7.000*2032.000	14,224.00	sqm
		Refer: TCS-10 **Formula:** cw*l	7.000*538.000	3,766.00	sqm
		Refer: TCS-11 **Formula:** cw*l	7.000*878.000	6,146.00	sqm
		Refer: TCS-12 **Formula:** cw*l	7.000*525.000	3,675.00	sqm
		Refer: TCS-13 **Formula:** cw*l	7.000*247.000	1,729.00	sqm
			Total :	**131,964.00**	**sqm**
4	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40			
		Refer: Extra Widening on Flexible **Formula:**Pavement ew_area*dbm	11114.000*0.070	777.98	cum
		Refer: TCS-01 **Formula:** cw*dbm*l	7.000*0.070*1807.000	885.43	cum

Quantity Backup Calculation For Bill : 04. Bituminous Courses

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-02 **Formula:** cw*dbm*l	7.000*0.070*338.000	165.62	cum
		Refer: TCS-03 **Formula:** cw*dbm*l	7.000*0.070*240.000	117.60	cum
		Refer: TCS-04 **Formula:** cw*dbm*l	7.000*0.070*2296.000	1,125.04	cum
		Refer: TCS-05 **Formula:** cw*dbm*l	7.000*0.070*340.000	166.60	cum
		Refer: TCS-06 **Formula:** cw*dbm*l	7.000*0.070*5558.000	2,723.42	cum
		Refer: TCS-07 **Formula:** cw*dbm*l	7.000*0.070*3558.000	1,743.42	cum
		Refer: TCS-08 **Formula:** cw*dbm*l	7.000*0.070*495.000	242.55	cum
		Refer: TCS-09 **Formula:** cw*dbm*l	7.000*0.070*2032.000	995.68	cum
		Refer: TCS-10 **Formula:** cw*dbm*l	7.000*0.070*538.000	263.62	cum
		Refer: TCS-11 **Formula:** cw*dbm*l	7.000*0.070*878.000	430.22	cum
		Refer: TCS-12 **Formula:** cw*dbm*l	7.000*0.070*525.000	257.25	cum
		Refer: TCS-13 **Formula:** cw*dbm*l	7.000*0.070*247.000	121.03	cum
			Total :	**10,015.46**	**cum**

Quantity Backup Calculation For Bill : 04. Bituminous Courses

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
5	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40			
		Refer: Extra Widening on Flexible **Formula:**Pavement ew_area*bc	11114.000*0.040	444.56	cum
		Refer: TCS-01 **Formula:** cw*bc*l	7.000*0.040*1807.000	505.96	cum
		Refer: TCS-02 **Formula:** cw*bc*l	7.000*0.040*338.000	94.64	cum
		Refer: TCS-03 **Formula:** cw*bc*l	7.000*0.040*240.000	67.20	cum
		Refer: TCS-04 **Formula:** cw*bc*l	7.000*0.040*2296.000	642.88	cum
		Refer: TCS-05 **Formula:** cw*bc*l	7.000*0.040*340.000	95.20	cum
		Refer: TCS-06 **Formula:** cw*bc*l	7.000*0.040*5558.000	1,556.24	cum
		Refer: TCS-07 **Formula:** cw*bc*l	7.000*0.040*3558.000	996.24	cum
		Refer: TCS-08 **Formula:** cw*bc*l	7.000*0.040*495.000	138.60	cum

Quantity Backup Calculation For Bill : 04. Bituminous Courses

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-09 **Formula:** cw*bc*l	7.000*0.040*2032.000	568.96	cum
		Refer: TCS-10 **Formula:** cw*bc*l	7.000*0.040*538.000	150.64	cum
		Refer: TCS-11 **Formula:** cw*bc*l	7.000*0.040*878.000	245.84	cum
		Refer: TCS-12 **Formula:** cw*bc*l	7.000*0.040*525.000	147.00	cum
		Refer: TCS-13 **Formula:** cw*bc*l	7.000*0.040*247.000	69.16	cum
			Total :	**5,723.12**	**cum**

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2	cum	132.88		
2	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	389.33		
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	40.87		
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	537.75		

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	2,151.00		
6	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 bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	2,151.00		
7	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	150.57		

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
8	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	86.04		
9	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	270.29		
10	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	7.00		
		Total of Bill 05. Junction Improvement (Major & Minor)				

Quantity Backup Calculation For Bill : 05. Junction Improvement (Major & Minor)

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2			
		Refer: Major Junction **Formula:** (area_is-(peri_kerb*width_kerb))*ht_med	(286.620-(270.290*0.150))*0.540	132.88	cum
			Total :	**132.88**	**cum**
2	04.01/Nsc1	Sub-base with Close Graded Material (Table: - 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material			
		Refer: Major Junction **Formula:** gsb*net_area*(1-gsb_per/100)	0.200*235.000*(1-9.500/100)	42.54	Cum
		Refer: Minor Junction **Formula:** (tot_area*gsb)*(1-gsb_per/100)	(1916.000*0.200)*(1-9.500/100)	346.80	Cum
			Total :	**389.33**	**Cum**
3	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401			
		Refer: Major Junction **Formula:** gsb*net_area*(gsb_per/100)	0.200*235.000*(9.500/100)	4.47	Cum
		Refer: Minor Junction **Formula:** (tot_area*gsb)*(gsb_per/100)	(1916.000*0.200)*(9.500/100)	36.40	Cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	**40.87**	**Cum**
4	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)			
		Refer: Major Junction **Formula:** net_area*(wmm1+wmm2)	235.000*(0.125+0.125)	58.75	Cum
		Refer: Minor Junction **Formula:** tot_area*(wmm1+wmm2)	1916.000*(0.125+0.125)	479.00	Cum
			Total :	**537.75**	**Cum**
5	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm			
		Refer: Major Junction **Formula:** net_area	235.000	235.00	sqm
		Refer: Minor Junction **Formula:** tot_area	1916.000	1,916.00	sqm
			Total :	**2,151.00**	**sqm**
6	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 bituminious Surface @ 0.20 - 0.30 kg/sqm			
		Refer: Major Junction **Formula:** net_area	235.000	235.00	sqm

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Minor Junction **Formula:** tot_area	1916.000	1,916.00	sqm
			Total :	**2,151.00**	**sqm**
7	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: Major Junction **Formula:** net_area*dbm	235.000*0.070	16.45	cum
		Refer: Minor Junction **Formula:** tot_area*dbm	1916.000*0.070	134.12	cum
			Total :	**150.57**	**cum**
8	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: Major Junction **Formula:** net_area*bc	235.000*0.040	9.40	cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Minor Junction **Formula:** tot_area*bc	1916.000*0.040	76.64	cum
			Total :	**86.04**	**cum**
9	08.01	Precast Cement concrete M20 Kerb including fixing at site			
		Refer: Major Junction **Formula:** peri_kerb	270.290	270.29	rm
			Total :	**270.29**	**rm**
10	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)			
		Refer: Major Junction **Formula:** tot_paint	7.000	7.00	sqm
			Total :	**7.00**	**sqm**

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

Sl 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	4.00		
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	16.00		
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design,fixed in position including finishing but excluding painting	each	193.00		
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	339.00		
6	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular				

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			each	5.00		
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	16.00		
8	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon	each	8.00		
9	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign 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	16.20		

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro- reflectorised sign asper IRC :67 made of high intensity grade sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)	sqm	9.00		
11	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	6,288.60		
12	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) 120x120 -Road Delineator	each	1,608.00		

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
13	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m	Rm	3,692.00		
14	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy morter, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	9,570.00		
15	08.22	Lighting on BridgesProviding & 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	309.00		
16	08/nsc/2	Convex Mirror For Blind Curve	nos	30.00		

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

Sl 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	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		
20	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		
21	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.70		

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

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
22	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.86		
23	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		
24	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	0.30		
		Total of Bill 06. Traffic signs, Road marking & other road appurtenances				

Quantity Backup Calculation For Bill : 06. Traffic signs, Road marking & other road appurtenances

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone			
		Refer: Traffic Signs **Formula:** 4	4	4.00	each
			Total :	**4.00**	**each**
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone			
		Refer: Traffic Signs **Formula:** 16	16	16.00	each
			Total :	**16.00**	**each**
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design,fixed in position including finishing but excluding painting			
		Refer: Traffic Signs **Formula:** 193	193	193.00	each
			Total :	**193.00**	**each**
4	08.06	Painting on Steel Surfaces Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade			
		Refer: Overhead Signs **Formula:** a*r*2*n	15.000*1.200*2*1.000	36.00	sqm
			Total :	**36.00**	**sqm**

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
5	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle			
		Refer: Traffic Signs **Formula:** 339	339	339.00	each
			Total :	**339.00**	**each**
6	08.11/iii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 60 cm circular			
		Refer: Traffic Signs **Formula:** 5	5	5.00	each
			Total :	**5.00**	**each**

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
7	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular			
		Refer: Traffic Signs **Formula:** 16	16	16.00	each
			Total :	**16.00**	**each**
8	08.11/vii	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm high octagon			
		Refer: Traffic Signs **Formula:** 8	8	8.00	each
			Total :	**8.00**	**each**

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
9	08.12	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign 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)			
		Refer: Traffic Signs **Formula:** 16.2	16.2	16.20	sqm
			Total :	**16.20**	**sqm**
10	08.13	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro- reflectorised sign 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 concrete45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing)			
		Refer: Traffic Signs **Formula:** 9	9	9.00	sqm
			Total :	**9.00**	**sqm**
11	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)			

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-01 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((1807.000+6)/9)*3.000*0.100)+ (2.000*1807.000*0.150)	602.53	sqm
		Refer: TCS-02 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((338.000+6)/9)*3.000*0.100)+ (2.000*338.000*0.150)	112.87	sqm
		Refer: TCS-03 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((240.000+6)/9)*3.000*0.100)+ (2.000*240.000*0.150)	80.20	sqm
		Refer: TCS-04 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((2296.000+6)/9)*3.000*0.100)+ (2.000*2296.000*0.150)	765.53	sqm
		Refer: TCS-04A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
		Refer: TCS-05 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((340.000+6)/9)*3.000*0.100)+ (2.000*340.000*0.150)	113.53	sqm
		Refer: TCS-06 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((5558.000+6)/9)*3.000*0.100)+ (2.000*5558.000*0.150)	1,852.87	sqm
		Refer: TCS-06A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
		Refer: TCS-07 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((3558.000+6)/9)*3.000*0.100)+ (2.000*3558.000*0.150)	1,186.20	sqm
		Refer: TCS-07A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
		Refer: TCS-08 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((495.000+6)/9)*3.000*0.100)+ (2.000*495.000*0.150)	165.20	sqm
		Refer: TCS-08A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
		Refer: TCS-09 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((2032.000+6)/9)*3.000*0.100)+ (2.000*2032.000*0.150)	677.53	sqm
		Refer: TCS-09A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-10 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((538.000+6)/9)*3.000*0.100)+ (2.000*538.000*0.150)	179.53	sqm
		Refer: TCS-10A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
		Refer: TCS-11 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((878.000+6)/9)*3.000*0.100)+ (2.000*878.000*0.150)	292.87	sqm
		Refer: TCS-11A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
		Refer: TCS-12 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((525.000+6)/9)*3.000*0.100)+ (2.000*525.000*0.150)	175.20	sqm
		Refer: TCS-12A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
		Refer: TCS-13 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((247.000+6)/9)*3.000*0.100)+ (2.000*247.000*0.150)	82.53	sqm
		Refer: TCS-14 **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
		Refer: TCS-15A **Formula:** (((l+6)/9)*lc*wc)+(nc*l*wid_mar)	(((0.000+6)/9)*3.000*0.100)+ (2.000*0.000*0.150)	0.20	sqm
			Total :	**6,288.60**	**sqm**
12	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings.) 120x120 -Road Delineator			
		Refer: Traffic Signs **Formula:** 1608	1608	1,608.00	each
			Total :	**1,608.00**	**each**

Quantity Backup Calculation For Bill : 06. Traffic signs, Road marking & other road appurtenances

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
13	08.18/A/b	Metal Beam Crash Barrier Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810) For post Height of 1.5 m			
		Refer: Crash Barrier **Formula:** tot_len	3692.000	3,692.00	Rm
			Total :	**3,692.00**	**Rm**
14	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy morter, all as per BS 873 part 4:1973 Light Reflecting Lense Type			
		Refer: Traffic Signs **Formula:** 9570	9570	9,570.00	nos
			Total :	**9,570.00**	**nos**
15	08.22	Lighting on BridgesProviding & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp			
		Refer: Traffic Signs **Formula:** 309	309	309.00	nos
			Total :	**309.00**	**nos**

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
16	08/nsc/2	Convex Mirror For Blind Curve			
		Refer: Traffic Signs **Formula:** 30	30	30.00	nos
			Total :	**30.00**	**nos**
17	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.			
		Refer: Overhead Signs **Formula:** (p*(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
			Total :	**1.04**	**Ton**
18	08/nsc/4/b	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans B)Aluminium Alloy Plate for Over Head Sign			
		Refer: Overhead Signs **Formula:** a*r*2*n	15.000*1.200*2*1.000	36.00	sqm
			Total :	**36.00**	**sqm**

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
19	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Overhead Signs **Formula:** (i+g+f)*(e+.5)*(e+.5)*2*n	(1.400+0.300+0.100)*(2.200+.5)* (2.200+.5)*2*1.000	26.24	cum
			Total :	**26.24**	**cum**
20	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Overhead Signs **Formula:** e*e*f*2*n	2.200*2.200*0.100*2*1.000	0.97	cum
			Total :	**0.97**	**cum**
21	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade			
		Refer: Overhead Signs **Formula:** (e*e*g+m*m*i)*2*n	(2.200*2.200*0.300+1.000*1.000*1.400)*2*1.000	5.70	cum
			Total :	**5.70**	**cum**
22	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification			
		Refer: Overhead Signs **Formula:** (e*e*g+m*m*i)*2*n*sf/1000	(2.200*2.200*0.300+1.000*1.000*1.400)*2*1.000*150.000/1000	0.86	MT
			Total :	**0.86**	**MT**

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
23	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height			
		Refer: Overhead Signs **Formula:** m*m*j*2*n	1.000*1.000*1.000*2*1.000	2.00	cum
			Total :	**2.00**	**cum**
24	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification			
		Refer: Overhead Signs **Formula:** m*m*j*2*n*ss/1000	1.000*1.000*1.000*2*1.000*150.000/1000	0.30	MT
			Total :	**0.30**	**MT**

Bill No : 07. Passenger Shelter

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	924.95		
2	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3	sqm	924.95		
3	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	138.72		
4	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications	cum	21.26		
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	14.09		
6	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	9.71		
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	1.17		
8	14/nsc2	Brick Flat Soling at Foundation	Sqm	188.13		
9	15.01	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications	cum	45.34		

Bill No : 07. Passenger Shelter

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	58.12		
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	5.81		
		Total of Bill 07. Passenger Shelter				

Quantity Backup Calculation For Bill : 07. Passenger Shelter

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.			
		Refer: Passenger Shelter **Formula:** ((sw_in*sw_ht*2)+(w_pass*sw_ht*2)+ (bw_in*bw_ht)+(l_pass*bw_ht)+ (col_l*fcol_h*6)+(l_pass*roof_w)- (2*win_n*win_l*win_h))*n	((1.875*3.830*2)+(2.000*3.830*2)+ (5.800*2.350)+(6.000*2.350)+ (0.250*2.650*6)+(6.000*1.530)- (2*2.000*1.250*0.900))*14.000	924.95	sqm
			Total :	**924.95**	**sqm**
2	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3			
		Refer: Passenger Shelter **Formula:** ((sw_in*sw_ht*2)+(w_pass*sw_ht*2)+ (bw_in*bw_ht)+(l_pass*bw_ht)+ (col_l*fcol_h*6)+(l_pass*roof_w)- (2*win_n*win_l*win_h))*n	((1.875*3.830*2)+(2.000*3.830*2)+ (5.800*2.350)+(6.000*2.350)+ (0.250*2.650*6)+(6.000*1.530)- (2*2.000*1.250*0.900))*14.000	924.95	sqm
			Total :	**924.95**	**sqm**
3	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Passenger Shelter **Formula:** (((a+0.25*2)*(b+0.25*2)*df*col_n)+ ((l+2*0.1)*(w+2*0.1)*db))*n	(((0.750+0.25*2)*(0.750+0.25*2) *0.750*6.000)+((13.500+2*0.1)* (0.500+2*0.1)*0.300))*14.000	138.72	cum
			Total :	**138.72**	**cum**
4	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications			
		Refer: Passenger Shelter **Formula:** ((l*w*wbtm_thk)+(l*fw_wall*wtop_thk))*n	((13.500*0.500*0.150)+ (13.500*0.250*0.150))*14.000	21.26	cum
			Total :	**21.26**	**cum**

Quantity Backup Calculation For Bill : 07. Passenger Shelter

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Passenger Shelter **Formula:** (l_pass-2*w_wall)*(w_pass-2*w_wall) *pcc_thk*n	(6.000-2*0.125)*(2.000-2*0.125) *0.100*14.000	14.09	cum
			Total :	**14.09**	**cum**
6	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade			
		Refer: Passenger Shelter **Formula:** (((a*b*btm_thk)+((a+col_l)*0.5)*((b+col_w) *0.5)*top_thk)+(col_l*col_w* (df-btm_thk-top_thk)))*col_n*n	(((0.750*0.750*0.100)+((0.750+0.250) *0.5)*((0.750+0.250)*0.5)*0.100)+ (0.250*0.250*(0.750-0.100-0.100))) *6.000*14.000	9.71	cum
			Total :	**9.71**	**cum**
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification			
		Refer: Passenger Shelter **Formula:** ((((a*b*btm_thk)+((a+col_l)*0.5)* ((b+col_w)*0.5)*top_thk)+(col_l*col_w* (df-btm_thk-top_thk)))*col_n*n)*rf/1000	((((0.750*0.750*0.100)+((0.750+0.250) *0.5)*((0.750+0.250)*0.5)*0.100)+ (0.250*0.250*(0.750-0.100-0.100))) *6.000*14.000)*120.000/1000	1.17	MT
			Total :	**1.17**	**MT**
8	14/nsc2	Brick Flat Soling at Foundation			

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Passenger Shelter **Formula:** (((l_pass-2*w_wall)*(w_pass-2*w_wall))+ (a*b*col_n))*n	(((6.000-2*0.125)*(2.000-2*0.125))+ (0.750*0.750*6.000))*14.000	188.13	Sqm
			Total :	**188.13**	**Sqm**
9	15.01	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications			
		Refer: Passenger Shelter **Formula:** ((((l*w_wall*wall_h)+(sw_l*2*w_wall*sw_h) +(bw_l*4*w_wall*bw_h)+ (rail_l*w_wall*rail_h))*n)- (win_l*w_wall*win_h*2*n)	(((13.500*0.125*0.550)+ (1.500*2*0.125*2.130)+ (2.650*4*0.125*0.950)+ (9.500*0.125*0.450))*14.000)- (1.250*0.125*0.900*2*14.000)	45.34	cum
			Total :	**45.34**	**cum**
10	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m			
		Refer: Passenger Shelter **Formula:** ((col_l*col_w*fcol_h*col_n*0.5)+ (col_l*col_w*bcol_h*col_n*0.5)+ (sb_l*sb_w*sb_thk*2)+ (sb_a*sb_w*sb_thk*4)+ (l_pass*roof_w*roof_thk)+ (l_pass*fchj_w*roof_thk)+ (l_pass*bchj_w*roof_thk)+ (bch_l*bch_w*bch_thk))*n	((0.250*0.250*2.650*6.000*0.5)+ (0.250*0.250*2.100*6.000*0.5)+ (1.530*0.250*0.350*2)+ (3.000*0.250*0.350*4)+ (6.000*1.530*0.110)+ (6.000*0.680*0.110)+ (6.000*0.450*0.110)+ (5.000*0.500*0.075))*14.000	58.12	cum
			Total :	**58.12**	**cum**
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications			

Quantity Backup Calculation For Bill : 07. Passenger Shelter

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Passenger Shelter **Formula:** ((col_l*col_w*fcol_h*col_n*0.5)+ (col_l*col_w*bcol_h*col_n*0.5)+ (sb_l*sb_w*sb_thk*2)+ (sb_a*sb_w*sb_thk*4)+ (l_pass*roof_w*roof_thk)+ (l_pass*fchj_w*roof_thk)+ (l_pass*bchj_w*roof_thk)+ (bch_l*bch_w*bch_thk))*n*srf/1000	((0.250*0.250*2.650*6.000*0.5)+ (0.250*0.250*2.100*6.000*0.5)+ (1.530*0.250*0.350*2)+ (3.000*0.250*0.350*4)+ (6.000*1.530*0.110)+ (6.000*0.680*0.110)+ (6.000*0.450*0.110)+ (5.000*0.500*0.075)) *14.000*100.000/1000	5.81	MT
			Total :	**5.81**	**MT**

