

Consultancy Services for Carrying out Feasibility Study, Preparation of Detailed Project Report and providing pre-construction services in respect of 2 laning with paved shoulder of *Imphal-Jiribam section of NH-37 (NH-53) (length- 220 Km)* in the State of Manipur (PKG NO. NHIDCL/DPR/CT-IJ-TP/Manipur/2017)

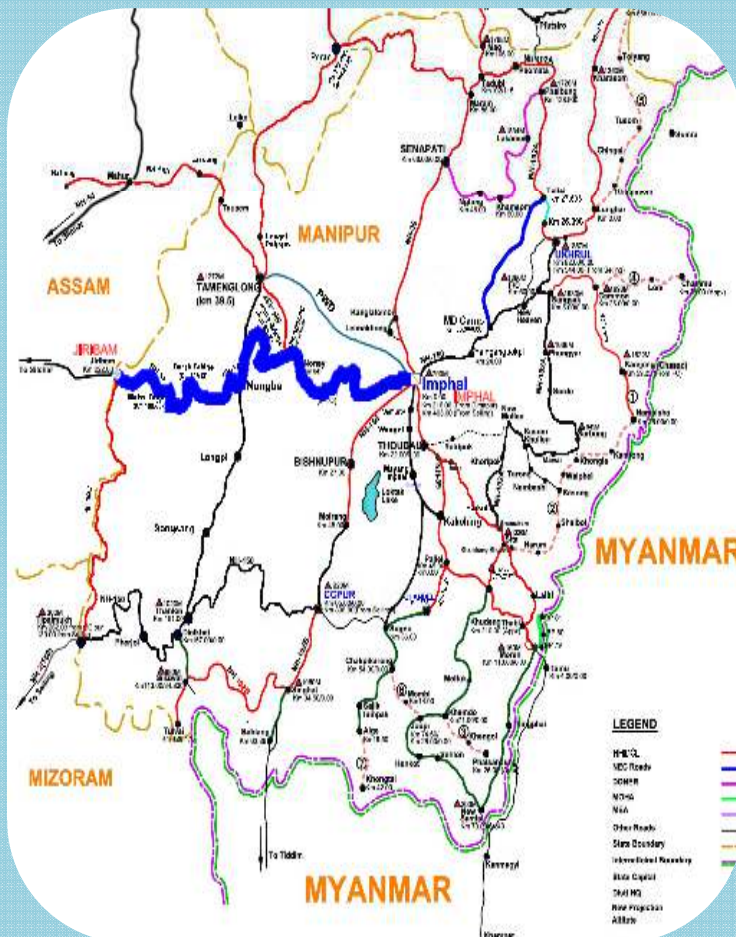
PACKAGE – I
DESIGN CH:
3+275 KM TO
15+940 KM

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.

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CET/4047/NHIDCL/NH-37/DDPR

Rev: R3

JAN, 2021

Road name- IMPHAL-JIRIBAM ROAD SECTION OF NH-53 (OLD NH-37)
PKG-I
(FROM DESIGN CH KM 3+275 TO KM 15+940)
GENERAL ABSTRACT OF COST

Length of Road (KM)

:

12.665

DESCRIPTION OF WORKS		TOTAL COST (IN Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	% of Cost of Civil Works (% of C)
A.	ROAD WORKS			
1	Site Clearance and Dismantling	1.45	0.11	1.35%
2	Earth work ,Subgrade and Erosion control	2.33	0.18	2.17%
3	Sub-Base & Base	23.07	1.82	21.53%
4	Bituminous Courses	26.83	2.12	25.04%
5	Junction Improvement	0.91	0.07	0.85%
6	Traffic signs, Road marking & other road appurtenances	5.63	0.44	5.26%
7	Passenger Shelter	0.12	0.01	0.11%
8	Busbay	4.63	0.37	4.32%
	Drainage and Protective Works			
9	Longitudinal Drains	14.02	1.11	13.09%
10	Toe Wall	0.26	0.02	0.24%
B.	BRIDGES & CULVERTS			
11	Culvert	22.41	1.77	20.92%
12	Repair & Rehabilitation of Bridges	2.35	0.19	2.19%
C.	COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)	104.01	8.21	
D.	Escalation @ 3% WPI	3.12		
E.	Total Civil Cost including Escalation@3%	107.13	8.46	
F.	Maintenance for 5 years, i.e 2.5% on civil cost (E)	2.68		
G.	GST @ 12% of (E)	12.86		
H.	Contingencies @ 2.8% over Civil Cost (E)	3.00		
I.	Supervision Charges @ 3% of (E)	3.21		
J.	Agency Charges @3% of (E)	3.21		
K	Escalation Cost @ 2.5% during Construction Period(For 1.5 Yrs of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)	2.68		
L.	TOTAL CONSTRUCTION COST (C+D+E+F+G+H+I)=J	134.77	10.64	
M.	DEPARTMENTAL COST			
a.	LA Cost	0.00		
b.	Encroachment Demolition Cost	2.14		
c.	Utility Shifting(Electrical+PHE)	1.61		
d.	Environmental Budget	3.00		
N	Sub Total (L)	6.75		
O	TOTAL PROJECT COST (N+M)=O	141.52	11.17	



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VOLUME - V

TECHNICAL SPECIFICATION



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Technical Specification

1.1 General

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

1.1.1. Inclusive Documents

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

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

1.1.2. Defective Works

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

1.2 Site Information

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

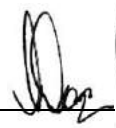
1.2.1 Location

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

Package -IA (Km 0+000 to Km 13+747) 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	500, 501, 502, 503, 505, 507, 509,

Sr. No.	Section No.	Section Title	Clause No.
		(Bituminous)	and 516
6.	800	Traffic signs, Markings and other Road Appurtenances	801, 802, 803, 804, 805, 807 and 811
7.	900	Quality Control for Road works	901 and 903
8.	1000	Materials for Structures	1007, 1008, 1010, 1012, 1014 and 1015
9.	1500	Form Work	1501,1502,1503,1504,1506, 1507 1508,1509, 1510 and 1513
10.	1600	Steel Reinforcement (Untensioned)	1602,1604,1605, and 1606
11.	1700	Structural Concrete	1705, 1707, 1711, 1716 and 1718
12.	2100	Open Foundations	2106
13.	2200	Substructures	2204 and 2210
14.	2500	River Training Work and Protection Work	2504, 2507 and 2509
15.	2600	Expansion Joints	2602, 2607, 2608, 2609, 2013, 2014, and 2615
16.	2700	Wearing Coat and Appurtenances	2702, 2703, 2704, 2705, 2706, 2708 and 2709

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

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

PART II

SUPPLEMENTARY TECHNICAL SPECIFICATION

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

SECTION 100 GENERAL

CLAUSE 102 DEFINITIONS

The following abbreviations shall be added in this Clause:

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

CLAUSE 105 SCOPE OF WORK

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

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

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



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

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

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

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

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

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

CLAUSE 106 CONSTRUCTION EQUIPMENT

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

- Adequate standby equipment including spare parts shall be available.
- All measuring devices and gauges shall be in good working condition. Measuring devices that can affect product quality shall be calibrated prior to use and at prescribed intervals against certified equipment. Calibration procedures shall be established, maintained and documented and corrective actions taken when results are unsatisfactory. Accuracy and fitness of measuring devices shall be ensured by proper maintenance.

CLAUSE 107 CONTRACT DRAWINGS

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

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

CLAUSE 108 SITE INFORMATION

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

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

Clause 109 SETTING OUT

Sub-Clause 109.9 *Delete the 2nd and 3rd sentences in Clause 109.8 and substitute the following:*

"Setting out of the road alignment and measurement of angles shall be done by using Total Station. Levels shall be taken by Automatic levels with precision micrometer staff having least count of 1mm."

Clause 110 PUBLIC UTILITIES

Replace whole of this Clause 110 with the following:

Clause 110 ENCUMBRANCES IN CONSTRUCTION AREA, INCLUDING TREES AND UTILITIES

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

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

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

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

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

Sub-Clause 110.6 Payment

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

Clause 111 PRECAUTIONS FOR SAFEGUARDING THE ENVIRONMENT

Sub-Clause 111.1 General

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

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

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

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

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

Sub-Clause 111.2 Borrow Pits for Embankment Construction

Delete the text of Clause 111.2 and substitute the following:

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

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

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

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

Sub-Clause 111.3 Quarry Operations

Delete the text of Clause 111.3 and substitute the following:

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

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

Delete the 1st sentence of Clause 111.5 and substitute the following:

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

Sub-Clause 111.8.2 Air Quality

Add the following text after the end of 1st Para

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

Add the following text after the end of last Para

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

Air quality parameters will include SPM, RPM, SO₂, NO_x, HC and CO. operational areas include work sites, haulage roads, hot mix plants, quarries, crushing plants, stockpiles, borrow sites and spoil disposal sites.

Sub-Clause 111.8.3 Water Sources and Water Quality

Add the following text after the end of 1st Para

Bore wells installed and used for the project shall be left in good operating condition for the use local communities. The Contractor shall prevent any interference with the supply to or abstraction from, and prevent any pollution of water resources (including underground percolating water) as a result of the execution of the Works.

Add the following text after the end of last Para

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

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

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

Sub-Clause 111.10 Control and Disposal of Wastes

Add the following text after the end of last Para

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

Degraded materials shall be disposed of in a manner as approved by the Engineer and wastewater shall be disposed into septic tanks and soak pits etc. The Contractor shall make arrangements to cleanup spoil as soon as the work finishes in a stretch. If such sites are located outside the ROW, restoration of the site to a level acceptable

to the land owner(s) will be carried out within a time period agreed between landowner(s) and the Contractor. Separators shall be used to separate POL materials from wastewater prior to discharging to the watercourses or as approved by the Engineer in conformance with directives and guidelines.

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

After Clause 111.13 Add the following new Clauses 111.14 to 111.17

Sub-Clause 111.14 Haulage Roads

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

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

Sub-Clause 111.15 Equipment and Vehicles used for the Works

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

Sub-Clause 111.16 Noise Control

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

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

requirements. The Contractor shall use all necessary measures and shall maintain all plant and silencing equipment in good conditions so as to minimize the noise emission during construction works.

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

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

Sub-Clause 111.17 Vibration Control

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

CLAUSE 112 ARRANGEMENT FOR TRAFFIC DURING CONSTRUCTION

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

This clause shall read as under:

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

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

Sub-Clause 112.3 Passage of Traffic along a Temporary Diversion

Add the following at the end of this Clause.

Where the new highway crosses or joins with an existing state highway, or an established road or cart track, the highway, road or cart track shall be kept open at

all times. In case the Engineer specifically orders to construct and maintain diversion as described below, the same will be paid for.

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

Drainage should be provided as directed by the Engineer.

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

Sub-Clause 112.4 Traffic Safety and Control

Add the following Para in the end of Clause 112.4

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

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

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

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

Sub-Clause 112.6 Measurements for payment and rate

Replace this clause by following:

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

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

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

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

CLAUSE 114 SCOPE OF RATES FOR DIFFERENT ITEMS OF WORK

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

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

Engineer's planning system.

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

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

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

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

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

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

Sub-Clause 114.4 Add the following as Clause 114.4

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

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

CLAUSE 120 FIELD LABORATORY

Sub-Clause 120.1 Scope

Add the following at the end of the clause.

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

Sub-Clause 120.2 Description

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

Add the following at the end of this Clause:

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

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

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

Sub-Clause 120.3 This clause stands deleted.

Sub-Clause 120.4 This clause stands deleted.

Table 100-2 Laboratory Equipment

S. No.	Sub No.	Item, Specifications	Nos. required
A: General			
i)		Balance	
	(a)	5 kg to 20 kg capacity semi -self-indicating Electronic Type –Accuracy 1 gm.	1
	(b)	500 gm. capacity semi self indicating Electronic Type – Accuracy 0.01 gm.	1
	(c)	Chemical balance 100gm capacity - Accuracy 0.0001gm	1
	(d)	Pan balance 5 kg capacity - Accuracy 0.5 gm.	1
	(e)	Platform Scale – 300 kg capacity	1
ii)		Ovens – Electrically operated, thermostatically controlled	
	(a)	From 0°C to 220°C – Sensitivity	1



S. No.	Sub No.	Item, Specifications	Nos. required
iii)		Sieves, as per IS 460-1962	
	(a)	IS Sieves 450 mm internal dia. of sieve sets as per BIS of required sieve sizes complete with lid and pan	1 set
	(b)	IS sieve 200 mm internal dia. (brass frame and steel or brass wire cloth mesh) consisting of sieve sets of required sieve sizes complete with lid and pan	2 set
iv)		Sieve shaker capable of taking 200 mm and 450 mm dia. Sieves electrically operated with time switch assembly (As per BIS)	1
v)		200 tones compression testing machine	1
vi)		Stop watches 1/5 sec. Accuracy	2
vii)		Glassware comprising of Beakers, Pipettes, dishes, measuring cylinders (100 to 1000 cc capacity) glass rods and funnels, glass thermometers range 0oC to 100oC and metallic thermometers range 300oC	2 Nos. each
viii)		Hot plates 200 mm dia (1500 watt.)	6
ix)		Enamel trays	
	(a)	600 mm x 450 mm x 50 mm	2
	(b)	450 mm x 300 mm x 40 mm	2
	(c)	300 mm x 250 mm x 40 mm	2
	(d)	Circular plates of 250 mm dia.	2
x)		Water Testing Kit	1

Sub-Clause 121.3.2 for Soils and Aggregates

B: For Soils and Aggregates			
i)		Water still, 3 liter/hr. with fittings and accessories	-
ii)		Liquid limit device with Casagrande and ASTM grooving tools as per IS: 2720	1
iii)		Sampling pipettes fitted with pressure and suction inlets, 10 ml Capacity	1 set
iv)		Compaction apparatus (Proctor) as per IS: 2720 (Part 8) complete with collar, base plate and hammer	1 set
v)		Modified AASHTO compaction apparatus as per IS. 2720 (Part 7) 1980 or Heavy Compaction Apparatus as per IS complete with collar, base plate and hammer	1 set

B: For Soils and Aggregates			
vi)		Sand pouring cylinder with conical funnel and tap and complete as per IS 2720 (Part 28) 1980 including modified equipment	2
vii)		Sampling tins with lids 100 mm dia x 75 mm ht ½ kg capacity and miscellaneous items like moisture, tins with lid (50 grams) etc.	4
viii)		Lab CBR testing equipment for conducting CBR testing, load frame with 5 Ton capacity, electrically operated with speed control as per IS: 2720 (Part 16), and consisting of following:	1 set
	(a)	CBR moulds 150-mm dia – 175-mm ht complete with collar, base plate etc.	6
	(b)	Tripod stands for holding dial gauge holder	4
	(c)	CBR plunger with settlement dial gauge holder	1
	(d)	Surcharge weight 147-mm dia 2.5 kg weight with central hole	6
	(e)	Spacer disc 148-mm dia, 47.7-mm ht. With handle	2
	(f)	Perforated plate (Brass)	2
	(g)	Soaking tank for accommodating 24 CBR moulds	2
	(h)	Proving rings of 1000 kg, 2500 kg and 5000 kg capacity	1 each
	(i)	Dial gauges, 25 mm travel- 0.01 mm/division	2
ix)		Standard Penetration test equipment	1
x)		Nuclear Moisture Density Meter or equivalent	1
xi)		Speedy moisture meter complete with chemicals	1
xii)		Unconfined compression test apparatus	1 set
xiii)		Aggregate Impact Test Apparatus as per IS 2386 (Part 4) 1963	1
xiv)		Los Angeles abrasion Test Apparatus as per IS 2386 (Part 4) 1963	1
xv)		Riffle Box of Slot size of 50mm as per ASTM C-136	1
xvi)		Dynamic Cone Penetrometer	1
xvii)		Hydrometer with high speed stirrer and jars	2 sets
xviii)		Post-hole augur (to BS-812)	3

Sub-Clause 121.3.3 For Bitumen and Bitumen Mixes

C: For Bitumen and Bituminous Mixes			
i)		Constant temperature bath for accommodating bitumen test specimen, electrically operated and thermostatically controlled, 50 liter capacity temp. range ambient 80° C	1
ii)		Penetrometer automatic type, adjustable weight arrangement and needles as per IS. 1203 – 1978	1
iii)		Solvent extraction or centrifuge type apparatus complete (AASHTO, T-164) with extraction thimbles with stocks of solvent and filter paper	1
iv)		Laboratory mixer including required accessories about .02 cum capacity electrically operated fitted with heating jacket	1
v)		Marshall compaction apparatus automatically operated as per ASTM 1559-62 T and complete with electrically operated loading unit, compaction pedestal heating head assembly, dial micrometer and bracket for flow measurement, load transfer bar, specimen mould 100 mm dia. (4 in) with base plate, collars, specimen extractor, compaction hammer 4.53 kg (10 lb.) x457 mm (18 in) fall	1 set
vi)		Distant Reading Digital Thermometer for Measuring Temperatures in Asphaltic Mixes	As required
vii)		Riffle Box	1
viii)		Automatic Asphalt Content Gauge [Nuclear or equivalent]	1
ix)		Thin film Oven test apparatus to the requirement of AASHTO T 179, including accessories	1
x)		Ring Ball Apparatus as per IS 1205- 1978	1
xi)		Asphalt Institute Vacuum Viscometer as per IS 1206(part II) – 1978	1
xii)		BS U- Tube Modified Reverse Floro Viscometer IS 1206(Part III) – 1978	1
xiii)		Apparatus for Determination of Ductility Test as per IS 1208 – 1978	1
xiv)		Pen Sky – Martars closed Tester for testing flash and fire point as per IS 1209 – 1978.	1
xv)		Apparatus for Float Test – IS – 1210 – 1978	1
xvi)		Apparatus for Determination of water content (Dean and Stark Method) IS – 1211 – 1978	1

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

Sub-Clause 121.3.4 for Cement, Cement Concrete and Materials

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



D: For Cement, Cement Concrete and Materials			
	(b)	Compaction factor test equipment	1
xiii)		Equipment for determination of specific gravity for fine and coarse aggregate as per IS 2386 (Part 3) 1963	2
xiv)		Core cutting machine with 150 mm dia. Diamond cutting edge	1
xv)		Needle vibrator	1
xvi)		Vibrating hammer as per BS specification	1
xvii)		Air entrainment meter ASTM C - 231	1
xviii)		0.5 Cft, 1 Cft cylinder for checking bulk density of aggregate with tamping rod	1
ix)		Soundness testing apparatus for cement	1
xx)		Compression testing machine with the provision of flexural attachment and accessories for testing flexural beam	1
xxi)		Chemicals solutions and consumable	As reqd.
xxii)		Chloride Testing kit for chemical analysis of chloride content.	1
xxiii)		ION Exchange kit for rapid determination of sulphate content.	1
xxiv)		Electronic PH meter	1

Sub-Clause 121.3.5 For Control of Profile and Surface Evenness

E: For Control of Profile and Surface Evenness			
i)		Total Station with all accessories	1 No.
ii)		Precision Automatic Level	1 set.
iii)		Distomat or equivalent	1 set.
iv)		Theodolite – Electronically operated with computerised output attachment	1 set.
v)		Precision Staff of 1mm least count	2 Sets.
vi)		3 metre straight edge and measuring wedge	1 set.
vii)		Camber templates 2 lane	
	(a)	Crown type cross-section	1 set.



E: For Control of Profile and Surface Evenness			
	(b)	Straight run cross-section	2 sets.
viii)		Steel tape	
	(a)	5 m long	2 Nos.
	(b)	10 m long	2 Nos.
	(c)	20 m long	2 Nos.
	(d)	30 m long	2 Nos.
	(e)	50 m long	2 Nos.
ix)		Roughometer (Bump Integrator)	1 Set.

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

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

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

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

Sub-Clause 120.5 Rate

"This Clause shall be read as under:"

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

SECTION 200 SITE CLEARANCE

CLAUSE 201 CLEARING AND GRUBBING

Sub-Clause 201.1 Scope

Replace with following Para:

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

Sub-Clause 201.5 Measurements for Payment

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

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

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

CLAUSE 202 DISMANTLING CULVERTS, BRIDGES AND OTHER STRUCTURES/ PAVEMENTS

Sub-Clause 202.5 Disposal of Materials

The first paragraph of the sub clause shall read as below

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

Contractor may use dismantled / milled road crushed material on as is where is basis,

by suitably modifying the material, or by crushing the material, or by breaking the material, and screening the same, after effecting due rebate in the BOQ, provided it meets the specifications and is approved by the Engineer.

Sub-Clause 202.6 Measurements for Payment

This Clause shall read as:

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

- | | | |
|------|--|-----------------|
| i) | Dismantling brick / stone masonry / plain concrete / reinforced concrete including reinforcement. |cum |
| ii) | Dismantling pavement structures such as Sub base / Base Course, Bituminous wearing course, Concrete wearing course |cum |
| iii) | Dismantling pipes, guard rails, road kerbs, gutters and fencing | ..running metre |
| iv) | Dismantling Guard Stones/KM stones/Sign post/Hectometre Stones |Nos |
| v) | Dismantling RCC railing | ..running metre |
| vi) | Dismantling of railing kerb | ..running metre |
| vii) | Dismantling of Stone pitching/ boulder apron/ brick soling/ stone soling |cum |

Sub-Clause 202.7 Rates

Add at the end of this sub clause:

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

SECTION 300 EARTHWORK, EROSION CONTROL AND DRAINAGE

CLAUSE 301 EXCAVATION FOR ROADWAY AND DRAINS

Sub-Clause 301.1 Scope

Add the following as second paragraph under this clause:

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

Sub-Clause 301.2.1 Classification

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

“(a) Soil

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

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

Delete Para b (iv)

Sub-Clause 301.3.3 Excavation – General

The following paragraph is added to the sub-clause 301.3.3

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

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

The title of this Clause shall read as under:

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

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

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

Clause 301.3.11 Use & Disposal of excavated materials

Delete this sub-clause and replace with:

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

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

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

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

Sub-Clause 301.6 Preparation of Cut Formation

Second Para shall be read as under:

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

Sub-Clause 301.8 Measurements for Payment

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

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

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

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

Sub-Clause 301.9 Rates

Sub-Clause 301.9.1

Add extra item after item (vii)

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

Sub-Clause 301.9.2 This Clause shall read as under:

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

Sub-Clause 301.9.3

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

Sub-Clause 301.9.6

Add new Sub Clause after 301.9.5 as under;

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

CLAUSE 304 EXCAVATIONS FOR STRUCTURES

Sub-Clause 304.3.2 Excavation

At the end of 1st paragraph of Clause 304.3.2 insert the following additional sentences:

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

CLAUSE 305 EMBANKMENT CONSTRUCTION

Sub-Clause 305.2 Material and General Requirements

Sub-Clause Physical Requirements:

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

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

Sub-Clause

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

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

Sub-Clause

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

Sub-Clause

305.2.2.4 Compaction Requirements

Delete Table 300-2 and substitute the following:

Table 300-2

Compaction Requirements of Embankment and Subgrade

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

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

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

- i) The values of maximum dry density and optimum moisture content obtained in

accordance with, IS: 2720 (Part 8) for each fill material proposed to be used in the construction of embankment and subgrade.

- ii) The graphs of Density plotted against moisture content from which each of the values in (i) above of maximum dry density and optimum moisture content were determined.
- iii) The dry density-moisture content-CBR relationships, heavy compactive efforts conforming to the IS 2720 (part 8) for each of the fill material proposed to be used in the sub grade.

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

Sub-Clause Add the following new sub-clause:

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

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

Sub-Clause 305.3 Construction Operations

Sub-Clause 305.3.1 Setting Out

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

Sub-Clause Compacting Ground Supporting Embankment/Subgrade

305.3.4 Para 1 of this clause shall be read as

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

Add at the end of Para 2

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

"Where necessary to facilitate compaction of the subgrade to 97% relative compaction as stated above, a further depth below the subgrade of maximum

thickness of 0.2m shall be loosened, watered and compacted in accordance with Sub Clause 305.3.5 and 305.3.6 to not less than 95% of dry density determined in accordance with IS: 2720(Part-8)".

Sub-Clause

305.3.6 Compaction

The second Para of this Clause shall read as under:

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

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

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

Sub-Clause 305.9 Rates

Sub-Clause 305.9.1

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

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

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

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

Clause 306 SOIL EROSION AND SEDIMENTATION CONTROL

Sub-Clause 306.4 Measurements for Payment

Substitute Clause 306.4 as follows:

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

Sub-Clause 306.5 Rates

This clause shall be deleted.

Clause 309 Surface/Sub-Surface Drains

Sub-Clause 309.2 Surface Drains

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

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

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

Sub-Clause 309.3 Sub-Surface Drains

Sub-Clause 309.3.1 Scope

The first sentence of this clause should read as:

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

Sub-Clause 309.3.2 Materials

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

Sub-Clause 309.3.2.1 Pipe

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

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

Sub-Clause 309.3.4 Laying of Pipe and Backfilling

Delete Para 4 of this clause.

Sub-Clause 309.4 Measurements for Payment

This Clause shall read as:

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

- | | | |
|--|-------|-----------------------|
| a) Unlined ditch drain | | as per Clause 301 Cum |
| b) Semi-Circular median drain as shown in the drawing with PCC M20, NP2 pipe, levelling concrete M15 and filter media. | | running metre |
| c) Open cross-drain in paved median as per drawing with PCC grade M-20 & levelling concrete M-15. | | running metre |
| d) Paved open/Covered drain | | |

(i) Levelling concrete M-15		cum
(ii) Course rubble masonry		cum
(iii) Stone pitching grouting with CM 1:3		cum
(iv) PCC/ RCC grade M-20		cum
(v) Steel Reinforcement		MT
(vi) Precast perforated slab		Nos.
(vii) Catchpits/ inspection chambers		Nos.
(viii) RCC pipes		running metre
e) Sub-surface drains		running metre
f) Iron grating		Nos.

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

General

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

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

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

Clause 401 GRANULAR SUB BASE

Sub-Clause 401.2 Materials

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

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

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

Sub-Clause 401.2.2

Add at the end of this clause as under:

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

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

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

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

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

Clause 406 WET MIX MACADAM SUB BASE/BASE

Clause 406.2.1.1 Physical requirement

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

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

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

Add the following at the end of the paragraph:

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

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

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

Sub-Clause 406.3.4 Spreading of Mix

Substitute 1st sentence of Para 2 of clause 406.3.4.

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

Sub-Clause 406.3.5 Compaction

Delete second sentence of Para 1 of Clause 406.3.5.

Clause 409 CEMENT CONCRETE KERB AND KERB WITH CHANNEL

Sub-Clause 409.5 Construction Operations

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

Sub-Clause 409.6 Substitute

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

Clause 409.7 This Clause shall read as under:

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

SECTION 500 BASE AND SURFACE COURSES (BITUMINOUS)

General

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

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

Sub-Clause 501.2 Materials

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

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

Sub-Clause 501.6 Compaction

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

Add new Para,

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

Sub-Clause

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

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

bitumen.

CLAUSE 502 PRIME COAT OVER GRANULAR BASE

Sub-Clause

Add the Sub-Clause 502.2.5 Choice of Primer after 502.2.4

This clause shall be read as under:

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

CLAUSE 503 TACK COAT

Sub-Clause

503.2 Materials

This clause shall be read as under:

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

CLAUSE 505 DENSE GRADED BITUMINOUS MACADAM

Sub-Clause 505.2.1 Bitumen

This Clause shall be read as under:

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

Sub-Clause 505.2.2 Coarse Aggregates

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

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

Add the following at the end of this clause:

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

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

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

Sub-Clause 505.2.5 Aggregate Grading and Binder Content

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

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

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

Grading	1	2
Layer Thickness	>75mm to 100mm	50-75mm

Sub Clause 505.3 Mix Design

Sub-Clause 505.3.1 Requirement for the Mixture

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

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

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

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

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

Sub-Clause 505.4.9 Rolling

Add at the end of Para 1

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

Add the following Sub-clause after Sub-clause 505.4.9

Clause 507 BITUMINOUS CONCRETE

Sub-Clause 507.1 Scope

Add the Following at the end of this clause:

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

Sub-Clause 507.2.1 Bitumen

This Clause shall be read as under:

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

Sub-Clause 507.2.2 Coarse Aggregates

Add the following as second para:

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

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

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

Sub-Clause 507.2.4 Filler

This clause shall read as under:

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

Sub-Clause 507.3 Mixture Design

Sub-Clause 507.3.1 Requirement for the mixture

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

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

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

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

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

Sub-Clause 507.9 Rate

Delete the existing Para and replace it with the following:

The contract unit rate shall be for all operations as specified in clause 505.9, except that the rate shall include the provision of modified bitumen at 5.40 percent by weight of total mixture. The variance in actual percentage of modified bitumen used will be assessed and payment adjusted up or down, accordingly. The modified

binder, the cost of modifier and its mixing with the bitumen for the preparation of modified bitumen shall not be paid separately and is inclusive of all costs

CLAUSE 516 MASTIC ASPHALT

Sub-Clause 516.2.2 Coarse Aggregate

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

SECTION 800 TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES

CLAUSE 801 TRAFFIC SIGNS

Sub-Clause 801.2.5 Substrate

2nd sentence of this clause shall read as under:

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

Sub- Clause 801.3 Traffic Signs Having Retro-reflective Sheeting

Sub-Clause 801.3.1 General Requirements

The fifth sentence of this clause should read as under:

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

Sub-clause Add following in the clause

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

Sub-Clause Warranty and Durability

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

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

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

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

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

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

CLAUSE 802 OVERHEAD SIGNS

Sub-Clause 802.4 Materials for Overhead Sign and Support Structures

Sub-Clause 802.4.2

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

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

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

Sub-Clause 802.8.1 this clause shall read as under:

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

CLAUSE 803 ROAD MARKINGS

Sub-Clause 803.2 Materials

This clause shall read as under:

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

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

Sub-Clause 803.3 Ordinary Road Marking Paint

This Clause shall be deleted.