Bill No : 08. Bus Bay

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	2,478.00		
2	04.01/Nsc1	Sub-base with Close Graded Material (Table:-400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	897.04		
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	94.16		
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	1,239.00		

Bill No : 08. Bus Bay

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	05.03	Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 25 mm thick cement concrete grade M15, over laid with pre-cast concrete tiles in cement mortar including provision of all drainage arrangements but excluding kerb channel.	sqm	2,065.00		
6	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	4,956.00		
7	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	4,956.00		
8	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	346.92		

Bill No : 08. Bus Bay

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	198.24		
10	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	210.00		
		Total of Bill 08. Bus Bay				

Quantity Backup Calculation For Bill : 08. Bus Bay

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2			
		Refer: Busbay (2 Lane) at Hill **Formula:** (((2*b+a)*(d+f))*n*sg)	(((2*22.000+15.000)*(3.500+2.500)) *14.000*0.500)	2,478.00	cum
			Total :	**2,478.00**	**cum**
2	04.01/Nsc1	Sub-base with Close Graded Material (Table: - 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material			
		Refer: Busbay (2 Lane) at Hill **Formula:** (((2*b+a)*(d+f))*n*gsb)*(1-gsb_per/100)	(((2*22.000+15.000)*(3.500+2.500)) *14.000*0.200)*(1-9.500/100)	897.04	Cum
			Total :	**897.04**	**Cum**
3	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401			
		Refer: Busbay (2 Lane) at Hill **Formula:** (((2*b+a)*(d+f))*n*gsb)*(gsb_per/100)	(((2*22.000+15.000)*(3.500+2.500)) *14.000*0.200)*(9.500/100)	94.16	Cum
			Total :	**94.16**	**Cum**

Quantity Backup Calculation For Bill : 08. Bus Bay

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
4	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)			
		Refer: Busbay (2 Lane) at Hill **Formula:** ((2*b+a)*(d+f))*n*(wmm1+wmm2)	((2*22.000+15.000)*(3.500+2.500)) *14.000*(0.125+0.125)	1,239.00	Cum
			Total :	**1,239.00**	**Cum**
5	05.03	Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 25 mm thick cement concrete grade M15, over laid with pre-cast concrete tiles in cement mortar including provision of all drainage arrangements but excluding kerb channel.			
		Refer: Busbay (2 Lane) at Hill **Formula:** ((2*b+a)*f)*n	((2*22.000+15.000)*2.500)*14.000	2,065.00	sqm
			Total :	**2,065.00**	**sqm**
6	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm			
		Refer: Busbay (2 Lane) at Hill **Formula:** ((2*b+a)*(d+f))*n	((2*22.000+15.000)*(3.500+2.500)) *14.000	4,956.00	sqm
			Total :	**4,956.00**	**sqm**
7	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminious Surface @ 0.20 - 0.30 kg/sqm			

Quantity Backup Calculation For Bill : 08. Bus Bay

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Busbay (2 Lane) at Hill **Formula:** ((2*b+a)*(d+f))*n	((2*22.000+15.000)*(3.500+2.500)) *14.000	4,956.00	sqm
			Total :	**4,956.00**	**sqm**
8	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40			
		Refer: Busbay (2 Lane) at Hill **Formula:** ((2*b+a)*(d+f))*n*dbm	((2*22.000+15.000)*(3.500+2.500)) *14.000*0.070	346.92	cum
			Total :	**346.92**	**cum**
9	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40			
		Refer: Busbay (2 Lane) at Hill **Formula:** ((2*b+a)*(d+f))*n*bc	((2*22.000+15.000)*(3.500+2.500)) *14.000*0.040	198.24	cum
			Total :	**198.24**	**cum**

Quantity Backup Calculation For Bill : 08. Bus Bay

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
10	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)			
		Refer: Busbay (2 Lane) at Hill **Formula:** ped_mar*(n/2)	30.000*(14.000/2)	210.00	sqm
			Total :	**210.00**	**sqm**

Bill No : 09. Longitudinal Drains

Sl 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	29,323.95		
2	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	11,157.87		
3	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	433.68		
4	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	1,238.92		
5	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	1,879.28		
6	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	93.96		
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	1,808.00		
8	24/i/b	Galvanised Mild steel J /L hook	kg	289.12		
9	40	Gextextile material (fine net)	sqm	325.26		
		Total of Bill 09. Longitudinal Drains				

Quantity Backup Calculation For Bill : 09. Longitudinal Drains

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: RCC Cover Drain **Formula:** (t_width+off*2)*((ht+b_slab_thk)/2)*l	(1.000+0.100*2)*((0.900+0.125)/2) *3614.000	2,222.61	cum
		Refer: RR Masonry Trapezoidal Drain **Formula:** (a+2*b)*(h+f)*l	(0.800+2*0.200)*(0.850+0.200) *21509.000	27,101.34	cum
			Total :	**29,323.95**	**cum**
2	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)			
		Refer: RR Masonry Trapezoidal Drain **Formula:** ((0.5*(c+j+2*b)*f)+((((a-j)/2)^2+h^2)^(1/2)) *b*2)*l	((0.5*(0.835+0.500+2*0.200)*0.200)+ ((((0.800-0.500)/2)^2+0.850^2)^(1/2)) *0.200*2)*21509.000	11,157.87	cum
			Total :	**11,157.87**	**cum**
3	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: RCC Cover Drain **Formula:** (t_width+off*2)*pcc_thk*l	(1.000+0.100*2)*0.100*3614.000	433.68	cum
			Total :	**433.68**	**cum**
4	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)			

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: RR Masonry Trapezoidal Drain **Formula:** (l-(l/5*0.2))*b*d	(21509.000-(21509.000/5*0.2)) *0.200*0.300	1,238.92	cum
			Total :	**1,238.92**	**cum**
5	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height			
		Refer: RCC Cover Drain **Formula:** (ht*w_thk*2+t_width*b_slab_thk+t_width* t_slab_thk)*l	(0.900*0.150*2+1.000*0.125+1.000*0.1 25)*3614.000	1,879.28	cum
			Total :	**1,879.28**	**cum**
6	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*0.1 25)*3614.000*0.050	93.96	MT
			Total :	**93.96**	**MT**
7	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)	(3614.000/2+1)	1,808.00	Rm
			Total :	**1,808.00**	**Rm**
8	24/i/b	Galvanised Mild steel J /L hook			

Quantity Backup Calculation For Bill : 09. Longitudinal Drains

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: RCC Cover Drain **Formula:** l/15*4*.3	3614.000/15*4*.3	289.12	kg
			Total :	**289.12**	**kg**
9	40	Gextextile material (fine net)			
		Refer: RCC Cover Drain **Formula:** (l/1)*4*(150*150/1000^2)	(3614.000/1)*4*(150*150/1000^2)	325.26	sqm
			Total :	**325.26**	**sqm**

Bill No : 10. Retaining wall

Sl 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	4,960.57		
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	cum	1,108.17		
3	13.04	Filter medium behind abutment,wing wall and return wall complete as per drawing and technical specification .	cum	4,722.00		
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	2,872.19		
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	1,487.98		
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	5,561.53		
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	8,070.00		
		Total of Bill 10. Retaining wall				

Quantity Backup Calculation For Bill : 10. Retaining wall

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Retaining Wall 1.5m **Formula:** (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*(1-p_c)	(((0.5*((0.300+0.183+0.600)+ (0.300+0.600))*(1.100+2*0.150))+ ((0.183+0.600)*(0.600-0.150))) *574.000)*(1-0.200)	799.22	cum
		Refer: Retaining Wall 2.0m **Formula:** (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*(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))) *722.000)*(1-0.200)	1,122.62	cum
		Refer: Retaining Wall 2.5m **Formula:** (((0.5*((pcc_tH1k+H2+d)+(pcc_tH1k+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*(1-p_c)	(((0.5*((0.300+0.239+0.600)+ (0.300+0.600))*(1.430+2*0.150))+ ((0.239+0.600)*(0.600-0.150))) *383.000)*(1-0.200)	656.09	cum
		Refer: Retaining Wall 3.0m **Formula:** (((0.5*((pcc_tH1k+H2+d)+(pcc_tH1k+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*(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))) *651.000)*(1-0.200)	1,225.86	cum
		Refer: Retaining Wall 4.0m **Formula:** (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*(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))) *344.000)*(1-0.200)	766.19	cum
		Refer: Retaining Wall 6.0m **Formula:** (((0.5*((pcc_tH1k+H2+d)+(pcc_tH1k+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*(1-p_c)	(((0.5*((0.300+0.450+0.900)+ (0.300+0.900))*(2.700+2*0.150))+ ((0.450+0.900)*(0.600-0.150))) *100.000)*(1-0.200)	390.60	cum
			Total :	**4,960.57**	**cum**
2	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to			
		Refer: Retaining Wall 1.5m **Formula:** ((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*l*p_c	((0.5*((0.300+0.183+0.600)+ (0.300+0.600))*(1.100+2*0.150))+ ((0.183+0.600)*(0.600-0.150))) *574.000*0.200	199.80	cum

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Retaining Wall 2.0m **Formula:** (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*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))) *722.000)*0.200	280.65	cum
		Refer: Retaining Wall 2.5m **Formula:** (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*p_c	(((0.5*((+0.239+0.600)+(+0.600))* (1.430+2*0.150))+((0.239+0.600)* (0.600-0.150)))*383.000)*0.200	124.27	cum
		Refer: Retaining Wall 3.0m **Formula:** (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*p_c	(((0.5*((+0.267+0.600)+(+0.600))* (1.600+2*0.150))+((0.267+0.600)* (0.600-0.150)))*651.000)*0.200	232.25	cum
		Refer: Retaining Wall 4.0m **Formula:** (((0.5*((pcc_thk+H2+d)+(pcc_thk+d))* (B1+2*o))+((H2+d)*(mw-o)))*l)*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))) *344.000)*0.200	191.55	cum
		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*((+0.450+0.900)+(+0.900))* (2.700+2*0.150))+((0.450+0.900)* (0.600-0.150)))*100.000)*0.200	79.65	cum
			Total :	**1,108.17**	**cum**
3	13.04	Filter medium behind abutment,wing wall and return wall complete as per drawing and technical specification .			
		Refer: Retaining Wall 1.5m **Formula:** mw*(H2+H1)*l	0.600*(0.183+1.500)*574.000	579.63	cum
		Refer: Retaining Wall 2.0m **Formula:** mw*(H2+H1)*l	0.600*(0.211+2.000)*722.000	957.81	cum
		Refer: Retaining Wall 2.5m **Formula:** mw*(H2+H1)*l	0.600*(0.239+2.500)*383.000	629.42	cum
		Refer: Retaining Wall 3.0m **Formula:** mw*(H2+H1)*l	0.600*(0.267+3.000)*651.000	1,276.09	cum
		Refer: Retaining Wall 4.0m **Formula:** mw*(H2+H1)*l	0.600*(0.322+4.000)*344.000	892.06	cum

Quantity Backup Calculation For Bill : 10. Retaining wall

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Retaining Wall 6.0m **Formula:** mw*(H2+H1)*l	0.600*(0.450+6.000)*100.000	387.00	cum
			Total :	**4,722.00**	**cum**
4	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)			
		Refer: Retaining Wall 1.5m **Formula:** ((0.5*(B1+e)*d)+(0.5*B1*H2))*l	((0.5*(1.100+0.900)*0.600)+ (0.5*1.100*0.183))*574.000	402.17	cum
		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))*722.000	602.93	cum
		Refer: Retaining Wall 2.5m **Formula:** ((0.5*(B1+B3)*d)+(0.5*B1*H2))*l	((0.5*(1.430+1.230)*0.600)+ (0.5*1.430*0.239))*383.000	371.08	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))*651.000	724.95	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))*344.000	485.39	cum
		Refer: Retaining Wall 6.0m **Formula:** ((0.5*(B1+B3)*d)+(0.5*B1*H2))*l	((0.5*(2.700+2.298)*0.900)+ (0.5*2.700*0.450))*100.000	285.66	cum
			Total :	**2,872.19**	**cum**
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Retaining Wall 1.5m **Formula:** (B2+2*o)*pcc_thk*l	(1.115+2*0.150)*0.300*574.000	243.66	cum
		Refer: Retaining Wall 2.0m **Formula:** (B2+2*o)*pcc_thk*l	(1.284+2*0.150)*0.300*722.000	343.09	cum

Quantity Backup Calculation For Bill : 10. Retaining wall

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Retaining Wall 2.5m **Formula:** (B2+2*o)*pcc_tH1k*l	(1.453+2*0.150)*0.300*383.000	201.42	cum
		Refer: Retaining Wall 3.0m **Formula:** (B2+2*o)*pcc_tH1k*l	(1.622+2*0.150)*0.300*651.000	375.37	cum
		Refer: Retaining Wall 4.0m **Formula:** (B2+2*o)*pcc_thk*l	(1.960+2*0.150)*0.300*344.000	233.23	cum
		Refer: Retaining Wall 6.0m **Formula:** (B2+2*o)*pcc_tH1k*l	(2.740+2*0.150)*0.300*100.000	91.20	cum
			Total :	**1,487.98**	**cum**
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)			
		Refer: Retaining Wall 1.5m **Formula:** (0.5*(T+e)*(H1-d))*l	(0.5*(0.600+0.900)*(1.500-0.600)) *574.000	387.45	cum
		Refer: Retaining Wall 2.0m **Formula:** (0.5*(T+e)*(H1-d))*l	(0.5*(0.600+1.067)*(2.000-0.600)) *722.000	842.50	cum
		Refer: Retaining Wall 2.5m **Formula:** (0.5*(T+B3)*(H1-d))*l	(0.5*(0.600+1.230)*(2.500-0.600)) *383.000	665.85	cum
		Refer: Retaining Wall 3.0m **Formula:** (0.5*(T+B3)*(H1-d))*l	(0.5*(0.600+1.400)*(3.000-0.600)) *651.000	1,562.40	cum
		Refer: Retaining Wall 4.0m **Formula:** (0.5*(T+B3)*(H1-d))*l	(0.5*(0.600+1.733)*(4.000-0.600)) *344.000	1,364.34	cum
		Refer: Retaining Wall 6.0m **Formula:** (0.5*(T+B3)*(H1-d))*l	(0.5*(0.600+2.298)*(6.000-0.900)) *100.000	738.99	cum
			Total :	**5,561.53**	**cum**

Quantity Backup Calculation For Bill : 10. Retaining wall

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			
		Refer: Retaining Wall 1.5m **Formula:** n*l	2.000*574.000	1,148.00	Rm
		Refer: Retaining Wall 2.0m **Formula:** n*l	2.000*722.000	1,444.00	Rm
		Refer: Retaining Wall 2.5m **Formula:** n*l	3.000*383.000	1,149.00	Rm
		Refer: Retaining Wall 3.0m **Formula:** n*l	3.000*651.000	1,953.00	Rm
		Refer: Retaining Wall 4.0m **Formula:** n*l	4.000*344.000	1,376.00	Rm
		Refer: Retaining Wall 6.0m **Formula:** n*l	10.000*100.000	1,000.00	Rm
			Total :	**8,070.00**	**Rm**

Bill No : 11. Breast wall

Sl 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	8,872.77		
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	cum	2,218.19		
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	961.38		
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	412.02		
5	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,179.53		
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	2,014.32		
7	15.02/b	Stone masonry work in cement mortar 1:3 in Sub-structure complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)	cum	4,349.10		
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	2,441.60		
		Total of Bill 11. Breast wall				

Quantity Backup Calculation For Bill : 11. Breast wall

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Breast Wall **Formula:** (h+2*0.5)*(e+f)*(1-p)*l	(2.160+2*0.5)*(0.850+0.300)*(1-0.200) *3052.000	8,872.77	cum
			Total :	**8,872.77**	**cum**
2	13.01/b/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary rock if blasting is not resorted to			
		Refer: Breast Wall **Formula:** (h+2*0.5)*(e+f)*p*l	(2.160+2*0.5)*(0.850+0.300) *0.200*3052.000	2,218.19	cum
			Total :	**2,218.19**	**cum**
3	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials			
		Refer: Breast Wall **Formula:** c*b*l	1.050*0.300*3052.000	961.38	cum
			Total :	**961.38**	**cum**
4	13.03/b	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Good Sandy Soil free from organic material			
		Refer: Breast Wall **Formula:** d*b*l	0.450*0.300*3052.000	412.02	cum
			Total :	**412.02**	**cum**

Quantity Backup Calculation For Bill : 11. Breast wall

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
5	14.02/b	Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification Random Rubble Masonry (coursed/uncoursed)			
		Refer: Breast Wall **Formula:** 0.5*(e+(e-(h/5)))*h*l	0.5*(0.850+(0.850-(2.160/5))) *2.160*3052.000	4,179.53	cum
			Total :	**4,179.53**	**cum**
6	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Breast Wall **Formula:** g*f*l	2.200*0.300*3052.000	2,014.32	cum
			Total :	**2,014.32**	**cum**
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)			
		Refer: Breast Wall **Formula:** (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)*3052.000	4,349.10	cum
			Total :	**4,349.10**	**cum**
8	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			
		Refer: Breast Wall **Formula:** (l/1.2)*(h-j-i)	(3052.000/1.2)*(2.160-1.000-0.200)	2,441.60	Rm
			Total :	**2,441.60**	**Rm**

Bill No : 12. Toe Wall

Sl 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	610.47		
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	87.21		
3	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	358.02		
4	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m	cum	344.25		
		Total of Bill 12. Toe Wall				

Quantity Backup Calculation For Bill : 12. Toe Wall

Sl No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Toe Wall 1m **Formula:** (b+2*g)*(d+f)*l	(0.750+2*0.100)*(0.600+0.100) *918.000	610.47	cum
			Total :	**610.47**	**cum**
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Toe Wall 1m **Formula:** (b+2*g)*f*l	(0.750+2*0.100)*0.100*918.000	87.21	cum
			Total :	**87.21**	**cum**
3	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade			
		Refer: Toe Wall 1m **Formula:** (0.5*(c+b)*d)*l	(0.5*(0.550+0.750)*0.600)*918.000	358.02	cum
			Total :	**358.02**	**cum**
4	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m			
		Refer: Toe Wall 1m **Formula:** (0.5*(T+c)*h)*l	(0.5*(0.200+0.550)*1.000)*918.000	344.25	cum
			Total :	**344.25**	**cum**

BILL OF QUANTITY

(STRUCTURE PART)

Bill No : 13. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
		Foundation				
1	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formrvork.	cum	613.44		
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	8,270.99		
		Sub Total of Foundation				
		Sub Structure				
3	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure	Ton	257.56		
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	890.03		
5	10.20/c	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting c)Filler Media behind abutment ,wing and return wall	cum	2,841.01		
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	3,679.47		
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications				

Bill No : 13. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			Rm	2,000.12		
		Sub Total of Sub Structure				
		Super Structure				
8	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	2,126.96		
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	138.25		
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	92.53		
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	1,233.74		
12	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	386.72		
13	16.11	Drainage Spouts complete as per drawing and Technical specification				

Bill No : 13. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			each	124.00		
14	16.17	Mastic asphalt (providing and laying 12mm thik mastic asphalt wearing coures on top of deck slab excluding prime coat with paving grade bitumem meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	2,126.96		
		Sub Total of Super Structure				
		Protection Work				
15	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formrvork. At Protection	cum	905.20		
16	13.01/a/i/Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	10,098.18		
17	16/nsc	For Protection Work - cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade upto 5m height	cum	2,038.21		
18	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	915.41		

Bill No : 13. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
19	17/nsc1	Flexible Apron - Construction of flexible apron 750mm thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall.	cum	929.08		
		Sub Total of Protection Work				
		Miscellanneous Work				
20	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	989.23		
		Sub Total of Miscellanneous Work				
		Total of Bill 13. Culvert				

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	17.01/c	laying apron complete as per drawing and Technical specification. Cement concrete block (M-15grade) (Filter Blanket+Toe Wall)	cum	251.86		
2	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	465.61		
3	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	931.12		
		Sub Total of				
		Foundation				
4	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	2,497.49		
5	13.01/a/ii	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth 3 m to 6 m	cum	1,173.85		
6	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	473.66		
7	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	119.63		
8	14.03/g	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M30 Grade	cum	894.62		

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	116.30		
		Sub Total of Foundation				
		Sub Structure				
10	13.03/a	Backfilling abutment, wing wall and Return walls complete as per drawing and technical specification Granular materials	cum	136.94		
11	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	2,141.27		
12	13.04	Filter medium behind abutment,wing wall and return wall complete as per drawing and technical specification .	cum	576.08		
13	15.03/g/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade upto 5m height	cum	638.60		
14	15.03/g/ii	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M30 Grade Between 5 to 10 m height	cum	419.02		
15	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	158.64		
16	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	655.00		
		Sub Total of Sub Structure				

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
		Super Structure				
17	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 bituminious Surface @ 0.20 - 0.30 kg/sqm	sqm	602.14		
18	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	24.09		
19	14/nsc1/i	Filler joint i)Providing & fixing 2 mm thick corrugated copper plate in expansion joint complete as per drawing & Technical Specification.	m	96.00		
20	14/nsc1/ii	Filler joint Providing & fixing 20 mm thick compressible fibre board in expansion joint complete as per drawing & Technical Specification.	m	96.00		
21	14/nsc1/ii	Filler joint iii)Providing and fixing in position 20 mm thick premoulded joint filler in expansion joint for fixed ends of simply supported spans not exceeding 10 m to cater for a horizontal movement upto 20 mm, covered with sealant complete as per drawing and technical specifications.	m	96.00		

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
22	14/nsc1/iv	Filler joint iv)Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6 per cent bitumen by weight.	m	96.00		
23	16.01/b/i/c2/ii	RCC Grade M30 For solid slab super-structure Approach Slab	cum	401.68		
24	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	80.34		
25	16.05	Cement concrete wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications	cum	12.32		
26	16.08	Reinforced concrete railing of M30 Gradecomplete as per approved drawings and technical specification	Rm	109.48		
27	16.11	Drainage Spouts complete as per drawing and Technical specification	each	12.00		
28	16.12/Nsc	Reinforced cement concrete approach slab M-30 including reinforcement and formwork complete as per drawing and Technical specification	cum	116.96		
29	16.13	PCC M15 ordinary Grade leveling course below approach slab complete as per drawing and Technical specification Below Approach Slab	cum	45.78		
30	16.16	Providing single gap(unitary) strip/seal type of expansion joint of movement capacity of 80 mm with fatigue tested structure section at the nosing and ancourage assembly complete as per approved drawing and standard specification to be installed under supervision of a specialist manufacture	Rm	64.00		

Bill No : 14. Minor Bridge

Sl No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
31	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	602.41		
		Sub Total of Super Structure				
		Protection Work				
32	08/nsc/5	Reinforced Cement Concrete Crash Barrier-Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-40 grade concrete with HYSD reinforcement conforming to IRC:21 and dowel bars 25 mm dia, 450 mm long at expansion joints filled with pre-moulded asphalt filler board, keyed to the structure on which it is built and installed as per design given in the enclosure to MOST circular No. RW/NH - 33022/1/94-DO III dated 24 June 1994 as per dimensions in the approved drawing and at locations directed by the Engineer, all as specified	m	109.48		
33	17.01/a	laying apron complete as per drawing and Technical specification. Boulder	cum	275.96		
		Sub Total of Protection Work				
		Miscellanneous Work				
34	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	636.46		
		Sub Total of Miscellanneous Work				
		Total of Bill 14. Minor Bridge				

Summary sheet of Small Culvert (Quantities & amount)

		Span (m) x Height (m) =	2.0 X 2.0 M_1 CELL_BOX C._Flex Ap._TW-12M with EC	2.0 X 2.0 M_1 CELL_BOX C._Flex Ap._TW-12M	2.0 X 2.0 M_1 CELL_BOX C._STEPPED Ap_NC_12M with EC	2.0 X 2.0 M_1 CELL_BOX C._STEPPED Ap_NC_TW-12M	2.0 X 3.0 M_1 CELL_BOX C._Flex Ap._TW-12M	2.0 X 3.0 M_1 CELL_BOX C._STEPPED Ap_NC_12M with EC	2.0 X 3.0 M_1 CELL_BOX C._STEPPED Ap_NC_TW-12M
	No. of Culverts =		**2**	**6**	**6**	**27**	**3**	**4**	**14**
ITEM NO.	**Description**	**Unit**							
	A. Foundation								
Item no 1(a)	Excavation (upto 3 m depth)	cum	61.05	62.61	104.47	105.03	87.76	130.98	145.62
Item no 3	P.C.C (M-15)	cum	7.29	7.05	7.29	7.05	10.30	9.62	10.30
	B. SubStructure								
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	31.68	36.22	33.30	36.69	61.39	56.03	62.27
Item no 3	Steel (Substructure)	ton	2.22	2.54	2.33	2.57	4.30	3.92	4.36
Item no 4	Weep Holes	metre	16.90	22.20	22.50	22.20	35.60	34.00	29.60
Item no 5	Backfilling - Granular Material	cum	8.34	9.26	10.85	11.75	11.82	12.47	14.57
Item no 6	Backfilling - Sandy Material	cum	147.41	164.89			349.08		
Item no 7	Filter Media	cum	31.67	32.71	32.80	30.18	46.91	53.66	51.91
	C. Super Structure								
Item no 1(b)	R.C.C M30 (Superstructure) upto 5m	cum	17.09	13.34	17.09	13.34	14.49	19.64	14.49
Item no 2	Steel (Superstructure)	ton	1.28	1.00	1.28	1.00	1.09	1.47	1.09
Item no 3(a)	Bituminous Concrete Wearing Coat(40mm)	cum	0.00	1.86	1.79	1.86	1.93	1.93	1.93
Item no 3(b)	Mastic Asphalt (12mm)	sqm	0.00	28.60	27.50	28.60	29.70	29.70	29.70
Item no 3(c)	Tack Coat	sqm	0.00	28.60	27.50	28.60	29.70	29.70	29.70
Item no 5	Crash Barrier	metre	0.00	5.20	5.00	5.20	5.40	5.40	5.40
Item no 6	Drainage Spout	each		4.00		2.00	4.00		2.00
	D. Protection Work								
Item no 1	Earth work for excavation	cum	299.35	305.24	100.49	100.49	362.68	100.49	100.49
Item no 2	Catch Pit PCC M15 slab	cum	9.35		1.44	1.08		1.44	1.08
Item no 3	Catch Pit Stone Masonry	cum			1.94	1.94		1.94	1.94
Item no 4	300 mm thick Rubble stone flooring laid over	cum			13.10	13.10		13.10	13.10
Item no 5	750 mm thick Flexible appron	cum	62.6805	64.8675			86.1975		
Item no 6	Curtain Wall & Guide Wall- PCC (M-20)	cum	63.28	64.38	20.09	20.09	75.09	20.09	20.09
Item no 7	PCC M15	cum		9.51	11.65	11.65	11.10	11.65	11.65
	D. Miscellaneus								
Item no 1	Painting	Sqm		13.30	12.79	13.30	13.81	13.81	13.81

Summary sheet of Small Culvert (Quantities & amount)

		Span (m) x Height (m) =	4.0 X 3.0 M_1 CELL_BOX C._STEPPED Ap_NC_TW-12M	4.0 X 3.0 M_1 CELL_BOX C._STEPPED Ap_NC_12M with EC	3.0 X 4.0 M_1 CELL_BOX C._STEPPED Ap_NC_12M with EC	5.0 X 5.0 M_1 CELL_BOX C._Flex Ap._TW-12M with EC	5.0 X 5.0 M_1 CELL_BOX C._STEPPED Ap_NC_12M with EC	Total Quantity
	No. of Culverts =		3	1	2	1	1	70
ITEM NO.	Description	Unit						
	A. Foundation							
Item no 1(a)	Excavation (upto 3 m depth)	cum	175.75	160.80	182.37	169.83	261.98	8270.986
Item no 3	P.C.C (M-15)	cum	12.35	11.30	13.07	17.22	17.22	613.437
	B. SubStructure							
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	103.47	70.85	98.38	173.90	176.42	3679.472
Item no 3	Steel (Substructure)	ton	7.24	4.96	6.89	12.17	12.35	257.563
Item no 4	Weep Holes	metre	54.80	33.52	48.00	71.40	76.20	2000.120
Item no 5	Backfilling - Granular Material	cum	17.09	15.94	17.19	20.67	23.99	890.031
Item no 6	Backfilling - Sandy Material	cum				998.22		3329.607
Item no 7	Filter Media	cum	44.71	45.56	69.40	76.79	92.30	2841.006
	C. Super Structure							
Item no 1(b)	R.C.C M30 (Superstructure) upto 5m	cum	35.13	39.22	30.83	62.96	62.96	1233.739
Item no 2	Steel (Superstructure)	ton	2.63	2.94	2.31	4.72	4.72	92.530
Item no 3(a)	Bituminous Concrete Wearing Coat(40mm)	cum	4.00	3.46	2.83		4.50	138.252
Item no 3(b)	Mastic Asphalt (12mm)	sqm	61.60	53.24	43.56		69.30	2126.960
Item no 3(c)	Tack Coat	sqm	61.60	53.24	43.56		69.30	2126.960
Item no 5	Crash Barrier	metre	11.20	9.68	7.92		12.60	386.720
Item no 6	Drainage Spout	each	2.00					124.000
	D. Protection Work							
Item no 1	Earth work for excavation	cum	131.40	131.40	115.95	550.46	146.85	10098.184
Item no 2	Catch Pit PCC M15 slab	cum	1.98	2.64	2.04		3.24	93.272
Item no 3	Catch Pit Stone Masonry	cum	2.66	2.66	2.30		3.02	117.432
Item no 4	300 mm thick Rubble stone flooring laid over	cum	19.01	19.01	16.05		21.96	797.974
Item no 5	750 mm thick Flexible appron	cum				155.925		929.084
Item no 6	Curtain Wall & Guide Wall- PCC (M-20)	cum	23.89	23.89	21.99	110.11	25.78	2038.208
Item no 7	PCC M15	cum	16.19	16.19	13.92	16.29	18.45	811.927
	D. Miscellaneus							
Item no 1	Painting	Sqm	28.65	24.76	20.26		32.23	989.230

Quantity Calculation of Small Culvert

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- **1 cell of 2 m x 2 m with Flexible Appron & EC**

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	4.700	13.000	0.750	45.825
	Shear Key	cum	2	4.700	1.800	0.900	15.228
						Total	**61.053**
2	**PCC-M15**						
	Box Bridge	cum	1	3.700	9.600	0.150	5.328
	Shear Key	cum	2	3.900	1.673	0.150	1.957
						Total	**7.285**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	3.700	12.000	0.300	13.320
	Box Side Wall	cum	2	12.000	0.250	2.000	12.000
	Return wall I	cum	4	0.600	0.200	2.275	1.092
	Shear key	cum	2	3.700	0.675		4.995
	Haunch	cum	2	12.000	0.011		0.270
						Total=	**31.677**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	2.217			2.217
						Total	**2.217**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =11.6/2+1 =					7	
	No of weep holes in vertical direction per abutment =1.8/1+1 =					3	
	No of weep holes in horizontal direction per return wall =1/2+1 =					2	
	No of weep holes in vertical direction per return wall =2/1 +1=					4	
	Total no of Weep holes per abutment = 7 x 3					21	
	Total no of Weep holes per return wall = 2 x 4					8	
	Total length of weep holes in metre = 21 x 2 + 8 x 4						**16.90**
6	**Backfilling - Granular Material**						
	Box	cum	1	16.700		0.300	5.010
	Shear key	cum	2	1.850		0.900	3.330
						Total	**8.340**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	11.60	3.393	2.275	179.083
	Deduct for the filter media	cum					31.668
						Total	**147.415**
8	**Filter media**						
	Behind Side wall	cum	2	11.600	0.600	2.275	31.668
						Total	**31.668**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- **1 cell of 2 m x 2 m with Flexible Appron & EC**

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
9	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	2.500	12.000	0.275	8.250
	RCC wall	cum	2	3.700	0.300	2.400	5.328
	RCC column beside Wall	cum	4	0.600	0.900	1.500	3.240
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**17.088**
10	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1	1.282			1.282
						Total	**1.282**
D. PROTECTION WORK							
11	**750 mm thick Flexible appron**						
	Upstream	cum	1	9.286	3.000	0.750	20.894
	Downstream	cum	1	9.286	6.000	0.750	41.787
						Total	**62.681**
12	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	21.286	1.910		40.656
	Upstream side	cum	1	15.286	1.480		22.623
						Total	**63.280**
13	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	22.286	2.850	2.650	168.315
	Curtain Wall (upstream)	cum	1	16.286	2.500	2.150	87.537
	Flexible appron(downstream)	cum	1	8.286	5.000	0.750	31.073
	Flexible appron(upstream)	cum	1	8.286	2.000	0.750	12.429
						Total	**299.354**
14	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	21.286	1.850	0.150	5.907
	Upstream side	cum	1	15.286	1.500	0.150	3.439
						Total	**9.346**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	4.600	13.000	0.830	49.634
	Shear Key	cum	2	4.600	1.720	0.820	12.976
						Total	**62.610**
2	**PCC-M15**						
	Box Bridge	cum	1	3.600	9.760	0.150	5.270
	Shear Key	cum	2	3.800	1.560	0.150	1.778
						Total	**7.048**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	3.600	12.000	0.380	16.416
	Box Side Wall	cum	2	12.000	0.300	2.000	14.400
	Return wall I	cum	4	0.500	0.200	2.350	0.940
	Shear key	cum	2	3.600	0.582		4.192
	Haunch	cum	2	12.000	0.011		0.270
						Total=	**36.218**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	2.535			2.535
						Total	**2.535**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =11.6/2+1 =					7	
	No of weep holes in vertical direction per abutment =1.8/1+1 =					3	
	No of weep holes in horizontal direction per return wall =4/2+1 =					3	
	No of weep holes in vertical direction per return wall =2.3/1 +1=					4	
	Total no of Weep holes per abutment = 7 x 3					21	
	Total no of Weep holes per return wall = 3 x 4					12	
	Total length of weep holes = 21 x 2 + 12 x 4						**22.20**
6	**Backfilling - Granular Material**						
	Box	cum	1	16.600		0.380	6.308
	Shear key	cum	2	1.800		0.820	2.952
						Total	**9.260**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	11.60	3.505	2.430	197.598
	Deduct for the filter media	cum					32.712
						Total	**164.886**
7	**Filter media**						
	Behind Side wall	cum	2	11.600	0.600	2.350	32.712
						Total	**32.712**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	2.600	12.000	0.419	13.065
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**13.335**
9	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1		1.000		1.000
						Total	**1.000**
10	**Bituminious Concrete wearing course**						
		cum	1	2.600	11.000	0.065	1.859
						Total	**1.859**
11	**Mastic Asphalt**						
		sqm	1	2.600	11.000		28.600
						Total	**28.600**
12	**Tack Coat**						
		sqm	1	2.600	11.000		28.600
						Total	**28.600**
13	**Crash Barrier R.C.C. M40**	m	2	2.600			5.200
						Total	**5.200**
14	**Drainage Spout**	nos.	4				**4**
D. PROTECTION WORK							
15	**750 mm thick Flexible appron**						
	Upstream	cum	1	9.610	3.000	0.750	21.623
	Downstream	cum	1	9.610	6.000	0.750	43.245
						Total	**64.868**
16	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	21.610	1.910		41.275
	Upstream side	cum	1	15.610	1.480		23.103
						Total	**64.378**
17	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	22.610	2.850	2.650	170.762
	Curtain Wall (upstream)	cum	1	16.610	2.500	2.150	89.279
	Flexible appron(downstream)	cum	1	8.610	5.000	0.750	32.288
	Flexible appron(upstream)	cum	1	8.610	2.000	0.750	12.915
						Total	**305.243**
18	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	21.610	1.850	0.150	5.997
	Upstream side	cum	1	15.610	1.500	0.150	3.512
						Total	**9.509**
Miscellaneous							
19	**Painting**						
	Crash Barrier	sqm	2	2.60	2.558		13.30
						Total	**13.30**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	4.600	15.000	0.830	57.270
	Shear Key	cum	2	4.600	1.720	0.820	12.976
						Total	**70.246**
2	**PCC-M15**						
	Box Bridge	cum	1	3.600	11.760	0.150	6.350
	Shear Key	cum	2	3.800	1.560	0.150	1.778
						Total	**8.128**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	3.600	14.000	0.380	19.152
	Box Side Wall	cum	2	14.000	0.300	2.000	16.800
	Return wall I	cum	4	0.500	0.200	2.350	0.940
	Shear key	cum	2	3.600	0.582		4.192
	Haunch	cum	2	14.000	0.011		0.315
						Total=	**41.399**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	2.898			2.898
						Total	**2.898**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =13.6/2+1 =					8	
	No of weep holes in vertical direction per abutment =1.8/1+1 =					3	
	No of weep holes in horizontal direction per return wall =4/2+1 =					3	
	No of weep holes in vertical direction per return wall =2.3/1 +1=					4	
	Total no of Weep holes per abutment = 8 x 3					24	
	Total no of Weep holes per return wall = 3 x 4					12	
	Total length of weep holes = 24 x 2 + 12 x 4						**24.00**
6	**Backfilling - Granular Material**						
	Box	cum	1	18.600		0.380	7.068
	Shear key	cum	2	1.800		0.820	2.952
						Total	**10.020**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	13.60	3.505	2.430	231.666
	Deduct for the filter media	cum					38.352
						Total	**193.314**
7	**Filter media**						
	Behind Side wall	cum	2	13.600	0.600	2.350	38.352
						Total	**38.352**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	2.600	14.000	0.431	15.698
	(+)Haunch	cum	2	14.000	0.011		0.315
						Total	**16.013**
9	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1		1.201		1.201
						Total	**1.201**
10	**Bituminious Concrete wearing course**						
		cum	1	2.600	13.000	0.065	2.197
						Total	**2.197**
11	**Mastic Asphalt**						
		sqm	1	2.600	13.000		33.800
						Total	**33.800**
12	**Tack Coat**						
		sqm	1	2.600	13.000		33.800
						Total	**33.800**
13	**Crash Barrier R.C.C. M40**	m	2	2.600			5.200
						Total	**5.200**
14	**Drainage Spout**	nos.	4				**4**
D. PROTECTION WORK							
15	**750 mm thick Flexible appron**						
	Upstream	cum	1	9.610	3.000	0.750	21.623
	Downstream	cum	1	9.610	6.000	0.750	43.245
						Total	**64.868**
16	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	21.610	1.910		41.275
	Upstream side	cum	1	15.610	1.480		23.103
						Total	**64.378**
17	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	22.610	2.850	2.650	170.762
	Curtain Wall (upstream)	cum	1	16.610	2.500	2.150	89.279
	Flexible appron(downstream)	cum	1	8.610	5.000	0.750	32.288
	Flexible appron(upstream)	cum	1	8.610	2.000	0.750	12.915
						Total	**305.243**
18	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	21.610	1.850	0.150	5.997
	Upstream side	cum	1	15.610	1.500	0.150	3.512
						Total	**9.509**
Miscellaneous							
19	**Painting**						
	Crash Barrier	sqm	2	2.60	2.558		13.30
						Total	**13.30**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
FOUNDATION							
1	**Excavation**						
	Box culvert	cum	1	4.70	13.00	1.450	88.60
	Shear Key	cum	2	4.90	1.800	0.900	15.88
						Total	**104.47**
2	**PCC-M15**						
	Box culvert	cum	1	3.70	9.60	0.15	5.33
	Shear Key	cum	2	3.90	1.673	0.15	1.96
						Total	**7.29**
SUBSTRUCTURE							
3	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall =11.4/2+1 =					7	
	No of weep holes in vertical direction per side wall =2/1+1 =					3	
	No of weep holes in horizontal direction per return wall l =0.6/2+1 =					2	
	No of weep holes in vertical direction per return wall l=3.8/1+1 =					5	
	Total no of Weep holes per side wall = 7 x 3					21	
	Total no of Weep holes per return wall l= 2 x 5					10	
	Total length of weep holes = 21 x 2 + 10 x 4						**22.50**
4	**RCC-M30**						
	Bottom Slab	cum	1	3.70	12.00	0.30	13.32
	Box Side Wall	cum	2	12.00	0.25	2.00	12.00
	Return wall l	cum	4	0.600	0.30	3.78	2.72
	Shear key	cum	2	3.700	0.675		5.00
	Haunch	cum	2	12.000	0.011		0.27
						Total=	**33.30**
5	**Steel**						
	@70 Kg per cum of concrete	ton					2.331
						Total	**2.331**
6	**Filter media**						
	Behind Side Wall	cum	2	11.400	0.60	2.000	27.36
	Behind Return Wall l	cum	4	0.600	0.60	3.775	5.44
						Total	**32.80**
7	**Backfilling by granular material**						
	Box culvert	cum	1	16.70		0.45	7.52
	Shear Key	cum	2	1.85		0.90	3.33
						Total	**10.85**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Top Slab	cum	1	2.500	12.000	0.275	8.250
	(+)Haunch	cum	2	12.000	0.011		0.270
	RCC wall	cum	2	3.70	0.30	2.40	5.33
	RCC column beside Wall	cum	4	0.60	0.90	1.50	3.24
						Total	**17.088**
9	**Steel**						
	@ 75 Kg per cum of concrete	ton					1.282
						Total	**1.282**
10	**Crash Barrier**	m	2	2.50			5.00
						Total	**5.00**
12	**Bituminas Concrete Wearing Coat**						
		cum	1	2.50	11.00	0.065	1.79
						Total	**1.79**
13	**Tack Coat**						
		sqm	1	2.50	11.00		27.50
						Total	**27.50**
14	**Mastic Asphalt**						
		sqm	1	2.50	11.00		27.50
						Total	**27.50**
PROTECTION WORK							
Upstream side							
15	**Eatrh work for excavation**						
		cum	1	3.40	2.00	1.00	6.80
						Total	**6.80**
16	**Catch Pit PCC M15 slab**						
		cum	1	2.40	2.00	0.30	1.44
						Total	**1.44**
17	**Catch Pit Stone Masonry**						
	Side wall length parallel to road	cum	1	2.40	0.36		0.86
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	**1.94**
18	**300 mm thick Boulder Pitching**						
		cum	1	2.00	1.30	0.30	0.78
		cum	1	4.89	5.00	0.30	7.33
						Total=	**8.11**
19	**Guide wall- PCC (M-20)**						
		cum	2	4.24		0.30	**2.55**
						Total=	**2.55**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