Sub-Clause 803.5 Reflectorised Paint

This Clause shall be deleted.

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

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

ii) Faulty Workmanship or Materials

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

CLAUSE 805 DISTANCE INDICATOR POSTS

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

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

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

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

Sub-Clause 804.4 Measurement of Payment

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

Sub-Clause 804.5 Rate

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

CLAUSE 806 ROAD DELINATORS

Sub-Clause 806.2 This clause shall read as follows:

- a) Triangular Object Marker shall be 300mm side with four red reflector, made out of 2mm thick aluminum sheet, face to be fully covered by high intensity grade white retro reflective sheeting of encapsulated lens type as per clause 801. The background/ border/ symbols shall be made by screen-printing of desired colour as per sign details. The sign plate shall be fixed with 6mm dia. aluminium rivets on MS angle iron frame. The angle iron frame shall be made with angle of size 40mmx40mmx5mm. The sign shall be fixed with nut-bolts & welding on MS pipe 50mm dia (NB-MW) and 500mm high or as shown in the drawings.
- b) Rectangular hazard marker 600mm x 300mm made out of 2mm thick aluminum sheet, face to be fully covered by high intensity grade white retro reflective sheeting of encapsulated lens type. The background/ border/ symbols shall be

made by screen-printing of desired colour as per sign details. The sign plate shall be fixed with 6mm dia aluminium rivets on MS angle iron frame. The angle iron frame shall be made with angle of size 40mmx40mmx5mm. The sign shall be fixed to 80mm dia (NB-MW) MS pipe or as shown in the drawings.

- c) Roadway Indicators shall be 1000mm high made with 100 mm dia. NB medium weight MS pipe. One reflector of high intensity grade retro reflective sheeting with encapsulated lens shall be provided on top of the reflector. The white & red reflector shall be provided alternatively of 40mm width, so that total width of reflector shall be 120mm. A wire mesh cover of 150mm height shall be provided on top or as shown in the drawings.
- d) All components of signs & supports shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy paint. The sign backside shall be with grey colour and post shall be white colour/ alternate white & black bands. The post below ground shall be painted with three coats of red lead.

CLAUSE 807 BOUNDARY STONES

Sub-Clause 807.1 Scope

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

CLAUSE 811.2 CONCRETE CRASH BARRIER

Sub-Clause 811.2.1.2 The Clause will be read as below

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

Sub-Clause 809.6 Rate:

Add at the end of the clause:

"And paid as per respective BOQ items."

CLAUSE 811.3 METAL BEAM CRASH BARRIER

Sub-Clause 811.3.1 Materials

Sub-Clause 811.3.1.1 this clause shall be read as:

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

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

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



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

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

Sub-Clause Add at the end of this Clause

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

Sub-Clause 811.3.3 Installation of Posts

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

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

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

Sub-Clause 811.3.7 Measurements for Payment

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

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

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

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

Sub-Clause 811.3.8 Rate

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

SECTION 900 QUALITY CONTROL FOR ROAD WORKS

Clause 901 GENERAL

Sub-Clause 901.1 This clause shall read as under:

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

Sub-Clause 901.5 This Clause shall read as under:

"The Contractor shall provide necessary cooperation and assistance in obtaining the samples for tests and carrying out the field tests as required by the 'Engineer' from

time to time. This shall include provision of laboratory, equipment, transport, consumables, personnel, including labour, attendants, assistance in packing and dispatching and any other assistance considered necessary in connection with the tests."

Clause 903 QUALITY CONTROL TESTS DURING CONSTRUCTION

Sub-Clause 903.4 Tests on Bituminous Constructions

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

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

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

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

Note:

Add the following note at the end

- The laboratory and field tests shall be performed on materials and works at the frequency values indicated against each. The Supervision Personnel shall ensure that there are no deviations in this regard.
- The Contractor shall prepare a detailed manual for Quality Assurance including

the methodology for the respective tests, the data formats and the methodology for the analysis and interpretation of test results based on the reference Standards and Practices indicated in the Technical Specifications and obtain the approval of the Engineer.

Add the following Sub-Clause 903.4.4 & 903.4.5

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

The characteristics to be tested on completed bituminous layers are:

Relative compaction

Layer thickness

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

a) Random Sampling

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

b) Lot Size

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

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

Sub-Clause 903.4.5 Add new clause

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

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

- a) Thickness (compacted) measured by extracting cores and shall be dealt in accordance with Specifications Section 900.
- b) Density (compaction) test as performed on the extracted cores
- c) Workmanship test by measuring roughness of the finished layer by duly

calibrated Towed Fifth Wheel Bump Integrator

d) Workmanship Test: Roughness measured longitudinally

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

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

Sub-Clause 903.5 Quality Control Tests for Road Constructions

Sub-Clause 903.5.2 Pavement Concrete

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

Replace first para ("At leastfor compliance.") with:

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

Sub-Clause 903.5.2.2 Replace 1st para with following:

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

- The average compressive strength of the six cores when corrected to 28 days strength using the factors given in Table 900-5 or an age-strength relationship for the actual mix determined by the Contractor and approved by the Engineer

– is at least the average compressive strength of the cores tested from the trial length, refer Clause 602.10.5.5;

- None of the cores show considerable honeycombing”.

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

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

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

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

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

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

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

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

Sub-Clause

903.5.2.2 In-situ density

Add as Para 5 of this clause:

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

Sub-Clause

903.5.2.5 Summary of Control Tests.

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

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

Sub-Clause

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

“As per Clause 903.5.2.1”.

Sub-Clause 903.5.2.6 Add the following new Clause:

Temperature Measurements

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

shall be installed, at commencement, in the middle of production and at completion of placing concrete. Measurements shall be recorded for 3 days after placing of the concrete."

SECTION 1000 MATERIALS FOR STRUCTURES

CLAUSE 1007 COARSE AGGREGATES

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

Add the following at the end of Para 2.

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

Add the following at the end of the Clause:

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

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

CLAUSE 1008 SAND/FINE AGGREGATES

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

Add the following at the end of the clause:

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

Clause 1010 WATER

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

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

Clause 1012 CONCRETE ADMIXTURES

Sub-Clause 1012.1 General

Add the following at the end

Admixtures shall not impair the durability of concrete; they shall not combine with the ingredients to form harmful compounds or endanger the protection of

reinforcement against corrosion. Only chloride free admixtures shall be used.

2. Storing

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

3. Dosage

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

Clause 1012.3.1 Information Required From the Manufacturer

Paragraph 1 shall read as follows:

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

Add the following at the end of the para h

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

Add the following at the end of the clause:

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

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

Workmanship

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

Manufacturer's experts should be available for consultation/trouble-shooting of problems associated with their product. The conditions of storage, shelf life etc., as

specified by the manufacturer should be strictly observed. The manufacturer's Quality Assurance Plan during process of production should be obtained and filed for reference/record.

Clause 1014 STORAGE OF MATERIALS

Sub-Clause 1014.3 Aggregates

The following shall be added to this Clause:

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

CLAUSE 1015 TESTS AND STANDARDS OF ACCEPTANCE

Add the following as Para 3:

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

CLAUSE 1104 MATERIALS

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

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

SECTION 1500 FORMWORK

CLAUSE 1501 DESCRIPTION

The Clause shall read as below.

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

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

CLAUSE 1502 MATERIALS

This Clause shall read as under:

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

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

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

Clause 1503 DESIGN OF FORMWORK

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

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

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

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

CLAUSE 1504 WORKMANSHIP

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

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

CLAUSE 1506 PRECAUTIONS

Add the following as items of this clause:

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

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

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

CLAUSE 1507 PREPARATION OF FORMWORK BEFORE CONCRETING

Add at the end of last para :



"Concreting shall not commence without approval of the Engineer"

CLAUSE 1508 REMOVAL OF FORMWORK

Add the following as para 7 Clause. 1508.

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

Clause 1509RE-USE OF FORMWORK

This Clause shall read as under:

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

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

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

CLAUSE 1510 SPECIALISED FORMWORK

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

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

Slip forming is not permitted.

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

Clause 1513 RATE

Add the following at the end of the first para:

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

SECTION 1600 STEEL REINFORCEMENT (UN-TENSIONED)

CLAUSE 1602 GENERAL

Paragraph 2 of Clause 1602 shall read as follows:

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

CLAUSE 1604 BENDING OF REINFORCEMENT

Para 1 shall be read as follows:

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

CLAUSE 1605 PLACING OF REINFORCEMENT

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

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

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

Tolerances:

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

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

CLAUSE 1606 BAR SPLICES

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

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

Add the following as paragraph 2 of Clause 1606.1:

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

Sub-Clause 1606.2 Welding

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

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

SECTION 1700 STRUCTURAL CONCRETE

CLAUSE 1703 GRADES OF CONCRETE

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

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

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

A) Minimum cement content and maximum water cement ratio

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

B) Minimum strength of concrete

Member	Major Bridges	Minor Bridges
PCC Members	M30	M20

RCC Members	M35	M25
PSC Members	M40	-

TABLE 1700-3 For culverts and other incidental structures:

A) Minimum cement content and maximum water cement ratio

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

B) Minimum strength of concrete

Member	Grade
PCC Members	M20
RCC Members	M25

Notes:

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

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

Clause 1704 PROPORTIONING OF CONCRETE

Add the following at the end of this Clause:

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

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

Sub-Clause 1704.4 Additional Requirements

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



Clause 1705 ADMIXTURES

This Clause shall read as under:

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

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

Clause 1706 SIZE OF COARSE AGGREGATE

Table 1700-7 shall be modified as given below :

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

Clause 1707 EQUIPMENT

Para 1 of this Clause shall read as under:

"Unless specified otherwise, equipment for production, transportation and

compaction of concrete shall be as under:

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

Paragraph 3 of this clause shall read as follows:

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

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

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

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

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

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

CLAUSE 1711 CONCRETING IN EXTREME WEATHER

Sub-Clause 1711.2 Hot Weather Conditions

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

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

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

Clause 1712 PROTECTION AND CURING

Sub-Clause 1712.2 Water Curing

Add the following at the end of Para 1:

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

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

CLAUSE 1716 TOLERANCES

Add the following at the end of Clause:

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

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

CLAUSE 1718 MEASUREMENT FOR PAYMENT

The clause may be read as under :

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

SECTION 1800 PRE-STRESSING

CLAUSE 1801 GENERAL

Add the following as the last paragraph of this clause:

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

CLAUSE 1802 MATERIALS

Sub-Clause 1802.2 Sheathing

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

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

Add the following at the end of Para 6:

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

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

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

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

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

floatation of empty cable duct during concreting.

Add the following as additional Sub-clause

Sub-Clause 1802.2.4 Corrugated HDPE sheathing ducts

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

Specific Density : 0.954 g/cm³ at 23 °C

Yield Stress : 18.0 N/mm²

Tensile Strength : 21.0 N/mm²

Shore Hardness D-3 sec. Value : 60

-15 sec. Value : 58

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

- 40 °C : 4 KJ/m²

Coefficient of Thermal Expansion for

20 °C - 80 °C : 1.50 x 10⁻⁴ KJ/m²

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

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

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

Screwed together with male and female threads.

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

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

Sub-Clause 1802.3 Anchorages

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

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

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

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

CLAUSE 1803 TESTING OF PRESTRESSING STEEL AND ANCHORAGE

Add following Paragraphs to the section.

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

The frequency of such tests should be as follows:

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

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

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

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

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

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

The measured anchorage efficiency should be:

(Refer CEB/FIP Guidelines for details).

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

b) Dynamic load test with tendon/ anchorage assembly

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

Requirements:

Each test result should meet the following requirements

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

Clause 1804 WORKMAN SHIP

Sub-Clause 1804.3.1 Post-tensioning

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

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

Sub-Clause 1804.5 Insert following Para after Para 1

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

CLAUSE 1806 TENSIONING EQUIPMENT

Add the following at the end of Para 2:

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

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

Add the following at the end:



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

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

CLAUSE 1807 POST TENSIONING

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

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

Add the following at the end of this Clause:

"The Contractor shall submit fabrication drawings, detailing prestressing cables, anchorages, couplers, chairs and supports, templates or forms holding anchorage assemblies etc. for Engineer's approval at least one month before commencement of work in superstructure. Stressing schedules shall be prepared by the Contractor and submitted to Engineer for approval."

CLAUSE 1808 GROUTING OF PRE-STRESSED TENDONS

Add new Para at the end of Clause as under:

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

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

CLAUSE 1815 RATE

Add at end of Para 4:

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

CLAUSE 1816 JOINTS IN CONSTRUCTION WITH PRE-CAST-UNIT

Add new clause:

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

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

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

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

SECTION 2000 BEARINGS

CLAUSE 2001 DESCRIPTION

Add the following as paragraph 2 of this clause:

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

CLAUSE 2004 SPECIAL BEARINGS

The clause shall read as follows:

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

Clause 2005 ELASTOMERIC BEARINGS

Sub-Clause 2005.4 Acceptance Specifications

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

Sub-Clause 2005.3.5 Inspection Certificate

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

Sub-Clause 2005.4.6 Quality Control Certificate

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

CLAUSE 2006 POT BEARINGS

The clause shall read follows:

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

Sub-Clause 2006.1 General

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

ADD new Clause 2009 as under and the existing Clauses 2009 and 2010 are renumbered as 2010 and 2011 respectively :

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

Clause 2010 MEASUREMENTS FOR PAYMENT

Add the following after Para 2:

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

SECTION 2100 OPEN FOUNDATIONS

CLAUSE 2106 TOLERANCES

Reference to Tolerance shall be made to Clause 1716.

SECTION 2200 SUB-STRUCTURE

CLAUSE 2204 PIERS AND ABUTMENTS

Sub-Clause 2204.2 replaced as follows:

"Slip forming will not be allowed."

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

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

operations as per Clause 304.5.1.”

Sub-Clause 2210 Rate

This Clause shall read as follows:

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

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

SECTION 2300 CONCRETE SUPER-STRUCTURE

Clause 2305 PRESTRESSED CONCRETE CONSTRUCTION

Sub-Clause 2305.2 Box Girder

Add the following at the end of paragraph 1:

“Contractor shall, in his methods statement, indicate the location of construction joints for Engineer’s approval.”

Add new sub clause 2305.5 as under:

Sub-Clause 2305.5 PSC Solid Slab

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

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

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

Sub-Clause 2504.2.2 Filter Media

Add after 1st Para:

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

Clause 2507 CURTAIN WALL AND FLEXIBLE APRON

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

Sub-Clause 2507.1 Curtain Wall

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

grade. The rigid flooring shall be continued over the top width of the curtain wall.

Sub-Clause 2507.2 Flexible Apron

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

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

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

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

SECTION 2600 EXPANSION JOINTS

Clause 2602 GENERAL

Add the following at the end of the clause.

“The expansion joints shall be procured only from those manufacturers/ suppliers of expansion joints who are empanelled with MOSRT&H. The MOSRT&H (formerly, Ministry of Surface Transport) had issued modified interim specifications for expansion joints vide letter dated 31/03/97 and revised vide letter No. RW/NH-34059/1/96 - S&R dated 30th Nov, 2000 and corrigendum of same circular dated 15th Jan., 2001 which shall be adopted. These specifications are reproduced below.”

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

Sl. No.	Type of Expansion	Suitability for Adoption Joint	Expected Service Life	Special Consideration
1.	Buried Joint	Simply supported spans upto 10 metres	10 Years	Only for deck with bituminous/ asphaltic wearing coat. Steel plate may need replacement, if found corroded or distorted at the time of relaying/ renewal of wearing coat.
2.	Filler Joint	Fixed end of simply supported spans with insignificant movement or simply supported spans not exceeding 10 metres.	10 Years	The sealant and joint filler would need replacement if found damaged.

3.	Asphaltic Plug Joint	Simply supported spans for right or skew (upto 20 degree), moderately curved or wide deck with maximum horizontal movement not exceeding 25 mm. Ambient temperature should be in the range of 5 degree to 50 degree Celsius.	10 Years	Only for decks with bituminous/ asphaltic wearing coat. Not suitable for bridge with longitudinal gradient more than 2 % and cross camber/ super-elevation exceeding 3%. Not suitable for curved spans and spans resting on yielding supports.
4.	Compression Seal Joint* (Chloroprene Seal & Cell Foam Seal)	Simply supported or continuous spans right or skew (upto 30 degree), moderately curved with maximum horizontal movement not exceeding 40 mm.	10 Years	Chloroprene/ Closed Foam Seal may need replacement during service.
5.	Elastomeric Slab Seal Joint*	Simply supported or continuous spans, Right or skew (less than 20 degree), moderately curved with maximum horizontal movement upto 50 mm	10 Years	Liable to excessive wear and tear under high traffic intensity. Not suitable for bridges located in heavy rainfall area and spans resting on yielding support.
6.	Single strip seal joint*	Moderate to large simply supported, cantilever/ continuous construction having right, skew or curved deck with maximum horizontal movement up to 70 mm	25 Years	Electrometric seal may need replacement during service.
7.	Modular Strip/ Box Seal Joint	Large to very large continuous/ cantilever construction with right, skew or curved deck having maximum horizontal movement in excess of 70 mm	25 Years	Electrometric seal may need replacement during service.
8.	Special Joints for	For bridges having wide decks and large	25 Years	Electrometric seal may need replacement

special conditions	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.	during service. Provision of these joints may be made with prior approval of the Ministry.
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* These are proprietary items for which 10 years warranty shall be insisted upon from the suppliers. The contractor shall submit all relevant information as per clause 115.1

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

Sub-Clause 2608.3

Installation

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

necessary.

Sub-Clause 2608.4 Handling and Storage

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

Clause 2608.5 Tests and Standard of Acceptance

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

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

The clause 2609 be replaced fully as below:

Clause 2609 COMPRESSION SEAL JOINT

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

Clause 2609.2 Material

(a) Steel nosing

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

(b) Anchorage

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

The minimum thickness of anchor plate shall be 12 mm. Total cross sectional area of bars, studs or bolts on each side of the joint shall not be less than 1600 mm sq. per metre length of the joint and the center

to center spacing shall not exceed 250 mm. The ultimate resistance of anchorages shall not be less than 600 KN/m in any direction.

(c) Corrosion Protection

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

(d) Joint Seal

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

Chloroprene Seal

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

Closed Cell Foam Seal

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

Table – 1

	Property	Specified Value
i)	Density	41.7 – 51.3 Kg/ cum
ii)	Compression Set on 25 mm	50 percent compression samples (ASTM D3575) for 22 hours at 23 degree Celcius, 2 hour recovery; 13 percent set.
iii)	Working temperature	-70 to +70 deg C.

- | | | |
|-----|--|-------------------|
| iv) | Water absorption (total immersion for 3 months) (ASTM D3575) | 0.09766 Kg/ sqm |
| v) | Tensile strength | 0.8 Mpa |
| vi) | Elongation at break (ASTM D3575) | 195 +/-20 percent |

(e) Lubricant cum Adhesive

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

Sub-Clause 2609.3 Handling and Storage

- (a) The expansion joint material shall be handled with care and stored under cover. All joint material and assemblies shall be protected from damage and assemblies shall be supported to maintain true shape and alignment during transportation and storage.

Sub-Clause 2609.4 Installation

- (a) The expansion joint shall be installed by the manufacturer/ supplier or their authorized representative, who will ensure compliance of installation procedure and instructions.
- (b) The dimension of the joint recess and the width of the gap shall conform to the approved drawings.
- (c) Anchoring steel shall be welded to the main reinforcement in the deck maintaining the level and alignment of the joint.
- (d) Concreting of pocket/ recess shall be done with great care using proper mix conforming to same grade as that of the deck concrete but not less than M30 grade in any case. The water cement ratio shall not be more than 0.40. If needed, suitable admixtures may be used to achieve the workability. The width of pocket shall not be less than 300 mm on either side of the joint. Care shall also be taken to ensure efficient bonding between already cast/ existing deck concrete and the concrete in the joint recess.
- (e) At the time of installation, joint shall be clean and dry and free from spalls and irregularities, which might impair a proper joint seal.
- (f) Concrete or metal surfaces shall be clean, free of rust, laitance, oils, dirt, dust or other deleterious materials.
- (g) The lubricant cum Adhesive shall be applied to both faces of the joint and joint seal prior to installation in accordance with the manufacturer's instructions. The joint seal shall be compressed to the specified thickness

for the rated joint opening and ambient temperature at the time of installation, which shall be between +5 to 35°C.

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

Sub-Clause 2609.5 Acceptance Criteria

- (a) All steel elements shall be furnished with corrosion protection system.
- (b) For the joint seal the acceptance test shall conform to the requirements stipulated in Para above. The manufacturer/ supplier of this type of joint shall produce a test certificate to this effect conducted in a recognized laboratory in India or aboard.
- (c) Prior to acceptance 25 percent of the completed and installed joints, subject to a minimum of one joint, shall be subjected to water tightness test. Water shall be continuously ponded along the entire length for a minimum period of 4 hours for a depth of 25 mm above the highest point of deck. The width of ponding shall be at least 50 mm beyond the anchorage block of the joint on either side. The depth of water shall not fall below 25 mm anytime during the test. A close inspection of the underside of the joint shall not reveal any leakage.

CLAUSE 2613 TEST AND STANDARDS OF ACCEPTANCE

The clause 2613 be replaced fully as Below

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

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

CLAUSE 2614 Measurement for payment

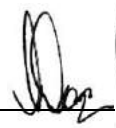
The clause 2614 be replaced fully as below

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

CLAUSE 2615 RATE

The clause 2615 be replaced fully as below

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



SECTION 2700 WEARING COAT AND APPURTENANCES

CLAUSE 2702 WEARING COAT

Sub-Clause 2702.1 Bituminous Wearing Coat

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

CLAUSE 2703 RAILINGS AND CRASH BARRIER

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

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

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

Add the following additional clauses:

Sub-Clause 2703.5 Concrete crash barrier for bridges

Sub-Clause 2703.5.1 General

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

Sub-Clause 2703.5.2 Materials

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

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

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

Sub-Clause 2703.5.3 Construction Operations

The location of crash barrier shall be strictly adhered to as shown on the drawing and as directed by the Engineer. Concrete crash barriers shall present a smooth, uniform appearance in their final position, conforming to the horizontal and vertical lines shown on the plans or as ordered by the Engineer and shall be free of lumps, sags or other irregularities. The top and exposed faces of the barriers shall conform

to the specified tolerances, as defined in Clause 809.4, when tested with 3 m straight edge, laid on the surface.

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

Sub-Clause 2703.5.4 Tolerance

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

Sub-Clause 2703.5.5 Measurements for Payment

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

Sub-Clause 2703.5.6 Rate

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

Sub-Clause 2703.6 Polysulphide Rubber Joint Sealant

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

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

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

Tensile strength	-	0.4 MPa $\pm$ 10%
Modulus of elasticity	-	At 100% elongation: 0.15 MPa



Elongation	-	Elongation at break 550%	
Hardness	-	Shore 'A' hardness @ 25°C	22 ± 3
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 cementitious (PMC) mortar / debonding slurry are as under:

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

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

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

Mixing proportion: Anti-corrosive polymer modified mortar

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

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

- a) Coarse Silica and
- b) Fine Silica

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

Quartz sand.

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

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

Curing

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

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

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

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

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

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

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

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

Mixing PMC

Methods of Mortar mixing

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

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

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

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

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

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

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

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

Mechanical Strength of Mortar

Anti-corrosive polymer modified mortar shall have the following:

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

For anti –corrosion polymer modified bonding slurry

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

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

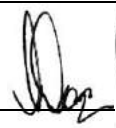
Mixing proportions of Bonding Slurry are as follows:

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

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

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

Mechanical Strength of Bonding Slurry




Bond Strength –

- WET - 3-4 N/MM²
- DRY - 7-8 N/MM²

Above bonding slurry should conform to following properties.

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

CLAUSE 2821 REPAIR TO VOID IN ARCHES WITH PMC MORTAR

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

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

CLAUSE 2822 SEALING OF CRACKS IN CONCRETE IN PIER / ABUTMENT CAPS, SLABS, GIRDERS, PEDESTAL WALLS ETC. WITH EPOXY RESIN INJECTION.

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

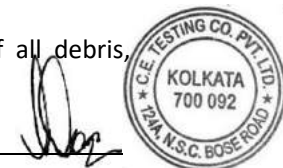
The work shall be executed in accordance with Specifications Section 2800 clauses 2803 & 2804.

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

CLAUSE 2823 INSPECTION & CLEANING OF BRIDGE BEARINGS AND GREASING OF STEEL ROCKER-ROLLER / PLATE BEARINGS AND REMOVAL OF ALL DEBRIS AROUND BEARINGS.

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

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



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

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

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

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

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

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

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

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



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

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

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

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

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

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

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

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

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

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

CLAUSE 2828 EARTH FILLING BELOW APPROACH SLAB

Cavities underneath the slab shall be filled.

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

watering.

CLAUSE 2829 CASTING OF APPROACH SLAB

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

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

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

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

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

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

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

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

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

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

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

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

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

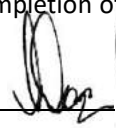
m)	Drainage spouts	Nos
n)	Repairs to concrete with PMC mortar with average thickness of 50 mm of mortar applied.	sqm
o)	Sealing of cracks in masonry by cement grouting (in terms of weight of cement consumption)	kg
p)	Building up of existing course rubble masonry / concrete wing walls	cum
q)	Repair of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

Existing clause 2813 of specifications shall be renumbered as 2832.

CLAUSE 2834 RATE

Add the following at the end of the Clause.