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

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
20	**PCC M15 Down stream side**						
	Below curtain wall						
		cum	1	7.912	1.85	0.15	2.20
	For PCC wall						
		cum	1	3.184	0.35	1.00	1.11
		cum	1	4.569	0.35	1.60	2.56
		cum	1	5.955	0.35	1.60	3.33
	Below PCC Wall						
		cum	1	3.38	0.55	0.10	0.19
		cum	1	4.77	0.55	0.10	0.26
		cum	1	6.15	0.55	0.10	0.34
	On trades						
		cum	1	2.491	0.85	0.10	0.21
		cum	1	3.876	0.85	0.10	0.33
		cum	1	5.262	0.85	0.10	0.45
		cum	1	6.734	1.00	0.10	0.67
						Total	**11.65**
21	**Eatrh work for excavation**						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
	stone Pitching	cum	1	3.23		1.100	3.55
		cum	1	4.89		1.700	8.32
		cum	1	6.56		1.700	11.15
		cum	1	6.73		0.500	3.37
						Total	**93.69**
22	**Curtain Wall & guide wall- PCC (M-20)**						
	Curtain Wall	cum	1	7.912	1.898		15.012
	Guide wall	cum	2	4.22		0.300	2.533
						Total	**17.546**
23	**300 MM thk stone pitching**						
	Below trades						
		cum	1	2.491	0.85	0.30	0.64
		cum	1	3.876	0.85	0.30	0.99
		cum	1	5.262	0.85	0.30	1.34
		cum	1	6.734	1.00	0.30	2.02
						Total	**4.99**
Miscellaneous							
24	**Painting**						
	Crash Barrier	sqm	2	2.50	2.558		12.79
						Total	**12.79**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
FOUNDATION							
1	**Excavation**						
	Box culvert	cum	1	4.60	13.00	1.530	91.49
	Shear Key	cum	2	4.80	1.720	0.820	13.54
						Total	**105.03**
2	**PCC-M15**						
	Box culvert	cum	1	3.60	9.76	0.15	5.27
	Shear Key	cum	2	3.80	1.560	0.15	1.78
						Total	**7.05**
SUBSTRUCTURE							
3	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall =11.4/2+1 =					7	
	No of weep holes in vertical direction per side wall =2/1+1 =					3	
	No of weep holes in horizontal direction per return wall l =0.5/2+1 =					2	
	No of weep holes in vertical direction per return wall l=2.4/1+1 =					4	
	Total no of Weep holes per side wall = 7 x 3					21	
	Total no of Weep holes per return wall l= 2 x 4					8	
	Total length of weep holes = 21 x 2 + 8 x 4						**22.20**
4	**RCC-M30**						
	Bottom Slab	cum	1	3.60	12.00	0.38	16.42
	Box Side Wall	cum	2	12.00	0.30	2.00	14.40
	Return wall l	cum	4	0.500	0.30	2.35	1.41
	Shear key	cum	2	3.600	0.582		4.19
	Haunch	cum	2	12.000	0.011		0.27
						Total=	**36.69**
5	**Steel**						
	@70 Kg per cum of concrete	ton					2.568
						Total	**2.568**
6	**Filter media**						
	Behind Side Wall	cum	2	11.400	0.60	2.000	27.36
	Behind Return Wall l	cum	4	0.500	0.60	2.350	2.82
						Total	**30.18**
7	**Backfilling by granular material**						
	Box culvert	cum	1	16.60		0.53	8.80
	Shear Key	cum	2	1.80		0.82	2.95
						Total	**11.75**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Top Slab	cum	1	2.600	12.000	0.419	13.065
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**13.335**
9	**Steel**						
	@ 75 Kg per cum of concrete	ton					1.000
						Total	**1.000**
10	**Crash Barrier**	m	2	2.60			5.20
						Total	**5.20**
11	**Drainage Spout**	nos.	2				**2.00**
12	**Bituminas Concrete Wearing Coat**						
		cum	1	2.60	11.00	0.065	1.86
						Total	**1.86**
13	**Tack Coat**						
		sqm	1	2.60	11.00		28.60
						Total	**28.60**
14	**Mastic Asphalt**						
		sqm	1	2.60	11.00		28.60
						Total	**28.60**
PROTECTION WORK							
Upstream side							
15	**Eatrh work for excavation**						
		cum	1	3.40	2.00	1.00	6.80
						Total	**6.80**
16	**Catch Pit PCC M15 slab**						
		cum	1	2.40	1.50	0.30	1.08
						Total	**1.08**
17	**Catch Pit Stone Masonry**						
	Side wall length parallel to road	cum	1	2.40	0.36		0.86
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	**1.94**
18	**300 mm thick Boulder Pitching**						
		cum	1	2.00	1.30	0.30	0.78
		cum	1	4.89	5.00	0.30	7.33
						Total=	**8.11**
19	**Guide wall- PCC (M-20)**						
		cum	2	4.24		0.30	**2.55**
						Total=	**2.55**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
20	**PCC M15 Down stream side**						
	Below curtain wall						
		cum	1	7.912	1.85	0.15	2.20
	For PCC wall						
		cum	1	3.184	0.35	1.00	1.11
		cum	1	4.569	0.35	1.60	2.56
		cum	1	5.955	0.35	1.60	3.33
	Below PCC Wall						
		cum	1	3.38	0.55	0.10	0.19
		cum	1	4.77	0.55	0.10	0.26
		cum	1	6.15	0.55	0.10	0.34
	On trades						
		cum	1	2.491	0.85	0.10	0.21
		cum	1	3.876	0.85	0.10	0.33
		cum	1	5.262	0.85	0.10	0.45
		cum	1	6.734	1.00	0.10	0.67
						Total	**11.65**
21	**Eatrh work for excavation**						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
	stone Pitching	cum	1	3.23		1.100	3.55
		cum	1	4.89		1.700	8.32
		cum	1	6.56		1.700	11.15
		cum	1	6.73		0.500	3.37
						Total	**93.69**
22	**Curtain Wall & guide wall- PCC (M-20)**						
	Curtain Wall	cum	1	7.912	1.898		15.012
	Guide wall	cum	2	4.22		0.300	2.533
						Total	**17.546**
23	**300 MM thk stone pitching**						
	Below trades						
		cum	1	2.491	0.85	0.30	0.64
		cum	1	3.876	0.85	0.30	0.99
		cum	1	5.262	0.85	0.30	1.34
		cum	1	6.734	1.00	0.30	2.02
						Total	**4.99**
Miscellaneous							
24	**Painting**						
	Crash Barrier	sqm	2	2.60	2.558		13.30
						Total	**13.30**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	6.300	13.000	0.870	71.253
	Shear Key	cum	2	6.300	1.680	0.780	16.511
						Total	**87.764**
2	**PCC-M15**						
	Box Bridge	cum	1	5.300	9.840	0.150	7.823
	Shear Key	cum	2	5.500	1.503	0.150	2.480
						Total	**10.303**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	5.300	12.000	0.420	26.712
	Box Side Wall	cum	2	12.000	0.350	3.000	25.200
	Return wall I	cum	4	1.300	0.200	3.370	3.505
	Shear key	cum	2	5.300	0.538		5.705
	Haunch	cum	2	12.000	0.011		0.270
						Total=	**61.392**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	4.297			4.297
						Total	**4.297**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =11.6/2+1 =					7	
	No of weep holes in vertical direction per abutment =2.8/1+1 =					4	
	No of weep holes in horizontal direction per return wall =6/2+1 =					4	
	No of weep holes in vertical direction per return wall =3.3/1 +1=					5	
	Total no of Weep holes per abutment = 7 x 4					28	
	Total no of Weep holes per return wall = 4 x 5					20	
	Total length of weep holes = 28 x 2 + 20 x 4						**35.60**
6	**Backfilling - Granular Material**						
	Box	cum	1	18.300		0.420	7.686
	Shear key	cum	2	2.650		0.780	4.134
						Total	**11.820**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	11.60	5.035	3.390	395.993
	Deduct for the filter media	cum					46.910
						Total	**349.082**
7	**Filter media**						
	Behind Side wall	cum	2	11.600	0.600	3.370	46.910
						Total	**46.910**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	2.700	12.000	0.439	14.216
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**14.486**
9	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1		1.086		1.086
						Total	**1.086**
10	**Bituminious Concrete wearing course**						
		cum	1	2.700	11.000	0.065	1.931
						Total	**1.931**
11	**Mastic Asphalt**						
		sqm	1	2.700	11.000		29.700
						Total	**29.700**
12	**Tack Coat**						
		sqm	1	2.700	11.000		29.700
						Total	**29.700**
13	**Crash Barrier R.C.C. M40**	m	2	2.700			5.400
						Total	**5.400**
14	**Drainage Spout**	nos.	4				**4**
D. PROTECTION WORK							
15	**750 mm thick Flexible appron**						
	Upstream	cum	1	12.770	3.000	0.750	28.733
	Downstream	cum	1	12.770	6.000	0.750	57.465
						Total	**86.198**
16	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	24.770	1.910		47.311
	Upstream side	cum	1	18.770	1.480		27.780
						Total	**75.090**
17	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	25.770	2.850	2.650	194.628
	Curtain Wall (upstream)	cum	1	19.770	2.500	2.150	106.264
	Flexible appron(downstream)	cum	1	11.770	5.000	0.750	44.138
	Flexible appron(upstream)	cum	1	11.770	2.000	0.750	17.655
						Total	**362.684**
18	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	24.770	1.850	0.150	6.874
	Upstream side	cum	1	18.770	1.500	0.150	4.223
						Total	**11.097**
Miscellaneous							
19	**Painting**						
	Crash Barrier	sqm	2	2.70	2.558		13.81
						Total	**13.81**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	6.300	13.000	0.870	71.253
	Shear Key	cum	2	6.300	1.680	0.780	16.511
						Total	**87.764**
2	**PCC-M15**						
	Box Bridge	cum	1	5.300	9.840	0.150	7.823
	Shear Key	cum	2	5.500	1.503	0.150	2.480
						Total	**10.303**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	5.300	12.000	0.420	26.712
	Box Side Wall	cum	2	12.000	0.350	3.000	25.200
	Return wall I	cum	4	1.300	0.200	3.397	3.533
	Shear key	cum	2	5.300	0.538		5.705
	Haunch	cum	2	12.000	0.011		0.270
						Total=	**61.420**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	4.299			4.299
						Total	**4.299**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =11.6/2+1 =					7	
	No of weep holes in vertical direction per abutment =2.8/1+1 =					4	
	No of weep holes in horizontal direction per return wall =2/2+1 =					2	
	No of weep holes in vertical direction per return wall =3.2/1 +1=					5	
	Total no of Weep holes per abutment = 7 x 4					28	
	Total no of Weep holes per return wall = 2 x 5					10	
	Total length of weep holes in metre = 28 x 2 + 10 x 4						**27.60**
6	**Backfilling - Granular Material**						
	Box	cum	1	18.300		0.420	7.686
	Shear key	cum	2	2.650		0.780	4.134
						Total	**11.820**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	11.60	5.076	3.417	402.397
	Deduct for the filter media	cum					47.286
						Total	**355.111**
8	**Filter media**						
	Behind Side wall	cum	2	11.600	0.600	3.397	47.286
						Total	**47.286**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
9	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	2.700	12.000	0.397	12.863
	RCC wall	cum	2	5.300	0.300	2.400	7.632
	RCC column beside Wall	cum	4	0.600	0.900	1.500	3.240
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**24.005**
10	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1	1.800			1.800
						Total	**1.800**
D. PROTECTION WORK							
11	**750 mm thick Flexible appron**						
	Upstream	cum	1	12.852	3.000	0.750	28.917
	Downstream	cum	1	12.852	6.000	0.750	57.834
						Total	**86.751**
12	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	24.852	1.910		47.467
	Upstream side	cum	1	18.852	1.480		27.901
						Total	**75.368**
13	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	25.852	2.850	2.650	195.247
	Curtain Wall (upstream)	cum	1	19.852	2.500	2.150	106.705
	Flexible appron(downstream)	cum	1	11.852	5.000	0.750	44.445
	Flexible appron(upstream)	cum	1	11.852	2.000	0.750	17.778
						Total	**364.175**
14	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	24.852	1.850	0.150	6.896
	Upstream side	cum	1	18.852	1.500	0.150	4.242
						Total	**11.138**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	6.300	15.000	0.870	82.215
	Shear Key	cum	2	6.300	1.680	0.780	16.511
						Total	**98.726**
2	**PCC-M15**						
	Box Bridge	cum	1	5.300	11.840	0.150	9.413
	Shear Key	cum	2	5.500	1.503	0.150	2.480
						Total	**11.893**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	5.300	14.000	0.420	31.164
	Box Side Wall	cum	2	14.000	0.350	3.000	29.400
	Return wall I	cum	4	1.300	0.200	3.370	3.505
	Shear key	cum	2	5.300	0.538		5.705
	Haunch	cum	2	14.000	0.011		0.315
						Total=	**70.089**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	4.906			4.906
						Total	**4.906**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =13.6/2+1 =					8	
	No of weep holes in vertical direction per abutment =2.8/1+1 =					4	
	No of weep holes in horizontal direction per return wall =6/2+1 =					4	
	No of weep holes in vertical direction per return wall =3.3/1 +1=					5	
	Total no of Weep holes per abutment = 8 x 4					32	
	Total no of Weep holes per return wall = 4 x 5					20	
	Total length of weep holes = 32 x 2 + 20 x 4						**38.40**
6	**Backfilling - Granular Material**						
	Box	cum	1	20.300		0.420	8.526
	Shear key	cum	2	2.650		0.780	4.134
						Total	**12.660**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	13.60	5.035	3.390	464.267
	Deduct for the filter media	cum					54.998
						Total	**409.269**
7	**Filter media**						
	Behind Side wall	cum	2	13.600	0.600	3.370	54.998
						Total	**54.998**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	2.700	14.000	0.451	17.057
	(+)Haunch	cum	2	14.000	0.011		0.315
						Total	**17.372**
9	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1		1.303		1.303
						Total	**1.303**
10	**Bituminious Concrete wearing course**						
		cum	1	2.700	13.000	0.065	2.282
						Total	**2.282**
11	**Mastic Asphalt**						
		sqm	1	2.700	13.000		35.100
						Total	**35.100**
12	**Tack Coat**						
		sqm	1	2.700	13.000		35.100
						Total	**35.100**
13	**Crash Barrier R.C.C. M40**	m	2	2.700			5.400
						Total	**5.400**
14	**Drainage Spout**	nos.	4				**4**
D. PROTECTION WORK							
15	**750 mm thick Flexible appron**						
	Upstream	cum	1	12.770	3.000	0.750	28.733
	Downstream	cum	1	12.770	6.000	0.750	57.465
						Total	**86.198**
16	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	24.770	1.910		47.311
	Upstream side	cum	1	18.770	1.480		27.780
						Total	**75.090**
17	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	25.770	2.850	2.650	194.628
	Curtain Wall (upstream)	cum	1	19.770	2.500	2.150	106.264
	Flexible appron(downstream)	cum	1	11.770	5.000	0.750	44.138
	Flexible appron(upstream)	cum	1	11.770	2.000	0.750	17.655
						Total	**362.684**
18	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	24.770	1.850	0.150	6.874
	Upstream side	cum	1	18.770	1.500	0.150	4.223
						Total	**11.097**
Miscellaneous							
19	**Painting**						
	Crash Barrier	sqm	2	2.70	2.558		13.81
						Total	**13.81**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
FOUNDATION							
1	**Excavation**						
	Box culvert	cum	1	5.90	13.00	1.450	111.22
	Shear Key	cum	2	6.10	1.800	0.900	19.76
						Total	**130.98**
2	**PCC-M15**						
	Box culvert	cum	1	4.90	9.60	0.15	7.06
	Shear Key	cum	2	5.10	1.673	0.15	2.56
						Total	**9.62**
SUBSTRUCTURE							
3	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall =11.4/2+1 =					7	
	No of weep holes in vertical direction per side wall =3/1+1 =					4	
	No of weep holes in horizontal direction per return wall l =1.1/2+1 =					2	
	No of weep holes in vertical direction per return wall l=4.8/1+1 =					6	
	Total no of Weep holes per side wall = 7 x 4					28	
	Total no of Weep holes per return wall l= 2 x 6					12	
	Total length of weep holes = 28 x 2 + 12 x 4						**34.00**
4	**RCC-M30**						
	Bottom Slab	cum	1	4.90	12.00	0.30	17.64
	Box Side Wall	cum	2	12.00	0.35	3.00	25.20
	Return wall l	cum	4	1.100	0.30	4.78	6.31
	Shear key	cum	2	4.900	0.675		6.62
	Haunch	cum	2	12.000	0.011		0.27
						Total=	**56.03**
5	**Steel**						
	@70 Kg per cum of concrete	ton					3.922
						Total	**3.922**
6	**Filter media**						
	Behind Side Wall	cum	2	11.400	0.60	3.000	41.04
	Behind Return Wall l	cum	4	1.100	0.60	4.780	12.62
						Total	**53.66**
7	**Backfilling by granular material**						
	Box culvert	cum	1	17.90		0.45	8.06
	Shear Key	cum	2	2.45		0.90	4.41
						Total	**12.47**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Top Slab	cum	1	2.700	12.000	0.280	9.072
	(+)Haunch	cum	2	12.000		0.011	0.270
	RCC wall	cum	2	4.90	0.30	2.40	7.06
	RCC column beside Wall	cum	4	0.60	0.90	1.50	3.24
						Total	**19.638**
9	**Steel**						
	@ 75 Kg per cum of concrete	ton					1.473
						Total	**1.473**
10	**Crash Barrier**	m	2	2.70			5.40
						Total	**5.40**
11	**Bituminas Concrete Wearing Coat**						
		cum	1	2.70	11.00	0.065	1.93
						Total	**1.93**
12	**Tack Coat**						
		sqm	1	2.70	11.00		29.70
						Total	**29.70**
13	**Mastic Asphalt**						
		sqm	1	2.70	11.00		29.70
						Total	**29.70**
PROTECTION WORK							
Upstream side							
14	**Eatrh work for excavation**						
		cum	1	3.40	2.00	1.00	6.80
						Total	**6.80**
15	**Catch Pit PCC M15 slab**						
		cum	1	2.40	2.00	0.30	1.44
						Total	**1.44**
16	**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**
17	**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**
18	**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							
19	**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**
20	**Eatrh work for excavation**						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
	stone Pitching	cum	1	3.23		1.100	3.55
		cum	1	4.89		1.700	8.32
		cum	1	6.56		1.700	11.15
		cum	1	6.73		0.500	3.37
						Total	**93.69**
21	**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**
22	**300 MM thk stone pitching**						
	Below trades						
		cum	1	2.491	0.85	0.30	0.64
		cum	1	3.876	0.85	0.30	0.99
		cum	1	5.262	0.85	0.30	1.34
		cum	1	6.734	1.00	0.30	2.02
						Total	**4.99**
Miscellaneous							
23	**Painting**						
	Crash Barrier	sqm	2	2.70	2.558		13.81
						Total	**13.81**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
FOUNDATION							
1	**Excavation**						
	Box culvert	cum	1	6.30	13.00	1.570	128.58
	Shear Key	cum	2	6.50	1.680	0.780	17.04
						Total	**145.62**
2	**PCC-M15**						
	Box culvert	cum	1	5.30	9.84	0.15	7.82
	Shear Key	cum	2	5.50	1.503	0.15	2.48
						Total	**10.30**
SUBSTRUCTURE							
3	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall =11.5/2+1 =					7	
	No of weep holes in vertical direction per side wall =3/1+1 =					4	
	No of weep holes in horizontal direction per return wall 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 = 7 x 4					28	
	Total no of Weep holes per return wall l= 2 x 5					10	
	Total length of weep holes = 28 x 2 + 10 x 4						**29.60**
4	**RCC-M30**						
	Bottom Slab	cum	1	5.30	12.00	0.42	26.71
	Box Side Wall	cum	2	12.00	0.35	3.00	25.20
	Return wall l	cum	4	1.300	0.25	3.37	4.38
	Shear key	cum	2	5.300	0.538		5.70
	Haunch	cum	2	12.000	0.011		0.27
						Total=	**62.27**
5	**Steel**						
	@70 Kg per cum of concrete	ton					4.359
						Total	**4.359**
6	**Filter media**						
	Behind Side Wall	cum	2	11.500	0.60	3.000	41.40
	Behind Return Wall l	cum	4	1.300	0.60	3.370	10.51
						Total	**51.91**
7	**Backfilling by granular material**						
	Box culvert	cum	1	18.30		0.57	10.43
	Shear Key	cum	2	2.65		0.78	4.13
						Total	**14.57**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Top Slab	cum	1	2.700	12.000	0.439	14.216
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**14.486**
9	**Steel**						
	@ 75 Kg per cum of concrete	ton					1.086
						Total	**1.086**
10	**Crash Barrier**	m	2	2.70			5.40
						Total	**5.40**
11	**Drainage Spout**	nos.	2				**2.00**
12	**Bituminas Concrete Wearing Coat**						
		cum	1	2.70	11.00	0.065	1.93
						Total	**1.93**
13	**Tack Coat**						
		sqm	1	2.70	11.00		29.70
						Total	**29.70**
14	**Mastic Asphalt**						
		sqm	1	2.70	11.00		29.70
						Total	**29.70**
PROTECTION WORK							
Upstream side							
15	**Eatrh work for excavation**						
		cum	1	3.40	2.00	1.00	6.80
						Total	**6.80**
16	**Catch Pit PCC M15 slab**						
		cum	1	2.40	1.50	0.30	1.08
						Total	**1.08**
17	**Catch Pit Stone Masonry**						
	Side wall length parallel to road	cum	1	2.40	0.36		0.86
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	**1.94**
18	**300 mm thick Boulder Pitching**						
		cum	1	2.00	1.30	0.30	0.78
		cum	1	4.89	5.00	0.30	7.33
						Total=	**8.11**
19	**Guide wall- PCC (M-20)**						
		cum	2	4.24		0.30	**2.55**
						Total=	**2.55**

ESTIMATE OF QUANTITY OF BOX CULVERT

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

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
20	**PCC M15 Down stream side**						
	Below curtain wall						
		cum	1	7.912	1.85	0.15	2.20
	For PCC wall						
		cum	1	3.184	0.35	1.00	1.11
		cum	1	4.569	0.35	1.60	2.56
		cum	1	5.955	0.35	1.60	3.33
	Below PCC Wall						
		cum	1	3.38	0.55	0.10	0.19
		cum	1	4.77	0.55	0.10	0.26
		cum	1	6.15	0.55	0.10	0.34
	On trades						
		cum	1	2.491	0.85	0.10	0.21
		cum	1	3.876	0.85	0.10	0.33
		cum	1	5.262	0.85	0.10	0.45
		cum	1	6.734	1.00	0.10	0.67
						Total	**11.65**
21	**Eatrh work for excavation**						
	Curtain Wall	cum	1	8.91	2.85	2.65	67.31
	stone Pitching	cum	1	3.23		1.100	3.55
		cum	1	4.89		1.700	8.32
		cum	1	6.56		1.700	11.15
		cum	1	6.73		0.500	3.37
						Total	**93.69**
22	**Curtain Wall & guide wall- PCC (M-20)**						
	Curtain Wall	cum	1	7.912	1.898		15.012
	Guide wall	cum	2	4.22		0.300	2.533
						Total	**17.546**
23	**300 MM thk stone pitching**						
	Below trades						
		cum	1	2.491	0.85	0.30	0.64
		cum	1	3.876	0.85	0.30	0.99
		cum	1	5.262	0.85	0.30	1.34
		cum	1	6.734	1.00	0.30	2.02
						Total	**4.99**
Miscellaneous							
24	**Painting**						
	Crash Barrier	sqm	2	2.70	2.558		13.81
						Total	**13.81**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- **1 cell of 4 m x 5 m with Flexible Appron**

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	10.060	15.000	1.070	161.463
	Shear Key	cum	2	10.060	1.480	0.580	17.271
						Total	**178.734**
2	**PCC-M15**						
	Box Bridge	cum	1	9.060	12.240	0.150	16.634
	Shear Key	cum	2	9.260	1.220	0.150	3.390
						Total	**20.024**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	9.060	14.000	0.620	78.641
	Box Side Wall	cum	2	14.000	0.630	5.000	88.200
	Return wall I	cum	4	1.900	0.300	5.520	12.586
	Shear key	cum	2	9.060	0.342		6.201
	Haunch	cum	2	14.000	0.011		0.315
						Total=	**185.942**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	13.016			13.016
						Total	**13.016**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =13.4/2+1 =					8	
	No of weep holes in vertical direction per abutment =4.8/1+1 =					6	
	No of weep holes in horizontal direction per return wall =9/2+1 =					6	
	No of weep holes in vertical direction per return wall =5.4/1 +1=					7	
	Total no of Weep holes per abutment = 8 x 6					48	
	Total no of Weep holes per return wall = 6 x 7					42	
	Total length of weep holes = 48 x 2 + 42 x 4						**110.88**
6	**Backfilling - Granular Material**						
	Box	cum	1	24.060		0.620	14.917
	Shear key	cum	2	4.530		0.580	5.255
						Total	**20.172**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	13.40	8.260	5.390	1193.174
	Deduct for the filter media	cum					88.762
						Total	**1104.412**
7	**Filter media**						
	Behind Side wall	cum	2	13.400	0.600	5.520	88.762
						Total	**88.762**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- **1 cell of 4 m x 5 m with Flexible Appron**

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	5.260	14.000	0.601	44.276
	(+)Haunch	cum	2	14.000	0.011		0.315
						Total	**44.591**
9	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1		3.344		3.344
						Total	**3.344**
10	**Bituminious Concrete wearing course**						
		cum	1	5.260	13.000	0.065	4.445
						Total	**4.445**
11	**Mastic Asphalt**						
		sqm	1	5.260	13.000		68.380
						Total	**68.380**
12	**Tack Coat**						
		sqm	1	5.260	13.000		68.380
						Total	**68.380**
13	**Crash Barrier R.C.C. M40**	m	2	5.260			10.520
						Total	**10.520**
14	**Drainage Spout**	nos.	4				**4**
D. PROTECTION WORK							
15	**750 mm thick Flexible appron**						
	Upstream	cum	1	21.780	3.000	0.750	49.005
	Downstream	cum	1	21.780	6.000	0.750	98.010
						Total	**147.015**
16	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	33.780	1.910		64.520
	Upstream side	cum	1	27.780	1.480		41.114
						Total	**105.634**
17	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	34.780	2.850	2.650	262.676
	Curtain Wall (upstream)	cum	1	28.780	2.500	2.150	154.693
	Flexible appron(downstream)	cum	1	20.780	5.000	0.750	77.925
	Flexible appron(upstream)	cum	1	20.780	2.000	0.750	31.170
						Total	**526.463**
18	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	33.780	1.850	0.150	9.374
	Upstream side	cum	1	27.780	1.500	0.150	6.251
						Total	**15.624**
Miscellaneous							
19	**Painting**						
	Crash Barrier	sqm	2	5.26	2.558		26.91
						Total	**26.91**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 4m x3m
4.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
FOUNDATION							
1	**Excavation**						
	Box culvert	cum	1	7.40	13.00	1.650	158.73
	Shear Key	cum	2	7.60	1.600	0.700	17.02
						Total	**175.75**
2	**PCC-M15**						
	Box culvert	cum	1	6.40	10.00	0.15	9.60
	Shear Key	cum	2	6.60	1.390	0.15	2.75
						Total	**12.35**
SUBSTRUCTURE							
3	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall =11.5/2+1 =					7	
	No of weep holes in vertical direction per side wall =3/1+1 =					4	
	No of weep holes in horizontal direction per return wall l =0.4/2+1 =					2	
	No of weep holes in vertical direction per return wall l=3.5/1+1 =					5	
	Total no of Weep holes per side wall = 7 x 4					28	
	Total no of Weep holes per return wall l= 2 x 5					10	
	Total length of weep holes = 28 x 2 + 10 x 4						**54.80**
4	**RCC-M30**						
	Bottom Slab	cum	1	6.40	12.00	0.50	38.40
	Box Side Wall	cum	2	12.00	0.80	3.00	57.60
	Return wall l	cum	4	0.400	0.25	3.45	1.38
	Shear key	cum	2	6.400	0.455		5.82
	Haunch	cum	2	12.000	0.011		0.27
						Total=	**103.47**
5	**Steel**						
	@70 Kg per cum of concrete	ton					7.243
						Total	**7.243**
6	**Filter media**						
	Behind Side Wall	cum	2	11.500	0.60	3.000	41.40
	Behind Return Wall l	cum	4	0.400	0.60	3.450	3.31
						Total	**44.71**
7	**Backfilling by granular material**						
	Box culvert	cum	1	19.40		0.65	12.61
	Shear Key	cum	2	3.20		0.70	4.48
						Total	**17.09**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 4m x3m
4.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Top Slab	cum	1	5.600	12.000	0.519	34.860
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**35.130**
9	**Steel**						
	@ 75 Kg per cum of concrete	ton					2.635
						Total	**2.635**
10	**Crash Barrier**	m	2	5.60			11.20
						Total	**11.20**
11	**Drainage Spout**	nos.	2				**2.00**
12	**Bituminas Concrete Wearing Coat**						
		cum	1	5.60	11.00	0.065	4.00
						Total	**4.00**
13	**Tack Coat**						
		sqm	1	5.60	11.00		61.60
						Total	**61.60**
14	**Mastic Asphalt**						
		sqm	1	5.60	11.00		61.60
						Total	**61.60**
PROTECTION WORK							
Upstream side							
15	**Eatrh work for excavation**						
		cum	1	5.40	2.00	1.00	10.80
						Total	**10.80**
16	**Catch Pit PCC M15 slab**						
		cum	1	4.40	1.50	0.30	1.98
						Total	**1.98**
17	**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
						Total	**2.66**
18	**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
						Total=	**11.89**
19	**Guide wall- PCC (M-20)**						
		cum	2	4.24		0.30	**2.55**
						Total=	**2.55**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 4m x3m
4.0x3.0x1 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	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
						Total	**16.19**
21	**Eatrh 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
						Total	**120.60**
22	**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
						Total	**21.341**
23	**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
						Total	**7.12**
Miscellaneous							
24	**Painting**						
	Crash Barrier	sqm	2	5.60	2.558		28.65
						Total	**28.65**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 4m x3m
4.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
FOUNDATION							
1	**Excavation**						
	Box culvert	cum	1	6.84	13.00	1.620	144.05
	Shear Key	cum	2	7.04	1.630	0.730	16.75
						Total	**160.80**
2	**PCC-M15**						
	Box culvert	cum	1	5.84	9.94	0.15	8.71
	Shear Key	cum	2	6.04	1.432	0.15	2.60
						Total	**11.30**
SUBSTRUCTURE							
3	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall =11.5/2+1 =					7	
	No of weep holes in vertical direction per side wall =3/1+1 =					4	
	No of weep holes in horizontal direction per return wall l =0.5/2+1 =					2	
	No of weep holes in vertical direction per return wall l=3.5/1+1 =					5	
	Total no of Weep holes per side wall = 7 x 4					28	
	Total no of Weep holes per return wall l= 2 x 5					10	
	Total length of weep holes = 28 x 2 + 10 x 4						**33.52**
4	**RCC-M30**						
	Bottom Slab	cum	1	5.84	12.00	0.47	32.94
	Box Side Wall	cum	2	12.00	0.42	3.00	30.24
	Return wall l	cum	4	0.500	0.25	3.47	1.74
	Shear key	cum	2	5.840	0.485		5.67
	Haunch	cum	2	12.000	0.011		0.27
						Total=	**70.85**
5	**Steel**						
	@70 Kg per cum of concrete	ton					4.960
						Total	**4.960**
6	**Filter media**						
	Behind Side Wall	cum	2	11.500	0.60	3.000	41.40
	Behind Return Wall l	cum	4	0.500	0.60	3.470	4.16
						Total	**45.56**
7	**Backfilling by granular material**						
	Box culvert	cum	1	18.84		0.62	11.68
	Shear Key	cum	2	2.92		0.73	4.26
						Total	**15.94**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 4m x3m
4.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Top Slab	cum	1	4.840	12.000	0.470	27.298
	(+)Haunch	cum	2	12.000	0.011		0.270
	RCC wall	cum	2	5.84	0.30	2.40	8.41
	RCC column beside Wall	cum	4	0.60	0.90	1.50	3.24
						Total	**39.217**
9	**Steel**						
	@ 75 Kg per cum of concrete	ton					2.941
						Total	**2.941**
10	**Crash Barrier**	m	2	4.84			9.68
						Total	**9.68**
11	**Drainage Spout**	nos.					**0.00**
12	**Bituminas Concrete Wearing Coat**						
		cum	1	4.84	11.00	0.065	3.46
						Total	**3.46**
13	**Tack Coat**						
		sqm	1	4.84	11.00		53.24
						Total	**53.24**
14	**Mastic Asphalt**						
		sqm	1	4.84	11.00		53.24
						Total	**53.24**
PROTECTION WORK							
Upstream side							
15	**Eatrh work for excavation**						
		cum	1	5.40	2.00	1.00	10.80
						Total	**10.80**
16	**Catch Pit PCC M15 slab**						
		cum	1	4.40	2.00	0.30	2.64
						Total	**2.64**
17	**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
						Total	**2.66**
18	**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
						Total=	**11.89**
19	**Guide wall- PCC (M-20)**						
		cum	2	4.24		0.30	**2.55**
						Total=	**2.55**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 4m x3m
4.0x3.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
20	**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
						Total	**16.19**
21	**Eatrh 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
						Total	**120.60**
22	**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
						Total	**21.341**
23	**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
						Total	**7.12**
Miscellaneous							
24	**Painting**						
	Crash Barrier	sqm	2	4.84	2.558		24.76
						Total	**24.76**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x4m
3.0x4.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
FOUNDATION							
1	**Excavation**						
	Box culvert	cum	1	7.76	13.00	1.620	163.43
	Shear Key	cum	2	7.96	1.630	0.730	18.94
						Total	**182.37**
2	**PCC-M15**						
	Box culvert	cum	1	6.76	9.94	0.15	10.08
	Shear Key	cum	2	6.96	1.432	0.15	2.99
						Total	**13.07**
SUBSTRUCTURE							
3	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall =11.4/2+1 =					7	
	No of weep holes in vertical direction per side wall =4/1+1 =					5	
	No of weep holes in horizontal direction per return wall l =1.4/2+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 = 7 x 5					35	
	Total no of Weep holes per return wall l= 2 x 6					12	
	Total length of weep holes = 35 x 2 + 12 x 4						**48.00**
4	**RCC-M30**						
	Bottom Slab	cum	1	6.76	12.00	0.47	38.13
	Box Side Wall	cum	2	12.00	0.48	4.00	46.08
	Return wall l	cum	4	1.400	0.30	4.37	7.34
	Shear key	cum	2	6.760	0.485		6.56
	Haunch	cum	2	12.000	0.011		0.27
						Total=	**98.38**
5	**Steel**						
	@70 Kg per cum of concrete	ton					6.887
						Total	**6.887**
6	**Filter media**						
	Behind Side Wall	cum	2	11.400	0.60	4.000	54.72
	Behind Return Wall l	cum	4	1.400	0.60	4.370	14.68
						Total	**69.40**
7	**Backfilling by granular material**						
	Box culvert	cum	1	19.76		0.62	12.25
	Shear Key	cum	2	3.38		0.73	4.93
						Total	**17.19**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x4m
3.0x4.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Top Slab	cum	1	3.960	12.000	0.370	17.582
	(+)Haunch	cum	2	12.000	0.011		0.270
	RCC wall	cum	2	6.76	0.30	2.40	9.73
	RCC column beside Wall	cum	4	0.60	0.90	1.50	3.24
						Total	**30.827**
9	**Steel**						
	@ 75 Kg per cum of concrete	ton					2.312
						Total	**2.312**
10	**Crash Barrier**	m	2	3.96			7.92
						Total	**7.92**
11	**Bituminas Concrete Wearing Coat**						
		cum	1	3.96	11.00	0.065	2.83
						Total	**2.83**
12	**Tack Coat**						
		sqm	1	3.96	11.00		43.56
						Total	**43.56**
13	**Mastic Asphalt**						
		sqm	1	3.96	11.00		43.56
						Total	**43.56**
PROTECTION WORK							
Upstream side							
14	**Eatrh work for excavation**						
		cum	1	4.40	2.00	1.00	8.80
						Total	**8.80**
15	**Catch Pit PCC M15 slab**						
		cum	1	3.40	2.00	0.30	2.04
						Total	**2.04**
16	**Catch Pit Stone Masonry**						
	Side wall length parallel to road	cum	1	3.40	0.36		1.22
	Side wall length perpendicular to road	cum	2	1.50	0.36		1.08
						Total	**2.30**
17	**300 mm thick Boulder Pitching**						
		cum	1	3.00	1.30	0.30	1.17
		cum	1	5.89	5.00	0.30	8.83
						Total=	**10.00**
18	**Guide wall- PCC (M-20)**						
		cum	2	4.24		0.30	**2.55**
						Total=	**2.55**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 3m x4m
3.0x4.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
19	**PCC M15 Down stream side**						
	Below curtain wall						
		cum	1	8.912	1.85	0.15	2.47
	For PCC wall						
		cum	1	4.184	0.35	1.00	1.46
		cum	1	5.569	0.35	1.60	3.12
		cum	1	6.955	0.35	1.60	3.89
	Below PCC Wall						
		cum	1	4.38	0.55	0.10	0.24
		cum	1	5.77	0.55	0.10	0.32
		cum	1	7.15	0.55	0.10	0.39
	On trades						
		cum	1	3.491	0.85	0.10	0.30
		cum	1	4.876	0.85	0.10	0.41
		cum	1	6.262	0.85	0.10	0.53
		cum	1	7.734	1.00	0.10	0.77
						Total	**13.92**
20	**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
						Total	**107.15**
21	**Curtain Wall & guide wall- PCC (M-20)**						
	Curtain Wall	cum	1	8.912	1.898		16.910
	Guide wall	cum	2	4.22		0.300	2.533
						Total	**19.443**
22	**300 MM thk stone pitching**						
	Below trades						
		cum	1	3.491	0.85	0.30	0.89
		cum	1	4.876	0.85	0.30	1.24
		cum	1	6.262	0.85	0.30	1.60
		cum	1	7.734	1.00	0.30	2.32
						Total	**6.05**
Miscellaneous							
23	**Painting**						
	Crash Barrier	sqm	2	3.96	2.558		20.26
						Total	**20.26**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- **1 cell of 5 m x 3 m with Flexible Appron**

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	7.740	13.000	1.020	102.632
	Shear Key	cum	2	7.740	1.530	0.630	14.921
						Total	**117.554**
2	**PCC-M15**						
	Box Bridge	cum	1	6.740	10.140	0.150	10.252
	Shear Key	cum	2	6.940	1.291	0.150	2.688
						Total	**12.939**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	6.740	12.000	0.570	46.102
	Box Side Wall	cum	2	12.000	0.570	3.000	41.040
	Return wall I	cum	4	0.300	0.200	3.500	0.840
	Shear key	cum	2	6.740	0.387		5.223
	Haunch	cum	2	12.000	0.011		0.270
						Total=	**93.474**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	6.543			6.543
						Total	**6.543**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =11.6/2+1 =					7	
	No of weep holes in vertical direction per abutment =2.8/1+1 =					4	
	No of weep holes in horizontal direction per return wall =6/2+1 =					4	
	No of weep holes in vertical direction per return wall =3.4/1 +1=					5	
	Total no of Weep holes per abutment = 7 x 4					28	
	Total no of Weep holes per return wall = 4 x 5					20	
	Total length of weep holes = 28 x 2 + 20 x 4						**47.92**
6	**Backfilling - Granular Material**						
	Box	cum	1	19.740		0.570	11.252
	Shear key	cum	2	3.370		0.630	4.246
						Total	**15.498**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	11.60	5.230	3.670	445.303
	Deduct for the filter media	cum					48.720
						Total	**396.583**
7	**Filter media**						
	Behind Side wall	cum	2	11.600	0.600	3.500	48.720
						Total	**48.720**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- **1 cell of 5 m x 3 m with Flexible Appron**