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




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

SECTION 3000 MAINTENANCE OF WORK

Clause 3002 RESTORATION OF RAIN CUTS

Clause 3002.1 Scope

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

Clause 3002.2 Materials

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

Clause 3002.3 Construction Operation

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

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

Clause 3002.4 Measurement of Payment

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

Clause 3003 MAINTENANCE OF EARTHEN SHOULDER

Clause 3003.1 Scope

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



Clause 3003.2 Material

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

Clause 3003.4 Measurement of Payment

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

Clause 3004.2 Filling Pot-holes and Patch Repairs

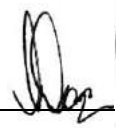
Clause 3004.2.1 Scope

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

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

Clause 3004.2.5 Measurement of Pavement

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



ADDITIONAL TECHNICAL SPECIFICATION

Appendix A-1 :: SPECIFICATION FOR PASSENGER SHELTER

1. Scope

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

2. Description

2.1 Passenger Shelter

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

3.0 Measurement for Payment

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

4.0 Rate

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

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

1. Painting with Synthetic Enamel Paint

Materials

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

Painting on New Surface

Preparation of surface.:

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

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

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

Lettering and Numbering on New Surface:

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

Measurement for payment:

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

Rate:

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

2. Water Proof Cement Painting

Material:

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

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

Preparation of Surface:

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

Preparation of mix:

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

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

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

Application :

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

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

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

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

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

Precaution:

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

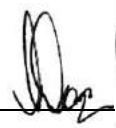
If water proof cement paint is required to be applied on existing surfaces previously treated with white wash, colour wash, etc., the surface shall be thoroughly cleaned by scrapping off all the white wash, colour was etc., completely. Thereafter, a coat of cement primer shall be applied followed by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

Measurement for Payment:

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

Rate:

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



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

1. Scope

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

2. Materials

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

3.0 Measurement for Payment

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

4.0 Rate

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

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

VOLUME - VI

RATE ANALYSIS



SCHEDULE OF RATE



Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Item Rate Analysis has been done considering

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Item Rate Analysis has been done considering

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Schedule Of Rate

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

Item Rate Analysis has been done considering

Schedule Of Rate

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

Item Rate Analysis has been done considering

Schedule Of Rate

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

Item Rate Analysis has been done considering

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



LEAD CHART



Leads for Various Materials

Sl. No.	Name of Material	Name of Source	Distance from Source to Mid Point of Project Road (Km)	Approach Road (Km)	Total Lead (Km)
1	Sand (Fine)	Noney	54.33	2	56.33
2	Filling Material	Local	-	-	10.00
3	Stone Metal	Noney	54.33	2	56.33
4	Stone Boulder	Barak	135.33	2	137.33
5	Stone Chips, Aggregate	Barak	135.33	2	137.33
6	Coarse Sand	Noney	54.33	2	56.33
7	Cement	Imphal	9.61	-	9.61
8	Steel	Imphal	9.61	-	9.61
9	Bitumen	Imphal	9.61	-	9.61
10	Bitumen Emulsion	Imphal	9.61	-	9.61
11	Structural Steel	Imphal	9.61	-	9.61
12	RCC Pipe	Imphal	9.61	-	9.61



CARRIAGE COST



Carriage Cost of Material (Including loading & unloading)

Rubbish

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

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

Stone aggregate below 40mm nominal size

Name of Quarries Noney
Lead Upto Site (Km)= 56.33

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost of Carriage (In Rs)
2	56.33	Upto 1	per m ³		156.35	
		Upto 2	per m ³		182.05	
		Upto 3	per m ³		207.29	
		Upto 4	per m ³		231.51	
		Upto 5	per m ³	5	254.79	254.79
		for Every km beyond 5 km up to 10 km	per m ³	5	25.33	126.65
		for Every km beyond10 km up to 20 km	per m ³	10	20.42	204.20
		for Every km beyond 20 km	per m ³	36.33	16.51	599.85
					Total	1185.49

Sand

Name of Quarries Noney
Lead Upto Site (Km)= 56.33

Sl.No.	Lead in km	Kilometer	Unit	Carriage (Km)	Rate (Rs)	Cost or Carriage (In Rs)
3	56.33	Upto 1	per m ³		156.35	
		Upto 2	per m ³		182.05	
		Upto 3	per m ³		207.29	
		Upto 4	per m ³		231.51	
		Upto 5	per m ³	5	254.79	254.79
		for Every km beyond 5 km up to 10 km	per m ³	5	25.33	126.65
		for Every km beyond10 km up to 20 km	per m ³	10	20.42	204.20
		for Every km beyond 20 km	per m ³	36.33	16.51	599.85
					Total	1185.49

Boulder

Name of Quarries Barak
Lead Upto Site (Km)= 137.33



Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
4	137.33	Upto 1	per m ³		173.23	
		Upto 2	per m ³		201.95	
		Upto 3	per m ³		229.94	
		Upto 4	per m ³		256.81	
		Upto 5	per m ³	5	282.63	282.63
		for Every km beyond 5 km up to 10 km	per m ³	5.00	28.10	140.50
		for Every km beyond10 km up to 20 km	per m ³	10.00	22.65	226.50
		for Every km beyond 20 km	per m ³	117.33	18.31	2148.36
					Total	2797.99

Cement, Steel

Name of Quarries

Imphal

Lead Upto Site (Km)=

9.61

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
5	9.61	Upto 1	per Tone		112.15	
		Upto 2	per Tone		130.59	
		Upto 3	per Tone		148.70	
		Upto 4	per Tone		166.07	
		Upto 5	per Tone	5	182.77	182.77
		for Every km beyond 5 km up to 10 km	per Tone	5	18.17	90.85
		for Every km beyond10 km up to 20 km	per Tone	10	14.65	146.50
		for Every km beyond 20 km	per Tone	-10.39	11.84	-123.05
					Total	297.07

Bitumen

Name of Quarries

Imphal

Lead Upto Site (Km)=

9.61

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
6	9.61	Upto 1	per Tone		112.15	
		Upto 2	per Tone		130.59	
		Upto 3	per Tone		148.70	
		Upto 4	per Tone		166.07	
		Upto 5	per Tone	5	182.77	182.77
		for Every km beyond 5 km up to 10 km	per Tone	5	18.17	90.85
		for Every km beyond10 km up to 20 km	per Tone	10	14.65	146.50
		for Every km beyond 20 km	per Tone	-10.39	11.84	-123.05
					Total	297.07

PIPE

300 mm Dia RCC Pipe from Imphal

Lead Upto Site (Km)=

9.61

Sl.No.	Lead in km	Kilometer	Unit	Carriage	Rate (Rs)	Cost of Carriage (In Rs)
7	10	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 beyond 10 km up to 20 km	Rm	10	1.50	15.00
		for Every km beyond 20 km	Rm	-10	1.21	-12.57
						30.46



FINISHED RATE



FINISHER RATE**Road Works**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
1	02.01/i	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth from 300 mm to 600 mm	Each	388.42					0.00	392.3
2	02.01/ii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 600 mm to 900 mm	Each	716.32					0.00	723.4
3	02.01/iii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 900 mm to 1800 mm	Each	1,360.04					0.00	1,373.6
4	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm	Each	2,550.68					0.00	2,576.1

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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



FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
5	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm	Each	4,287.80					0.00	4,330.6
6	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)	Ha	59,319.65					0.00	59,912.8
7	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above	cum	1,739.01					0.00	1,756.4
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	489.32					0.00	494.2
9	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	264.99					0.00	267.6

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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



FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
10	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	358.77					0.00	362.3
11	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	614.08					0.00	620.2
12	02.04/viii/f /ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attatched with scarifier	sqm	57.08					0.00	57.6
13	03.13	Construction of Embankment with Material Deposited from Roadway Cutting Construction of embankment with approved materials deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2	cum	160.20					0.00	161.8

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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



FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
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	248.7
15	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					0.00	315.4
16	03.31	Excavation in Hill Area in Soil by Mechanical Means Excavation in soil in hilly area by mechanical means including cutting and trimming of side slopes and disposing of excavated earth with all lifts and lead upto 1000 metres	cum	211.39					0.00	213.5
17	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					1,841.06	4,886.4
					Course Sand	0.380	cum	1,449.65		

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone	0.250	cum	1,449.65		
					Chips/Aggregate					
					Stone Metal Cat1	0.640	cum	1,449.65		
18	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401	Cum	2,063.00					0.00	2,083.6
19	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					1,913.54	4,927.6
					Course Sand	0.396	cum	1,449.65		
					Stone Metal Cat1	0.924	cum	1,449.65		
20	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					343.85	1,735.5
					Cement	0.012	Ton	297.07		
					Sand	0.064	cum	1,217.15		

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone	0.112	cum	1,449.65		
					Chips/Aggregate					
					Stone Metal Cat1	0.069	cum	1,449.65		
21	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	Bitumen Emulsion	0.001	Ton	297.07	0.21	58.3
22	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	15.63	Bitumen Emulsion	0.000	Ton	297.07	0.06	15.8
23	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	17.16	Bitumen Emulsion	0.000	Ton	297.07	0.07	17.4

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
24	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					2,134.36	13,532.3
					Aggregate	1.440	cum	1,449.65		
					Bitumen 30/40	0.104	Ton	297.07		
					Filler	0.040	Ton	399.23		
25	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					2,161.29	14,677.6
					Aggregate	1.456	cum	1,449.65		

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Bitumen 30/40	0.130	Ton	297.07		
					Filler	0.030	Ton	399.23		
26	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	622.79					136.67	767.0
					Cement	0.016	Ton	297.07		
					Course Sand	0.030	cum	1,449.65		
					Stone Chips/Aggregate	0.061	cum	1,449.65		
27	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					759.22	5,369.2
					Cement	0.108	Ton	297.07		
					Sand	0.176	cum	1,217.15		
					Steel	0.004	Ton	297.07		
					Stone Chips/Aggregate	0.353	cum	1,449.65		
28	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					520.64	3,228.8
					Cement	0.074	Ton	297.07		
					Sand	0.121	cum	1,217.15		
					Steel	0.002	Ton	297.07		
					Stone Chips/Aggregate	0.242	cum	1,449.65		

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
29	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	843.03	Sand	0.566	cum	1,217.15	2,379.77	3,255.0
					Steel	0.080	Ton	297.07		
					Stone Chips/Aggregate	1.150	cum	1,449.65		
30	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	93.41					0.00	94.3
31	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	85.9
32	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle	each	4,931.35	Cement	0.033	Ton	297.07	829.27	5,818.2
					Sand	0.540	cum	1,217.15		

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Steel	0.019	Ton	297.07		
					Stone Chips/Aggregate	0.108	cum	1,449.65		
33	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					829.27	6,600.8
					Cement	0.033	Ton	297.07		
					Sand	0.540	cum	1,217.15		
					Steel	0.019	Ton	297.07		
					Stone Chips	0.108	cum	1,449.65		
34	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	1,002.14					0.00	1,012.1

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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



FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
35	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming to IRC-79 and the drawings.) 120x120 -Road Delineator	each	1,063.19					0.00	1,073.8
36	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	383.64					0.00	387.4
37	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp	nos	21,165.02					0.00	21,376.6

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
38	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	297.07	311.92	185,813.6
39	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	701.9
40	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.	sqm	1,224.98					0.00	1,237.2

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
41	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork. At Protection	cum	7,496.35	Aggregate	0.850	cum	1,449.65	1,877.95	9,468.0
					Cement	0.330	Ton	297.07		
					Sand	0.450	cum	1,217.15		
42	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure	Ton	72,983.59	Steel	1.050	Ton	297.07	311.92	74,028.4
43	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	72,983.59	Steel	1.050	Ton	297.07	311.92	74,028.4
44	10.16	Cement Plaster 12mm Thick in Cement Mortar 1:3	sqm	223.49					0.00	225.7
45	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					1,739.58	2,943.0

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

FINISHER RATE

Road Works

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	1.200	cum	1,449.65		
46	10.20/c	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting c) Filler Media behind abutment, wing and return wall	cum	1,157.28	Stone Chips/Aggregate	1.200	cum	1,449.65	1,739.58	2,925.8
47	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork.	cum	7,496.35	Aggregate	0.850	cum	1,449.65	1,877.95	9,468.0
					Cement	0.330	Ton	297.07		
					Sand	0.450	cum	1,217.15		
48	24/i/b	Galvanised Mild steel J /L hook	kg	120.00					0.00	121.2
49	40	Geotextile material (fine net)	sqm	25.50					0.00	25.7

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
1	13.01/a/i/N sc	Earth work in excavation Ordinary soil For Protection Work	cum	218.93					0.00	221.1
2	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	218.93					0.00	221.1
3	14.01	Brick masonry work in cement mortar 1:3 in foundation complete excluding pointing and plastering, as per drawing and technical specifications	cum	11,849.87					0.00	11,968.3
4	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					1,877.95	10,328.4
					Aggregate	0.850	cum	1,449.65		
					Cement	0.330	Ton	297.07		
					Sand	0.450	cum	1,217.15		

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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



FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
5	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	9,333.75	Aggregate	0.900	cum	1,449.65	1,965.29	11,412.0
					Cement	0.380	Ton	297.07		
					Sand	0.450	cum	1,217.15		
6	14.03/e/II	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	9,077.25	Aggregate	0.900	cum	1,449.65	1,974.20	11,161.9
					Cement	0.410	Ton	297.07		
					Sand	0.450	cum	1,217.15		
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	77,427.65	Steel	1.050	Ton	297.07	311.92	78,516.9
8	14/nsc2	Brick Flat Soling at Foundation	Sqm	1,077.89	Brick	1.000	Sqm	40.00	40.00	1,129.0
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	11,961.59					0.00	12,081.2

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
10	15.03/b/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade Upto 5m	cum	9,067.33	Cement	0.344	Ton	297.07	1,954.59	11,132.1
					Sand	0.450	cum	1,217.15		
					Stone Chips/Aggregate	0.900	cum	1,449.65		
11	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	9,938.25	Cement	0.403	Ton	297.07	1,972.12	12,029.4
					Sand	0.450	cum	1,217.15		
					Stone Chips/Aggregate	0.900	cum	1,449.65		
12	15.05	HYSR bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	77,427.65	Steel	1.050	Ton	297.07	311.92	78,516.9
13	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	445.75	Cement	0.001	Ton	297.07	2.46	452.6

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Sand	0.002	cum	1,217.15		
14	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complete as per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	10,446.36					2,078.75	12,650.3
					Cement	0.400	Ton	297.07		
					Course Sand	0.452	cum	1,449.65		
					Stone Chips/Aggregate	0.900	cum	1,449.65		
15	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	85,183.86					311.92	86,350.7
					Steel	1.050	Ton	297.07		
16	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	2,711.68					174.31	2,914.8
					Cement	0.035	Ton	297.07		
					Sand	0.039	cum	1,217.15		
					Steel	0.018	Ton	297.07		
					Stone Chips/Aggregate	0.077	cum	1,449.65		
17	16.09	Mild steel railing complete as per drawing and Technical Specifications	Rm	4,559.31					12.74	4,617.7

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Steel	0.043	Ton	297.07		
18	16.11	Drainage Spouts complete as per drawing and Technical specification	each	2,158.99					1.19	2,181.7
					Structural Steel	0.004	Ton	297.07		
19	16.17	Mastic asphalt (providing and laying 12mm thick mastic asphalt wearing courses on top of deck slab excluding prime coat with paving grade bitumen meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10sqm and at an approximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	532.56					22.40	560.5
					Bitumen	0.003	Ton	297.07		
					Lime	0.005	Ton	399.23		
					Stone Chips/Aggregate	0.014	cum	1,449.65		
20	16/nsc	For Protection Work - cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade upto 5m height	cum	9,067.33					1,954.59	11,132.1

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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



FINISHER RATE

Minor Bridge

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Cement	0.344	Ton	297.07		
					Sand	0.450	cum	1,217.15		
					Stone Chips/Aggregate	0.900	cum	1,449.65		
21	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	2,426.95					1,739.58	4,208.2
					Aggregate	1.200	cum	1,449.65		
22	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	1,655.65					3,709.14	5,418.4
					Stone Bolder	1.200	cum	3,090.95		
23	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					3,709.14	5,400.6
					Stone Bolder	1.200	cum	3,090.95		
24	18.01	Removal of existing cement concrete wearing coat manually or jack hammer including its disposal complete as per drawing and technical specification without causing any detrimental effect to any part of bridge structure	sqm	328.23					0.00	331.5
25	18.04/a	Sealing of Cracks by Injection process through nipples complete as per technical specification with	cum	412,296.00					1,970.93	418,409.6
					Cement	0.399	Ton	297.07		
					Sand	0.450	cum	1,217.15		

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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



FINISHER RATE**Minor Bridge**

SI No	State SOR Ref	Item description	Unit	SOR Rate	Material	Material Qty/Unit	Material Unit	Material Carr Cost	Carriage Cost	Finished Rate
					Stone Chips/Aggregate	0.900	cum	1,449.65		

**Note: Finished Rate inclusive of 1% labour cess

Item Rate Analysis has been done considering

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

NON SCHEDULE ITEM



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



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

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



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 $12 \times 0.1 \times 0.01 = 0.012$ cum					
			Weight $0.012 \times 1400 = 16.8$ kg					
			Bitumen	cum	0.001	42361.44	42.36	Schedule M-4 (xix)
			$16.8 \times 0.06 = 1$ kg					
			c) Overhead charges @ 0.25 on (a+b)				79.43	
			d) Contractor's profit @ 0.1 on (a+b+c)				39.71	
			Cost for 12 m = (a+b+c+d)				436.84	
			Rate per m = (a+b+c+d)/12				36.40	
						say	36.40	
							36.00	
		Note	For arriving at the final rate of filler joints per m					
			length and per cm depth of joint filling compound,					
			the rates at Sl. No. i), ii), iii) & iv) shall be added					



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



Flexible Apron

Sr No	Ref. to MoRTH Spec.	Description	Unit	Quantity	Rate Rs	Cost Rs	Remarks/ Input ref.
15.11	2507.2	Flexible Apron :Construction of flexible apron 1 m thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall					
		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 concrete M30 Grade Refer relevant item of concrete in item 12.8(G) by using batching plant, excluding formwork i.e. per cum basic cost (a+b+c) (Excluding OH & CP)	cum	1.00	8235.60	8235.60	Item 12.8 (G)
		(Refer relevant item of concrete in item No. 13.8 (G) except that form work may be added at the rate of 2 per cent of cost against 3.5 per cent provided in the foundation concrete.				164.71	
		HYSD bar reinforcement Rate as per item No 14.2(Excluding OH & CP)	tonne	0.05	59458.22	2972.91	Item 14.2 A
		b) Overhead charges @ 22.5% on (a)				2558.97	
		c) Contractor's profit @ 10% on (a+b)				1393.22	
		Rate per cum (a+b+c)				15325.42	
					say	15325.00	
						15325.00	



BASES AND SURFACE COURSES (BITUMINOUS VG-40)

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

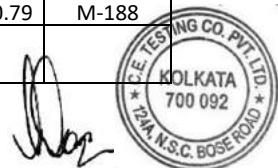


		c) Materials					
		Bitumen @ 4.25 per cent of weight of mix	tonne	19.130	42361.44	810374.35	M-074
		Aggregate					
		Total weight of mix = 450 tonnes					
		Weight of bitumen = 19.13 tonnes					
		Weight of aggregate = 450 - 19.13 = 430.87 tonnes					
		Taking density of aggregate = 1.5 ton/cum				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



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

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



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

CHAPTER-9

PIPE CULVERTS

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



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



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



VOLUME VII

COST ESTIMATE



ABSTRACT OF COST



Road name- IMPHAL-JIRIBAM ROAD SECTION OF NH-53 (OLD NH-37)
PKG-I
(FROM DESIGN CH KM 3+275 TO KM 15+940)
GENERAL ABSTRACT OF COST

Length of Road (KM)

:

12.665

DESCRIPTION OF WORKS		TOTAL COST (IN Cr.)	COST PER KM. OF TOTAL ROAD LENGTH (IN Cr.)	% of Cost of Civil Works (% of C)
A.	ROAD WORKS			
1	Site Clearance and Dismantling	1.45	0.11	1.35%
2	Earth work ,Subgrade and Erosion control	2.33	0.18	2.17%
3	Sub-Base & Base	23.07	1.82	21.53%
4	Bituminous Courses	26.83	2.12	25.04%
5	Junction Improvement	0.91	0.07	0.85%
6	Traffic signs, Road marking & other road appurtenances	5.63	0.44	5.26%
7	Passenger Shelter	0.12	0.01	0.11%
8	Busbay	4.63	0.37	4.32%
	Drainage and Protective Works			
9	Longitudinal Drains	14.02	1.11	13.09%
10	Toe Wall	0.26	0.02	0.24%
B.	BRIDGES & CULVERTS			
11	Culvert	22.41	1.77	20.92%
12	Repair & Rehabilitation of Bridges	2.35	0.19	2.19%
C.	COST OF CIVIL WORKS IN LAKHS (AS PER SOR 2018)	104.01	8.21	
D.	Escalation @ 3% WPI	3.12		
E.	Total Civil Cost including Escalation@3%	107.13	8.46	
F.	Maintenance for 5 years, i.e 2.5% on civil cost (E)	2.68		
G.	GST @ 12% of (E)	12.86		
H.	Contingencies @ 2.8% over Civil Cost (E)	3.00		
I.	Supervision Charges @ 3% of (E)	3.21		
J.	Agency Charges @3% of (E)	3.21		
K	Escalation Cost @ 2.5% during Construction Period(For 1.5 Yrs of construction period, No escalation in 1st Year and 2.5% for 0.5 Years)	2.68		
L.	TOTAL CONSTRUCTION COST (C+D+E+F+G+H+I)=J	134.77	10.64	
M.	DEPARTMENTAL COST			
a.	LA Cost	0.00		
b.	Encroachment Demolition Cost	2.14		
c.	Utility Shifting(Electrical+PHE)	1.61		
d.	Environmental Budget	3.00		
N	Sub Total (L)	6.75		
O	TOTAL PROJECT COST (N+M)=O	141.52	11.17	



BILL
(ROAD PART)



Summary of Bill of Quantity

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	02.01/i	Cutting of Girth 300-600mm	Each	16.00	392.30	6,277
2	02.01/ii	Cutting of Girth 600-900mm	Each	37.00	723.48	26,769
3	02.01/iii	Cutting of Girth 900-1800mm	Each	488.00	1,373.64	670,336
4	02.01/iv	Cutting of Girth 1800-2700mm	Each	97.00	2,576.19	249,890
5	02.01/v	Cutting of Girth 2700mm more	Each	23.00	4,330.68	99,606
6	02.03/b	Clearing & grubbing(Mechanical - Light Jungle)	Ha	19.63	59,912.85	1,176,089
7	02.04/i/c	Dismantling Structure RCC	cum	68.00	1,756.40	119,435
8	02.04/iii/b	Dismantling Structure Rubble Stone Masonry Cement	Cum	882.00	494.21	435,893
9	02.04/vii/a	Mortar Dismantle HP (300-600)	rm	30.00	267.64	8,029
10	02.04/vii/b	Dismantle HP (upto 600 - 900 mm dia)	rm	100.00	362.36	36,236
11	02.04/vii/c	Dismantle HP (above 900 mm dia)	rm	90.00	620.22	55,820
12	02.04/viii/e	Dismantle Flexible Pavement Granular	sqm	80,220.00	34.33	2,753,953
13	02.04/viii/f/ii	Dismantle Flexible Pavement Bituminous(Roller & Scarifier)	sqm	153,669.00	57.65	8,859,018
Total of Bill						14,497,351

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	03.03	Excavation Soil (Mechanical)	cum	46,506.00	165.21	7,683,256
2	03.13	Embankment fill from Roadway Cutting	cum	10,838.00	161.80	1,753,588
3	03.14	Subgrade and Earthen Shoulder Fill From Borrow Pit	cum	44,084.14	315.46	13,906,783
Total of Bill						23,343,627

Bill No : 03. Sub-Base & Base Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	04.01/Nsc1	GSB Close Graded GR V	Cum	10,762.09	4,547.60	48,941,667
2	04/nsc1	GSB Reuse	Cum	10,483.28	2,083.63	21,843,273
3	05.02	WMM	Cum	34,953.28	4,575.49	159,928,365
Total of Bill						230,713,304

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
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Summary of Bill of Quantity

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	06.01/a	Prime Coat	sqm	136,760.60	58.33	7,977,246
2	06.02/ii	Tack Coat(Granular Layer)	sqm	135,700.00	17.40	2,361,180
3	06/Nsc1	DBM GR II	cum	13,676.06	13,148.15	179,814,888
4	06/Nsc2	BC GR II	cum	5,470.42	14,289.15	78,167,709
Total of Bill						268,321,023

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	04.01/Nsc1	GSB Close Graded GR V	Cum	300.04	4,547.60	1,364,466
2	04/nsc1	GSB Reuse	Cum	175.16	2,083.63	364,967
3	05.02	WMM	Cum	594.00	4,575.49	2,717,841
4	06.01/a	Prime Coat	sqm	2,376.00	58.33	138,592
5	06.02/i	Tack Coat(Bituminous Layer)	sqm	2,376.00	15.85	37,660
6	06/Nsc1	DBM GR II	cum	237.60	13,148.15	3,124,000
7	06/Nsc2	BC GR II	cum	95.04	14,289.15	1,358,041
Total of Bill						9,105,567

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	08.02/a	5 th km Stone	each	3.00	5,269.41	15,808
2	08.02/b	Ordinary km Stone	each	9.00	3,160.41	28,444
3	08.04	Boundary Stone	each	131.00	2,930.11	383,844
4	08.06	Paint on Steel Surface	sqm	38.40	85.91	3,299
5	08.11/i	90 cm equilateral triangle	each	288.00	5,772.15	1,662,379
6	08.11/iv	80 cm x 60 cm rectangular	each	6.00	6,554.78	39,329
7	08.14	Paint on Bituminous Surface	sqm	4,222.27	1,012.16	4,273,609
8	08.15/c/v	Road Delineators(100 cm long above Road)	each	542.00	1,073.82	582,010
9	08.18/A/b	Type-A, "W" Metal Beam Crash Barrier	Rm	200.00	3,367.42	673,484
10	08.20/ii	Road Stud/Road Markers	nos	1,869.00	387.48	724,200
11	08.22	Lighting on Bridges	nos	212.00	21,376.67	4,531,854
12	08/nsc/4/a	Overhead Signs-Truss and Vertical Support	Ton	1.08	185,813.66	199,935
13	08/nsc/4/b	Overhead Signs-Aluminium Alloy Plate for Over Head Sign	sqm	38.40	701.95	26,955

Item Rate Analysis has been done considering

Summary of Bill of Quantity

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
14	08/nsc/6	Rumble Strip	sqm	1,160.00	1,237.23	1,435,187
15	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	26.24	221.12	5,803
16	14.03/a	Foundation PCC M15	cum	0.97	10,087.25	9,764
17	14.03/e/II	Foundation RCC M25	cum	5.70	10,907.45	62,216
18	14.08	Foundation Steel (HYSD)	MT	0.86	78,516.97	67,211
19	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	2.00	11,774.96	23,550
20	15.05	Sub Structure Steel (HYSD)	MT	0.30	78,516.97	23,555
21	16.09	Protection Work Steel Railing	Rm	8,984.00	4,617.77	41,486,046
Total of Bill						56,258,483

Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	08.05	Paint on Concrete Surface(2 Coat)	sqm	396.41	94.34	37,397
2	10.16	Sub Structure Plaster with 1:3 Cement Morter	sqm	396.41	225.72	89,477
3	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	59.45	221.12	13,146
4	14.01	Foundation Brick Work C.M. 1:3	cum	9.11	11,968.37	109,068
5	14.03/a	Foundation PCC M15	cum	6.04	10,087.25	60,907
6	14.03/e/II	Foundation RCC M25	cum	4.16	10,907.45	45,408
7	14.08	Foundation Steel (HYSD)	MT	0.50	78,516.97	39,258
8	14/nsc2	Brick Flat Soling	Sqm	80.63	1,129.07	91,031
9	15.01	Sub Structure Brick Work	cum	19.43	12,081.21	234,774
10	16.01/a/i	Super Structure RCC M25 - Solid Slab Super	cum	24.91	12,289.65	306,123
11	16.03	Structure(Upto 5m) Super Structure Steel(HYSD)	MT	2.49	86,350.74	215,100
Total of Bill						1,241,688

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	03.14/Nsc	Subgrade and Earthen Shoulder Fill From Roadway	cum	5,160.00	248.74	1,283,498
2	04.01/Nsc1	Cutting GSB Close Graded GR V	Cum	1,303.21	4,547.60	5,926,478
3	04/nsc1	GSB Reuse	Cum	760.79	2,083.63	1,585,205
4	05.02	WMM	Cum	2,580.00	4,575.49	11,804,764

Summary of Bill of Quantity

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
5	05.03	Footpath Area	sqm	3,225.00	1,685.21	5,434,802
6	06.01/a	Prime Coat	sqm	10,320.00	58.33	601,966
7	06.02/i	Tack Coat(Bituminous Layer)	sqm	10,320.00	15.85	163,572
8	06/Nsc1	DBM GR II	cum	1,032.00	13,148.15	13,568,891
9	06/Nsc2	BC GR II	cum	412.80	14,289.15	5,898,561
Total of Bill						46,267,737

Bill No : 09. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	9,174.85	221.12	2,028,742
2	14.03/a	Foundation PCC M15	cum	1,747.59	10,087.25	17,628,377
3	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	7,539.28	11,774.96	88,774,756
4	15.05	Sub Structure Steel (HYSO)	MT	376.96	78,516.97	29,598,071
5	15.12	Sub Structure Weepholes per Meter	Rm	4,482.00	452.63	2,028,688
6	24/i/b	MS Hook(300gm each)	kg	716.96	121.20	86,896
7	40	Geotextile filter(75mm sqm)	sqm	806.58	25.76	20,778
Total of Bill						140,166,307

Bill No : 10. Toe Wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	179.55	221.12	39,702
2	14.03/a	Foundation PCC M15	cum	25.65	10,087.25	258,738
3	14.03/b	Foundation PCC M20	cum	105.30	11,157.52	1,174,887
4	15.03/b/i	Sub Structure PCC M20	cum	101.25	10,877.63	1,101,360
Total of Bill						2,574,687

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02.01/i	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth from 300 mm to 600 mm	Each	16.00	392.30	6,276.80
2	02.01/ii	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 600 mm to 900 mm	Each	37.00	723.48	26,768.76
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	488.00	1373.64	670,336.32
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	97.00	2576.19	249,890.43
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	23.00	4330.68	99,605.64
6	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)	Ha	19.63	59912.85	1,176,089.25

Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above	cum	68.00	1756.40	119,435.20
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	882.00	494.21	435,893.22
9	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	30.00	267.64	8,029.20
10	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	100.00	362.36	36,236.00
11	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	90.00	620.22	55,819.80
12	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier	sqm	80,220.00	34.33	2,753,952.60
13	02.04/viii/f/ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier	sqm	153,669.00	57.65	8,859,017.85
Total of Bill 01. Site Clearance and Dismantling						14,497,351.07

Item Rate Analysis has been done considering

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.03	Excavation in Soil with Dozer with lead upto 100 metres (Excavation for road way in soil by mechanical means including cutting and pushing the earth to site of embankment upto a distance of 100 metres (average lead 50 metres), including trimming bottom and side slopes in accordance with requirements of lines, grades and cross sections.)	cum	46,506.00	165.21	7,683,256.26
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	10,838.00	161.80	1,753,588.40
3	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	44,084.14	315.46	13,906,782.80
Total of Bill 02. Earth work,Subgrade and Erosion control						23,343,627.46

Bill No : 03. Sub-Base & Base Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Ns c1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	10,762.09	4547.60	48,941,666.84
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	10,483.28	2083.63	21,843,272.54
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	34,953.28	4575.49	159,928,364.81
Total of Bill 03. Sub-Base & Base Courses						230,713,304.19

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	136,760.60	58.33	7,977,245.80
2	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	135,700.00	17.40	2,361,180.00
3	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	13,676.06	13148.15	179,814,888.29

Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
4	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	5,470.42	14289.15	78,167,709.10
Total of Bill 04. Bituminous Courses						268,321,023.19

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	300.04	4547.60	1,364,466.45
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	175.16	2083.63	364,966.55
3	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)	Cum	594.00	4575.49	2,717,841.06
4	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	2,376.00	58.33	138,592.08

Item Rate Analysis has been done considering

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	2,376.00	15.85	37,659.60
6	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	237.60	13148.15	3,124,000.44
7	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	95.04	14289.15	1,358,040.82
Total of Bill 05. Junction Improvement (Major & Minor)						9,105,566.99

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone	each	3.00	5269.41	15,808.23
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone	each	9.00	3160.41	28,443.69
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	131.00	2930.11	383,844.41
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	38.40	85.91	3,298.94
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	288.00	5772.15	1,662,379.20

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
6	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular	each	6.00	6554.78	39,328.68
7	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorisng Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorisng glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)	sqm	4,222.27	1012.16	4,273,608.75
8	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming to IRC-79 and the drawings.) 120x120 -Road Delineator	each	542.00	1073.82	582,010.44

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	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	200.00	3367.42	673,484.00
10	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	1,869.00	387.48	724,200.12
11	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp	nos	212.00	21376.67	4,531,854.04
12	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.				