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	6.140	12.000	0.569	41.906
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**42.176**
9	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1		3.163		3.163
						Total	**3.163**
10	**Bituminious Concrete wearing course**						
		cum	1	6.140	11.000	0.065	4.390
						Total	**4.390**
11	**Mastic Asphalt**						
		sqm	1	6.140	11.000		67.540
						Total	**67.540**
12	**Tack Coat**						
		sqm	1	6.140	11.000		67.540
						Total	**67.540**
13	**Crash Barrier R.C.C. M40**	m	2	6.140			12.280
						Total	**12.280**
14	**Drainage Spout**	nos.	4				**4**
D. PROTECTION WORK							
15	**750 mm thick Flexible appron**						
	Upstream	cum	1	16.600	3.000	0.750	37.350
	Downstream	cum	1	16.600	6.000	0.750	74.700
						Total	**112.050**
16	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	28.600	1.910		54.626
	Upstream side	cum	1	22.600	1.480		33.448
						Total	**88.074**
17	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	29.600	2.850	2.650	223.554
	Curtain Wall (upstream)	cum	1	23.600	2.500	2.150	126.850
	Flexible appron(downstream)	cum	1	15.600	5.000	0.750	58.500
	Flexible appron(upstream)	cum	1	15.600	2.000	0.750	23.400
						Total	**432.304**
18	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	28.600	1.850	0.150	7.937
	Upstream side	cum	1	22.600	1.500	0.150	5.085
						Total	**13.022**
Miscellaneous							
19	**Painting**						
	Crash Barrier	sqm	2	6.14	2.558		31.41
						Total	**31.41**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- **1 cell of 5 m x 5 m with Flexible Appron & EC**

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation(up to 3m)**						
	Box Bridge	cum	1	10.100	13.000	1.200	157.560
	Shear Key	cum	2	10.100	1.350	0.450	12.272
						Total	**169.831**
2	**PCC-M15**						
	Box Bridge	cum	1	9.100	10.500	0.150	14.333
	Shear Key	cum	2	9.300	1.036	0.150	2.892
						Total	**17.224**
B. SUBSTRUCTURE							
3	**RCC-M30 (upto 5m)**						
	Bottom Slab	cum	1	9.100	12.000	0.750	81.900
	Box Side Wall	cum	2	12.000	0.650	5.000	78.000
	Return wall I	cum	4	1.400	0.300	5.613	9.430
	Shear key	cum	2	9.100	0.236		4.300
	Haunch	cum	2	12.000	0.011		0.270
						Total=	**173.900**
4	**Substructure Steel**						
	70 kg/cum of Concrete	ton	1	12.173			12.173
						Total	**12.173**
5	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =11.4/2+1 =					7	
	No of weep holes in vertical direction per abutment =4.8/1+1 =					6	
	No of weep holes in horizontal direction per return wall =2/2+1 =					2	
	No of weep holes in vertical direction per return wall =5.4/1 +1=					7	
	Total no of Weep holes per abutment = 7 x 6					42	
	Total no of Weep holes per return wall = 2 x 7					14	
	Total length of weep holes in metre = 42 x 2 + 14 x 4						**71.40**
6	**Backfilling - Granular Material**						
	Box	cum	1	22.100		0.750	16.575
	Shear key	cum	2	4.550		0.450	4.095
						Total	**20.670**
7	**Backfilling - Sandy Material**						
	Behind the side wall and return wall	cum	2	11.40	8.400	5.613	1075.002
	Deduct for the filter media	cum					76.786
						Total	**998.216**
8	**Filter media**						
	Behind Side wall	cum	2	11.400	0.600	5.613	76.786
						Total	**76.786**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- **1 cell of 5 m x 5 m with Flexible Appron & EC**

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
9	**RCC-M30(up to 5m)**						
	Box Bridge	cum	1	6.300	12.000	0.613	46.343
	RCC wall	cum	2	9.100	0.300	2.400	13.104
	RCC column beside Wall	cum	4	0.600	0.900	1.500	3.240
	(+)Haunch	cum	2	12.000	0.011		0.270
						Total	**62.957**
10	**Superstructure Steel**						
	75 kg/cum of concrete	ton	1	4.722			4.722
						Total	**4.722**
D. PROTECTION WORK							
11	**750 mm thick Flexible appron**						
	Upstream	cum	1	23.100	3.000	0.750	51.975
	Downstream	cum	1	23.100	6.000	0.750	103.950
						Total	**155.925**
12	**Curtain Wall- PCC (M-20)**						
	Downstream side	cum	1	35.100	1.910		67.041
	Upstream side	cum	1	29.100	1.480		43.068
						Total	**110.109**
13	**Excavation in Soil**						
	Curtain Wall (downstream)	cum	1	36.100	2.850	2.650	272.645
	Curtain Wall (upstream)	cum	1	30.100	2.500	2.150	161.788
	Flexible appron(downstream)	cum	1	22.100	5.000	0.750	82.875
	Flexible appron(upstream)	cum	1	22.100	2.000	0.750	33.150
						Total	**550.458**
14	**PCC (M-15)**						
	Below Curtain Wall						
	Downstream side	cum	1	35.100	1.850	0.150	9.740
	Upstream side	cum	1	29.100	1.500	0.150	6.548
						Total	**16.288**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 5m x5m
5.0x5.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
FOUNDATION							
1	**Excavation**						
	Box culvert	cum	1	10.10	13.00	1.900	249.47
	Shear Key	cum	2	10.30	1.350	0.450	12.51
						Total	**261.98**
2	**PCC-M15**						
	Box culvert	cum	1	9.10	10.50	0.15	14.33
	Shear Key	cum	2	9.30	1.036	0.15	2.89
						Total	**17.22**
SUBSTRUCTURE							
3	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per side wall =11.4/2+1 =					7	
	No of weep holes in vertical direction per side wall =5/1+1 =					6	
	No of weep holes in horizontal direction per return wall l =1.4/2+1 =					2	
	No of weep holes in vertical direction per return wall l=7.1/1+1 =					9	
	Total no of Weep holes per side wall = 7 x 6					42	
	Total no of Weep holes per return wall l= 2 x 9					18	
	Total length of weep holes = 42 x 2 + 18 x 4						**76.20**
4	**RCC-M30**						
	Bottom Slab	cum	1	9.10	12.00	0.75	81.90
	Box Side Wall	cum	2	12.00	0.65	5.00	78.00
	Return wall l	cum	4	1.400	0.30	7.11	11.95
	Shear key	cum	2	9.100	0.236		4.30
	Haunch	cum	2	12.000	0.011		0.27
						Total=	**176.42**
5	**Steel**						
	@70 Kg per cum of concrete	ton					12.349
						Total	**12.349**
6	**Filter media**						
	Behind Side Wall	cum	2	11.400	0.60	5.000	68.40
	Behind Return Wall l	cum	4	1.400	0.60	7.113	23.90
						Total	**92.30**
7	**Backfilling by granular material**						
	Box culvert	cum	1	22.10		0.90	19.89
	Shear Key	cum	2	4.55		0.45	4.10
						Total	**23.99**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 5m x5m
5.0x5.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

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

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 5m x5m
5.0x5.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
SUPERSTRUCTURE							
8	**RCC-M30(up to 5m)**						
	Top Slab	cum	1	6.300	12.000	0.613	46.343
	(+)Haunch	cum	2	12.000	0.011		0.270
	RCC wall	cum	2	9.10	0.30	2.40	13.10
	RCC column beside Wall	cum	4	0.60	0.90	1.50	3.24
						Total	**62.957**
9	**Steel**						
	@ 75 Kg per cum of concrete	ton					4.722
						Total	**4.722**
10	**Crash Barrier**	m	2	6.30			12.60
						Total	**12.60**
11	**Bituminas Concrete Wearing Coat**						
		cum	1	6.30	11.00	0.065	4.50
						Total	**4.50**
12	**Tack Coat**						
		sqm	1	6.30	11.00		69.30
						Total	**69.30**
13	**Mastic Asphalt**						
		sqm	1	6.30	11.00		69.30
						Total	**69.30**
PROTECTION WORK							
Upstream side							
14	**Eatrh work for excavation**						
		cum	1	6.40	2.00	1.00	12.80
						Total	**12.80**
15	**Catch Pit PCC M15 slab**						
		cum	1	5.40	2.00	0.30	3.24
						Total	**3.24**
16	**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**
17	**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**
18	**Guide wall- PCC (M-20)**						
		cum	2	4.24		0.30	**2.55**
						Total=	**2.55**

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 5m x5m
5.0x5.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

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

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 1 cell of 5m x5m
5.0x5.0x1 Cell_With Catch Pit_Step Protection_Normal Camber with EC

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
Downstream side							
19	**PCC M15 Down stream side**						
	Below curtain wall						
		cum	1	10.912	1.85	0.15	3.03
	For PCC wall						
		cum	1	6.184	0.35	1.00	2.16
		cum	1	7.569	0.35	1.60	4.24
		cum	1	8.955	0.35	1.60	5.01
	Below PCC Wall						
		cum	1	6.38	0.55	0.10	0.35
		cum	1	7.77	0.55	0.10	0.43
		cum	1	9.15	0.55	0.10	0.50
	On trades						
		cum	1	5.491	0.85	0.10	0.47
		cum	1	6.876	0.85	0.10	0.58
		cum	1	8.262	0.85	0.10	0.70
		cum	1	9.734	1.00	0.10	0.97
						Total	**18.45**
20	**Eatrh work for excavation**						
	Curtain Wall	cum	1	11.91	2.85	2.65	89.96
	stone Pitching	cum	1	6.83		1.100	7.51
		cum	1	8.49		1.700	14.44
		cum	1	10.16		1.700	17.27
		cum	1	9.73		0.500	4.87
						Total	**134.05**
21	**Curtain Wall & guide wall- PCC (M-20)**						
	Curtain Wall	cum	1	10.912	1.898		20.705
	Guide wall	cum	2	4.22		0.300	2.533
						Total	**23.238**
22	**300 MM thk stone pitching**						
	Below trades						
		cum	1	5.491	0.85	0.30	1.40
		cum	1	6.876	0.85	0.30	1.75
		cum	1	8.262	0.85	0.30	2.11
		cum	1	9.734	1.00	0.30	2.92
						Total	**8.18**
Miscellaneous							
23	**Painting**						
	Crash Barrier	sqm	2	6.30	2.558		32.23
						Total	**32.23**

Summary sheet of Minor Bridges (Quantities)

		CHAINAGE	14.223	17.017	21.104	
		Span(m)x Height(m)=	1 X 12.0m INTEGRAL SLAB	1 X 10.0m RCC SLAB	1 X 8.0m RCC SLAB	Total Quantity
ITEM NO.	Description	Unit				
	A. Foundation					
Item no 1(a)	Excavation (upto 3 m depth)	cum	1141.800	805.842	549.850	2497.492
Item no 1(b)	Excavation (3 m to 6 m depth)	cum	1141.800	32.052		1173.852
Item no 1(c)	Excavation (avove 6 m depth)	cum	473.657			473.657
Item no 2	R.C.C M30 (Foundation)	cum	513.450	175.788	205.380	894.618
Item no 3	P.C.C (M-15)	cum	51.294	33.978	34.362	119.634
Item no 4	Steel (Foundation)	ton	66.75	22.85	26.70	116.300
	B. SubStructure					
Item no 1(a)	R.C.C M30 (Substructure) upto 5m	cum	240.000	188.603	210.000	638.603
Item no 1(b)	R.C.C M30 (Substructure) from 5m to 10m	cum	276.890	32.979	109.147	419.016
Item no 3	Steel (Substructure)	ton	77.534	33.237	47.872	158.643
Item no 4	Weep Holes	Rm	329.000	134.000	192.000	655.000
Item no 5	Backfilling - Granular Material	cum	62.790	38.295	35.850	136.935
Item no 6	Backfilling - Sandy Material	cum	960.793	484.672	695.800	2141.265
Item no 7	Filter Media	cum	238.951	164.928	172.200	576.079
	C. Super Structure					
Item no 1(a)	R.C.C M30 (Superstructure)	cum	192.45	125.34	83.90	401.683
Item no 2	Steel (Superstructure)	ton	38.49	25.07	16.78	80.336
Item no 3(a)	Bituminous Concrete Wearing Coat(65mm)	cum	9.02	7.97	7.09	24.086
Item no 3(b)	Mastic Asphalt (12mm)	sqm	225.50	199.32	177.32	602.140
Item no 3(c)	Tack Coat	sqm	225.50	199.32	177.32	602.140
Item no 3(d)	Cement Concrete Wearing Course	cum	4.61	4.08	3.63	12.317
Item no 4	RCC railing	metre	41.00	36.24	32.24	109.480
Item no 5	Crash Barrier	metre	41.00	36.24	32.24	109.480
Item no 6	Drainage Spout	each	4.00	4.00	4.00	12.000
Item no 7	PCC below approach slab	cum	15.13	15.33	15.33	45.779
Item no 8	R.C.C. Approach Slab with steel (M30)	cum	38.64	39.16	39.16	116.958
Item no 9	Strip Seal Expansion Joint	metre		32.00	32.00	64.000
Item no 10	Filler Joint					
	(i) copper plate	metre	32.0	32.0	32.0	96.000
	(ii) fibar board	metre	32.0	32.0	32.0	96.000
	(iii) 20mm thick premoulded joint filler	metre	32.0	32.0	32.0	96.000
	(iv) joint sealing compound	metre	32.0	32.0	32.0	96.000
	D. Protection Work					
Item no 1a	Boulder Pitching	cum	304.08	215.77	411.27	931.121
Item no 2	Filter Blanket	cum	152.04	107.89	205.68	465.606
Item no 3	Falling Apron on River Bed	cum		61.02	76.97	137.981
Item no 4	Toe Wall	cum	84.57	74.53	92.76	251.860
	E. Miscelleaneous					
Item no 1	Painting	sqm	238.97	210.09	187.40	636.460

QUANTITY ESTIMATE

AT CH_5.793 KM

ESTIMATE OF QUANTITY OF SLAB BRIDGE

Chainage_5.793 Km **1 span of 10 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	6.400	3.000	332.160
	Foundation A2	cum	1	17.300	6.400	3.000	332.160
						Total	**664.320**
2	**Excavation (3 m to 6 m depth)**						
	Foundation A1	cum	1	17.300	6.400	1.722	190.660
	Foundation A2	cum	1	17.300	6.400	1.158	128.214
						Total	**318.874**
3	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	5.400	0.600	105.624
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	3.300	0.600	64.548
						Total	**170.172**
4	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	5.700	0.150	28.386
						Total	**28.386**
5	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			22.122		22.122
						Total	**22.122**

ESTIMATE OF QUANTITY OF SLAB BRIDGE

Chainage_5.793 Km **1 span of 10 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
B. SUBSTRUCTURE							
6	**RCC M30 for Substructure upto 5 m**						
	Abutment	cum	2	1.000	16.000	4.800	153.600
	Abutment Cap	cum	2	0.800	16.000	0.200	5.120
	Fin Wall	cum	4	4.000	0.400	2.350	15.040
						Total=	**173.760**
7	**RCC M30 for Substructure 5 - 10**						
	Abutment Cap	cum	2	0.800	16.000	0.600	15.360
	Dirt wall	cum	2	0.360	16.000	0.819	9.435
	Bracket	cum	2	0.142		16.000	4.544
						Total=	**29.339**
8	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton		30.465			30.465
						Total	**30.465**
9	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =4.8/1 +1=					6	
	No of weep holes in vertical direction per return wall =6.7+1 =					8	
	No of weep holes in horizontal direction per return wall =3.5/2+1 =					3	
	Total no of Weep holes per abutment = 9 x 6					54	
	Total no of Weep holes per return wall = 8 x 3					24	
	Total length of weep holes in metre = 54 x 2 x 1 + 24 x 4 x 0.4						**146.40**
10	**Backfilling(Granular Material)**						
	Foundation	cum	2	22.700		0.750	34.050
						Total	**34.050**
11	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	5.900	660.800
	Deduct for filter media	cum					128.784
						Total	**532.016**
12	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	5.900	113.280
	Behind fin wall	cum	4	3.400	0.600	1.900	15.504
						Total=	**128.784**
C. SUPERSTRUCTURE							
13	**RCC-M30(Up to 5M)**						
	Slab bridge	cum	1	10.400	11.660		121.264
	Kerb	cum	2	18.120	0.500	0.225	4.077
						Total=	**125.341**

ESTIMATE OF QUANTITY OF SLAB BRIDGE

Chainage_5.793 Km **1 span of 10 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
14	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		25.068			25.068
						Total=	**25.068**
15	**Bituminus concrete wearing course**						
		cum	1	18.120	11.000	0.040	7.973
						Total=	**7.973**
16	**Wearing Course (Mastic Asphalt)**						
		sqm	1	18.120	11.000		199.320
						Total=	**199.320**
17	**Tack Coat**						
		sqm	1	18.120	11.000		199.320
						Total=	**199.320**
18	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	18.120	1.500	0.075	4.077
						Total=	**4.077**
19	**RCC Railing**	m	2	18.120			36.240
						Total	**36.240**

ESTIMATE OF QUANTITY OF SLAB BRIDGE

Chainage_5.793 Km **1 span of 10 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
20	**Crash Barrier (RCC M40)**	m	2	18.120			36.240
						Total	**36.240**
21	**Drainage Spout**	nos.	4			**Total**	**4**
22	**PCC below Approach Slab**						
		cum	2	15.160	3.370	0.150	15.327
						Total	**15.327**
23	**Approach Slab**						
		cum	2	15.160	3.500	0.369	39.158
						Total	**39.158**
24	**Strip Seal Expansion Joint**						
		m	2	16.000			32.000
						Total	**32.000**
25	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint filler	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

26	**Painting**						
	Kerb below railing.	sqm	2	18.120	0.950		34.43
	Railing(Post)	sqm	22	1.05		1.10	25.41
	Railing(Beam)	sqm	6	0.69		18.12	75.02
	Crash Barrier	sqm	2	2.076		18.12	75.23
						Total	**210.090**

E.PROTECTION WORK

27	**Boulder Pitching**						
	A1 side	cum	2	99.163		0.300	59.498
	A2 side	cum	2	122.597		0.300	73.558
	Bank protection A1 side	cum	1	31.400		0.300	9.420
	Bank protection A2 side	cum	1	30.900		0.300	9.270
						Total	**151.746**
28	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	99.163		0.150	29.749
	A2 side	cum	2	122.597		0.150	36.779
	Bank protection A1 side	cum	1	31.400		0.150	4.710
	Bank protection A2 side	cum	1	30.900		0.150	4.635
						Total	**75.873**
29	**Floor Protection(A-1 & A-2 side) with stone blanket**						
	A1 side	cum	2	12.372	1.050		**25.981**
	A2 side	cum	2	13.147	1.050		**27.609**
						Total	**53.590**
30	**PCC(M10) Toe Wall**						
	A1 side	cum	2	26.745	0.600		32.094
	A2 side	cum	2	28.295	0.600		33.954
						Total	**66.048**

QUANTITY ESTIMATE

AT CH_7.123 KM

QUANTITY ESTIMATE OF INTEGRAL SLAB BRIDGE

Chainage_7.123 Km **1 span of 12 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	7.000	3.000	363.300
	Foundation A2	cum	1	17.300	7.000	3.000	363.300
						Total	**726.600**
2	**Excavation (3 m to 6 m depth)**						
	Foundation A1	cum	1	17.300	7.000	0.993	120.252
	Foundation A2	cum	1	17.300	7.000	0.764	92.520
						Total	**212.772**
3	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	6.000	0.500	97.800
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	3.600	0.500	58.680
						Total	**156.480**
4	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	6.300	0.150	31.374
						Total	**31.374**
5	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			20.342		20.342
						Total	**20.342**
B. SUBSTRUCTURE							
6	**RCC M30 for Substructure upto 5 m**						
	Abutment Shaft	cum	2	1.200	16.000	5.000	192.000
						Total=	**192.000**
7	**RCC M30 for Substructure 5 m To 10 m**						
	Abutment Shaft	cum	2	1.200	16.000	1.000	38.400
	Fin Wall	cum	4	5.000	0.500	2.665	26.650
	Bracket	cum	2	0.180		16.000	5.760
						Total=	**70.810**
7	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton			39.422		39.422
						Total	**39.422**
8	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =6/1 +1=					7	
	No of weep holes in vertical direction per Fin wall =5.3/2+1 =					4	
	No of weep holes in horizontal direction per fin wall =5/2+1 =					4	
	Total no of Weep holes per abutment = 9 x 7					63	
	Total no of Weep holes per fin wall = 4 x 4					16	
	Total length of weep holes in metre = 63 x 2 x 1.2 + 16 x 4 x 0.5						**183.20**
9	**Backfilling(Granular Material)**						
	Foundation	cum	2	23.300		0.650	30.290
						Total	**30.290**

QUANTITY ESTIMATE OF INTEGRAL SLAB BRIDGE

Chainage_7.123 Km **1 span of 12 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
10	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	6.550	733.600
	Deduct for filter media	cum					153.902
						Total	**579.698**
11	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	6.550	125.760
	Behind Fin Wall	cum	4	4.400	0.600	2.665	28.142
						Total=	**153.902**