Item Rate Analysis has been done considering

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			Ton	1.08	185813.66	199,935.50
13	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	38.40	701.95	26,954.88
14	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	1,160.00	1237.23	1,435,186.80
15	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
16	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	10087.25	9,764.46
17	14.03/e/I	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.70	10907.45	62,216.09
18	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.86	78516.97	67,210.53

Item Rate Analysis has been done considering

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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
19	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	2.00	11774.96	23,549.92
20	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	0.30	78516.97	23,555.09
21	16.09	Mild steel railing complete as per drawing and Technical Specifications	Rm	8,984.00	4617.77	41,486,045.68
Total of Bill 06. Traffic signs, Road marking & other road appurtenances						56,258,482.53

Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	396.41	94.34	37,396.85
2	10.16	Cement Plaster 12mm Thick in Cement Mortar 1:3	sqm	396.41	225.72	89,476.54
3	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	59.45	221.12	13,145.58
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	9.11	11968.37	109,067.76
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	6.04	10087.25	60,906.82
6	14.03/e/l	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	4.16	10907.45	45,407.71
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.50	78516.97	39,258.49
8	14/nsc2	Brick Flat Soling at Foundation	Sqm	80.63	1129.07	91,031.27
9	15.01	Brick masonry work in cement mortar 1:3 in Sub-structure complete excluding pointing and plastering, as per drawing and technical specifications				

Item Rate Analysis has been done considering

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

Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	19.43	12081.21	234,774.15
10	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	24.91	12289.65	306,122.89
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	2.49	86350.74	215,099.69
		Total of Bill 07. Passenger Shelter				1,241,687.75

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	5,160.00	248.74	1,283,498.40
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	1,303.21	4547.60	5,926,477.80
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	760.79	2083.63	1,585,204.87
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	2,580.00	4575.49	11,804,764.20

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	05.03	Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 25 mm thick cement concrete grade M15, over laid with pre-cast concrete tiles in cement mortar including provision of all drainage arrangements but excluding kerb channel.	sqm	3,225.00	1685.21	5,434,802.25
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	10,320.00	58.33	601,965.60
7	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	10,320.00	15.85	163,572.00
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	1,032.00	13148.15	13,568,890.80

Item Rate Analysis has been done considering

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

Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	412.80	14289.15	5,898,561.12
Total of Bill 08. Bus Bay						46,267,737.03

Bill No : 09. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	9,174.85	221.12	2,028,742.39
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	1,747.59	10087.25	17,628,377.23
3	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	7,539.28	11774.96	88,774,755.75
4	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	376.96	78516.97	29,598,071.08
5	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	4,482.00	452.63	2,028,687.66
6	24/i/b	Galvanised Mild steel J /L hook	kg	716.96	121.20	86,895.55
7	40	Gextextile material (fine net)	sqm	806.58	25.76	20,777.50
Total of Bill 09. Longitudinal Drains						140,166,307.16

Item Rate Analysis has been done considering

Bill No : 10. Toe Wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	179.55	221.12	39,702.10
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	25.65	10087.25	258,737.96
3	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	105.30	11157.52	1,174,886.86
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	101.25	10877.63	1,101,360.04
Total of Bill 10. Toe Wall						2,574,686.95



BILL
(STRUCTURE PART)



Summary of Bill of Quantity

Bill No : 11. Culvert

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
Foundation						
1	10.20	Foundation Culvert PCC M15	cum	904.33	9,226.88	8,344,144
2	13.01/a/i	Foundation Earthwork Ordinary Soil (0 -3m)	cum	6,521.08	221.12	1,441,941
End of Sub Total Foundation						9,786,086
Sub Structure						
3	10.06/a	Steel culvert for Sub-Structure	Ton	361.66	74,028.47	26,773,136
4	10.20/b	Culvert Backfilling culvert by Gravelly materials	cum	2,505.23	2,622.87	6,570,893
5	10.20/c	Filter Media culvert behind abutment, wing and return wall	cum	3,429.71	2,605.67	8,936,692
6	15.03/f/i	Sub Structure RCC M25 (Upto 5m)	cum	4,520.71	11,774.96	53,231,179
7	15.12	Sub Structure Weepholes per Meter	Rm	1,620.00	452.63	733,261
End of Sub Total Sub Structure						96,245,162
Super Structure						
8	06.02/i	Tack Coat(Bituminous Layer)	sqm	1,840.20	15.85	29,167
9	06/Nsc2	BC GR II	cum	73.61	14,289.15	1,051,824
10	10.06/b	Steel culvert for Super-Structure	Ton	71.10	74,028.47	5,263,424
11	16.01/a/i	Super Structure RCC M25 - Solid Slab Super Structure(Upto 5m)	cum	888.71	12,289.65	10,921,935
12	16.08	Protection Work RCC Railing M30 (Precast 12mm Aggregate)	Rm	272.64	2,893.15	788,788
13	16.11	Super Structure Drainage Spout	each	94.00	2,181.78	205,087
14	16.17	Super Structure Mastic Asphalt	sqm	1,840.20	556.90	1,024,807
End of Sub Total Super Structure						19,285,034
Protection Work						
15	10.02/Nsc	Protection Work Culvert M15	cum	3,467.65	9,226.88	31,995,590
16	13.01/a/i/Nsc	Excavation For Protection work	cum	16,715.87	221.12	3,696,213
17	16/nsc	Protection Work Curtain Wall- PCC (M-15)	cum	3,980.08	10,877.63	43,293,838
18	17/nsc1	Protection Work Flexible Apron	cum	3,928.64	5,045.55	19,822,150
End of Sub Total Protection Work						98,807,791
Total						224,124,072

Bill No : 12. Repair and Rehabilitation

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
1	15.05	Sub Structure Steel (HYSD)	MT	21.00	78,516.97	1,648,856
End of Sub Total						1,648,856

Summary of Bill of Quantity

Bill No : 12. Repair and Rehabilitation

Sl No	SOR Ref No	Description	Unit	Quantity	Rate	Cost
Super Structure						
2	06.02/i	Tack Coat(Bituminous Layer)	sqm	638.00	15.85	10,112
3	06/Nsc2	BC GR II	cum	26.00	14,289.15	371,518
4	08.01	Precast Concrete Kerb(M20) fix at site	rm	106.00	742.77	78,734
5	16.09	Protection Work Steel Railing	Rm	106.00	4,617.77	489,484
6	16.17	Super Structure Mastic Asphalt	sqm	638.00	556.90	355,302
7	18.01	Removal of existing cement concrete wearing coat	sqm	638.00	331.51	211,503
8	18.04/a	Grouting using Concrete	cum	35.00	418,155.09	14,635,428
End of Sub Total Super Structure						16,152,081
Protection Work						
9	15.03/b/i	Sub Structure PCC M20	cum	140.00	10,877.63	1,522,868
10	17.02	Protection Work Filter material underneath pitching in slopes	cum	294.00	3,888.04	1,143,084
11	17.03/a	Protection Work Pitching on slopes laid over prepared filter media(Stone)	cum	588.00	5,063.37	2,977,262
End of Sub Total Protection Work						5,643,214
Miscellaneous Work						
12	08.05	Paint on Concrete Surface(2 Coat)	sqm	792.00	94.34	74,717
End of Sub Total Miscellaneous Work						74,717
Total						23,518,868

Item Rate Analysis has been done considering

Bill No : 11. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
Foundation						
1	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork.	cum	904.33	9226.88	8,344,144.39
2	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	6,521.08	221.12	1,441,941.21
Sub Total of Foundation						9,786,085.60
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	361.66	74028.47	26,773,136.46
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	2,505.23	2622.87	6,570,892.61
5	10.20/c	Providing and filling in foundation trenches and at the back of abutments, wing walls etc. and below pipe bed in layers not exceeding 150mm thick including watering and compacting c)Filler Media behind abutment ,wing and return wall	cum	3,429.71	2605.67	8,936,692.46
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	4,520.71	11774.96	53,231,179.42

Bill No : 11. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	1,620.00	452.63	733,260.60
Sub Total of Sub Structure						96,245,161.55
Super Structure						
8	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	1,840.20	15.85	29,167.17
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	73.61	14289.15	1,051,824.33
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure	Ton	71.10	74028.47	5,263,424.22
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	888.71	12289.65	10,921,934.85

Item Rate Analysis has been done considering

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

Bill No : 11. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
12	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification	Rm	272.64	2893.15	788,788.42
13	16.11	Drainage Spouts complete as per drawing and Technical specification	each	94.00	2181.78	205,087.32
14	16.17	Mastic asphalt (providing and laying 12mm thick mastic asphalt wearing coures on top of deck slab excluding prime coat with paving grade bitumem meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an aproximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	1,840.20	556.90	1,024,807.38
Sub Total of Super Structure						19,285,033.69
		Protection Work				
15	10.02/N sc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formvork. At Protection	cum	3,467.65	9226.88	31,995,590.43
16	13.01/a/ i/Nsc	Earth work in excavation Ordinary soil For Protection Work	cum	16,715.87	221.12	3,696,213.17
17	16/nsc	For Protection Work - cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification PCC M20 Grade upto 5m height				

Item Rate Analysis has been done considering

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

Bill No : 11. Culvert

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			cum	3,980.08	10877.63	43,293,837.61
18	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	3,928.64	5045.55	19,822,149.55
Sub Total of Protection Work						98,807,790.77
		Total of Bill 11. Culvert				224,124,071.60

Item Rate Analysis has been done considering



Bill No : 12. Repair and Rehabilitation

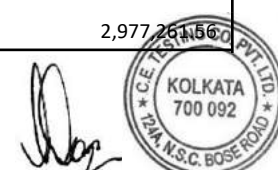
SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	21.00	78516.97	1,648,856.37
Sub Total of						1,648,856.37
Super Structure						
2	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	638.00	15.85	10,112.30
3	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	26.00	14289.15	371,517.90
4	08.01	Precast Cement concrete M20 Kerb including fixing at site	rm	106.00	742.77	78,733.62
5	16.09	Mild steel railing complete as per drawing and Technical Specifications	Rm	106.00	4617.77	489,483.62

Bill No : 12. Repair and Rehabilitation

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
6	16.17	Mastic asphalt (providing and laying 12mm thick mastic asphalt wearing courses on top of deck slab excluding prime coat with paving grade bitumen meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10sqm and at an approximate spacing of 10cm centre in both direction ,pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface ,all complete as per clause 515) using Bitumen VG-40 (3/40)	sqm	638.00	556.90	355,302.20
7	18.01	Removal of existing cement concrete wearing coat manually or jack hammer including its disposal complete as per drawing and technical specification without causing any detrimental effect to any part of bridge structure	sqm	638.00	331.51	211,503.38
8	18.04/a	Sealing of Cracks by Injection process through nipples complete as per technical specification with	cum	35.00	418155.09	14,635,428.15
Sub Total of Super Structure						16,152,081.17
Protection Work						
9	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	140.00	10877.63	1,522,868.20
10	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification	cum	294.00	3888.04	1,143,083.76
11	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone	cum	588.00	5063.37	2,977,261.60

Item Rate Analysis has been done considering

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



Bill No : 12. Repair and Rehabilitation

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
Sub Total of Protection Work						5,643,213.52
Miscellaneous Work						
12	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	792.00	94.34	74,717.28
Sub Total of Miscellaneous Work						74,717.28
Total of Bill 12. Repair and Rehabilitation						23,518,868.34

Item Rate Analysis has been done considering



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



SI No	TCS DESCRIPTION	TCS TYPE
1	Typical Cross Section of RECONSTRUCTION OF TWO LANE CARRIAGEWAY IN BUILT UP AREA with Both side covered drain cum footpath in plain terrain	TCS-1
2	Typical Cross Section of RECONSTRUCTION OF TWO LANE CARRIAGEWAY IN RURAL AREA with Both side earthen shoulder in plain terrain	TCS-2
3	Typical Cross Section of RECONSTRUCTION OF TWO LANE CARRIAGEWAY IN RURAL AREA WITH ONE SIDE TOE WALL	TCS-3



Chainage (m)		CD Length (m)	Length (m)	TCS Type
From	To			
3275	5700	16.94	2425	TCS-1
5700	6060	7.9	360	TCS-2
6060	6330		270	TCS-3
6330	7500	10.6	1170	TCS-2
7500	8400	7.9	900	TCS-1
8400	9150	26.3	750	TCS-2
9150	9400		250	TCS-1
9400	11850	26.32	2450	TCS-2
11850	12375	2.6	525	TCS-1
12375	12700	5.3	325	TCS-2
12700	13125	16.4	425	TCS-1
13125	15940	48.26	2815	TCS-2
Total =		169	12665	

Summary of TCS Length

TCS No.	Length (m)
TCS-1	4525
TCS-2	7870
TCS-3	270
Length of Extisting Structure	169
Total=	12834

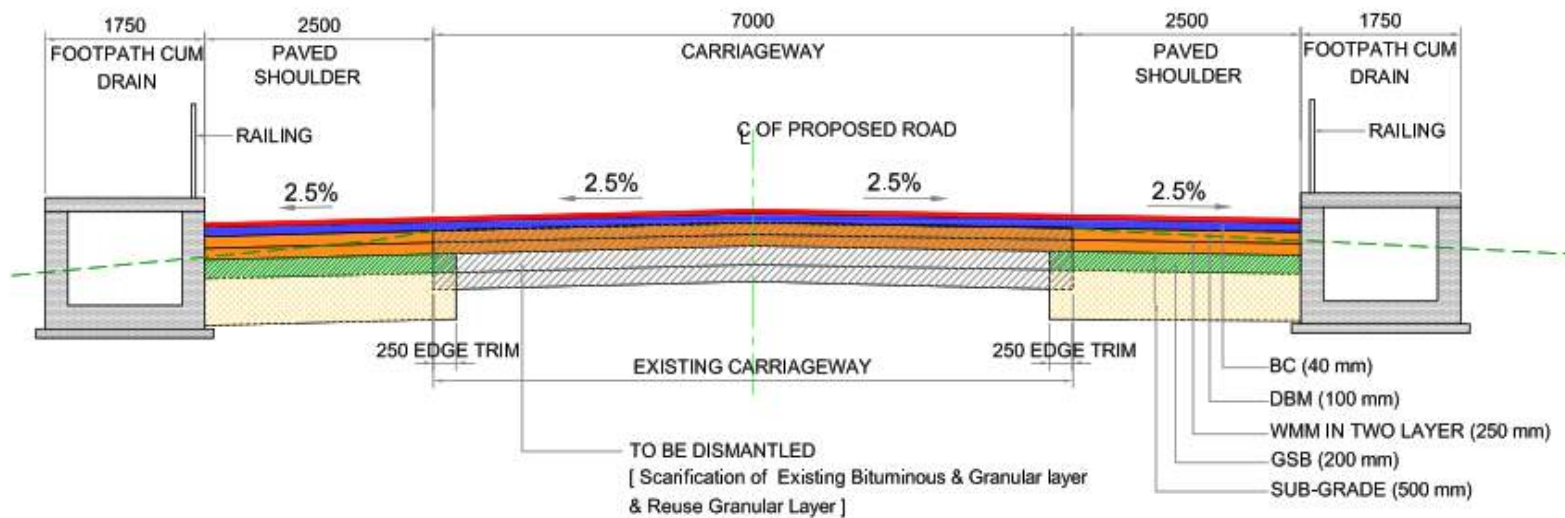


Variable Declaration

TCS-01

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Paved Shoulder	ps	2.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.100	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	4525.000	m
9	Existing Pavement Width	ext_pav	7.000	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	0.000	m
16	GSB Reuse	gsb_per	36.86%	
17	Hard Shoulder	hs	1.000	m

Variable Declaration



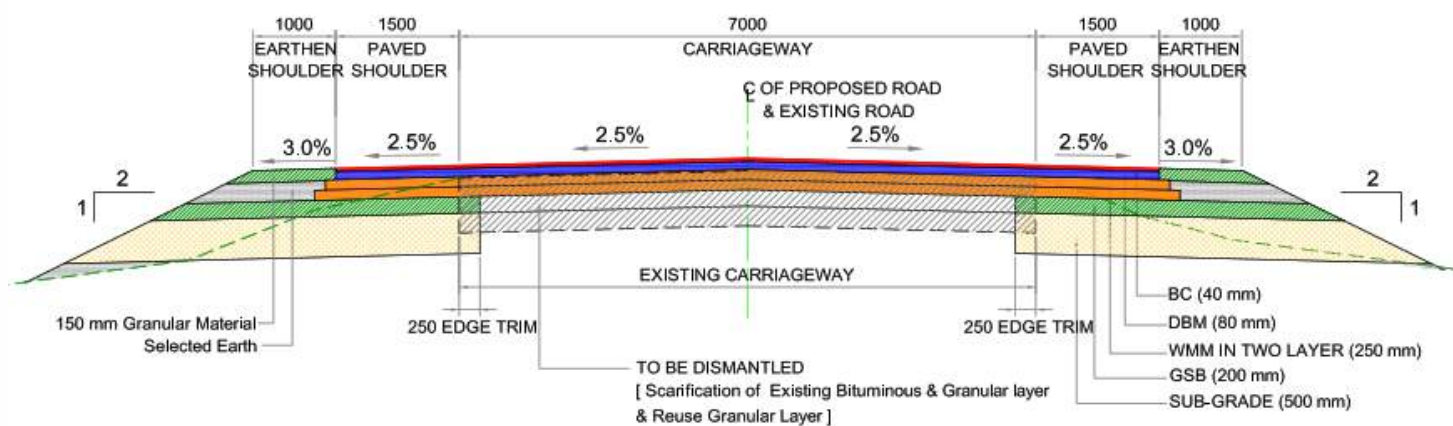
**TCS- 1 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH PAVED SHOULDER IN BUILT UP AREA
WITH BOTH SIDE COVERED DRAIN CUM FOOTPATH IN PLAIN TERRAIN**

Variable Declaration

TCS-02

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Paved Shoulder	ps	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.100	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	7870.000	m
9	Existing Pavement Width	ext_pav	7.000	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	36.86%	
17	Hard Shoulder	hs	1.000	m
18	150mm GSB at Earthen Shoulder Portion area	es_gsb	0.158	sqm
19	Earthen Shoulder Portion area	es_area	0.343	sqm

Variable Declaration



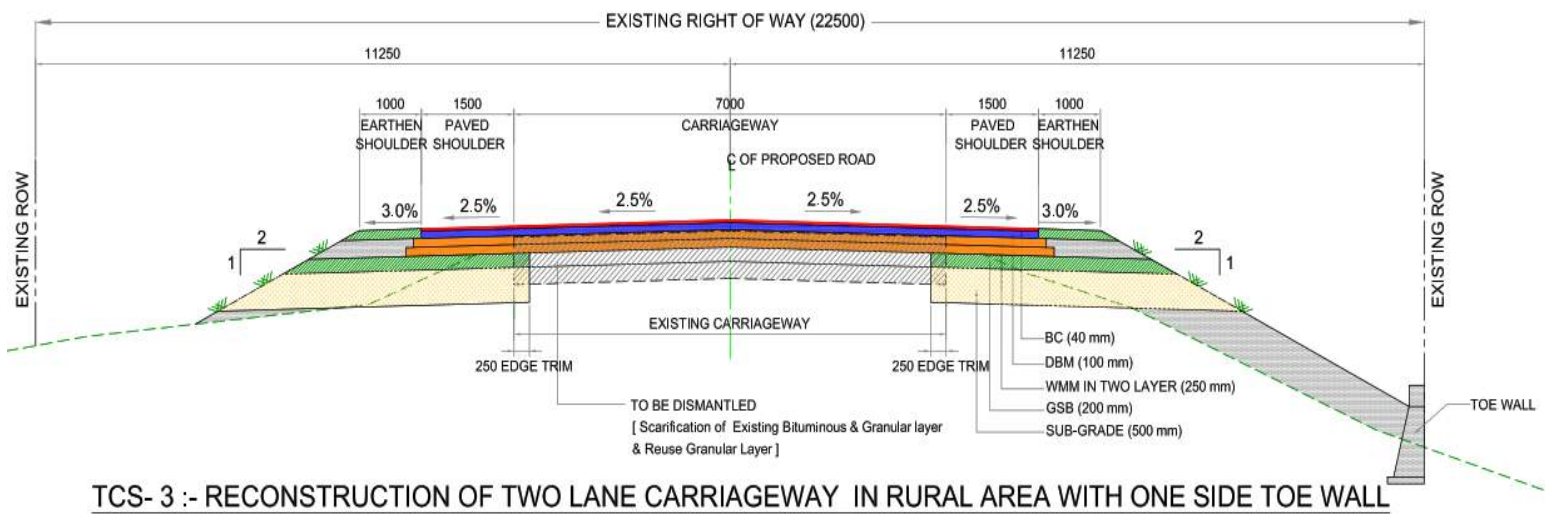
**TCS- 2 :- TYPICAL CROSS SECTION OF TWO LANE CARRIAGEWAY WITH PAVED SHOULDER
RURAL AREA IN PLAIN TERRAIN (RECONSTRUCTION)**

Variable Declaration

TCS-03

SI No	Variable Description	Variable	Dimension	Unit
1	Width of Carriageway	cw	7.000	m
2	Paved Shoulder	ps	1.500	m
3	BC Thickness	bc	0.040	m
4	DBM Thickness	dbm	0.100	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	270.000	m
9	Existing Pavement Width	ext_pav	7.000	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	36.86%	
17	Hard Shoulder	hs	1.000	m
18	150mm GSB at Earthen Shoulder Portion area	es_gsb	0.158	sqm
19	Earthen Shoulder Portion area	es_area	0.343	sqm

Variable Declaration



Site Clearance and Dismantling

A.Tree Cutting

SI No	Girth Details		
1	Girth from 300 mm to 600 mm	16	Each
1	Girth from 600 mm to 900 mm	37	Each
2	Girth from 900 mm to 1800 mm	488	Each
4	Girth from 1800 mm to 2700 mm	97	Each
5	Above 2700 mm	23	Each

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

B.Clearing and grubbing

Clearing and Grubbing Area 19.63 Ha

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

C. Dismantling

SI No A.Rubble stone masonry in cement mortar

1	Culvert	=	882	Cum
		Total=	882	cum

..... Bill No- 01, Sl. No- 8

SI No B.Total Dismantling of Reinforced cement concrete

1	Culvert	=	68	Cum
		Total=	68	cum

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

SI No C.Total Dismantling Hume Pipe Culvert

1	up to 600 mm dia=	30	m
2	600-900 mm dia=	100	m
3	above 900 mm dia=	90	m

..... Bill No- 01, Sl. No- 9
 Bill No- 01, Sl. No-10
 Bill No- 01, Sl. No- 11

SI No D.Total Dismantling of Bituminous layer

1	Road	=	153669	sqm
		Total=	153669	sqm

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

SI No E.Total Dismantling of Granular Layer

1	Road	=	80220	sqm
	Refer backup calculation sheet			
		Total=	80220	sqm

..... Bill No- 01, Sl. No- 13



**Site Clearance and Dismantling
(Tree Cutting List)**

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
1	3+283	592080.792	2742823.08	LHS	1.3
2	3+329	592036.589	2742809.529	LHS	2.9
3	3+335	592031.256	2742807.834	LHS	0.8
4	3+390	591979.276	2742789.842	LHS	0.5
5	3+400	591968.3	2742791.423	LHS	0.8
6	3+480	591892.116	2742768.557	LHS	3.2
7	3+494	591878.268	2742764.284	LHS	2.6
8	3+521	591846.898	2742774.65	RHS	0.9
9	3+526	591841.988	2742773.611	RHS	0.5
10	3+527	591845.851	2742757.499	LHS	2.7
11	3+615	591756.807	2742747.837	RHS	1.3
12	3+771	591617.379	2742674.082	LHS	0.8
13	3+798	591591.022	2742666.163	LHS	1.6
14	3+838	591549.256	2742659.474	LHS	2.9
15	3+846	591540.831	2742657.837	LHS	2.6
16	3+982	591406.792	2742693.854	LHS	0.8
17	3+990	591406.788	2742712.689	RHS	0.7
18	4+033	591366.443	2742731.193	RHS	1.5
19	4+081	591315.636	2742726.855	LHS	1
20	4+114	591286.143	2742745.883	RHS	2.8
21	4+143	591257.611	2742753.392	RHS	1.5
22	4+150	591250.534	2742752.379	RHS	2.3
23	4+209	591192.022	2742761.039	RHS	1.3
24	4+274	591125.987	2742766.341	RHS	1.5
25	4+299	591100.782	2742763.985	RHS	1.5
26	4+364	591034.979	2742761.628	RHS	2.8
27	4+367	591035.014	2742743.775	LHS	2.8
28	4+448	590952.92	2742742.068	RHS	2
29	4+465	590942.116	2742719.059	LHS	1.4
30	4+477	590930.82	2742716.477	LHS	2.6
31	4+522	590889.894	2742700.289	LHS	1.5
32	4+586	590827.639	2742682.548	RHS	3.1
33	4+605	590812.014	2742672.431	RHS	1.8
34	4+610	590813.508	2742653.942	LHS	1.3
35	4+672	590753.185	2742636.408	LHS	2.8
36	4+905	590524.911	2742586.903	LHS	1.4
37	4+926	590505.359	2742581.45	LHS	1.4
38	4+982	590447.13	2742576.66	RHS	1.5
39	5+204	590251.791	2742468.459	LHS	1.5
40	5+391	590064.033	2742474.574	LHS	0.9
41	5+573	589888.318	2742523.414	LHS	0.5
42	5+584	589876.793	2742524.422	LHS	0.6
43	5+588	589873.289	2742526.053	LHS	1.5
44	5+642	589823.317	2742545.549	LHS	0.9
45	5+688	589779.851	2742557.519	LHS	0.4
46	5+691	589776.493	2742559.454	LHS	0.8
47	5+696	589771.889	2742560.21	LHS	1.3
48	6+008	589469.948	2742642.303	LHS	2.9
49	6+563	588940.687	2742777.04	LHS	2.6
50	6+582	588918.927	2742789.522		1.6
51		588288.525	2742436.64		0.5
52		588141.971	2742356.343		0.8
53		588031.398	2742272.159		1.1
54		588013.148	2742261.505		0.8
55		587784.94	2742170.024		0.8
56		587412.769	2742058.078		1
57		587407.24	2742057.261		0.7



**Site Clearance and Dismantling
(Tree Cutting List)**

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
58	8+271	587407.052	2742057.703	LHS	1.6
59	8+350	587334.562	2742027.231	LHS	0.9
60	8+370	587310.119	2742031.991	RHS	1.7
61	9+220	586569.014	2741617.213	LHS	1.3
62	9+249	586546.842	2741599.447	LHS	1.4
63	9+311	586500.76	2741558.672	LHS	1.4
64	9+455	586363.887	2741508.942	LHS	0.9
65	9+591	586228.148	2741487.584	RHS	1.5
66	9+594	586225.622	2741485.959	RHS	2.9
67	9+603	586219.237	2741479.119	RHS	2.3
68	9+647	586183.682	2741448.786	LHS	2.9
69	9+647	586178.511	2741464.019	RHS	1.5
70	9+724	586103.826	2741448.41	RHS	1
71	10+629	585484.91	2740853.341	LHS	0.5
72	10+630	585485.77	2740852.068	LHS	0.9
73	10+634	585484.876	2740847.785	LHS	0.4
74	10+634	585482.847	2740848.301	LHS	0.5
75	10+65	585462.295	2740838.328	RHS	1
76	10+946	585384.088	2740551.433	LHS	2.6
77	11+677	584823.254	2740088.904	LHS	2.9
78	11+817	584686.66	2740055.216	RHS	1.5
79	12+175	584338.883	2739973.391	LHS	2.9
80	12+274	584240.071	2739955.241	LHS	1.3
81	12+276	584237.693	2739957.254	LHS	1.6
82	12+312	584200.963	2739960.518	LHS	2
83	12+316	584197.654	2739961.594	LHS	1.5
84	12+339	584173.954	2739965.107	LHS	1.5
85	12+341	584172.476	2739965.692	LHS	1.5
86	12+587	583928.678	2739996.929	LHS	1.3
87	12+592	583923.841	2739997.293	LHS	0.7
88	12+599	583918.318	2740014.274	RHS	1.5
89	12+603	583913.482	2739996.219	LHS	1.6
90	12+633	583882.872	2740000.131	LHS	2.6
91	12+673	583845.037	2740020.401	RHS	1.3
92	12+686	583831.827	2740020.746	RHS	1.6
93	12+814	583705.632	2739998.706	LHS	1.3
94	12+998	583537.886	2739921.291	RHS	1.4
95	13+068	583491.468	2739867.053	LHS	1.6
96	13+106	583461.655	2739844.038	LHS	1.6
97	13+721	582922.79	2739563.924	RHS	1.6
98	13+722	582922.299	2739563.711	RHS	0.9
99	13+726	582918.215	2739562.861	RHS	0.9
100	13+726	582917.786	2739562.69	RHS	1.5
101	13+736	582907.984	2739560.905	RHS	0.9
102	13+737	582907.081	2739560.799	RHS	1.5
103	13+738	582905.908	2739560.499	RHS	1.5
104	13+822	582824.97	2739534.919	LHS	0.5
105	13+860	582786.289	2739544.959	RHS	1.5
106	13+903	582743.641	2739539.295	RHS	1.5
107		582727.185	2739528.168		1.5
108		582657.916	2739541.327		1.6
109		582610.642	2739540.228		1.6
110		582601.765	2739538.993		1.5
111		582556.743	2739517.288		1.6
112		582553.324	2739516.966		1.5
113		582552.104	2739516.495		1.5
114		582537.213	2739526.458		1.1