C. SUPERSTRUCTURE

12	**RCC-M30 (Up to 5M)**						
	Slab bridge (Middle Straight part)	cum	1	6.000	9.540		57.240
	Slab bridge (End Straight part)	cum	2	1.250	16.760		41.900
	Slab bridge (End Varrying part)	cum	2	2.350	13.150		61.805
	Kerb	cum	2	20.200	0.500	0.225	4.545
						Total=	**165.490**
13	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		33.098			33.098
						Total=	**33.098**
14	**Bituminus concrete wearing course**						
		cum	1	20.200	11.000	0.040	8.888
						Total=	**8.888**
15	**Wearing Course (Mastic Asphalt)**						
		sqm	1	20.200	11.000		222.200
						Total=	**222.200**
16	**Tack Coat**						
		sqm	1	20.200	11.000		222.200
						Total=	**222.200**
17	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	20.200	1.500	0.075	4.545
						Total=	**4.545**
18	**RCC Railing**	m	2	20.200			40.400
						Total	**40.400**
19	**Crash Barrier (RCC M40)**	m	2	20.200			40.400
						Total	**40.400**
20	**Drainage Spout**	nos.	4			**Total**	**4**
21	**PCC below Approach Slab**						
		cum	2	14.960	3.370	0.150	15.125
						Total	**15.125**

QUANTITY ESTIMATE OF INTEGRAL SLAB BRIDGE

Chainage_7.123 Km **1 span of 12 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
22	**Approach Slab**						
		cum	2	14.960	3.500	0.369	38.642
						Total	**38.642**
23	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

24	**Painting**						
	Kerb below railing.	sqm	2	20.200	0.950		38.38
	Railing(Post)	sqm	26	1.05		1.10	30.03
	Railing(Beam)	sqm	6	0.69		20.20	83.63
	Crash Barrier	sqm	2	2.076		20.20	83.87
						Total	**235.910**

E.PROTECTION WORK

26	**Boulder Pitching**						
	A1 side	cum	2	150.155		0.300	90.093
	A2 side	cum	2	160.956		0.300	96.574
						Total	**186.667**
27	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	150.155		0.150	45.047
	A2 side	cum	2	160.956		0.150	48.287
						Total	**93.334**
29	**PCC(M10) Toe Wall**						
	A1 side	cum	2	29.985	0.600		35.982
	A2 side	cum	2	30.615	0.600		36.738
						Total	**72.720**

QUANTITY ESTIMATE

AT CH_11.545 KM

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_11.545 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	8.000	2.068	286.211
	Foundation A2	cum	1	17.300	8.000	2.068	286.211
						Total	**572.422**
2	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	7.000	0.700	159.740
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	4.200	0.700	95.844
						Total	**255.584**
3	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	7.300	0.150	36.354
						Total	**36.354**
4	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			33.226		33.226
						Total	**33.226**
B. SUBSTRUCTURE							
5	**RCC M30 for Substructure upto 5 m**						
	Abutment	cum	2	1.200	16.000	5.000	192.000
	Fin Wall	cum	4	4.500	0.400	2.500	18.000
						Total=	**210.000**
6	**RCC M30 for Substructure 5 - 10**						
	Abutment	cum	2	1.200	16.000	2.400	92.160
	Abutment Cap	cum	2	1.000	16.000	0.800	25.600
	Dirt wall	cum	2	0.360	16.000	0.669	7.707
	Bracket	cum	2		0.050	16.000	1.600
						Total=	**127.067**
7	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton			50.560		50.560
						Total	**50.560**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_11.545 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
8	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =7.4/1 +1=					8	
	No of weep holes in vertical direction per Fin wall =5/2+1 =					4	
	No of weep holes in horizontal direction per fin wall =4.5/2+1 =					3	
	Total no of Weep holes per abutment = 9 x 8					72	
	Total no of Weep holes per fin wall = 4 x 3					12	
	Total length of weep holes in metre = 72 x 2 x 1.2 + 12 x 4 x 0.4						**192.00**
9	**Backfilling(Granular Material)**						
	Foundation	cum	2	24.300		0.850	41.310
						Total	**41.310**
10	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	8.350	935.200
	Deduct for filter media	cum					183.720
						Total	**751.480**
11	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	8.350	160.320
	Behind Fin Wall	cum	4	3.900	0.600	2.500	23.400
						Total=	**183.720**

C. SUPERSTRUCTURE

12	**RCC-M30(Up to 5M)**						
	Slab bridge	cum	1	8.400	9.556		80.270
	Kerb	cum	2	16.120	0.500	0.225	3.627
						Total=	**83.897**
13	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		16.779			16.779
						Total=	**16.779**
14	**Bituminus concrete wearing course**						
		cum	1	16.120	11.000	0.040	7.093
						Total=	**7.093**
15	**Wearing Course (Mastic Asphalt)**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
16	**Tack Coat**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
17	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	16.120	1.500	0.075	3.627
						Total=	**3.627**
18	**RCC Railing**	m	2	16.120			32.240
						Total	**32.240**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_11.545 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
19	**Crash Barrier (RCC M40)**	m	2	16.120			32.240
						Total	**32.240**
20	**Drainage Spout**	nos.	4			**Total**	**4**
21	**PCC below Approach Slab**						
		cum	2	15.160	3.370	0.150	15.327
						Total	**15.327**
22	**Approach Slab**						
		cum	2	15.160	3.500	0.369	39.158
						Total	**39.158**
23	**Strip Seal Expansion Joint**						
		m	2	16.000			32.000
						Total	**32.000**
24	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

25	**Painting**						
	Kerb below railing.	sqm	2	16.120	0.950		30.63
	Railing(Post)	sqm	20	1.05		1.10	23.10
	Railing(Beam)	sqm	6	0.69		16.12	66.74
	Crash Barrier	sqm	2	2.076		16.12	66.93
						Total	**187.400**

E.PROTECTION WORK

26	**Boulder Pitching**						
	A1 side	cum	2	378.840		0.300	227.304
	A2 side	cum	2	378.840		0.300	227.304
	Bank protection (A1 side)	cum	1	70.000		0.300	21.000
	Bank protection (A2 side)	cum	1	3.700		0.300	1.110
						Total	**476.718**
27	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	378.840		0.150	113.652
	A2 side	cum	2	378.840		0.150	113.652
	Bank protection (A1 side)	cum	1	70.000		0.150	10.500
	Bank protection (A2 side)	cum	1	4.000		0.150	0.600
						Total	**238.404**
28	**Floor Protection(A-1 & A-2 side) with stone blanket**						
	A1 side	cum	2	19.456	1.050		**40.858**
	A2 side	cum	2	19.456	1.050		**40.858**
						Total	**81.716**
29	**PCC(M10) Toe Wall**						
	A1 side	cum	2	40.912	0.600		49.094
	A2 side	cum	2	40.912	0.600		49.094
						Total	**98.188**

QUANTITY ESTIMATE

AT CH_11.882 KM

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_11.882 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	6.700	2.085	241.672
	Foundation A2	cum	1	17.300	6.700	2.085	241.672
						Total	**483.344**
2	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	5.700	0.700	130.074
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	3.450	0.500	56.235
						Total	**186.309**
3	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	6.000	0.150	29.880
						Total	**29.880**
4	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			24.220		24.220
						Total	**24.220**
B. SUBSTRUCTURE							
5	**RCC M30 for Substructure upto 5 m**						
	Abutment	cum	2	1.200	16.000	5.000	192.000
	Fin Wall	cum	4	4.500	0.400	2.500	18.000
						Total=	**210.000**
6	**RCC M30 for Substructure 5 - 10**						
	Abutment	cum	2	1.200	16.000	0.700	26.880
	Abutment Cap	cum	2	1.200	16.000	0.800	30.720
	Dirt wall	cum	2	0.360	16.000	0.669	7.707
	Bracket	cum	2		0.050	16.000	1.600
						Total=	**66.907**
7	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton			41.536		41.536
						Total	**41.536**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_11.882 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
8	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =5.7/1 +1=					7	
	No of weep holes in vertical direction per Fin wall =5/2+1 =					4	
	No of weep holes in horizontal direction per fin wall =4.5/2+1 =					3	
	Total no of Weep holes per abutment = 9 x 7					63	
	Total no of Weep holes per fin wall = 4 x 3					12	
	Total length of weep holes in metre = 63 x 2 x 1.2 + 12 x 4 x 0.4						**170.40**
9	**Backfilling(Granular Material)**						
	Foundation	cum	2	23.000		0.850	39.100
						Total	**39.100**
10	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	6.650	744.800
	Deduct for filter media	cum					151.080
						Total	**593.720**
11	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	6.650	127.680
	Behind Fin Wall	cum	4	3.900	0.600	2.500	23.400
						Total=	**151.080**

C. SUPERSTRUCTURE

12	**RCC-M30(Up to 5M)**						
	Slab bridge	cum	1	8.400	9.556		80.270
	Kerb	cum	2	16.120	0.500	0.225	3.627
						Total=	**83.897**
13	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		16.779			16.779
						Total=	**16.779**
14	**Bituminus concrete wearing course**						
		cum	1	16.120	11.000	0.040	7.093
						Total=	**7.093**
15	**Wearing Course (Mastic Asphalt)**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
16	**Tack Coat**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
17	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	16.120	1.500	0.075	3.627
						Total=	**3.627**
18	**RCC Railing**	m	2	16.120			32.240
						Total	**32.240**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_11.882 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
19	**Crash Barrier (RCC M40)**	m	2	16.120			32.240
						Total	**32.240**
20	**Drainage Spout**	nos.	4			**Total**	**4**
21	**PCC below Approach Slab**						
		cum	2	15.160	3.370	0.150	15.327
						Total	**15.327**
22	**Approach Slab**						
		cum	2	15.160	3.500	0.369	39.158
						Total	**39.158**
23	**Strip Seal Expansion Joint**						
		m	2	16.000			32.000
						Total	**32.000**
24	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

25	**Painting**						
	Kerb below railing.	sqm	2	16.120	0.950		30.63
	Railing(Post)	sqm	20	1.05		1.10	23.10
	Railing(Beam)	sqm	6	0.69		16.12	66.74
	Crash Barrier	sqm	2	2.076		16.12	66.93
						Total	**187.400**

E.PROTECTION WORK

26	**Boulder Pitching**						
	A1 side	cum	2	257.621		0.300	154.573
	A2 side	cum	2	257.621		0.300	154.573
	Bank protection (A1 side)	cum	1	70.000		0.300	21.000
	Bank protection (A2 side)	cum	1	3.700		0.300	1.110
						Total	**331.256**
27	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	257.621		0.150	77.286
	A2 side	cum	2	257.621		0.150	77.286
	Bank protection (A1 side)	cum	1	70.000		0.150	10.500
	Bank protection (A2 side)	cum	1	4.000		0.150	0.600
						Total	**165.672**
28	**Floor Protection(A-1 & A-2 side) with stone blanket**						
	A1 side	cum	2	16.821	1.050		**35.324**
	A2 side	cum	2	16.821	1.050		**35.324**
						Total	**70.648**
29	**PCC(M10) Toe Wall**						
	A1 side	cum	2	35.642	0.600		42.770
	A2 side	cum	2	35.642	0.600		42.770
						Total	**85.540**

QUANTITY ESTIMATE

AT CH_12.495 KM

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_12.495 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	8.000	2.083	288.287
	Foundation A2	cum	1	17.300	8.000	2.083	288.287
						Total	**576.574**
2	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	7.000	0.700	159.740
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	4.200	0.700	95.844
						Total	**255.584**
3	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	7.300	0.150	36.354
						Total	**36.354**
4	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			33.226		33.226
						Total	**33.226**
B. SUBSTRUCTURE							
5	**RCC M30 for Substructure upto 5 m**						
	Abutment	cum	2	1.200	16.000	5.000	192.000
	Fin Wall	cum	4	4.500	0.400	2.500	18.000
						Total=	**210.000**
6	**RCC M30 for Substructure 5 - 10**						
	Abutment	cum	2	1.200	16.000	2.200	84.480
	Abutment Cap	cum	2	1.000	16.000	0.800	25.600
	Dirt wall	cum	2	0.360	16.000	0.669	7.707
	Bracket	cum	2		0.050	16.000	1.600
						Total=	**119.387**
7	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton			49.408		49.408
						Total	**49.408**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_12.495 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
8	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =7.2/1 +1=					8	
	No of weep holes in vertical direction per Fin wall =5/2+1 =					4	
	No of weep holes in horizontal direction per fin wall =4.5/2+1 =					3	
	Total no of Weep holes per abutment = 9 x 8					72	
	Total no of Weep holes per fin wall = 4 x 3					12	
	Total length of weep holes in metre = 72 x 2 x 1.2 + 12 x 4 x 0.4						**192.00**
9	**Backfilling(Granular Material)**						
	Foundation	cum	2	24.300		0.850	41.310
						Total	**41.310**
10	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	8.150	912.800
	Deduct for filter media	cum					179.880
						Total	**732.920**
11	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	8.150	156.480
	Behind Fin Wall	cum	4	3.900	0.600	2.500	23.400
						Total=	**179.880**

C. SUPERSTRUCTURE

12	**RCC-M30(Up to 5M)**						
	Slab bridge	cum	1	8.400	9.556		80.270
	Kerb	cum	2	16.120	0.500	0.225	3.627
						Total=	**83.897**
13	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		16.779			16.779
						Total=	**16.779**
14	**Bituminus concrete wearing course**						
		cum	1	16.120	11.000	0.040	7.093
						Total=	**7.093**
15	**Wearing Course (Mastic Asphalt)**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
16	**Tack Coat**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
17	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	16.120	1.500	0.075	3.627
						Total=	**3.627**
18	**RCC Railing**	m	2	16.120			32.240
						Total	**32.240**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_12.495 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
19	**Crash Barrier (RCC M40)**	m	2	16.120			32.240
						Total	**32.240**
20	**Drainage Spout**	nos.	4			**Total**	**4**
21	**PCC below Approach Slab**						
		cum	2	15.160	3.370	0.150	15.327
						Total	**15.327**
22	**Approach Slab**						
		cum	2	15.160	3.500	0.369	39.158
						Total	**39.158**
23	**Strip Seal Expansion Joint**						
		m	2	16.000			32.000
						Total	**32.000**
24	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

25	**Painting**						
	Kerb below railing.	sqm	2	16.120	0.950		30.63
	Railing(Post)	sqm	20	1.05		1.10	23.10
	Railing(Beam)	sqm	6	0.69		16.12	66.74
	Crash Barrier	sqm	2	2.076		16.12	66.93
						Total	**187.400**

E.PROTECTION WORK

26	**Boulder Pitching**						
	A1 side	cum	2	364.226		0.300	218.536
	A2 side	cum	2	364.226		0.300	218.536
	Bank protection (A1 side)	cum	1	70.000		0.300	21.000
	Bank protection (A2 side)	cum	1	3.700		0.300	1.110
						Total	**459.182**
27	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	364.226		0.150	109.268
	A2 side	cum	2	364.226		0.150	109.268
	Bank protection (A1 side)	cum	1	70.000		0.150	10.500
	Bank protection (A2 side)	cum	1	4.000		0.150	0.600
						Total	**229.636**
28	**Floor Protection(A-1 & A-2 side) with stone blanket**						
	A1 side	cum	2	19.161	1.050		**40.238**
	A2 side	cum	2	19.161	1.050		**40.238**
						Total	**80.476**
29	**PCC(M10) Toe Wall**						
	A1 side	cum	2	40.321	0.600		48.385
	A2 side	cum	2	40.321	0.600		48.385
						Total	**96.770**

QUANTITY ESTIMATE

AT CH_13.110 KM

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_13.110 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	6.500	2.220	249.639
	Foundation A2	cum	1	17.300	6.500	2.220	249.639
						Total	**499.278**
2	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	5.500	0.700	125.510
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	3.350	0.500	54.605
						Total	**180.115**
3	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	5.800	0.150	28.884
						Total	**28.884**
4	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			23.415		23.415
						Total	**23.415**
B. SUBSTRUCTURE							
5	**RCC M30 for Substructure upto 5 m**						
	Abutment	cum	2	1.200	16.000	5.000	192.000
	Fin Wall	cum	4	4.500	0.400	2.500	18.000
						Total=	**210.000**
6	**RCC M30 for Substructure 5 - 10**						
	Abutment	cum	2	1.200	16.000	0.300	11.520
	Abutment Cap	cum	2	1.200	16.000	0.800	30.720
	Dirt wall	cum	2	0.360	16.000	0.669	7.707
	Bracket	cum	2		0.050	16.000	1.600
						Total=	**51.547**
7	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton			39.232		39.232
						Total	**39.232**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_13.110 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
8	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =5.3/1 +1=					6	
	No of weep holes in vertical direction per Fin wall =5/2+1 =					4	
	No of weep holes in horizontal direction per fin wall =4.5/2+1 =					3	
	Total no of Weep holes per abutment = 9 x 6					54	
	Total no of Weep holes per fin wall = 4 x 3					12	
	Total length of weep holes in metre = 54 x 2 x 1.2 + 12 x 4 x 0.4						**148.80**
9	**Backfilling(Granular Material)**						
	Foundation	cum	2	22.800		0.850	38.760
						Total	**38.760**
10	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	6.250	700.000
	Deduct for filter media	cum					143.400
						Total	**556.600**
11	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	6.250	120.000
	Behind Fin Wall	cum	4	3.900	0.600	2.500	23.400
						Total=	**143.400**

C. SUPERSTRUCTURE

12	**RCC-M30(Up to 5M)**						
	Slab bridge	cum	1	8.400	9.556		80.270
	Kerb	cum	2	16.120	0.500	0.225	3.627
						Total=	**83.897**
13	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		16.779			16.779
						Total=	**16.779**
14	**Bituminus concrete wearing course**						
		cum	1	16.120	11.000	0.040	7.093
						Total=	**7.093**
15	**Wearing Course (Mastic Asphalt)**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
16	**Tack Coat**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
17	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	16.120	1.500	0.075	3.627
						Total=	**3.627**
18	**RCC Railing**	m	2	16.120			32.240
						Total	**32.240**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_13.110 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
19	**Crash Barrier (RCC M40)**	m	2	16.120			32.240
						Total	**32.240**
20	**Drainage Spout**	nos.	4			**Total**	**4**
21	**PCC below Approach Slab**						
		cum	2	15.160	3.370	0.150	15.327
						Total	**15.327**
22	**Approach Slab**						
		cum	2	15.160	3.500	0.369	39.158
						Total	**39.158**
23	**Strip Seal Expansion Joint**						
		m	2	16.000			32.000
						Total	**32.000**
24	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

25	**Painting**						
	Kerb below railing.	sqm	2	16.120	0.950		30.63
	Railing(Post)	sqm	20	1.05		1.10	23.10
	Railing(Beam)	sqm	6	0.69		16.12	66.74
	Crash Barrier	sqm	2	2.076		16.12	66.93
						Total	**187.400**

E.PROTECTION WORK

26	**Boulder Pitching**						
	A1 side	cum	2	227.431		0.300	136.459
	A2 side	cum	2	227.431		0.300	136.459
	Bank protection (A1 side)	cum	1	70.000		0.300	21.000
	Bank protection (A2 side)	cum	1	3.700		0.300	1.110
						Total	**295.028**
27	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	227.431		0.150	68.229
	A2 side	cum	2	227.431		0.150	68.229
	Bank protection (A1 side)	cum	1	70.000		0.150	10.500
	Bank protection (A2 side)	cum	1	4.000		0.150	0.600
						Total	**147.558**
28	**Floor Protection(A-1 & A-2 side) with stone blanket**						
	A1 side	cum	2	16.086	1.050		**33.781**
	A2 side	cum	2	16.086	1.050		**33.781**
						Total	**67.562**
29	**PCC(M10) Toe Wall**						
	A1 side	cum	2	34.172	0.600		41.006
	A2 side	cum	2	34.172	0.600		41.006
						Total	**82.012**