**Site Clearance and Dismantling
(Tree Cutting List)**

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
115	14+132	582515.527	2739522.471	RHS	1.8
116	14+138	582508.792	2739521.191	RHS	1.3
117	14+170	582480.722	2739501.748	LHS	1.2
118	14+173	582477.806	2739500.961	LHS	1.5
119	14+189	582458.736	2739511.531	RHS	1.5
120	14+194	582457.215	2739496.596	LHS	2.9
121	14+199	582452.375	2739495.727	LHS	2.6
122	14+215	582433.729	2739504.34	RHS	1.2
123	14+217	582432.207	2739503.742	RHS	1.6
124	14+218	582430.721	2739503.593	RHS	1.4
125	14+222	582427.559	2739502.629	RHS	1.4
126	14+224	582425.268	2739502.206	RHS	1.3
127	14+226	582423.513	2739502.058	RHS	1.5
128	14+229	582420.502	2739501.259	RHS	1.4
129	14+231	582418.57	2739500.784	RHS	1.5
130	14+233	582416.792	2739500.123	RHS	1.3
131	14+237	582412.42	2739499.18	RHS	1.4
132	14+24	582410.245	2739498.692	RHS	1.6
133	14+241	582408.599	2739498.371	RHS	1.7
134	14+243	582406.956	2739498.299	RHS	1.5
135	14+245	582405.087	2739497.798	RHS	1.6
136	14+247	582403.048	2739497.109	RHS	1.6
137	14+250	582400.011	2739496.226	RHS	1.2
138	14+252	582400.497	2739483.515	LHS	1.3
139	14+253	582399.379	2739483.204	LHS	1.5
140	14+255	582398.007	2739481.843	LHS	1.5
141	14+257	582393.437	2739495.175	RHS	1.6
142	14+258	582395.224	2739482.111	LHS	1.6
143	14+258	582391.882	2739494.6	RHS	1.3
144	14+260	582390.315	2739494.125	RHS	1.5
145	14+262	582388.525	2739493.796	RHS	1.5
146	14+264	582386.776	2739493.688	RHS	1.6
147	14+265	582385.089	2739493.014	RHS	1.3
148	14+266	582387.693	2739478.756	LHS	1.8
149	14+267	582383.491	2739492.546	RHS	1.6
150	14+268	582385.096	2739479.659	LHS	1.5
151	14+269	582381.386	2739492.521	RHS	1.5
152	14+272	582378.29	2739492.069	RHS	1.5
153	14+274	582376.735	2739491.227	RHS	1.5
154	14+276	582374.803	2739489.66	RHS	2
155	14+279	582371.881	2739488.598	RHS	1.5
156	14+280	582370.657	2739490.029	RHS	1.5
157	14+281	582373.042	2739476.217	LHS	1.8
158	14+282	582368.696	2739489.458	RHS	1.5
159	14+284	582366.861	2739489.363	RHS	1.5
160	14+286	582364.83	2739489.079	RHS	2.6
161	14+288	582362.993	2739488.629	RHS	1.5
162	14+289	582361.801	2739488.42	RHS	1.5
163	14+290	582361.423	2739487.13	RHS	1.5
164		582361.239	2739487.101		1.5
165		582359.867	2739488.336		1.4
166		582361.177	2739473.389		1.6
167		582357.869	2739487.81		1.6
168		582353.385	2739486.422		2
169		582351.638	2739486.175		1.6
170		582351.393	2739485.275		1.5
171		582345.943	2739485.655		1.6



**Site Clearance and Dismantling
(Tree Cutting List)**

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
172	14+307	582344.508	2739485.078	RHS	1.5
173	14+309	582342.538	2739484.75	RHS	2
174	14+311	582340.976	2739483.369	RHS	1.9
175	14+312	582339.202	2739483.861	RHS	1.4
176	14+313	582338.568	2739482.499	RHS	1.7
177	14+315	582339.039	2739471.288	LHS	1.6
178	14+317	582334.475	2739483.221	RHS	1.5
179	14+317	582336.835	2739468.936	LHS	1.5
180	14+318	582333.642	2739482.139	RHS	1.2
181	14+321	582330.886	2739483.058	RHS	1.6
182	14+322	582330.346	2739481.295	RHS	1.3
183	14+323	582328.592	2739482.443	RHS	1.6
184	14+325	582327.164	2739481.796	RHS	1.8
185	14+326	582328.45	2739468.777	LHS	11.9
186	14+326	582325.463	2739481.823	RHS	1.8
187	14+328	582325.623	2739469.161	LHS	1.5
188	14+332	582321.746	2739467.468	LHS	1.5
189	14+335	582319.281	2739466.868	LHS	1.3
190	14+337	582317.534	2739466.82	LHS	1.9
191	14+339	582313.254	2739479.973	RHS	1.5
192	14+339	582315.364	2739467.426	LHS	1.6
193	14+340	582313.571	2739467.138	LHS	1.9
194	14+342	582309.703	2739479.41	RHS	1.5
195	14+343	582310.687	2739466.575	LHS	1.9
196	14+344	582308.135	2739478.214	RHS	2
197	14+344	582307.665	2739479.132	RHS	1.9
198	14+347	582305.196	2739478.608	RHS	1.6
199	14+347	582306.991	2739464.526	LHS	1.5
200	14+349	582305.197	2739466.245	LHS	1.6
201	14+350	582302.272	2739478.129	RHS	1.5
202	14+350	582304.299	2739463.899	LHS	1.6
203	14+352	582302.354	2739463.627	LHS	1.9
204	14+353	582299.145	2739477.5	RHS	2
205	14+354	582300.348	2739465.084	LHS	1.9
206	14+355	582299.705	2739462.782	LHS	1.5
207	14+356	582295.816	2739477.235	RHS	1.2
208	14+357	582297.237	2739462.746	LHS	1
209	14+358	582296.148	2739464.335	LHS	1.5
210	14+360	582292.285	2739476.502	RHS	2
211	14+363	582289.465	2739476.116	RHS	1.9
212	14+363	582291.303	2739461.86	LHS	1
213	14+365	582289.247	2739463.527	LHS	1.5
214	14+365	582286.8	2739475.734	RHS	1.2
215	14+368	582284.591	2739475.204	RHS	1.9
216	14+370	582284.449	2739460.934	LHS	1.9
217	14+371	582281.425	2739474.869	RHS	1.5
218	14+372	582282.942	2739462.167	LHS	1.5
219	14+373	582281.728	2739460.266	LHS	2
220	14+377	582275.678	2739474.132	RHS	1.7
221		582274.3	2739473.817		2
222		582276.202	2739459.385		1.6
223		582271.836	2739473.188		1.6
224		582272.923	2739458.845		1.9
225		582269.232	2739458.219		2
226		582265.489	2739472.077		1.3
227		582264.22	2739471.076		1.6
228		582266.146	2739459.424		0.8



**Site Clearance and Dismantling
(Tree Cutting List)**

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
229	14+391	582264.26	2739457.332	LHS	0.7
230	14+392	582260.251	2739471.465	RHS	1.5
231	14+393	582262.135	2739458.972	LHS	0.9
232	14+395	582259.5	2739458.626	LHS	1.2
233	14+395	582257.274	2739471.148	RHS	1
234	14+396	582258.662	2739456.609	LHS	1.6
235	14+398	582256.428	2739457.55	LHS	1.3
236	14+399	582254.101	2739470.698	RHS	1.6
237	14+399	582256.267	2739455.867	LHS	1.5
238	14+401	582251.74	2739470.417	RHS	1
239	14+404	582248.734	2739469.673	RHS	1.5
240	14+406	582249.313	2739454.887	LHS	1.8
241	14+406	582246.667	2739469.459	RHS	1.5
242	14+408	582247.447	2739456.159	LHS	1.5
243	14+408	582244.959	2739468.906	RHS	1.8
244	14+409	582246.154	2739454.292	LHS	1.2
245	14+409	582243.442	2739468.69	RHS	1.6
246	14+411	582241.519	2739468.253	RHS	1.8
247	14+414	582239.216	2739467.849	RHS	1.1
248	14+415	582240.335	2739453.334	LHS	1.4
249	14+415	582237.397	2739467.727	RHS	1.6
250	14+417	582236.028	2739467.368	RHS	1.7
251	14+418	582237.625	2739452.721	LHS	1.2
252	14+419	582234.337	2739467.184	RHS	1.2
253	14+420	582235.648	2739452.233	LHS	1.6
254	14+420	582232.514	2739466.95	RHS	2
255	14+422	582232.818	2739454.08	LHS	1.6
256	14+422	582230.517	2739466.61	RHS	2.9
257	14+424	582231.85	2739451.765	LHS	1.3
258	14+426	582226.971	2739465.872	RHS	2.5
259	14+427	582228.747	2739452.752	LHS	0.8
260	14+427	582225.913	2739464.29	RHS	1.6
261	14+429	582227.003	2739451.431	LHS	1.5
262	14+437	582218.801	2739449.798	LHS	1.7
263	14+443	582209.981	2739463.286	RHS	1.5
264	14+445	582208.339	2739462.882	RHS	1.5
265	14+448	582205.224	2739461.861	RHS	1.3
266	14+487	582167.159	2739452.435	RHS	1.5
267	14+500	582154.313	2739449.291	RHS	1.5
268	14+502	582152.738	2739448.972	RHS	1.7
269	14+504	582150.796	2739448.629	RHS	1.6
270	14+505	582149.708	2739448.44	RHS	1.5
271	14+513	582141.775	2739447.025	RHS	1.6
272	14+513	582141.716	2739447.004	RHS	1.6
273	14+526	582129.305	2739443.99	RHS	1.4
274	14+528	582129.155	2739435.002	LHS	1.5
275	14+530	582125.195	2739443.167	RHS	1.5
276	14+532	582124.728	2739433.554	LHS	1.4
277	14+533	582121.897	2739443.339	RHS	1.6
278		582118.193	2739442.863		1.8
279		582115.83	2739442.47		1.5
280		582114.252	2739442.1		1.7
281		582111.816	2739441.959		0.8
282		582112.025	2739430.624		1.5
283		582109.014	2739441.352		1.5
284		582107.421	2739441.232		1.6
285		582106.403	2739429.703		2



**Site Clearance and Dismantling
(Tree Cutting List)**

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
286	14+551	582104.571	2739440.268	RHS	1.8
287	14+554	582101.685	2739439.772	RHS	1.5
288	14+555	582100.37	2739439.779	RHS	1.2
289	14+557	582098.896	2739439.489	RHS	1.6
290	14+558	582097.483	2739439.009	RHS	1.6
291	14+564	582091.648	2739437.576	RHS	1.3
292	14+566	582089.628	2739437.877	RHS	1
293	14+575	582081.189	2739436.628	RHS	1.6
294	14+580	582076.396	2739436.161	RHS	1.5
295	14+582	582073.778	2739435.816	RHS	1.4
296	14+585	582070.842	2739435.312	RHS	1.5
297	14+587	582068.888	2739435.163	RHS	1
298	14+594	582062.419	2739434.544	RHS	1
299	14+598	582058.235	2739434.195	RHS	1
300	14+600	582056.38	2739434.189	RHS	1.3
301	14+602	582054.723	2739433.855	RHS	1.5
302	14+605	582051.891	2739433.576	RHS	1.5
303	14+606	582050.56	2739433.548	RHS	1.5
304	14+608	582048.717	2739433.178	RHS	1.8
305	14+610	582046.651	2739433.719	RHS	2
306	14+611	582045.01	2739433.813	RHS	1.3
307	14+612	582044.235	2739432.641	RHS	1.3
308	14+613	582043.29	2739433.402	RHS	1.5
309	14+615	582041.875	2739433.363	RHS	1.6
310	14+618	582038.213	2739432.156	RHS	2
311	14+621	582035.899	2739432.811	RHS	1.5
312	14+624	582032.723	2739432.71	RHS	1.9
313	14+625	582031.469	2739432.728	RHS	1.9
314	14+627	582029.824	2739432.212	RHS	1.3
315	14+628	582028.337	2739432.16	RHS	1.6
316	14+628	582028.332	2739432.194	RHS	1.6
317	14+630	582026.708	2739432.217	RHS	1.3
318	14+635	582021.825	2739432.169	RHS	1.6
319	14+637	582019.957	2739432.195	RHS	1.3
320	14+640	582016.737	2739432.198	RHS	1.5
321	14+641	582015.2	2739432.256	RHS	1.4
322	14+645	582011.721	2739421.162	LHS	1.8
323	14+648	582009.064	2739432.191	RHS	2
324	14+649	582007.66	2739431.258	RHS	1.5
325	14+649	582007.727	2739420.152	LHS	1.6
326	14+65	582007.109	2739432.28	RHS	1.6
327	14+651	582006.045	2739419.695	LHS	1.6
328	14+654	582003.179	2739430.657	RHS	1.2
329	14+655	582002.015	2739420.521	LHS	1.5
330	14+655	582001.98	2739419.218	LHS	1.7
331	14+657	581999.665	2739431.96	RHS	1.6
332	14+663	581993.708	2739431.979	RHS	1.6
333	14+665	581992.187	2739431.981	RHS	1.3
334	14+666	581990.551	2739432.072	RHS	1.5
335		581990.117	2739418.641		1.5
336		581989.809	2739418.993		1.3
337		581988.301	2739420.083		1.2
338		581987.843	2739418.583		1.5
339		581985.804	2739420.546		1.5
340		581985.41	2739418.678		1.2
341		581983.121	2739418.832		1.3
342		581980.519	2739418.833		1.4



Site Clearance and Dismantling
(Tree Cutting List)

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
343	14+677	581980.395	2739419.677	LHS	1.5
344	14+680	581977.296	2739418.989	LHS	1.6
345	14+682	581974.843	2739418.884	LHS	1.6
346	14+684	581972.694	2739418.851	LHS	2
347	14+686	581970.938	2739420.586	LHS	1.5
348	14+689	581967.628	2739419.097	LHS	1.6
349	14+690	581967.155	2739420.672	LHS	0.8
350	14+691	581965.615	2739419.417	LHS	1.6
351	14+693	581964.149	2739419.386	LHS	1.8
352	14+695	581962.223	2739419.35	LHS	1.5
353	14+697	581960.144	2739419.271	LHS	1.5
354	14+699	581957.745	2739419.382	LHS	1.6
355	14+701	581955.636	2739418.886	LHS	0.6
356	14+703	581953.69	2739419.483	LHS	0.9
357	14+708	581948.771	2739420.693	LHS	0.9
358	14+712	581944.916	2739420.004	LHS	1.6
359	14+713	581943.327	2739420	LHS	1.3
360	14+714	581942.603	2739420.803	LHS	2.6
361	14+715	581941.652	2739419.854	LHS	1.5
362	14+717	581939.52	2739420.066	LHS	2.8
363	14+721	581935.31	2739420.242	LHS	2.6
364	14+723	581934.031	2739421.176	LHS	0.9
365	14+725	581932.294	2739421.749	LHS	1.5
366	14+728	581928.885	2739420.007	LHS	1.2
367	14+729	581928.374	2739431.851	RHS	2.6
368	14+730	581926.691	2739421.232	LHS	0.8
369	14+732	581924.655	2739420.258	LHS	1.5
370	14+732	581924.607	2739421.591	LHS	0.8
371	14+733	581924.081	2739432.634	RHS	1.3
372	14+734	581923.015	2739420.319	LHS	1.5
373	14+738	581919.168	2739420.752	LHS	2
374	14+740	581916.535	2739421.497	LHS	0.8
375	14+741	581915.497	2739420.518	LHS	1.6
376	14+743	581914.161	2739432.856	RHS	1
377	14+743	581913.341	2739420.414	LHS	1.4
378	14+744	581912.598	2739432.825	RHS	1.9
379	14+745	581912.183	2739420.682	LHS	1.1
380	14+746	581910.738	2739420.428	LHS	2
381	14+749	581907.437	2739420.894	LHS	1.9
382	14+75	581907.236	2739421.409	LHS	2
383	14+751	581905.515	2739420.735	LHS	1.5
384	14+753	581904.189	2739421.05	LHS	1.5
385	14+754	581902.647	2739421.275	LHS	1.6
386	14+755	581901.697	2739433.68	RHS	1.5
387	14+756	581901.178	2739421.156	LHS	1.5
388	14+757	581899.572	2739421.139	LHS	1.7
389	14+760	581896.705	2739433.887	RHS	3.1
390	14+762	581895.196	2739421.338	LHS	1
391	14+763	581893.561	2739421.316	LHS	1.5
392		581880.743	2739433.96		1.8
393		581872.318	2739422.25		1.3
394		581870.97	2739422.54		1.6
395		581868.203	2739422.859		1.5
396		581865.332	2739422.409		1.7
397		581864.122	2739423.17		1.5
398		581863.052	2739423.084		1.4
399		581859.136	2739423.143		1.4



Site Clearance and Dismantling
(Tree Cutting List)

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
400	14+799	581857.458	2739424.311	LHS	1.6
401	14+805	581852.072	2739422.955	LHS	1.4
402	14+805	581851.474	2739422.826	LHS	1.5
403	14+806	581851.198	2739424.038	LHS	1
404	14+807	581850.234	2739424.178	LHS	1.8
405	14+817	581839.736	2739423.541	LHS	1.8
406	14+819	581837.371	2739423.466	LHS	1.9
407	14+824	581832.818	2739423.387	LHS	1.3
408	14+827	581829.969	2739423.402	LHS	1.2
409	14+830	581827.034	2739423.639	LHS	1.6
410	14+833	581823.562	2739423.691	LHS	1.9
411	14+838	581819.172	2739423.917	LHS	1.8
412	14+839	581817.917	2739423.928	LHS	1.9
413	14+843	581814.05	2739435.734	RHS	1.6
414	14+844	581812.944	2739435.64	RHS	1.5
415	14+848	581809.238	2739425.14	LHS	1.5
416	14+851	581805.967	2739423.497	LHS	0.8
417	14+851	581805.629	2739435.31	RHS	1.5
418	14+853	581804.21	2739424.133	LHS	1.5
419	14+857	581800.529	2739435.417	RHS	1.8
420	14+857	581799.831	2739425.343	LHS	1.8
421	14+859	581798.174	2739435.583	RHS	1.2
422	14+86	581797.294	2739424.615	LHS	1.6
423	14+86	581797.232	2739423.609	LHS	1.4
424	14+870	581786.99	2739424.281	LHS	1.6
425	14+871	581786.499	2739435.588	RHS	1.5
426	14+873	581784.073	2739423.828	LHS	1.5
427	14+874	581782.526	2739423.887	LHS	1.3
428	14+878	581778.918	2739435.958	RHS	1.6
429	14+882	581774.851	2739423.957	LHS	1.6
430	14+884	581772.298	2739423.978	LHS	1.5
431	14+888	581768.593	2739424.202	LHS	1.5
432	14+893	581764.552	2739436.574	RHS	3.2
433	14+898	581759.113	2739424.54	LHS	1.5
434	14+906	581750.712	2739436.583	RHS	1.5
435	14+907	581749.855	2739425.042	LHS	1.9
436	14+911	581745.792	2739426.526	LHS	1.3
437	14+912	581745.317	2739437.681	RHS	1.6
438	14+912	581744.913	2739436.569	RHS	1.2
439	14+912	581744.406	2739426.983	LHS	1.5
440	14+919	581737.601	2739425.6	LHS	1
441	14+920	581737.468	2739436.84	RHS	1.2
442	14+920	581736.929	2739427.08	LHS	1.5
443	14+926	581731.009	2739427.254	LHS	1.3
444	14+928	581729.136	2739426.53	LHS	0.7
445	14+929	581728.078	2739425.236	LHS	1
446	14+929	581728.449	2739437.357	RHS	1.6
447	14+932	581724.471	2739426.953	LHS	1.9
448	14+947	581710.232	2739426.427	LHS	1
449		581708.689	2739426.539		1
450		581708.927	2739439.462		0.8
451		581706.418	2739426.15		1
452		581704.236	2739438.358		1.5
453		581701.062	2739438.413		1
454		581696.818	2739438.114		1.5
455		581691.477	2739438.377		0.9
456		581671.984	2739428.207		1.6



**Site Clearance and Dismantling
(Tree Cutting List)**

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
457	14+995	581661.683	2739428.358	LHS	0.5
458	14+997	581659.915	2739427.055	LHS	1
459	14+997	581660.166	2739438.971	RHS	0.7
460	15+000	581656.77	2739427.074	LHS	0.9
461	15+004	581652.816	2739439.639	RHS	0.9
462	15+005	581651.683	2739428.38	LHS	1.9
463	15+009	581648.061	2739439.483	RHS	0.9
464	15+011	581646.281	2739427.077	LHS	1.8
465	15+011	581645.984	2739439.573	RHS	1.3
466	15+019	581637.626	2739427.913	LHS	1
467	15+021	581635.845	2739429.338	LHS	1.5
468	15+025	581632.213	2739429.553	LHS	1.4
469	15+037	581619.568	2739429.545	LHS	1
470	15+041	581615.916	2739429.862	LHS	1.9
471	15+043	581614.114	2739441.619	RHS	1.3
472	15+045	581612.2	2739441.771	RHS	1.2
473	15+045	581611.716	2739430.366	LHS	1.2
474	15+051	581605.794	2739430.302	LHS	1.5
475	15+055	581601.876	2739430.412	LHS	1
476	15+059	581598.165	2739430.549	LHS	1.3
477	15+073	581584.167	2739442.704	RHS	1.5
478	15+075	581582.528	2739442.698	RHS	1.5
479	15+075	581582.539	2739442.709	RHS	1.6
480	15+098	581559.524	2739442.701	RHS	1.6
481	15+102	581555.48	2739442.643	RHS	1.5
482	15+107	581550.349	2739442.635	RHS	1.3
483	15+111	581546.069	2739442.991	RHS	1.4
484	15+121	581536.537	2739443.147	RHS	1.3
485	15+122	581535.263	2739432.37	LHS	1.6
486	15+123	581534.707	2739443.167	RHS	1.2
487	15+124	581532.595	2739432.651	LHS	1.6
488	15+126	581530.825	2739443.268	RHS	1.4
489	15+128	581529.015	2739433.018	LHS	1.6
490	15+132	581525.307	2739443.279	RHS	1.5
491	15+141	581516.241	2739443.363	RHS	1.3
492	15+193	581464.161	2739444.654	RHS	1.6
493	15+195	581461.742	2739433.521	LHS	0.9
494	15+206	581450.861	2739445.276	RHS	1.5
495	15+207	581450.176	2739434.075	LHS	0.9
496	15+213	581443.384	2739434.686	LHS	1.7
497	15+217	581440.024	2739434.083	LHS	1.6
498	15+221	581435.686	2739434.065	LHS	0.8
499	15+224	581433.172	2739435.678	LHS	1.5
500	15+224	581432.98	2739435.698	LHS	1.5
501	15+234	581422.803	2739435.737	LHS	1.5
502	15+237	581419.668	2739436.379	LHS	1.3
503	15+239	581418.891	2739448.179	RHS	1.5
504	15+240	581416.538	2739435.539	LHS	0.8
505	15+243	581413.952	2739435.492	LHS	1.3
506		581409.197	2739447.713		1.5
507		581405.214	2739436.977		1.6
508		581403.805	2739447.93		1.4
509		581401.777	2739437.991		1.7
510		581398.024	2739448.794		1.5
511		581396.257	2739449.164		1.6
512		581392.846	2739439.372		1.6
513		581394.488	2739449.632		1.3



**Site Clearance and Dismantling
(Tree Cutting List)**

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
514	15+265	581391.432	2739439.74	LHS	1.7
515	15+265	581392.718	2739449.985	RHS	1
516	15+275	581381.064	2739440.921	LHS	1.6
517	15+277	581379.145	2739441.607	LHS	1
518	15+277	581381.567	2739452.235	RHS	1.8
519	15+282	581376.93	2739454.985	RHS	1
520	15+288	581371.095	2739455.167	RHS	1.8
521	15+291	581365.447	2739445.81	LHS	1.6
522	15+294	581362.806	2739446.948	LHS	1.3
523	15+296	581361.169	2739447.622	LHS	0.8
524	15+298	581358.52	2739448.117	LHS	1.5
525	15+299	581361.019	2739459.037	RHS	0.6
526	15+308	581349.265	2739450.989	LHS	1.5
527	15+309	581348.305	2739451.784	LHS	1
528	15+315	581346.66	2739465.303	RHS	1.5
529	15+315	581346.617	2739465.339	RHS	1.4
530	15+318	581344.15	2739465.847	RHS	0.6
531	15+322	581342.368	2739471.808	RHS	0.8
532	15+326	581331.17	2739457.28	LHS	1.5
533	15+331	581327.219	2739459.228	LHS	2.5
534	15+333	581330.286	2739470.778	RHS	0.9
535	15+342	581322.386	2739474.911	RHS	1.2
536	15+346	581313.61	2739466.875	LHS	0.5
537	15+347	581317.542	2739477.273	RHS	0.8
538	15+351	581309.233	2739469.131	LHS	0.5
539	15+352	581308.005	2739469.909	LHS	0.9
540	15+357	581303.516	2739472.918	LHS	0.6
541	15+360	581306.803	2739484.186	RHS	1.9
542	15+367	581294.79	2739477.993	LHS	1.8
543	15+372	581290.03	2739480.321	LHS	1.3
544	15+374	581288.43	2739481.211	LHS	1.5
545	15+380	581283.636	2739484.326	LHS	1.6
546	15+381	581289.287	2739494.86	RHS	1.5
547	15+383	581281.13	2739486.992	LHS	2
548	15+394	581272.3	2739493.112	LHS	2
549	15+395	581278.071	2739502.751	RHS	2.6
550	15+404	581264.303	2739499.284	LHS	2.6
551	15+442	581234.025	2739522.458	LHS	1.5
552	15+442	581233.728	2739522.678	LHS	1.6
553	15+452	581224.804	2739527.401	LHS	1.6
554	15+453	581230.389	2739536.585	RHS	1.9
555	15+455	581223.551	2739529.322	LHS	1.6
556	15+455	581223.49	2739529.417	LHS	1.2
557	15+459	581219.922	2739531.147	LHS	2.5
558	15+459	581219.834	2739531.073	LHS	1.7
559	15+463	581222.859	2739542.282	RHS	1.5
560	15+466	581214.225	2739535.304	LHS	1.4
561	15+466	581214.114	2739535.217	LHS	1.8
562	15+484	581199.389	2739545.538	LHS	1.6
563		581199.346	2739545.543		1.5
564		581191.858	2739564.409		1.2
565		581183.884	2739557.06		1.3
566		581175.468	2739576.771		1.3
567		581171.679	2739579.616		1.1
568		581151.264	2739580.6		1.6
569		581149.911	2739581.781		1.4
570		581156.683	2739591.56		1.4



**Site Clearance and Dismantling
(Tree Cutting List)**

Sl No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
571	15+545	581156.642	2739591.509	RHS	1.9
572	15+547	581148.775	2739582.848	LHS	1.5
573	15+550	581146.085	2739584.432	LHS	1
574	15+552	581144.49	2739585.692	LHS	1.6
575	15+555	581142.141	2739587.33	LHS	1
576	15+561	581137.312	2739591.239	LHS	1.5
577	15+563	581135.811	2739592.313	LHS	1.5
578	15+564	581134.952	2739593.11	LHS	1.6
579	15+567	581132.047	2739595.177	LHS	1.7
580	15+568	581130.686	2739593.897	LHS	1.5
581	15+575	581125.135	2739598.028	LHS	1.3
582	15+575	581125.891	2739599.477	LHS	1.8
583	15+575	581125.001	2739599.133	LHS	1.5
584	15+588	581121.521	2739616.485	RHS	1.8
585	15+592	581112.374	2739609.846	LHS	0.8
586	15+594	581117.312	2739619.764	RHS	1.8
587	15+597	581108.05	2739612.788	LHS	1.2
588	15+600	581105.694	2739614.261	LHS	0.5
589	15+600	581105.009	2739613.506	LHS	0.5
590	15+604	581101.571	2739615.777	LHS	1.7
591	15+606	581099.784	2739616.465	LHS	1.6
592	15+606	581100.667	2739618.281	LHS	1.5
593	15+611	581103.132	2739629.686	RHS	1.8
594	15+612	581095.911	2739621.054	LHS	1.6
595	15+619	581096.559	2739634.187	RHS	1.5
596	15+621	581088.844	2739626.211	LHS	1.5
597	15+627	581090.238	2739639.11	RHS	1.3
598	15+631	581079.525	2739631.465	LHS	1.5
599	15+635	581083.807	2739643.412	RHS	1.3
600	15+638	581074.519	2739636.251	LHS	1.3
601	15+640	581073.248	2739637.213	LHS	1.6
602	15+641	581072.233	2739638.206	LHS	1.3
603	15+645	581075.645	2739649.744	RHS	1.7
604	15+646	581068.332	2739640.869	LHS	1.2
605	15+650	581065.184	2739643.461	LHS	1.6
606	15+653	581061.923	2739645.027	LHS	1.6
607	15+654	581068.889	2739655.366	RHS	1.4
608	15+659	581064.25	2739658.057	RHS	1.5
609	15+661	581062.864	2739658.78	RHS	1.5
610	15+665	581059.066	2739661.561	RHS	0.7
611	15+668	581049.694	2739652.718	LHS	0.5
612	15+668	581050.308	2739653.924	LHS	1
613	15+669	581049.188	2739653.776	LHS	0.9
614	15+669	581049.505	2739654.647	LHS	1.5
615	15+670	581055.626	2739663.997	RHS	0.5
616	15+685	581043.597	2739672.81	RHS	1.5
617	15+710	581016.234	2739678.565	LHS	3.5
618	15+739	580993.362	2739695.525	LHS	1.6
619	15+740	580992.134	2739696.157	LHS	1.4
620		580983.135	2739702.113		1.1
621		580975.383	2739723.115		0.9
622		580967.909	2739714.72		1
623		580972.519	2739725.355		1.4
624		580968.878	2739728.062		1.5
625		580960.928	2739734.077		0.8
626		580950.667	2739727.192		1.6
627		580949.705	2739726.866		1



Site Clearance and Dismantling (Tree Cutting List)

SI No	Design Ch	EASTING(M)	NORTHING	Side	GIRTH (M)
628	15+794	580948.49	2739728.828	LHS	1
629	15+798	580951.965	2739739.662	RHS	1.5
630	15+804	580946.98	2739743.438	RHS	1.2
631	15+815	580937.888	2739748.933	RHS	0.9
632	15+83	580924.865	2739757.009	RHS	1.6
633	15+830	580918.253	2739746.81	LHS	1.5
634	15+833	580922.183	2739758.541	RHS	1.6
635	15+833	580916.038	2739748.364	LHS	2
636	15+835	580920.408	2739759.725	RHS	1.3
637	15+840	580915.246	2739762.497	RHS	1.6
638	15+842	580913.73	2739763.378	RHS	1.5
639	15+846	580904.963	2739754.554	LHS	2
640	15+848	580902.891	2739754.957	LHS	1
641	15+851	580905.078	2739767.332	RHS	1.3
642	15+854	580897.891	2739757.783	LHS	2.7
643	15+861	580891.341	2739760.444	LHS	2.9
644	15+877	580876.8	2739766.015	LHS	0.9
645	15+881	580876.782	2739777.837	RHS	1.6
646	15+885	580868.773	2739767.416	LHS	1.4
647	15+886	580868.732	2739768.369	LHS	1.3
648	15+888	580865.94	2739768.39	LHS	0.8
649	15+889	580869.114	2739780.608	RHS	1.5
650	15+893	580861.686	2739771.133	LHS	1.5
651	15+900	580855.42	2739772.341	LHS	1.3
652	15+902	580853.025	2739773.571	LHS	1.5
653	15+905	580850.605	2739774.017	LHS	1.6
654	15+914	580844.497	2739787.62	RHS	1.2
655	15+915	580841.199	2739776.442	LHS	1.6
656	15+922	580837.278	2739789.606	RHS	1.1
657	15+923	580833.369	2739778.593	LHS	1.5
658	15+927	580829.353	2739779.651	LHS	1.5
659	15+928	580828.007	2739780.383	LHS	1
660	15+938	580818.818	2739782.879	LHS	2
661	15+940	580816.958	2739783.55	LHS	1.3

Summary:

Girth from 300 mm to 600 mm	16	Nos
Girth from 600 mm to 900 mm	37	Nos
Girth from 900 mm to 1800 mm	488	Nos
Girth from 1800 mm to 2700 mm	97	Nos
Above 2700 mm	23	Nos



Site Clearance and Dismantling
Clearing and Grubbing Road Land

TCS Type	Net Length (m)	Existing Road Width (m)	Width to be cleared and grubbed (m)	Area to be cleared and grubbed (Ha)
TCS-1	4525	7.0	22.5	7.01
TCS-2	7870	7.0	22.5	12.20
TCS-3	270	7.0	22.5	0.42
TCS-4	0	7.0	22.5	0.00

Total= 19.63

Total area of clearing & grubbing=

19.63 ha



Site Clearance and Dismantling
Calculation of Quantities for Dismantling

Sl. No.	Brief Description	Unit	Survey ch.	No.	L	B / H	T	Quantity	Total Quantity
A) Stone Masonry	Head wall for existing pipe culvert H=h, Length=L, and thickness=t	Cum	3.535	2	5.5	2.5	0.8	22.00	
			4.761	2	5.5	2.5	0.8	22.00	
			4.810	2	5.5	2.5	0.8	22.00	
			5.728	2	5.6	2.6	0.8	23.30	
			7.334	2	6.6	2.6	0.8	27.46	
			8.296	2	5.6	2.6	0.8	23.30	
			11.333	2	7.0	2.8	0.8	31.36	
			12.159	2	5.8	2.8	0.8	25.98	
			12.431	2	5.5	2.5	0.8	22.00	
			12.599	2	5.5	2.5	0.8	22.00	
			13.047	2	5.5	2.5	0.8	22.00	
			13.775	2	5.8	2.2	0.8	20.42	
			13.870	2	6.4	2.5	0.8	25.60	
			14.190	2	5.6	2.6	0.8	23.30	
			14.226	2	5.5	2.5	0.8	22.00	
			14.412	2	5.2	2.2	0.8	18.30	
			14.492	2	5.5	2.5	0.8	22.00	
			14.700	2	5.6	2.6	0.8	23.30	
			15.196	2	6.4	2.5	0.8	25.60	
			15.455	2	6.4	2.5	0.8	25.60	
A) Stone Masonry	Abutments for existing slab culvert H=h, Length=L, and thickness=t.	cum	5.135	2	12.5	3.00	0.50	37.50	
			5.284	2	12.7	3.00	0.50	38.10	
			5.783	2	12.5	3.00	0.50	37.50	
			6.565	2	12.2	3.00	0.50	36.60	
			6.796	2	12.5	3.00	0.50	37.50	
			9.557	2	12.5	3.00	0.50	37.50	
			9.860	2	12.9	3.00	0.50	38.70	
			10.962	2	11.8	3.00	0.50	35.40	
			12.722	2	12.0	3.00	0.50	36.00	
			13.417	2	13.0	3.00	0.50	39.00	
13.656	2	13.0	3.00	0.50	39.00				
Total =								882.30	



Site Clearance and Dismantling
Calculation of Quantities for Dismantling

Sl. No.	Brief Description	Unit	Survey ch.	No.	L	B / H	T	Quantity	Total Quantity
B) RCC	For Slab culvert	Cum	5.135	1	12.5	1.20	0.3	4.50	
			5.284	1	12.7	1.50	0.3	5.72	
			5.783	1	12.5	1.00	0.3	3.75	
			6.565	1	12.2	1.00	0.3	3.66	
			6.796	1	12.5	1.50	0.3	5.63	
			9.557	1	12.5	1.00	0.3	3.75	
			9.860	1	12.9	1.50	0.3	5.81	
			10.962	1	11.8	2.00	0.3	7.08	
			12.722	1	12.0	1.00	0.3	3.60	
			13.417	1	13.0	1.20	0.3	4.68	
			13.656	1	13.0	5.00	0.3	19.50	
								Total=	67.67
	Hume Pipe								
C) Hume Pipe	Dia upto 600 mm =	m		3	10.00				30.00
	Dia from 600-900 mm =	m		10	10.00				100.00
	Dia above 900mm=	m		9	10.00				90.00

Quantity Summary of Dismantling of Existing Culvert::

Total Dismantling of Rubble stone masonry in cement mortar=	882 cum
Total Dismantling of Reinforced cement concrete=	68 cum
Total Dismantling of up to 600 mm dia Hume Pipe=	30 cum
Total Dismantling of above 600 mm to 900 mm dia Hume Pipe=	100 cum
Total Dismantling of above 900 mm dia Hume Pipe=	90 cum



Site Clearance and Dismantling
Quantity calculation for dismantling of Flexible Pavement

TCS	Net Length (m)	Avg. Width (m)	Thickness of Bituminous Layer (m)	Quantity of Bituminous Layer to be dismantled (cum)	Thickness of Base Layer/Sub Base Layer to be dismantled (m)	Quantity of Base Layer for reuse (cum)
TCS-1	4525	7	0.1300	4118	0.2	6335
TCS-2	7870	7	0.1300	7162	0.1	5509
TCS-3	270	7	0.1300	246	0.1	189
Total =				11525		12033

Total quantity for dismantling (Bituminous layer)=	11525	cum
Quantity of Dismantelled Bituminous Material(sqm) (Assume avg thickness 75mm)	153669	sqm
Total quantity for dismantling (Granular Layer)=	12033	cum
Quantity of Granular Material(sqm) (Assume avg thickness 150mm)	80220	sqm

Quantity of stone material for reuse (@ 60%) = **7220 cum**



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
3300	10.71	0	0.000	0.000
3325	10.59	0	266.250	0.000
3350	10.46	0	263.125	0.000
3375	9.17	0	245.375	0.000
3400	8.86	0	225.375	0.000
3425	9.4	0	228.250	0.000
3450	9.73	0	239.125	0.000
3475	9.56	0	241.125	0.000
3500	8.9	0	230.750	0.000
3525	7.51	0	205.125	0.000
3550	7.78	0	191.125	0.000
3575	9.56	0	216.750	0.000
3600	10.5	0	250.750	0.000
3625	10.34	0	260.500	0.000
3650	11.57	0	273.875	0.000
3675	11.83	0	292.500	0.000
3700	11.53	0	292.000	0.000
3725	10.27	0	272.500	0.000
3750	8.74	0	237.625	0.000
3775	6.75	0	193.625	0.000
3800	7.91	0	183.250	0.000
3825	9.91	0	222.750	0.000
3850	9.45	0	242.000	0.000
3875	9.89	0	241.750	0.000
3900	10.37	0	253.250	0.000
3925	11.61	0	274.750	0.000
3950	12.41	0	300.250	0.000
3975	12.04	0	305.625	0.000
4000	10.04	0	276.000	0.000
4025	8.63	0	233.375	0.000
4050	7.92	0	206.875	0.000
4075	7.45	0	192.125	0.000
4100	7.58	0	187.875	0.000
4125	8.87	0	205.625	0.000
4150	10.87	0	246.750	0.000
4175	11.34	0	277.625	0.000
4200	10.58	0	274.000	0.000
4225	10.58	0	264.500	0.000
4250	10.57	0	264.375	0.000
4275	11.5	0	275.875	0.000
4300	10.99	0	281.125	0.000
4325	10.88	0	273.375	0.000
4350	10.18	0	263.250	0.000
4375	11.01	0	264.875	0.000
4400	10.43	0	268.000	0.000
4425	8.08	0	231.375	0.000
4450	6.33	0	180.125	0.000
4475	5.91	0	153.000	0.000
4500	5.3	0	140.125	0.000
4525	4.7	0	125.000	0.000
4550	6.39	0	138.625	0.000
4575	9.34	0	196.625	0.000
4600	12.16	0	268.750	0.000



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
4625	12.03	0	302.375	0.000
4650	11.31	0	291.750	0.000
4675	9.8	0	263.875	0.000
4700	8.72	0	231.500	0.000
4725	9.14	0	223.250	0.000
4750	9.17	0	228.875	0.000
4775	9.39	0	232.000	0.000
4800	10.08	0	243.375	0.000
4825	11.38	0	268.250	0.000
4850	12.33	0	296.375	0.000
4875	12.55	0	311.000	0.000
4900	12.43	0	312.250	0.000
4925	8.89	0	266.500	0.000
4950	6.27	0	189.500	0.000
4975	5.89	0	152.000	0.000
5000	5.08	0	137.125	0.000
5025	5.44	0	131.500	0.000
5050	5.66	0	138.750	0.000
5075	6.46	0	151.500	0.000
5100	9.26	0	196.500	0.000
5125	13	0	278.250	0.000
5150	12.09	0	313.625	0.000
5175	10.22	0	278.875	0.000
5200	9.79	0	250.125	0.000
5225	9.37	0	239.500	0.000
5250	9.3	0	233.375	0.000
5275	9	0	228.750	0.000
5300	9.24	0	228.000	0.000
5325	9.18	0	230.250	0.000
5350	8.46	0	220.500	0.000
5375	7.51	0	199.625	0.000
5400	8.65	0	202.000	0.000
5425	8.88	0	219.125	0.000
5450	10.13	0	237.625	0.000
5475	10.95	0	263.500	0.000
5500	11.15	0	276.250	0.000
5525	10.41	0	269.500	0.000
5550	11.1	0	268.875	0.000
5575	10.92	0	275.250	0.000
5600	10.69	0	270.125	0.000
5625	10.56	0	265.625	0.000
5650	10.26	0	260.250	0.000
5675	10.58	0	260.500	0.000
5700	9.7	0.06	253.500	0.750
5725	16.36	0	325.750	0.750
5750	15.3	0	395.750	0.000
5775	15.48	0	384.750	0.000
5800	12.4	0	348.500	0.000
5825	12.76	0	314.500	0.000
5850	8.11	0.34	260.875	4.250
5875	12.27	0	254.750	4.250
5900	9.98	0	278.125	0.000
5925	9.64	0	245.250	0.000



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
5950	6.93	0	207.125	0.000
5975	5.89	0.72	160.250	9.000
6000	6.91	0	160.000	9.000
6025	7.47	0	179.750	0.000
6050	7.23	0	183.750	0.000
6075	7.4	0.64	182.875	8.000
6100	7.79	0.48	189.875	14.000
6125	8.51	0.05	203.750	6.625
6150	7.72	0	202.875	0.625
6175	7.67	0.02	192.375	0.250
6200	7.53	0	190.000	0.250
6225	7.31	0.53	185.500	6.625
6250	10.65	0	224.500	6.625
6275	9.6	0	253.125	0.000
6300	7.52	4.01	214.000	50.125
6325	9.37	0	211.125	50.125
6350	11.37	0	259.250	0.000
6375	11.34	0	283.875	0.000
6400	12.22	0	294.500	0.000
6425	11.59	0	297.625	0.000
6450	12.71	0	303.750	0.000
6475	10.62	0	291.625	0.000
6500	10.86	0	268.500	0.000
6525	11.07	0.09	274.125	1.125
6550	11.19	0	278.250	1.125
6575	11.46	0	283.125	0.000
6600	11.46	0	286.500	0.000
6625	6.03	10.42	218.625	130.250
6650	6.55	0.68	157.250	138.750
6675	5.38	0.45	149.125	14.125
6700	5.08	0.05	130.750	6.250
6725	4.04	0	114.000	0.625
6750	3.39	2.28	92.875	28.500
6775	3.11	0.19	81.250	30.875
6800	1.64	4.38	59.375	57.125
6825	2.04	4.12	46.000	106.250
6850	3.02	0.56	63.250	58.500
6875	3.63	0.81	83.125	17.125
6900	5.73	0.09	117.000	11.250
6925	10.28	0	200.125	1.125
6950	12.81	0	288.625	0.000
6975	13	0	322.625	0.000
7000	13.05	0	0.000	0.000
7025	7.87	0.63	261.500	7.875
7050	10.08	0.88	224.375	18.875
7075	8.67	1.54	234.375	30.250
7100	6.53	0	190.000	19.250
7125	2.75	1.14	116.000	14.250
7150	1.27	1.67	50.250	35.125
7175	1.68	0.16	36.875	22.875
7200	2.3	0	49.750	2.000
7225	1.06	8.25	42.000	103.125
7250	1.95	2.79	37.625	138.000



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
7275	4.7	0	83.125	34.875
7300	3.87	4.13	107.125	51.625
7325	4.8	0.47	108.375	57.500
7350	7.22	0	150.250	5.875
7375	8.44	0	195.750	0.000
7400	9.84	0	228.500	0.000
7425	10.73	0	257.125	0.000
7450	11.99	0	284.000	0.000
7475	9.75	0.13	271.750	1.625
7500	7.83	0	219.750	1.625
7525	8.21	0	200.500	0.000
7550	9.39	0	220.000	0.000
7575	8.68	0	225.875	0.000
7600	8.27	0	211.875	0.000
7625	7.33	0	195.000	0.000
7650	6.84	0	177.125	0.000
7675	7.04	0	173.500	0.000
7700	6.85	0	173.625	0.000
7725	8.33	0	189.750	0.000
7750	11.03	0	242.000	0.000
7775	12.21	0	290.500	0.000
7800	9.79	0	275.000	0.000
7825	9.26	0	238.125	0.000
7850	9.17	0	230.375	0.000
7875	8.27	0	218.000	0.000
7900	6.34	0	182.625	0.000
7925	4.14	0	131.000	0.000
7950	4.72	0	110.750	0.000
7975	5.24	0.46	124.500	5.750
8000	6.87	0	151.375	5.750
8025	8.04	0	186.375	0.000
8050	7.25	0	191.125	0.000
8075	7.35	0	182.500	0.000
8100	8.97	0	204.000	0.000
8125	8.83	0	222.500	0.000
8150	7.87	0	208.750	0.000
8175	10.64	0	231.375	0.000
8200	9.07	0	246.375	0.000
8225	8.49	0	219.500	0.000
8250	7.66	0	201.875	0.000
8275	7.79	0	193.125	0.000
8300	6.43	0.36	177.750	4.500
8325	9.38	0	197.625	4.500
8350	10.48	0	248.250	0.000
8375	9.97	0	255.625	0.000
8400	14.03	0	300.000	0.000
8425	11.03	0	313.250	0.000
8450	8.16	0.08	239.875	1.000
8475	3.92	1.91	151.000	24.875
8500	2.42	0.68	79.250	32.375
8525	0.57	7.06	37.375	96.750
8550	0.01	2.77	7.250	122.875
8575	0	8.37	0.125	139.250



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
8600	0	9.41	0.000	222.250
8625	0	8.87	0.000	228.500
8650	0	8.14	0.000	212.625
8675	0	8.71	0.000	210.625
8700	0.25	2.12	3.125	135.375
8725	2.46	11.91	33.875	175.375
8750	3.16	2.25	70.250	177.000
8775	9	0	152.000	28.125
8800	14.69	3.46	296.125	43.250
8825	10.06	0.22	309.375	46.000
8850	0.4	1.58	130.750	22.500
8875	0	6.79	5.000	104.625
8900	0	9.1	0.000	198.625
8925	0	11.62	0.000	259.000
8950	1.14	6.83	14.250	230.625
8975	4.65	0	72.375	85.375
9000	4.02	2.22	108.375	27.750
9025	3.79	1.85	97.625	50.875
9050	5.98	1.15	122.125	37.500
9075	8.02	0	175.000	14.375
9100	8.53	0.15	206.875	1.875
9125	11.88	0	255.125	1.875
9150	9.92	0	272.500	0.000
9175	10.46	0	254.750	0.000
9200	11.6	0	275.750	0.000
9225	10.82	0	280.250	0.000
9250	10.49	0	266.375	0.000
9275	10.05	0	256.750	0.000
9300	9.38	0	242.875	0.000
9325	8.75	0	226.625	0.000
9350	7.29	0	200.500	0.000
9375	6.21	0	168.750	0.000
9400	6.41	0	157.750	0.000
9425	8.31	0	184.000	0.000
9450	7.83	0	201.750	0.000
9475	6.89	0	184.000	0.000
9500	6.14	0.3	162.875	3.750
9525	6.25	1.79	154.875	26.125
9550	5.14	1.39	142.375	39.750
9575	8.36	0	168.750	17.375
9600	8.3	0	208.250	0.000
9625	8.27	0	207.125	0.000
9650	4.18	0.11	155.625	1.375
9675	4.97	0.12	114.375	2.875
9700	6.08	0	138.125	1.500
9725	8.41	0	181.125	0.000
9750	7.82	0	202.875	0.000
9775	7.32	0	189.250	0.000
9800	7.63	1.98	186.875	24.750
9825	8.69	0.25	204.000	27.875
9850	9.39	0.08	226.000	4.125
9875	9.17	0	232.000	1.000
9900	9.53	0.51	233.750	6.375



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
9925	10.29	0	247.750	6.375
9950	10.8	0	263.625	0.000
9975	7.94	0.86	234.250	10.750
10000	10.5	0	230.500	10.750
10025	9.71	0	252.625	0.000
10050	8.87	0.04	232.250	0.500
10075	7.75	0	207.750	0.500
10100	5.88	1.92	170.375	24.000
10125	7.84	0.44	171.500	29.500
10150	9.86	0	221.250	5.500
10175	7.72	1.96	219.750	24.500
10200	6.12	1.1	173.000	38.250
10225	5.21	5.41	141.625	81.375
10250	4.76	1.68	124.625	88.625
10275	5.47	2.77	127.875	55.625
10300	5.75	1.35	140.250	51.500
10325	7.52	0.5	165.875	23.125
10350	5.21	0.04	159.125	6.750
10375	4.47	1.68	121.000	21.500
10400	7.41	5.33	148.500	87.625
10425	7.28	0.25	183.625	69.750
10450	6.87	1.68	176.875	24.125
10475	6.26	1.02	164.125	33.750
10500	7.35	1.14	170.125	27.000
10525	9.51	0	210.750	14.250
10550	9.14	0.15	233.125	1.875
10575	8.51	0	220.625	1.875
10600	8.76	0	215.875	0.000
10625	6.53	0.36	191.125	4.500
10650	7.82	0	179.375	4.500
10675	7.38	0	190.000	0.000
10700	5.13	0.29	156.375	3.625
10725	9.39	0	181.500	3.625
10750	6.97	1.34	204.500	16.750
10775	5.75	2.19	159.000	44.125
10800	3.61	2.85	117.000	63.000
10825	3.84	1.59	93.125	55.500
10850	5.12	0.13	112.000	21.500
10875	3.32	3.99	105.500	51.500
10900	3.67	2.27	87.375	78.250
10925	4.84	0	106.375	28.375
10950	7.72	0	157.000	0.000
10975	10.12	0	223.000	0.000
11000	8.92	13.07	238.000	163.375
11025	8.73	0.28	220.625	166.875
11050	8.01	0.16	209.250	5.500
11075	8.48	0.16	206.125	4.000
11100	6.04	0	181.500	2.000
11125	4.99	0	137.875	0.000
11150	3.71	3.2	108.750	40.000
11175	5.16	13.93	110.875	214.125
11200	7.33	0.67	156.125	182.500
11225	7.84	3.44	189.625	51.375



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
11250	7.88	0	196.500	43.000
11275	7.34	0	190.250	0.000
11300	6.45	0	172.375	0.000
11325	4.05	6.96	131.250	87.000
11350	6.65	4.6	133.750	144.500
11375	5.74	10.67	154.875	190.875
11400	4.05	6.7	122.375	217.125
11425	5.28	1.6	116.625	103.750
11450	7.5	0	159.750	20.000
11475	3.35	4.18	135.625	52.250
11500	2.01	2.24	67.000	80.250
11525	0.79	7.36	35.000	120.000
11550	0.28	8.49	13.375	198.125
11575	0.28	20.1	7.000	357.375
11600	0.87	3.89	14.375	299.875
11625	2.15	0.71	37.750	57.500
11650	4.43	0.13	82.250	10.500
11675	6.26	0	133.625	1.625
11700	7.12	0	167.250	0.000
11725	6.12	0.35	165.500	4.375
11750	7.98	0	176.250	4.375
11775	6.26	0.29	178.000	3.625
11800	7.29	0	169.375	3.625
11825	7.61	2.82	186.250	35.250
11850	9.01	0	207.750	35.250
11875	9.44	0	230.625	0.000
11900	7.65	0	213.625	0.000
11925	7.12	0.05	184.625	0.625
11950	9.2	0	204.000	0.625
11975	10.17	0	242.125	0.000
12000	9.89	0	250.750	0.000
12025	8.78	0	233.375	0.000
12050	7.78	0	207.000	0.000
12075	7.18	0	187.000	0.000
12100	7.6	0	184.750	0.000
12125	9.22	0	210.250	0.000
12150	11.17	0	254.875	0.000
12175	11.2	0	279.625	0.000
12200	9.46	0	258.250	0.000
12225	10.75	0	252.625	0.000
12250	11.36	0	276.375	0.000
12275	10.53	0	273.625	0.000
12300	9.73	0	253.250	0.000
12325	8.04	0	222.125	0.000
12350	5.81	0.89	173.125	11.125
12375	5.99	0.14	147.500	12.875
12400	3.33	12.86	116.500	162.500
12425	5.95	0	116.000	160.750
12450	4.32	3.2	128.375	40.000
12475	3.4	5.3	96.500	106.250
12500	2.66	5.19	75.750	131.125
12525	3.24	0.99	73.750	77.250
12550	3.2	1.12	80.500	26.375



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
12575	2.72	6.32	74.000	93.000
12600	3.09	8.57	72.625	186.125
12625	4.73	4.17	97.750	159.250
12650	7.42	0	151.875	52.125
12675	8.93	2.03	204.375	25.375
12700	10.91	0	248.000	25.375
12725	12.9	0	297.625	0.000
12750	11.15	0.73	300.625	9.125
12775	9.08	0	252.875	9.125
12800	5.5	0	182.250	0.000
12825	4.64	0	126.750	0.000
12850	4.79	0	117.875	0.000
12875	4.59	0.27	117.250	3.375
12900	5.57	0	127.000	3.375
12925	5.61	0	139.750	0.000
12950	7.17	0	159.750	0.000
12975	6.51	0.03	171.000	0.375
13000	7.31	0	172.750	0.375
13025	6.84	0	176.875	0.000
13050	9.66	0	206.250	0.000
13075	8.75	0	230.125	0.000
13100	9.09	0	223.000	0.000
13125	10.91	0	250.000	0.000
13150	7.42	0.02	229.125	0.250
13175	4.41	0.19	147.875	2.625
13200	4.63	0.7	113.000	11.125
13225	6.38	0.68	137.625	17.250
13250	7.43	1.1	172.625	22.250
13275	8.78	1.16	202.625	28.250
13300	11.47	0	253.125	14.500
13325	10.33	0.05	272.500	0.625
13350	11.23	0	269.500	0.625
13375	9.92	0.63	264.375	7.875
13400	10.23	0	251.875	7.875
13425	9.34	0.44	244.625	5.500
13450	8.16	0	218.750	5.500
13475	7.81	0.02	199.625	0.250
13500	7.06	0.95	185.875	12.125
13525	6.74	0.42	172.500	17.125
13550	7.85	1.8	182.375	27.750
13575	8.27	0.02	201.500	22.750
13600	6.92	0.95	189.875	12.125
13625	8.25	0	189.625	11.875
13650	10.45	0	233.750	0.000
13675	7.53	0.69	224.750	8.625
13700	5.79	0.34	166.500	12.875
13725	5.22	0.38	137.625	9.000
13750	5.18	0.59	130.000	12.125
13775	4.31	0.08	118.625	8.375
13800	5.15	0	118.250	1.000
13825	4.99	0.08	126.750	1.000
13850	11.39	0	204.750	1.000
13875	9.91	0	266.250	0.000



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
13900	14.01	2.84	299.000	35.500
13925	12.61	0	332.750	35.500
13950	9.85	0	280.750	0.000
13975	9.84	0.05	246.125	0.625
14000	9.82	0	245.750	0.625
14025	9.76	0	244.750	0.000
14050	10.92	0	258.500	0.000
14075	8.03	3.85	236.875	48.125
14100	10.14	0	227.125	48.125
14125	7.83	1.03	224.625	12.875
14150	12.56	0	254.875	12.875
14175	10.94	0.16	293.750	2.000
14200	9.42	0	254.500	2.000
14225	6.09	0.06	193.875	0.750
14250	5.6	0.21	146.125	3.375
14275	6	0	145.000	2.625
14300	5.45	0.5	143.125	6.250
14325	8.77	0	177.750	6.250



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
14350	7.33	0	201.250	0.000
14375	9.24	0	207.125	0.000
14400	4.49	0	171.625	0.000
14425	4.48	0.15	112.125	1.875
14450	6.43	0	136.375	1.875
14475	10.85	0	216.000	0.000
14500	12.63	0	293.500	0.000
14525	8.61	0	265.500	0.000
14550	7.55	0	202.000	0.000
14575	2.22	5.48	122.125	68.500
14600	3.59	0	72.625	68.500
14625	5.36	0	111.875	0.000
14650	4.06	1.83	117.750	22.875
14675	9.31	0.43	167.125	28.250
14700	16.62	0	324.125	5.375
14725	18.62	0	440.500	0.000
14750	17.27	0	448.625	0.000
14775	10.78	0.04	350.625	0.500
14800	9.51	0.03	253.625	0.875
14825	9.91	0	242.750	0.375
14850	9.33	0	240.500	0.000
14875	7.91	0.34	0.000	0.000
14900	7.48	0.12	0.000	0.000
14925	6.91	0	0.000	0.000
14950	7.25	0	177.000	0.000
14975	8.38	0	195.375	0.000
15000	8.35	0	209.125	0.000
15025	9.71	0	225.750	0.000
15050	12.16	0	273.375	0.000
15075	12.44	0	307.500	0.000
15100	9.63	0	275.875	0.000
15125	9.41	0	238.000	0.000
15150	10.21	0	245.250	0.000
15175	10.78	0	262.375	0.000
15200	12	0	284.750	0.000
15225	13.07	0	313.375	0.000
15250	5.17	0.11	228.000	1.375
15275	4.49	0.75	120.750	10.750
15300	5.21	0.2	121.250	11.875
15325	6.49	0.61	146.250	10.125
15350	5.28	0.25	147.125	10.750
15375	4.74	0.25	125.250	6.250
15400	6.53	0.03	140.875	3.500
15425	7.35	0	173.500	0.375
15450	9.36	0	208.875	0.000
15475	12.87	0	277.875	0.000
15500	15.5	0	354.625	0.000
15525	17.28	0	409.750	0.000
15550	19.22	0	456.250	0.000
15575	16.8	0	450.250	0.000
15600	13.52	0	379.000	0.000
15625	13.47	0	337.375	0.000
15650	12.54	0	325.125	0.000