QUANTITY ESTIMATE

AT CH_13.585 KM

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_13.585 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	7.900	2.060	281.540
	Foundation A2	cum	1	17.300	7.900	2.060	281.540
						Total	**563.080**
2	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	6.900	0.800	179.952
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	4.150	0.600	81.174
						Total	**261.126**
3	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	7.200	0.150	35.856
						Total	**35.856**
4	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			33.946		33.946
						Total	**33.946**
B. SUBSTRUCTURE							
5	**RCC M30 for Substructure upto 5 m**						
	Abutment	cum	2	1.200	16.000	5.000	192.000
	Fin Wall	cum	4	4.500	0.400	2.500	18.000
						Total=	**210.000**
6	**RCC M30 for Substructure 5 - 10**						
	Abutment	cum	2	1.200	16.000	2.100	80.640
	Abutment Cap	cum	2	1.000	16.000	0.800	25.600
	Dirt wall	cum	2	0.360	16.000	0.669	7.707
	Bracket	cum	2		0.050	16.000	1.600
						Total=	**115.547**
7	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton			48.832		48.832
						Total	**48.832**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_13.585 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
8	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =7.1/1 +1=					8	
	No of weep holes in vertical direction per Fin wall =5/2+1 =					4	
	No of weep holes in horizontal direction per fin wall =4.5/2+1 =					3	
	Total no of Weep holes per abutment = 9 x 8					72	
	Total no of Weep holes per fin wall = 4 x 3					12	
	Total length of weep holes in metre = 72 x 2 x 1.2 + 12 x 4 x 0.4						**192.00**
9	**Backfilling(Granular Material)**						
	Foundation	cum	2	24.200		0.950	45.980
						Total	**45.980**
10	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	8.050	901.600
	Deduct for filter media	cum					177.960
						Total	**723.640**
11	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	8.050	154.560
	Behind Fin Wall	cum	4	3.900	0.600	2.500	23.400
						Total=	**177.960**

C. SUPERSTRUCTURE

12	**RCC-M30(Up to 5M)**						
	Slab bridge	cum	1	8.400	9.556		80.270
	Kerb	cum	2	16.120	0.500	0.225	3.627
						Total=	**83.897**
13	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		16.779			16.779
						Total=	**16.779**
14	**Bituminus concrete wearing course**						
		cum	1	16.120	11.000	0.040	7.093
						Total=	**7.093**
15	**Wearing Course (Mastic Asphalt)**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
16	**Tack Coat**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
17	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	16.120	1.500	0.075	3.627
						Total=	**3.627**
18	**RCC Railing**	m	2	16.120			32.240
						Total	**32.240**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_13.585 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
19	**Crash Barrier (RCC M40)**	m	2	16.120			32.240
						Total	**32.240**
20	**Drainage Spout**	nos.	4			**Total**	**4**
21	**PCC below Approach Slab**						
		cum	2	15.160	3.370	0.150	15.327
						Total	**15.327**
22	**Approach Slab**						
		cum	2	15.160	3.500	0.369	39.158
						Total	**39.158**
23	**Strip Seal Expansion Joint**						
		m	2	16.000			32.000
						Total	**32.000**
24	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

25	**Painting**						
	Kerb below railing.	sqm	2	16.120	0.950		30.63
	Railing(Post)	sqm	20	1.05		1.10	23.10
	Railing(Beam)	sqm	6	0.69		16.12	66.74
	Crash Barrier	sqm	2	2.076		16.12	66.93
						Total	**187.400**

E.PROTECTION WORK

26	**Boulder Pitching**						
	A1 side	cum	2	359.062		0.300	215.437
	A2 side	cum	2	359.062		0.300	215.437
	Bank protection (A1 side)	cum	1	70.000		0.300	21.000
	Bank protection (A2 side)	cum	1	3.700		0.300	1.110
						Total	**452.984**
27	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	359.062		0.150	107.719
	A2 side	cum	2	359.062		0.150	107.719
	Bank protection (A1 side)	cum	1	70.000		0.150	10.500
	Bank protection (A2 side)	cum	1	4.000		0.150	0.600
						Total	**226.538**
28	**Floor Protection(A-1 & A-2 side) with stone blanket**						
	A1 side	cum	2	19.055	1.050		**40.016**
	A2 side	cum	2	19.055	1.050		**40.016**
						Total	**80.032**
29	**PCC(M10) Toe Wall**						
	A1 side	cum	2	40.110	0.600		48.132
	A2 side	cum	2	40.110	0.600		48.132
						Total	**96.264**

QUANTITY ESTIMATE

AT CH_14.223 KM

QUANTITY ESTIMATE OF INTEGRAL SLAB BRIDGE

Chainage_14.223 Km **1 span of 12 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	11.000	3.000	570.900
	Foundation A2	cum	1	17.300	11.000	3.000	570.900
						Total	**1141.800**
2	**Excavation (3 m to 6 m depth)**						
	Foundation A1	cum	1	17.300	11.000	3.000	570.900
	Foundation A2	cum	1	17.300	11.000	3.000	570.900
						Total	**1141.800**
3	**Excavation (above 6 m depth)**						
	Foundation A1	cum	1	17.300	11.000	2.484	472.705
	Foundation A2	cum	1	17.300	11.000	0.005	0.952
						Total	**473.657**
4	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	10.000	1.000	326.000
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	5.750	1.000	187.450
						Total	**513.450**
5	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	10.300	0.150	51.294
						Total	**51.294**
6	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			66.749		66.749
						Total	**66.749**
B. SUBSTRUCTURE							
7	**RCC M30 for Substructure upto 5 m**						
	Abutment Shaft	cum	2	1.500	16.000	5.000	240.000
						Total=	**240.000**
8	**RCC M30 for Substructure 5 m To 10 m**						
	Abutment Shaft	cum	2	1.500	16.000	5.000	240.000
	Fin Wall	cum	4	5.500	0.500	2.830	31.130
	Bracket	cum	2	0.180		16.000	5.760
						Total=	**276.890**
8	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton			77.534		77.534
						Total	**77.534**
9	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =10/1 +1=					11	
	No of weep holes in vertical direction per Fin wall =5.7/2+1 =					4	
	No of weep holes in horizontal direction per fin wall =5.5/2+1 =					4	
	Total no of Weep holes per abutment = 9 x 11					99	
	Total no of Weep holes per fin wall = 4 x 4					16	
	Total length of weep holes in metre = 99 x 2 x 1.5 + 16 x 4 x 0.5						**329.00**
10	**Backfilling(Granular Material)**						
	Foundation	cum	2	27.300		1.150	62.790
						Total	**62.790**

QUANTITY ESTIMATE OF INTEGRAL SLAB BRIDGE

Chainage_14.223 Km **1 span of 12 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
11	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	10.712	1199.744
	Deduct for filter media	cum					238.951
						Total	**960.793**
12	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	10.712	205.670
	Behind Fin Wall	cum	4	4.900	0.600	2.830	33.281
						Total=	**238.951**

C. SUPERSTRUCTURE

13	**RCC-M30 (Up to 5M)**						
	Slab bridge (Middle Straight part)	cum	1	6.000	10.400		62.400
	Slab bridge (End Straight part)	cum	2	1.550	19.349		59.982
	Slab bridge (End Varrying part)	cum	2	2.200	14.875		65.450
	Kerb	cum	2	20.500	0.500	0.225	4.613
						Total=	**192.445**
14	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		38.489			38.489
						Total=	**38.489**
15	**Bituminus concrete wearing course**						
		cum	1	20.500	11.000	0.040	9.020
						Total=	**9.020**
16	**Wearing Course (Mastic Asphalt)**						
		sqm	1	20.500	11.000		225.500
						Total=	**225.500**
17	**Tack Coat**						
		sqm	1	20.500	11.000		225.500
						Total=	**225.500**
18	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	20.500	1.500	0.075	4.613
						Total=	**4.613**
19	**RCC Railing**	m	2	20.500			41.000
						Total	**41.000**
20	**Crash Barrier (RCC M40)**	m	2	20.500			41.000
						Total	**41.000**
21	**Drainage Spout**	nos.	4			**Total**	**4**
22	**PCC below Approach Slab**						
		cum	2	14.960	3.370	0.150	15.125
						Total	**15.125**

QUANTITY ESTIMATE OF INTEGRAL SLAB BRIDGE

Chainage_14.223 Km **1 span of 12 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
23	**Approach Slab**						
		cum	2	14.960	3.500	0.369	38.642
						Total	**38.642**
24	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

25	**Painting**						
	Kerb below railing.	sqm	2	20.500	0.950		38.95
	Railing(Post)	sqm	26	1.05		1.10	30.03
	Railing(Beam)	sqm	6	0.69		20.50	84.87
	Crash Barrier	sqm	2	2.076		20.50	85.12
						Total	**238.970**

E.PROTECTION WORK

27	**Boulder Pitching**						
	A1 side	cum	2	182.619		0.300	109.571
	A2 side	cum	2	324.173		0.300	194.504
						Total	**304.075**
28	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	182.619		0.150	54.786
	A2 side	cum	2	324.173		0.150	97.252
						Total	**152.038**
30	**PCC(M10) Toe Wall**						
	A1 side	cum	2	31.830	0.600		38.196
	A2 side	cum	2	38.644	0.600		46.373
						Total	**84.569**

QUANTITY ESTIMATE

AT CH_17.017 KM

ESTIMATE OF QUANTITY OF SLAB BRIDGE

Chainage_17.017 Km **1 span of 10 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	6.200	3.000	321.780
	Foundation A2	cum	1	17.300	6.200	3.000	321.780
	Return Wall II at A1 side	cum	2	3.400	4.300	2.550	74.562
	Return Wall II at A2 side	cum	2	3.400	4.300	3.000	87.720
						Total	**805.842**
2	**Excavation (3 m to 6 m depth)**						
	Foundation A1	cum	1	17.300	6.200	0.071	7.615
	Foundation A2	cum	1	17.300	6.200	0.037	3.969
	Return Wall II at A2 side		2	3.400	4.300	0.700	20.468
						Total	**32.052**
3	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	5.200	0.600	101.712
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	3.200	0.600	62.592
	Return Wall II	cum	4	2.900	3.300	0.300	11.484
						Total	**175.788**
4	**Levelling Course M15**						
	Below Abutment Foundation Slab	cum	2	16.600	5.500	0.150	27.390
	Below Return Wall II Foundation	cum	4	3.050	3.600	0.150	6.588
						Total	**33.978**
5	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			22.852		22.852
						Total	**22.852**

ESTIMATE OF QUANTITY OF SLAB BRIDGE

Chainage_17.017 Km **1 span of 10 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
B. SUBSTRUCTURE							
6	**RCC M30 for Substructure upto 5 m**						
	Abutment	cum	2	1.000	16.000	4.500	144.000
	Abutment Cap	cum	2	0.800	16.000	0.500	12.800
	Pier Shaft(Rectangular Portion)	cum		0.900		889.756	
	Pier Shaft(Circular Portion)	cum				889.756	
	Pier Cap(Rectangular Portion)	cum		0.900	0.900	0.500	
	Pier Cap(trapezoidal Portion)	cum		0.900	0.450	0.600	
	Fin Wall	cum	4		0.400	0.800	
	Return wall II	cum		0.525	5.000	6.900	
	Dirt wall	cum	2	0.360	16.000		
	Bracket	cum	2	0.142		16.000	
	Return wall-I	cum	4	2.500	0.400	5.000	20.000
	Return wall-II	cum	4	2.900	0.275	3.700	11.803
						Total=	**188.603**
7	**RCC M30 for Substructure 5 - 10**						
	Abutment Cap	cum	2	0.800	16.000	0.500	12.800
	Dirt wall	cum	2	0.360	16.000	0.819	9.435
	Return wall- I	cum	4	2.500	0.400	1.550	6.200
	Bracket	cum	2	0.142		16.000	4.544
						Total=	**32.979**
8	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton		33.237			33.237
						Total	**33.237**
9	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =4.5/1 +1=					6	
	No of weep holes in vertical direction per return wall =6.6+1 =					8	
	No of weep holes in horizontal direction per return wall =2.5/2+1 =					2	
	Total no of Weep holes per abutment = 9 x 6					54	
	Total no of Weep holes per return wall = 8 x 2					16	
	Total length of weep holes in metre = 54 x 2 x 1 + 16 x 4 x 0.4						**134**
10	**Backfilling(Granular Material)**						
	Arround Abutment Foundation	cum	2	22.500		0.750	33.750
	Arround Return wall-II Foundation	cum	2	5.050		0.450	4.545
						Total	**38.295**
11	**Backfilling(Sandy Material)**						
	Behind Abutment & Return wall	cum	2	3.500	16.000	5.800	649.600
	Deduct for filter media	cum					164.928
						Total	**484.672**
12	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	5.800	111.360
	Behind return wall-I	cum	4	1.900	0.600	6.100	27.816
	Behind return wall-II	cum	4	2.900	0.600	3.700	25.752
						Total=	**164.928**

ESTIMATE OF QUANTITY OF SLAB BRIDGE

Chainage_17.017 Km **1 span of 10 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
C. SUPERSTRUCTURE							
13	**RCC-M30(Up to 5M)**						
	Slab bridge	cum	1	10.400	11.660		121.264
	Kerb	cum	2	18.120	0.500	0.225	4.077
						Total=	**125.341**
14	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		25.068			25.068
						Total=	**25.068**
15	**Bituminus concrete wearing course**						
		cum	1	18.120	11.000	0.040	7.973
						Total=	**7.973**
16	**Wearing Course (Mastic Asphalt)**						
		sqm	1	18.120	11.000		199.320
						Total=	**199.320**
17	**Tack Coat**						
		sqm	1	18.120	11.000		199.320
						Total=	**199.320**
18	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	18.120	1.500	0.075	4.077
						Total=	**4.077**
19	**RCC Railing**	m	2	18.120			36.240
						Total	**36.240**

ESTIMATE OF QUANTITY OF SLAB BRIDGE

Chainage_17.017 Km **1 span of 10 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
20	**Crash Barrier (RCC M40)**	m	2	18.120			36.240
						Total	**36.240**
21	**Drainage Spout**	nos.	4			**Total**	**4**
22	**PCC below Approach Slab**						
		cum	2	15.160	3.370	0.150	15.327
						Total	**15.327**
23	**Approach Slab**						
		cum	2	15.160	3.500	0.369	39.158
						Total	**39.158**
24	**Strip Seal Expansion Joint**						
		m	2	16.000			32.000
						Total	**32.000**
25	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint filler	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

26	**Painting**						
	Kerb below railing.	sqm	2	18.120	0.950		34.43
	Railing(Post)	sqm	22	1.05		1.10	25.41
	Railing(Beam)	sqm	6	0.69		18.12	75.02
	Crash Barrier	sqm	2	2.076		18.12	75.23
						Total	**210.090**

E.PROTECTION WORK

27	**Boulder Pitching**						
	A1 side	cum	2	167.842		0.300	100.705
	A2 side	cum	2	169.497		0.300	101.698
	Bank protection A1 side	cum	1	1.250	17.000	0.300	6.375
	Bank protection A2 side	cum	1	1.060	22.000	0.300	6.996
						Total	**215.774**
28	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	167.842		0.150	50.353
	A2 side	cum	2	169.497		0.150	50.849
	Bank protection A1 side	cum	1	1.250	17.000	0.150	3.188
	Bank protection A2 side	cum	1	1.060	22.000	0.150	3.498
						Total	**107.888**
29	**Floor Protection(A-1 & A-2 side) with stone blanket**						
	A1 side	cum	2	14.504	1.050		**30.458**
	A2 side	cum	2	14.551	1.050		**30.557**
						Total	**61.015**
30	**PCC(M10) Toe Wall**						
	A1 side	cum	2	31.008	0.600		37.210
	A2 side	cum	2	31.101	0.600		37.321
						Total	**74.531**

QUANTITY ESTIMATE

AT CH_21.104 KM

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_21.104 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
A. FOUNDATION							
1	**Excavation (up to 3m)**						
	Foundation A1	cum	1	17.300	7.600	2.091	274.925
	Foundation A2	cum	1	17.300	7.600	2.091	274.925
						Total	**549.850**
2	**Foundation Slab RCC-M30**						
	Abutment-1 & 2 (Rectangular Part)	cum	2	16.300	6.600	0.600	129.096
	Abutment-1 & 2 (Trapezoidal Part)	cum	2	16.300	3.900	0.600	76.284
						Total	**205.380**
3	**Levelling Course M15**						
	Foundation Slab	cum	2	16.600	6.900	0.150	34.362
						Total	**34.362**
4	**Steel Reinforcement (HYSD) for Foundation Slab**						
	130 kg/cum	ton			26.699		26.699
						Total	**26.699**
B. SUBSTRUCTURE							
5	**RCC M30 for Substructure upto 5 m**						
	Abutment	cum	2	1.200	16.000	5.000	192.000
	Fin Wall	cum	4	4.500	0.400	2.500	18.000
						Total=	**210.000**
6	**RCC M30 for Substructure 5 - 10**						
	Abutment	cum	2	1.200	16.000	1.800	69.120
	Abutment Cap	cum	2	1.200	16.000	0.800	30.720
	Dirt wall	cum	2	0.360	16.000	0.669	7.707
	Bracket	cum	2	0.050		16.000	1.600
						Total=	**109.147**
7	**Steel reinforcement (HYSD Bars) for substructure**						
	150 kg/cum	ton			47.872		47.872
						Total	**47.872**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_21.104 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
8	**Weep holes**						
	Spacing for weep holes = 2 m in horizontal and 1 m in vertical direction						
	No of weep holes in horizontal direction per abutment =16/2+1 =					9	
	No of weep holes in vertical direction per abutment =6.8/1 +1=					8	
	No of weep holes in vertical direction per Fin wall =5/2+1 =					4	
	No of weep holes in horizontal direction per fin wall =4.5/2+1 =					3	
	Total no of Weep holes per abutment = 9 x 8					72	
	Total no of Weep holes per fin wall = 4 x 3					12	
	Total length of weep holes in metre = 72 x 2 x 1.2 + 12 x 4 x 0.4						**192.00**
9	**Backfilling(Granular Material)**						
	Foundation	cum	2	23.900		0.750	35.850
						Total	**35.850**
10	**Backfilling(Sandy Material)**						
	Behind Abutment & Fin wall	cum	2	3.500	16.000	7.750	868.000
	Deduct for filter media	cum					172.200
						Total	**695.800**
11	**Filter media**						
	Behind Abutment	cum	2	16.000	0.600	7.750	148.800
	Behind Fin Wall	cum	4	3.900	0.600	2.500	23.400
						Total=	**172.200**

C. SUPERSTRUCTURE

12	**RCC-M30(Up to 5M)**						
	Slab bridge	cum	1	8.400	9.556		80.270
	Kerb	cum	2	16.120	0.500	0.225	3.627
						Total=	**83.897**
13	**Superstructure Steel (HYSD Bars)**						
	200 kg/cum	Ton		16.779			16.779
						Total=	**16.779**
14	**Bituminus concrete wearing course**						
		cum	1	16.120	11.000	0.040	7.093
						Total=	**7.093**
15	**Wearing Course (Mastic Asphalt)**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
16	**Tack Coat**						
		sqm	1	16.120	11.000		177.320
						Total=	**177.320**
17	**Wearing Course on footpath (Cement Concrete)**						
		cum	2	16.120	1.500	0.075	3.627
						Total=	**3.627**
18	**RCC Railing**	m	2	16.120			32.240
						Total	**32.240**

QUANTITY ESTIMATE OF SLAB BRIDGE

Chainage_21.104 Km **1 span of 8 m Slab**

Item	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
19	**Crash Barrier (RCC M40)**	m	2	16.120			32.240
						Total	**32.240**
20	**Drainage Spout**	nos.	4			**Total**	**4**
21	**PCC below Approach Slab**						
		cum	2	15.160	3.370	0.150	15.327
						Total	**15.327**
22	**Approach Slab**						
		cum	2	15.160	3.500	0.369	39.158
						Total	**39.158**
23	**Strip Seal Expansion Joint**						
		m	2	16.000			32.000
						Total	**32.000**
24	**Filler Joint**						
	(i) copper plate	m	2	16.000			**32.000**
	(ii) fibar board	m	2	16.000			**32.000**
	(iii) 20mm thick premoulded joint	m	2	16.000			**32.000**
	(iv) joint sealing compound	m	2	16.000			**32.000**

D. MISCELLANEOUS

25	**Painting**						
	Kerb below railing.	sqm	2	16.120	0.950		30.63
	Railing(Post)	sqm	20	1.05		1.10	23.10
	Railing(Beam)	sqm	6	0.69		16.12	66.74
	Crash Barrier	sqm	2	2.076		16.12	66.93
						Total	**187.400**

E.PROTECTION WORK

26	**Boulder Pitching**						
	A1 side	cum	2	324.301		0.300	194.581
	A2 side	cum	2	324.301		0.300	194.581
	Bank protection (A1 side)	cum	1	70.000		0.300	21.000
	Bank protection (A2 side)	cum	1	3.700		0.300	1.110
						Total	**411.272**
27	**Filter Blanket 150mm thick below pitching**						
	A1 side	cum	2	324.301		0.150	97.290
	A2 side	cum	2	324.301		0.150	97.290
	Bank protection (A1 side)	cum	1	70.000		0.150	10.500
	Bank protection (A2 side)	cum	1	4.000		0.150	0.600
						Total	**205.680**
28	**Floor Protection(A-1 & A-2 side) with stone blanket**						
	A1 side	cum	2	18.325	1.050		**38.483**
	A2 side	cum	2	18.325	1.050		**38.483**
						Total	**76.966**
29	**PCC(M10) Toe Wall**						
	A1 side	cum	2	38.650	0.600		46.380
	A2 side	cum	2	38.650	0.600		46.380
						Total	**92.760**