QUANTITY CALCULATION OF CUTFILL

For Soil & Ordinary Rock:-

Chainage (m)	Cut Area (sqm)	Fill Area (sqm)	Earthwork - Cut Volume (cum)	Earthwork - Fill Volume (cum)
15675	9.54	0	276.000	0.000
15700	4.53	10.06	175.875	125.750
15725	4.3	0.32	110.375	129.750
15750	7.9	0	152.500	4.000
15775	6.67	0	182.125	0.000
15800	6.07	0.25	159.250	3.125
15825	5.75	0.17	147.750	5.250
15850	4.54	0.8	128.625	12.125
15875	1.87	1.24	80.125	25.500
15900	0.61	1.97	31.000	40.125
		Total =	99,477	10,838

Scarified Bituminous and Granular Material(c)=	23558	cum
Subgrade Quantity at Built Up Section(A)	29,413	cum
Subgrade Quantity at Rural Section(D)	52910	cum
Total Earthwork in cutting(B) =	99477	cum
Total earthwork in soil(B-A-C-D)=	46,506	cum

Earthwork in filling =	10,838	cum
Total Earthwork in filling =	10,838	cum

Using 40% of cutting material for filling earthworks in embankment
Earthwork used from Roadway Cutting Material= 18602 cum
So no Earthwork required for embankment const from borrowpit ::



Calculation of Extra Widening

	Start chainage of arc	End chainage of arc	Chord length (m)	Width	Transition length	Total area for extra-widening (in Arc Portion) (sqm.)	Total area for extra-widening (in Transition Portion)	Total area for extra-widening (Sqm.)
Arc	3792.408	3918.945	124.801	0.6	50	74.88	30	104.88
Arc	4451.714	4497.818	46.02	0.6	35	27.61	21	48.61
Arc	4578.88	4610.498	31.591	0.6	35	18.95	21	39.95
Arc	4936.73	4978.638	41.854	0.6	50	25.11	30	55.11
Arc	6541.857	6609.494	67.316	0.6	60	40.39	36	76.39
Arc	8799.284	8833.301	33.999	0.6	35	20.40	21	41.40
Arc	9328.436	9405.186	76.28	0.6	35	45.77	21	66.77
Arc	9513.906	9557.298	43.333	0.6	30	26.00	18	44.00
Arc	9629.633	9661.682	32.034	0.6	40	19.22	24	43.22
Arc	9766.628	9776.746	10.116	0.6	45	6.07	27	33.07
Arc	10324.614	10415.126	89.976	0.6	90	53.99	54	107.99
Arc	11104.681	11143.386	38.663	0.6	50	23.20	30	53.20
Arc	11649.405	11658.731	9.325	0.6	75	5.60	45	50.60
Arc	12252.191	12293.289	41.066	0.6	75	24.64	45	69.64
Arc	12748.205	12836.772	88.065	0.6	50	52.84	30	82.84
Arc	15273.152	15333.222	59.925	0.6	90	35.96	54	89.96
Arc	15825.824	15864.095	38.233	0.6	50	22.94	30	52.94
								1060.56

Total Area of Extra Widening= 1060.6 Sqm



Variable Declaration

Extra Widening on Flexible Pavement

SI No	Variable Description	Variable	Dimension	Unit
1	Total Area of Extra Widening	ew_area	1060.600	m
2	BC	bc	0.040	m
3	DBM	dbm	0.100	m
4	WMM-I	wmm1	0.125	m
5	WMM-II	wmm2	0.125	m
6	GSB	gsb	0.200	m
7	Reuseble GSB percentage	gsb_per	36.86	

percentage

RCC Cover Drain

Cover Drain(Main Road)

Chainage (km)		Length(km)	Side	Length of CD(m)	Net Length (m)
From	To				
3275	5700	2425	Both	16.94	4816.12
7500	8400	900	Both	7.9	1784.2
9150	9400	250	Both		500
11850	12375	525	Both	2.6	1044.8
12700	13125	425	Both	16.4	817.2
				Net Length	8962

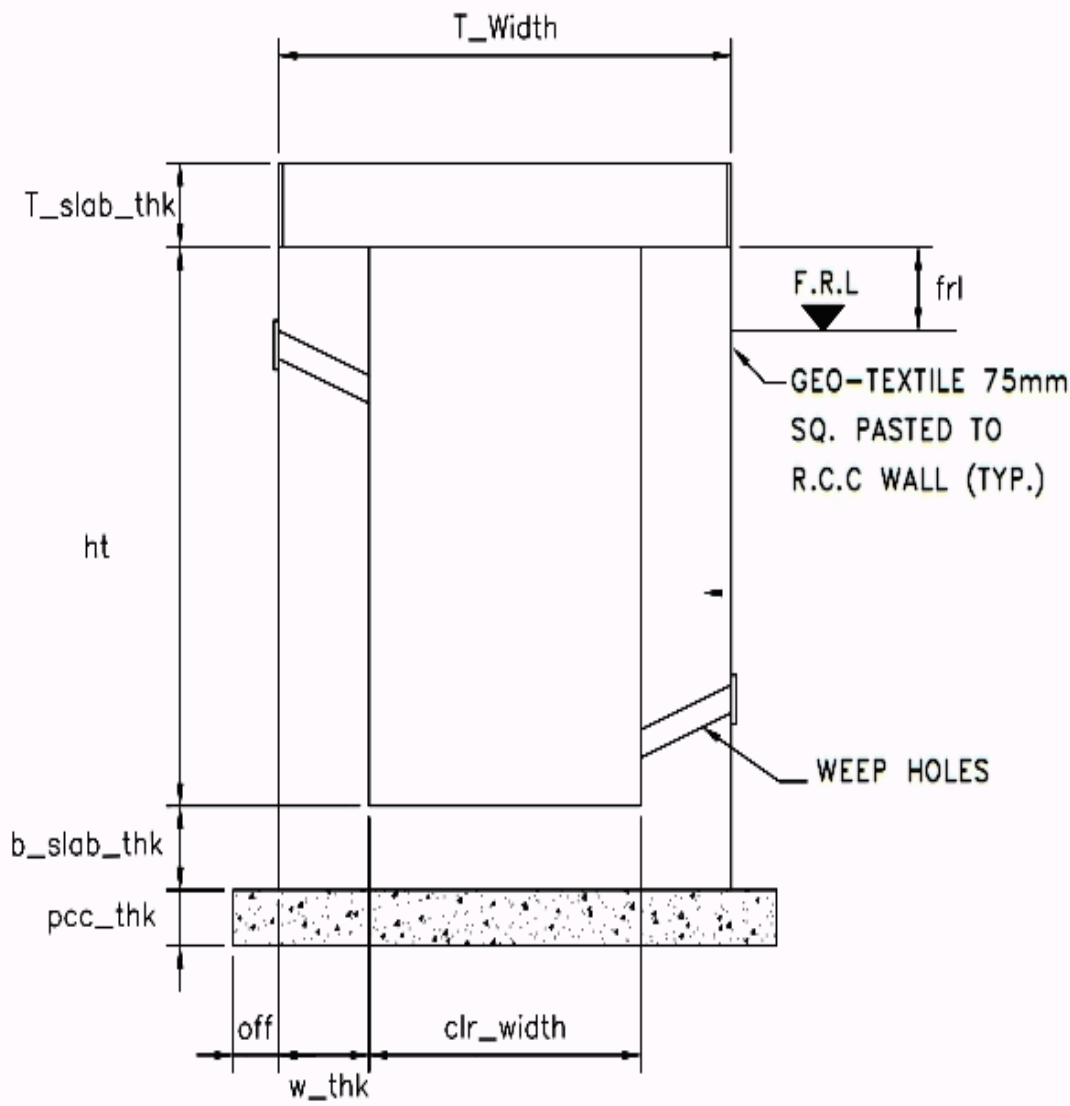


Variable Declaration

RCC Cover Drain

Sl No	Variable Description	Variable	Dimension	Unit
1	Top Width	t_width	1.750	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	0.150	m
5	Side Wall Thickness	w_thk	0.200	m
6	Foundation PCC thickness	pcc_thk	0.100	m
7	Foundation PCC Offset	off	0.100	m
8	Length	l	8962.000	m
9	Reinforcement Per Cum RCC	s	0.050	MT/Cum RCC
10	Finished Road Level	fri	0.300	m

Variable Declaration



Minor Junction

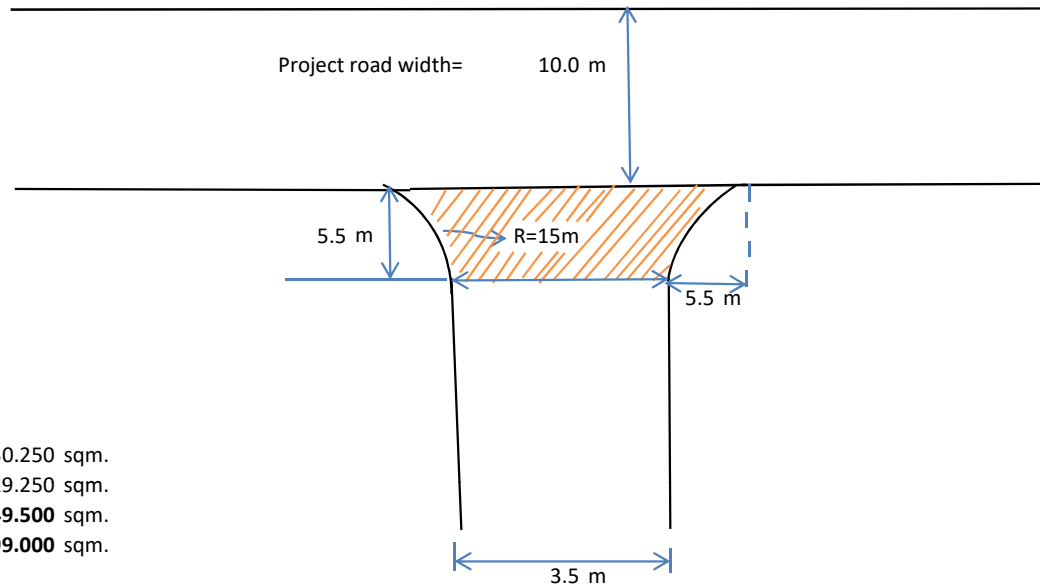
SI No	Ch(Existing Ch)	Type Of Junction
1	3250	T
2	3270	T
3	3525	T
4	3540	T
5	3600	T
6	3650	T
7	3760	T
8	3880	T
9	3890	T
10	3950	T
11	4010	T
12	4050	T
13	4110	T
14	4250	Y
15	4350	T
16	4400	T
17	4450	T
18	4700	Y
19	5190	T
20	5210	Y
21	5330	T
22	6350	Y
23	7060	Y
24	7370	T
25	7400	X
26	7540	T
27	7650	Y
28	8150	X
29	9000	X
30	9150	Y
31	9550	Y
32	10190	Y
33	10350	T
34	11950	X
35	12500	T
36	12520	X

SI No	Ch(Existing Ch)	Type Of Junction
37	12750	Y
38	13550	T
39	13950	T
40	14200	X
41	14450	T



Minor Junction

Pavement Layer	Thickness (m)
GSB =	0.200
WMM-II =	0.125
WMM-I =	0.125
DBM=	0.100
BC =	0.040



For triangular portion area = 30.250 sqm.
 For rectangular portion area = 19.250 sqm.
 Total area of 3 legged Junction = **49.500** sqm.
 Total area of 4 legged Junction = **99.000** sqm.

Quantity Calculation for Minor Junction

Type	No	Each Avg. area	Total Area (sqm)
3 legged	35	49.50	1733
4 legged	6	99.000	594
		Total =	2327

Variable Declaration

Minor Junction

SI No	Variable Description	Variable	Dimension	Unit
1	Total_area	tot_area	2376.000	area
2	BC	bc	0.040	m
3	DBM	dbm	0.100	m
4	WMM1	wmm1	0.125	m
5	WMM2	wmm2	0.125	m
6	GSB Thickness	gsb	0.200	m
7	GSB Reuse	gsb_per	36.86	

TOE WALL

Chainage (m)		Length of CD	Net Length (m)	TCS No.	Side
From	To				
8900	8980		80.0	TCS-3	One
10200	10250		50.0	TCS-3	One
Total =			130		

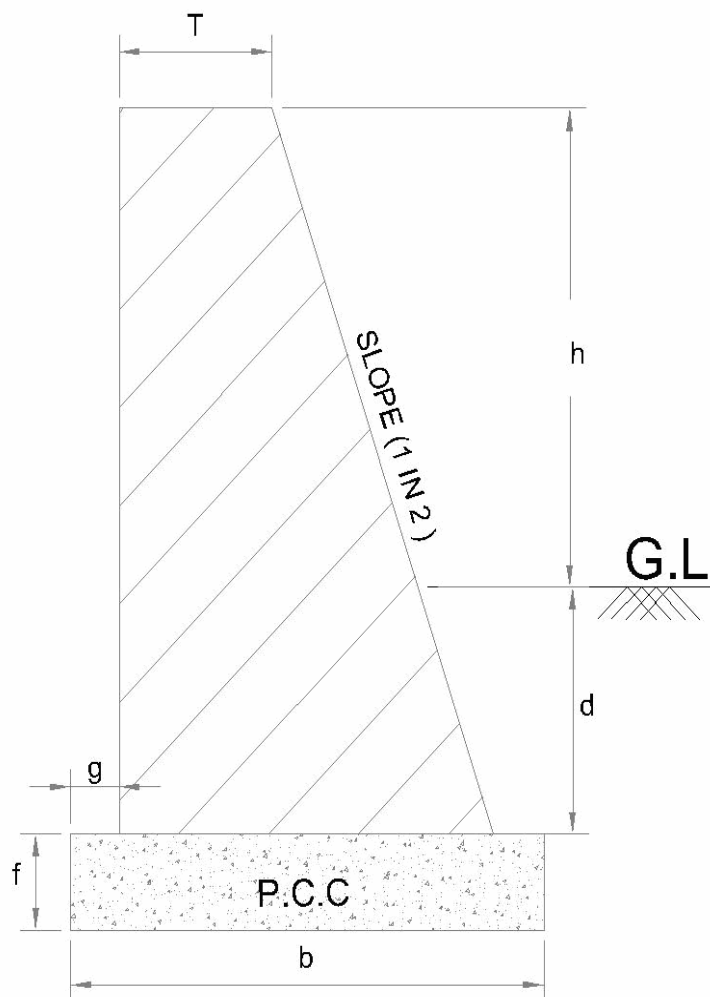


Variable Declaration

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	270.000	m
8	Width At GL ($c = b - 2.g - h/2$)	c	0.550	m

Variable Declaration



**TYPICAL CROSS SECTION OF
TOE WALL**

OVERHEAD SIGN

Chainage Details:		
Location	Ch. Km	Nos
Starting of Road	3+275 km	1
	Total	1

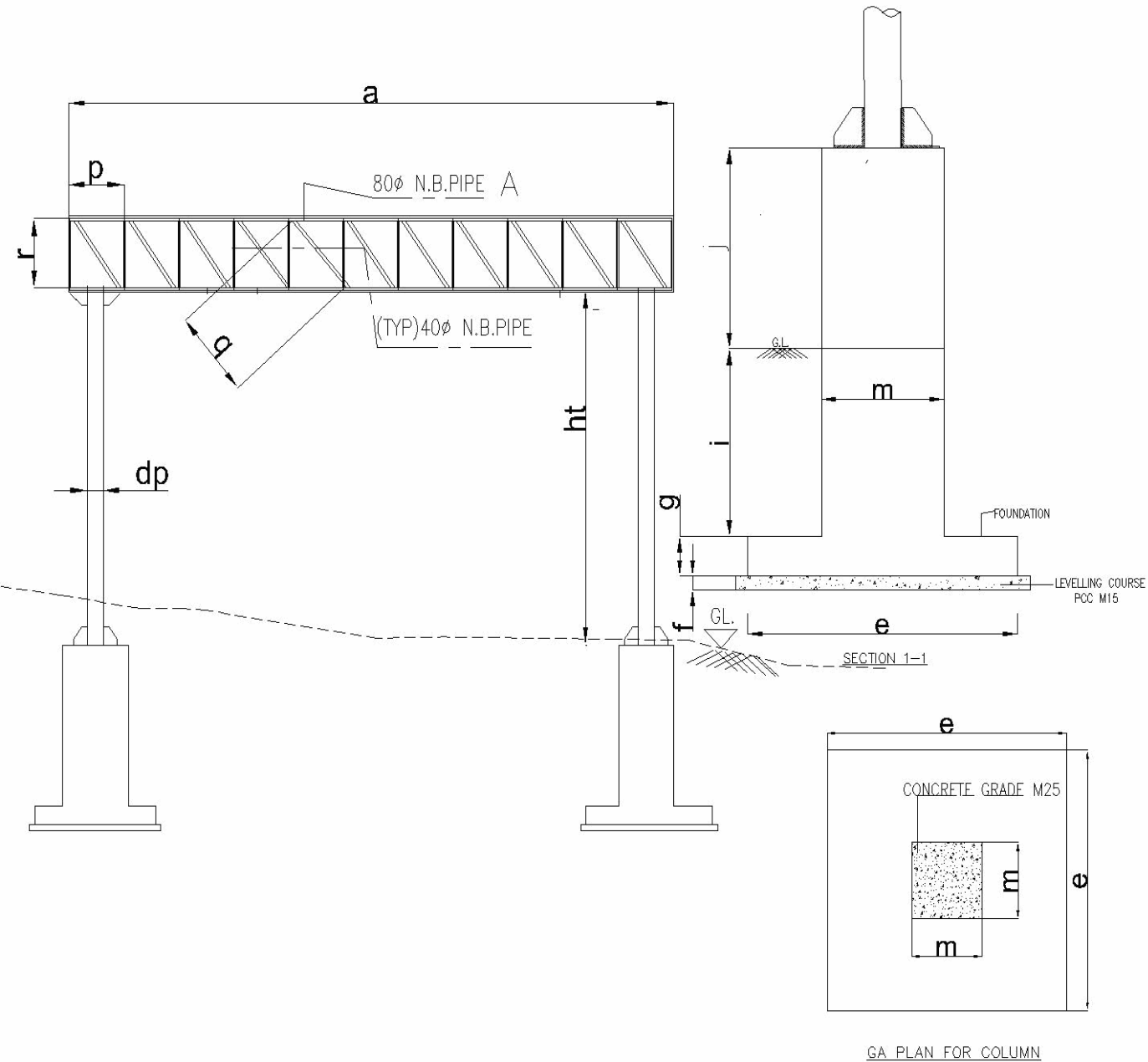


Variable Declaration

Overhead Signs

SI No	Variable Description	Variable	Dimension	Unit
1	Nos of Signs	n	1.000	Nos
2	End to end Grantry Distance	a	16.000	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



CALCULATION FOR BUSBAY & PASSENGER SHELTER

Chainage of Passenger Shelter

<i>Sl No</i>	<i>Chainage (KM)</i>	<i>Name of the Place</i>	<i>Side</i>
1	5.750	Both	Khamnam Market
2	10.600	Both	Konkhouljam
3	12.600	Both	Khumbong

Total Number of Bus Bay = 6



Variable Declaration

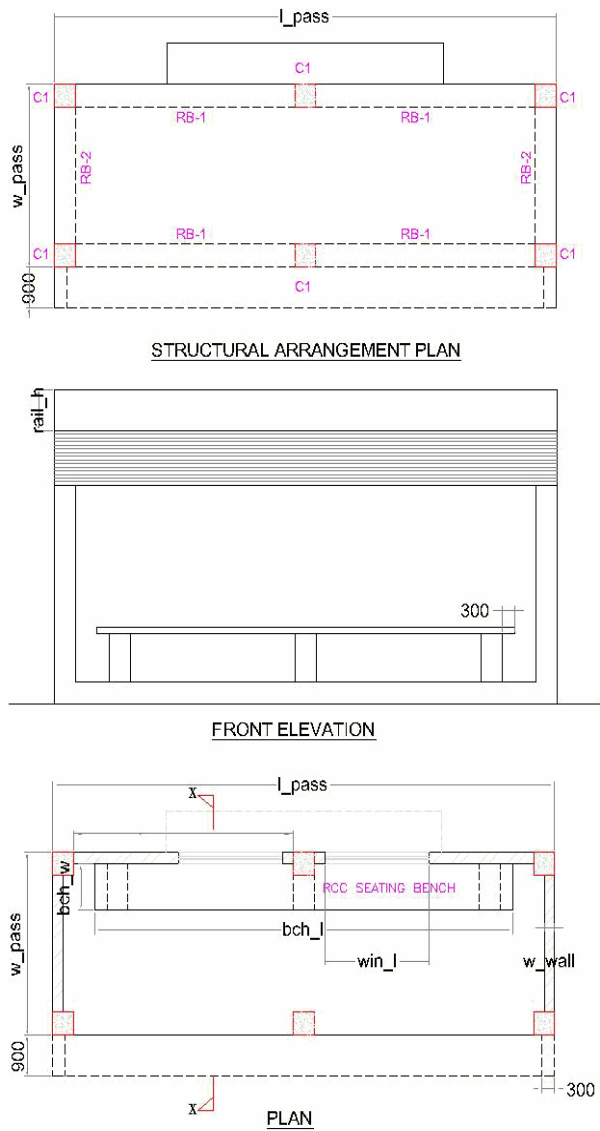
Passenger Shelter

SI No	Variable Description	Variable	Dimension	Unit
1	No of Passenger Shelter	n	6.000	nos
2	Foundation Length for column	a	0.750	m
3	Foundation Width for column	b	0.750	m
4	Foundation Depth for column	df	0.750	m
5	Nos of column	col_n	6.000	Nos
6	Foundation length for Brick work	l	13.500	m
7	Foundation width for Brick work	w	0.500	m
8	Foundation depth for Brick work	db	0.300	m
9	Each column length	col_l	0.250	m
10	Each column width	col_w	0.250	m
11	Thickness of foundation at bottom	btm_thk	0.100	m
12	Thickness of foundation at top	top_thk	0.100	m
13	Foundation reinforcement	rf	120.000	kg/cum
14	Width of brick wall	w_wall	0.125	m
15	Thickness of pcc	pcc_thk	0.100	m
16	Length of Passenger shelter	l_pass	6.000	m
17	Width of Passenger shelter	w_pass	2.000	m
18	Foundation brick wall top thickness	wtop_thk	0.150	m
19	Foundation brick wall btm thickness	wbtm_thk	0.150	m
20	Side wall & back wall lower portion height	wall_h	0.550	m
21	Side wall upper portion length	sw_l	1.500	m
22	Side wall upper portion height	sw_h	2.130	m
23	Back wall upper portion Length	bw_l	2.650	m
24	Back wall upper portion height	bw_h	0.950	m
25	Seating bench length	bch_l	5.000	m
26	Seating bench width	bch_w	0.500	m
27	Seating bench thickness	bch_thk	0.075	m
28	Nos of window	win_n	2.000	nos
29	Length of window	win_l	1.250	m
30	Height of window	win_h	0.900	m
31	Front column height	fcol_h	2.650	m
32	Back column height	bcol_h	2.100	m
33	Side beam length (RB2)	sb_l	1.530	m
34	Side beam width	sb_w	0.250	m
35	Side beam thickness	sb_thk	0.350	m
36	Side beam length (RB1)	sb_a	3.000	m

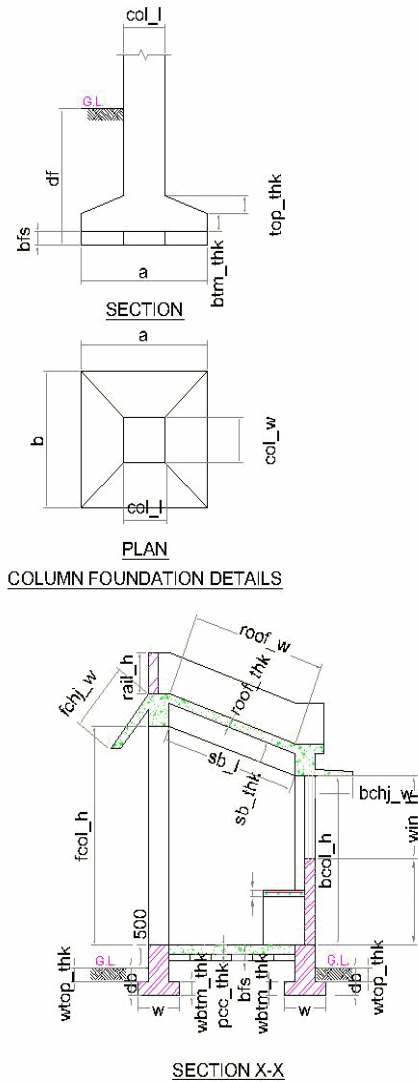
Variable Declaration

37	Thickness of Roof slab	roof_thk	0.110	m
38	Width of front Chajja	fchj_w	0.680	m
39	Width of back Chajja	bchj_w	0.450	m
40	Length of railing	rail_l	9.500	m
41	Height of railing	rail_h	0.450	m
42	Width of roof slab	roof_w	1.530	m
43	Superstructure reinforcement	srf	100.000	kg/cum
44	Side wall inner side length	sw_in	1.875	m
45	Back wall inner side length	bw_in	5.800	m
46	Side wall height (plastering &painting)	sw_ht	3.830	m
47	Back wall height (plastering &painting)	bw_ht	2.350	m
48	top width of wall in foundation	fw_wall	0.250	m

Variable Declaration



PASSENGER SHELTER



CALCULATION FOR BUSBAY & PASSENGER SHELTER

Chainage of Passenger Shelter

<i>Sl No</i>	<i>Chainage (KM)</i>	<i>Name of the Place</i>	<i>Side</i>
1	5.750	Both	Khamnam Market
2	10.600	Both	Konkhouljam
3	12.600	Both	Khumbong

Total Number of Bus Bay = 6

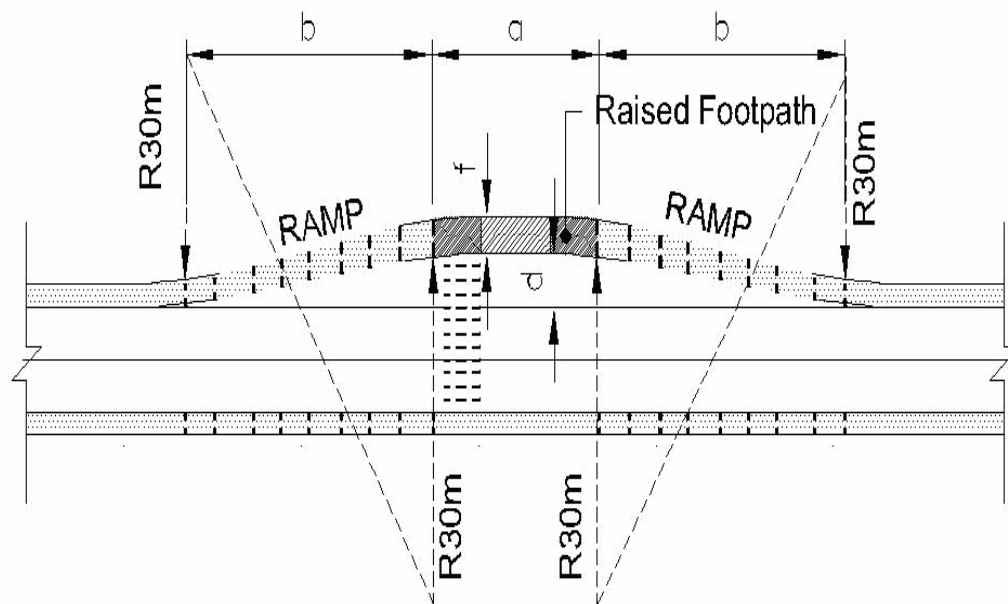


Variable Declaration

Busbay (2 Lane)

SI No	Variable Description	Variable	Dimension	Unit
1	BC Thickness	bc	0.040	m
2	DBM Thickness	dbm	0.100	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	6.000	nos
8	Width Foothpath	f	2.500	m
9	Ref Drawing	a	15.000	m
10	Ref Drawing	b	100.000	m
11	Ref Drawing	d	5.500	m
12	GSB percentage Re-use	gsb_per	36.86%	

Variable Declaration



TYPICAL LAYOUT OF PICK-UP BUS STOP ON HILLY AREA

Traffic Signs and Other Appurtenance

Summary Of Traffic Signs			
Total No of Street Light=	212	Nos	Bill No- 06, Sl. No- 10
Kilometer stones=	9	Nos	Bill No- 06, Sl. No- 2
5th Kilometer stones=	3	Nos	Bill No- 06, Sl. No- 1
Boundary Stones=	131	Nos	Bill No- 06, Sl. No- 3
Delineators (100 cm long and circular shaped)+Hazard marker =	542	Nos	Bill No- 06, Sl. No- 8
Road Stud=	1869	Nos	Bill No- 06, Sl. No- 9
900 mm Tringular	288	Nos	Bill No- 06, Sl. No- 5
800 mm x 600 mm rectangular	6	Nos	Bill No- 06, Sl. No- 6
Rumble Strip=	1160	sqm	Bill No- 06, Sl. No- 13



Traffic sign Calculation

Sl No	Type	IRC-67 2012 Specification	Dimension	Chainage / Location	No	Remarks
1	Right Hand Side Curve	fig 15.02	900 mm Tringular		10	@ 2per location
2	Left Hand Side Curve	fig 15.01	900 mm Tringular		12	@ 2per location
3	Zig-Zag Curve	fig 15.07	900 mm Tringular		0	@ 1per location
4	Reverse Curve	fig 15.06 & 15.05	900 mm Tringular		0	@ 1per location
5	Built-up area	fig 15.35	900 mm Tringular		10	@ 2per location
6	Side road	fig 15.09 & 15.10	900 mm Tringular		96	@ 2per location
7	Pedestain Crossing		900 mm Tringular	side road, bus bay	102	@ 2per location
8	Bus Stop	fig 17.35	800x600 rectangular		6	@ 2per location
9	Direction Sign		<.0.9 sqm	Side road & cross road	0	@ 2per location
10	Direction Sign		>0.9 sqm	bridge	0	@ 2per location
11	Hazard Marker	fig 15.76 & fig 15.77	900x300 mm rectangular	Culvert, Bridge Location	200	@ 4 per structure
12	Stop Sign	fig 14.01	900 mm Octagonal	Side road & cross road	0	@ 1 per location
13	Speed limit	fig 14.37	600mm Cicular		0	@ 2per location
14	Rumble strip	fig 15.50	900 Tringular		58	@ 2per location in Built Up Area & @ 1per location in Side Road
15	Hair pin Bend	fig 15.03 & 15.04	900 mm Tringular		0	@ 2per location
16	Convex Mirror for Blind Curve				0	@ 1per location

Traffic sign Calculation

SUMMARY			
90 cm equilateral triangle		288	nos
Stop Sign (90 cm high octagon)		0	nos
60 cm circular		0	nos
80 cm x 60 cm rectangular		6	nos
Direction Sign	<.0.9 sqm	0	nos
Direction Sign	>0.9 sqm	0	nos
Hazard Marker		200	nos
Convex Mirror for Blind Curve		0	nos
Rumble Strip		58	nos

Calculation of km Stone, Hectometer Stone and Boundary Stone

Item	Remarks	Nos
Kilometer stones	Total KM Stone	
	No. of 5th KM stone	9
5th Kilometer stones	(km stone 5th, 10th , 15th, 20th etc)	3
Boundary stones	(Total Lengthx5x2) + 2x1	131



Quantity Calculation for Road Stud

SL. No.	Description of section	START	END	Transition length	START CH.	END CH.	Length	Radius	Spacing on Curve (S)	Total On median (nos)	Total On shoulder
		CHAINAGE	CHAINAGE		Road Stud	Road stud					
1	Horizontal curve ::	3792.408	3918.945	50	3722.408	3988.945	266.54	20	6	45	90
		4451.714	4497.818	35	4396.714	4552.818	156.10	80	6	27	54
		4578.88	4610.498	35	4523.880	4665.498	141.62	20	6	24	48
	Curve radii upto 450 , spacing =6m.	4936.73	4978.638	50	4866.730	5048.638	181.91	20	6	31	62
		6541.857	6609.494	60	6461.857	6689.494	227.64	125	6	38	76
		9328.436	9405.186	35	9273.436	9460.186	186.75	40	6	32	64
	Curve radii 451 to 750 , spacing =9m.	9513.906	9557.298	30	9463.906	9607.298	143.39	50	6	24	48
		9629.633	9661.682	40	9569.633	9721.682	152.05	125	6	26	52
		9766.628	9776.746	45	9701.628	9841.746	140.12	20	6	24	48
	Curve radii 751 to 2000m & critical sections, spacing =18m	10324.614	10415.126	90	10214.614	10525.126	310.51	20	6	52	104
		11104.681	11143.386	50	11034.681	11213.386	178.71	125	6	30	60
		11649.405	11658.731	75	11554.405	11753.731	199.33	125	6	34	68
		12252.191	12293.289	75	12157.191	12388.289	231.10	30	6	39	78
		12748.205	12836.772	50	12678.205	12906.772	228.57	20	6	39	78
		15273.152	15333.222	90	15163.152	15443.222	280.07	80	6	47	94
		15825.824	15864.095	50	15755.824	15934.095	178.27	125	6	30	60
										623	1246

Total no. of Road stud = 1869 no.



CALCULATION FOR DELINEATOR

In horizontal Curves (radius > 1000m)

HIP / CURVE NO.	ELEMENT	START CHAINAGE	END CHAINAGE	RADIUS (M)	Spacing on Curve (S)	HAND OF ARC	Length	Nos in outside curve (s)	Nos in inner curve (2s)	1.8s beginning of curve	1.8s end of curve	3s beginning of curve	3s end of curve	6s beginning of curve	6s end of curve	
					as per IRC:79- 1981											
2	Arc	3792.408	3918.945	220	20	Right	126.537	7	4	1	0	1	0	1	0	
3	Arc	3984.897	4119.367	500	35	Left	134.470	4	2	0	0	1	0	1	0	
4	Arc	4197.03	4368.579	500	35	Left	171.549	5	3	0	0	1	0	1	0	
5	Arc	4451.714	4497.818	220	20	Left	46.104	3	2	1	1	1	0	1	0	
6	Arc	4578.88	4610.498	220	20	Right	31.618	2	1	1	1	1	1	1	0	
8	Arc	4936.73	4978.638	240	20	Left	41.908	3	2	1	1	1	0	1	0	
9	Arc	5060.715	5264.094	370	25	Right	203.379	9	5	0	1	1	0	1	0	
10	Arc	5416.05	5522.315	360	25	Right	106.265	5	3	1	0	1	0	1	0	
11	Arc	5589.14	5641.589	500	35	Left	52.449	2	1	0	1	1	0	1	0	
13	Arc	5933.162	6023.684	800	45	Right	90.522	3	2	1	1	1	0	1	0	
15	Arc	6332.302	6432.894	800	45	Left	100.592	3	2	1	0	1	0	1	0	
16	Arc	6541.857	6609.494	200	20	Left	67.637	4	2	1	1	1	1	1	1	
18	Arc	7820.509	7959.919	600	38	Right	139.410	4	2	1	1	1	1	1	0	
21	Arc	8649.397	8709.106	800	45	Right	59.709	2	1	1	0	1	0	1	0	
22	Arc	8743.157	8783.781	800	45	Right	40.624	1	1	0	0	1	0	1	0	
23	Arc	8799.284	8833.301	300	25	Left	34.017	2	1	0	1	1	1	1	0	
25	Arc	9192.262	9278.8	500	35	Left	86.538	3	2	1	0	1	0	1	0	
26	Arc	9328.436	9405.186	200	20	Right	76.750	4	2	0	1	1	0	1	0	
27	Arc	9513.906	9557.298	240	20	Left	43.392	3	2	1	1	1	0	1	0	
28	Arc	9629.633	9661.682	300	25	Right	32.049	2	1	0	1	1	0	1	0	
29	Arc	9766.628	9776.746	150	12	Left	10.118	1	1	1	1	1	1	1	0	
31	Arc	9991.025	10046.984	800	45	Left	55.959	2	1	1	1	1	0	1	0	
33	Arc	10324.614	10415.126	240	20	Left	90.512	5	3	1	1	1	1	1	0	
34	Arc	10792.274	10998.941	650	38	Right	206.667	6	3	1	0	1	0	1	0	
35	Arc	11104.681	11143.386	240	20	Right	38.705	2	1	1	1	1	1	1	1	
38	Arc	11649.405	11658.731	300	25	Right	9.326	1	1	1	1	1	0	1	0	
39	Arc	11850.67	11896.43	500	35	Right	45.760	2	1	1	1	1	1	1	0	
41	Arc	12252.191	12293.289	300	25	Right	41.098	2	1	1	1	1	1	1	0	
43	Arc	12748.205	12836.772	240	20	Left	88.567	5	3	1	1	1	0	1	0	
44	Arc	12919.53	13121.381	800	45	Left	201.851	5	3	0	0	1	0	1	0	
45	Arc	13123.005	13242.5	800	45	Right	119.495	3	2	0	0	1	0	1	0	
46	Arc	13318.278	13732.144	1000	50	Right	413.866	9	5	0	0	1	0	1	0	
47	Arc	13770.406	13929.982	750	42	Right	159.576	4	2	0	0	1	0	1	0	
48	Arc	13984.118	14093.233	600	38	Left	109.115	3	2	0	1	1	1	1	0	
51	Arc	14543.531	14687.603	800	45	Right	144.072	4	2	1	1	1	1	1	0	
52	Arc	15273.152	15333.222	250	20	Right	60.070	4	2	1	1	1	1	1	1	
53	Arc	15825.824	15864.095	250	20	Left	38.271	2	1	1	0	1	0	1	0	
TOTAL								=	131	75	24	23	37	12	37	3

Total No of Road Delineators =

342 nos.



CALCULATION FOR STREET LIGHTING

Street light in Built Up Location:

TCS Type	Length	Length (m)
TCS-1	4525	9050.00
	Total =	9050

Total length = 9050 m

Assuming , street lights @= 50m interval

for 9050 m 182 nos

At Busbay location=

(@ 5 nos per Busbay) 30 nos

Total nos of street light= 212 nos



RAILING

Chainage (km)		Length(km)	Side	Length of CD(m)	Net Length (m)
From	To				
3275	5700	2425	Both	16.94	4816.12
7500	8400	900	Both	7.9	1784.2
9150	9400	250	Both		500
11850	12375	525	Both	2.6	1044.8
12700	13125	425	Both	16.4	817.2
				Net Length	8962



Metal Beam Crash Barrier

For Bridge Approaches = 200 m
(Taking 25 m each Approach)

Total length of crash barrier = 200 m



**Reusable Sub-base Base Calculation
GSB Calculation**

	Required GSB Qty	Reusable GSB Quantity	
TCS-01	4525	1667.915	Cum
TCS-02	11899.44	4386.134	Cum
TCS-03	408.24	150.477	Cum
Busbay (2 Lane)	2064	760.790	Cum
Extra Widening on Flexible Pavement	212.12	78.187	Cum
Minor Junction	475.2	175.159	Cum
	19584	7219	

Reuseable GSB Quantity= **36.86%**

Total Dismantle Granular Quantity(cum)= **12033**
use 60% of Total Dismantle Granular Quantity for GSB (cum)= **7220**

Refer backup calculation sheet

Total Required GSB Qty (Cum)= **19584**
36.86 % of this required quantity will be bought from dismantle material i.e **7219**

Re Useable Quantity of GSB Material(cum)= **7219**
Remaining Quantity of GSB(cum) = **12365**



VOLUME VIII
BILL OF QUANTITY



BILL OF QUANTITY (ROAD PART)



Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	02.01/i	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth from 300 mm to 600 mm	Each	16.00		
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	37.00		
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	488.00		
4	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm	Each	97.00		
5	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm	Each	23.00		
6	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)	Ha	19.63		



Bill No : 01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
7	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above	cum	68.00		
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar	Cum	882.00		
9	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia	rm	30.00		
10	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia	rm	100.00		
11	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia	rm	90.00		
12	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier	sqm	80,220.00		
13	02.04/viii/f/ii	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f)Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii)With road roller attached with scarifier	sqm	153,669.00		
Total of Bill 01. Site Clearance and Dismantling						



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.03	Excavation in Soil with Dozer with lead upto 100 metres (Excavation for road way in soil by mechanical means including cutting and pushing the earth to site of embankment upto a distance of 100 metres (average lead 50 metres), including trimming bottom and side slopes in accordance with requirements of lines, grades and cross sections.)	cum	46,506.00		
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	10,838.00		
3	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	44,084.14		
		Total of Bill 02. Earth work,Subgrade and Erosion control				



Bill No : 03. Sub-Base & Base Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Nsc1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	10,762.09		
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	10,483.28		
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	34,953.28		
Total of Bill 03. Sub-Base & Base Courses						



Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	136,760.60		
2	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm	sqm	135,700.00		
3	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	13,676.06		



Bill No : 04. Bituminous Courses

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
4	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	5,470.42		
		Total of Bill 04. Bituminous Courses				



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	04.01/Ns c1	Sub-base with Close Graded Material (Table:- 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material	Cum	300.04		
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	175.16		
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	594.00		
4	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm	sqm	2,376.00		



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	2,376.00		
6	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40	cum	237.60		
7	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	95.04		
Total of Bill 05. Junction Improvement (Major & Minor)						



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone	each	3.00		
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone	each	9.00		
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting	each	131.00		
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	38.40		
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	288.00		
6	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				



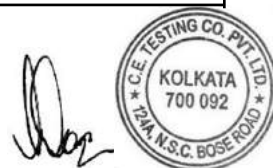
Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
			each	6.00		
7	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	4,222.27		
8	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming to IRC-79 and the drawings.) 120x120 -Road Delineator	each	542.00		
9	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	200.00		



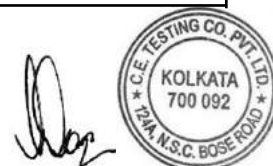
Bill No : 06. Traffic signs, Road marking & other road appurtenances

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type	nos	1,869.00		
11	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp	nos	212.00		
12	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	1.08		
13	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	38.40		



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

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
14	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	1,160.00		
15	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		
16	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		
17	14.03/e/l	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	5.70		
18	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.86		
19	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	2.00		
20	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	0.30		
21	16.09	Mild steel railing complete as per drawing and Technical Specifications	Rm	8,984.00		
Total of Bill 06. Traffic signs, Road marking & other road appurtenances						



Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.	sqm	396.41		
2	10.16	Cement Plaster 12mm Thick in Cement Mortar 1:3	sqm	396.41		
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	59.45		
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	9.11		
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	6.04		
6	14.03/e/l	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications RCC M25Grade	cum	4.16		
7	14.08	HYSD bar reinforcement in foundation complete as per drawing and technical specification	MT	0.50		
8	14/nsc2	Brick Flat Soling at Foundation	Sqm	80.63		
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	19.43		



Bill No : 07. Passenger Shelter

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
10	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complete as per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m	cum	24.91		
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications	MT	2.49		
		Total of Bill 07. Passenger Shelter				



Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2	cum	5,160.00		
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	1,303.21		
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	760.79		
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	2,580.00		



Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
5	05.03	Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 25 mm thick cement concrete grade M15, over laid with pre-cast concrete tiles in cement mortar including provision of all drainage arrangements but excluding kerb channel.	sqm	3,225.00		
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	10,320.00		
7	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm	sqm	10,320.00		
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	1,032.00		



Bill No : 08. Bus Bay

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
9	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40	cum	412.80		
		Total of Bill 08. Bus Bay				



Bill No : 09. Longitudinal Drains

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	9,174.85		
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	1,747.59		
3	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height	cum	7,539.28		
4	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification	MT	376.96		
5	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications	Rm	4,482.00		
6	24/i/b	Galvanised Mild steel J /L hook	kg	716.96		
7	40	Gextextile material (fine net)	sqm	806.58		
Total of Bill 09. Longitudinal Drains						



Bill No : 10. Toe Wall

SI No	SOR Ref No	Description	Unit	Quantity	Rate(Rs)	Cost(Rs)
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m	cum	179.55		
2	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade	cum	25.65		
3	14.03/b	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M20 Grade	cum	105.30		
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	101.25		
Total of Bill 10. Toe Wall						



QUANTITY CALCULATION (ROAD PART)



Quantity Backup Calculation For Bill :

01. Site Clearance and Dismantling

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	02.01/i	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth from 300 mm to 600 mm			
		Refer: Site Clearance and Dismantling Formula: 16	16	16.00	Each
			Total :	16.00	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: 37	37	37.00	Each
			Total :	37.00	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: 488	488	488.00	Each
			Total :	488.00	Each
4	02.01/iv	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 1800 mm to 2700 mm			
		Refer: Site Clearance and Dismantling Formula: 97	97	97.00	Each
			Total :	97.00	Each

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	02.01/v	Cutting of Trees, including cutting of trunks, branches and removal of stumps including stacking of serviceable materials within a lead of 100 m. and earth filling in the depression/pit. Girth above 2700 mm			
		Refer: Site Clearance and Dismantling Formula: 23	23	23.00	Each
			Total :	23.00	Each
6	02.03/b	Clearing and grubbing road land including uprooting rank vegetation, grass, brush shrubs, saplings and trees of girth upto 300 mm, removal of stumps, disposal of unserviceable materials and stacking of serviceable materials and stacking of serviceable materials upto 100m. from road boundary. (by mechanical means)			
		Refer: Site Clearance and Dismantling Formula: 19.63	19.63	19.63	Ha
			Total :	19.63	Ha
7	02.04/i/c	Dismantling upto 1.5m in foundation and/or 1.5m above ground level including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of un-serviceable materials and stacking the serviceable materials within a lead of 100m. c)Pre- stressed/ Reinforced Cement Concrete grade M20 & above			
		Refer: Site Clearance and Dismantling Formula: 68	68	68.00	cum
			Total :	68.00	cum
8	02.04/iii/b	Dismantling stone masonry b) Rubble stone masonry in cement mortar			
		Refer: Site Clearance and Dismantling Formula: 882	882	882.00	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	882.00	Cum
9	02.04/vii/a	Removing hume pipes class NP-3 a) 300mm to 600mm dia			
		Refer: Site Clearance and Dismantling Formula: 30	30	30.00	rm
			Total :	30.00	rm
10	02.04/vii/b	Removing hume pipes class NP-4 b) Above 600mm to 900mm dia			
		Refer: Site Clearance and Dismantling Formula: 100	100	100.00	rm
			Total :	100.00	rm
11	02.04/vii/c	Removing hume pipes class NP-5 c) Above 900mm dia			
		Refer: Site Clearance and Dismantling Formula: 90	90	90.00	rm
			Total :	90.00	rm
12	02.04/viii/e	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m e)Kandar/Gravel metal crust upto 150 mm thick with power Roller with scarifier			
		Refer: Site Clearance and Dismantling Formula: 80220	80220	80,220.00	sqm
			Total :	80,220.00	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
13	12.04/viii/f/i	Scarifying including picking up scarified material and stacking of old serviceable material within a lead of 100m f) Bituminous coarses 50-70mm along with premix Carpet and Surface dressing but without disturbing the base ii) With road roller attached with scarifier			
		Refer: Site Clearance and Dismantling Formula: 153669	153669	153,669.00	sqm
			Total :	153,669.00	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	03.03	Excavation in Soil with Dozer with lead upto 100 metres (Excavation for road way in soil by mechanical means including cutting and pushing the earth to site of embankment upto a distance of 100 metres (average lead 50 metres), including trimming bottom and side slopes in accordance with requirements of lines, grades and cross sections.)			
		Refer: Earthwork Formula: $\text{tot_cut} * (1 - \text{per_rock} / 100)$	$46506.000 * (1 - 0.000 / 100)$	46,506.00	cum
			Total :	46,506.00	cum
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	10838.000	10,838.00	cum
			Total :	10,838.00	cum
3	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			
		Refer: TCS-01 Formula: $(\text{cw} + 2 * \text{ps} - \text{ext_pav}) * \text{l} * \text{sg}$	$(7.000 + 2 * 2.500 - 7.000) * 4525.000 * 0.500$	11,312.50	cum
		Refer: TCS-02 Formula: $(\text{cw} + 2 * \text{ps} + 2 * \text{es} - \text{ext_pav} + (\text{bc} + \text{dbm} + \text{wmm1} + \text{wmm2} + \text{gsb} + 0.5 * \text{sg}) * 1 * 2) * \text{l} * \text{sg} + \text{es_area} * 2 * \text{l}$	$(7.000 + 2 * 1.500 + 2 * 1.000 - 7.000 + (0.040 + 0.100 + 0.125 + 0.125 + 0.200 + 0.5 * 0.500) * 1 * 2) * 7870.000 * 0.500 + 0.343 * 2 * 7870.000$	31,684.62	cum
		Refer: TCS-03 Formula: $(\text{cw} + 2 * \text{ps} + 2 * \text{es} - \text{ext_pav} + (\text{bc} + \text{dbm} + \text{wmm1} + \text{wmm2} + \text{gsb} + 0.5 * \text{sg}) * 1 * 2) * \text{l} * \text{sg} + \text{es_area} * 2 * \text{l}$	$(7.000 + 2 * 1.500 + 2 * 1.000 - 7.000 + (0.040 + 0.100 + 0.125 + 0.125 + 0.200 + 0.5 * 0.500) * 1 * 2) * 270.000 * 0.500 + 0.343 * 2 * 270.000$	1,087.02	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	44,084.14	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	04.01/Nsc1	Sub-base with Close Graded Material (Table: - 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material			
		Refer: Extra Widening on Flexible Formula: Pavement $ew_area * gsb * (1 - gsb_per / 100)$	$1060.600 * 0.200 * (1 - 36.860 / 100)$	133.93	Cum
		Refer: TCS-01 Formula: $(cw + 2 * ps - ext_pav) * gsb * (1 - gsb_per / 100)$	$(7.000 + 2 * 2.500 - 7.000) * 0.200 * 4525.000 * (1 - 36.860 / 100)$	2,857.09	Cum
		Refer: TCS-02 Formula: $((cw + 2 * ps + 2 * es - ext_pav + (bc + dbm + wmm1 + wmm2 + gsb * 0.5) * 1 * 2) * 1 * gsb + es_gsb * 2 * 1) * (1 - gsb_per / 100)$	$((7.000 + 2 * 1.500 + 2 * 1.000 - 7.000 + (0.040 + 0.100 + 0.125 + 0.125 + 0.200 * 0.5) * 1 * 2) * 7870.000 * 0.200 + 0.158 * 2 * 7870.000) * (1 - 36.860 / 100)$	7,513.31	Cum
		Refer: TCS-03 Formula: $((cw + 2 * ps + 2 * es - ext_pav + (bc + dbm + wmm1 + wmm2 + gsb * 0.5) * 1 * 2) * 1 * gsb + es_gsb * 2 * 1) * (1 - gsb_per / 100)$	$((7.000 + 2 * 1.500 + 2 * 1.000 - 7.000 + (0.040 + 0.100 + 0.125 + 0.125 + 0.200 * 0.5) * 1 * 2) * 270.000 * 0.200 + 0.158 * 2 * 270.000) * (1 - 36.860 / 100)$	257.76	Cum
			Total :	10,762.09	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 $ew_area * gsb * (gsb_per / 100)$	$1060.600 * 0.200 * (36.860 / 100)$	78.19	Cum
		Refer: TCS-01 Formula: $(cw + 2 * ps - ext_pav) * gsb * (gsb_per / 100)$	$(7.000 + 2 * 2.500 - 7.000) * 0.200 * 4525.000 * (36.860 / 100)$	1,667.92	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-02 Formula: $((cw+2*ps+2*es+(bc+dbm+wmm1+wmm2+gsb*0.5)*1*2)*1*gsb+es_gsb*2*I)*(gsb_per/100)$	$((7.000+2*1.500+2*1.000+(0.040+0.100+0.125+0.125+0.200*0.5)*1*2)*7870.000*0.200+0.158*2*7870.000)*(36.860/100)$	8,447.37	Cum
		Refer: TCS-03 Formula: $((cw+2*ps+2*es+(bc+dbm+wmm1+wmm2+gsb*0.5)*1*2)*1*gsb+es_gsb*2*I)*(gsb_per/100)$	$((7.000+2*1.500+2*1.000+(0.040+0.100+0.125+0.125+0.200*0.5)*1*2)*270.000*0.200+0.158*2*270.000)*(36.860/100)$	289.81	Cum
			Total :	10,483.28	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 $ew_area*(wmm1+wmm2)$	$1060.600*(0.125+0.125)$	265.15	Cum
		Refer: TCS-01 Formula: $((((cw+2*ps)*wmm1)+((cw+2*ps)*wmm2))*I)$	$((((7.000+2*2.500)*0.125)+((7.000+2*2.500)*0.125))*4525.000)$	13,575.00	Cum
		Refer: TCS-02 Formula: $((((cw+2*ps+0.125*2)*wmm1)+((cw+2*ps+0.250*2)*wmm2))*I)$	$((((7.000+2*1.500+0.125*2)*0.125)+((7.000+2*1.500+0.250*2)*0.125))*7870.000)$	20,412.81	Cum
		Refer: TCS-03 Formula: $((((cw+2*ps+0.125*2)*wmm1)+((cw+2*ps+0.250*2)*wmm2))*I)$	$((((7.000+2*1.500+0.125*2)*0.125)+((7.000+2*1.500+0.250*2)*0.125))*270.000)$	700.31	Cum
			Total :	34,953.28	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm			
		Refer: Extra Widening on Flexible Formula: Pavement ew_area	1060.600	1,060.60	sqm
		Refer: TCS-01 Formula: (cw+2*ps)*l	(7.000+2*2.500)*4525.000	54,300.00	sqm
		Refer: TCS-02 Formula: (cw+2*ps)*l	(7.000+2*1.500)*7870.000	78,700.00	sqm
		Refer: TCS-03 Formula: (cw+2*ps)*l	(7.000+2*1.500)*270.000	2,700.00	sqm
			Total :	136,760.60	sqm
2	06.02/ii	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. ii) On granular Surface Pre treated with prime Coat @ 0.25 - 0.30 kg/sqm			
		Refer: TCS-01 Formula: (cw+2*ps)*l	(7.000+2*2.500)*4525.000	54,300.00	sqm
		Refer: TCS-02 Formula: (cw+2*ps)*l	(7.000+2*1.500)*7870.000	78,700.00	sqm
		Refer: TCS-03 Formula: (cw+2*ps)*l	(7.000+2*1.500)*270.000	2,700.00	sqm
			Total :	135,700.00	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
3	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40			
		Refer: Extra Widening on Flexible Formula: Pavement $ew_area*dbm$	$1060.600*0.100$	106.06	cum
		Refer: TCS-01 Formula: $(cw+2*ps)*dbm*I$	$(7.000+2*2.500)*0.100*4525.000$	5,430.00	cum
		Refer: TCS-02 Formula: $(cw+2*ps)*dbm*I$	$(7.000+2*1.500)*0.100*7870.000$	7,870.00	cum
		Refer: TCS-03 Formula: $(cw+2*ps)*dbm*I$	$(7.000+2*1.500)*0.100*270.000$	270.00	cum
			Total :	13,676.06	cum
4	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Extra Widening on Flexible Formula: Pavement $ew_area * bc$	$1060.600 * 0.040$	42.42	cum
		Refer: TCS-01 Formula: $(cw + 2 * ps) * bc * l$	$(7.000 + 2 * 2.500) * 0.040 * 4525.000$	2,172.00	cum
		Refer: TCS-02 Formula: $(cw + 2 * ps) * bc * l$	$(7.000 + 2 * 1.500) * 0.040 * 7870.000$	3,148.00	cum
		Refer: TCS-03 Formula: $(cw + 2 * ps) * bc * l$	$(7.000 + 2 * 1.500) * 0.040 * 270.000$	108.00	cum
			Total :	5,470.42	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	04.01/Nsc1	Sub-base with Close Graded Material (Table: - 400-1) Plant Mix Method Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401 For Grading- V Material			
		Refer: Minor Junction Formula: $\text{tot_area} * \text{gsb} * (1 - \text{gsb_per} / 100)$	$2376.000 * 0.200 * (1 - 36.860 / 100)$	300.04	Cum
			Total :	300.04	Cum
2	04/nsc1	Plant Mix Method (material Reuse) Construction of granular sub-base by providing close graded Material, mixing in a mechanical mix plant at OMC, carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface and compacting with vibratory power roller to achieve the desired density, complete as per clause 401			
		Refer: Minor Junction Formula: $\text{tot_area} * \text{gsb} * (\text{gsb_per} / 100)$	$2376.000 * 0.200 * (36.860 / 100)$	175.16	Cum
			Total :	175.16	Cum
3	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)			
		Refer: Minor Junction Formula: $\text{tot_area} * (\text{wmm1} + \text{wmm2})$	$2376.000 * (0.125 + 0.125)$	594.00	Cum
			Total :	594.00	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
4	06.01/a	Prime coat (Providing and applying primer coat with bitumen emulsion on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means.) A) On WBM/ WMM Surface @ 0.70-1.00 kg/sqm			
		Refer: Minor Junction Formula: tot_area	2376.000	2,376.00	sqm
			Total :	2,376.00	sqm
5	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm			
		Refer: Minor Junction Formula: tot_area	2376.000	2,376.00	sqm
			Total :	2,376.00	sqm
6	06/Nsc1	Providing and laying dense bituminous macadam with 40-60 TPH batch type HMP producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 4.25 % by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MoRTH specification clause No. 507 complete in all respects. B) GradingII(19 mm nominal size) iii)Using bitumen 30/40			
		Refer: Minor Junction Formula: tot_area*dbm	2376.000*0.100	237.60	cum
			Total :	237.60	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
7	06/Nsc2	Providing and laying bituminous concrete with 40-600 TPH batch type hot mix plant producing an average output of 35 tonnes per hour using crushed aggregates of specified grading, premixed with bituminous binder @ 5.5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 509 complete in all respects B) Grading-II (13 mm nominal size) iii)Using bitumen 30/40			
		Refer: Minor Junction Formula: tot_area*bc	2376.000*0.040	95.04	cum
			Total :	95.04	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	08.02/a	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. a) 5th KM stone			
		Refer: Traffic Signs Formula: 3	3	3.00	each
			Total :	3.00	each
2	08.02/b	Reinforced cement concrete M15 kilometer stone of standard design fixed in Position including painting and painting letters etc. b) Ordinary kilometer stone			
		Refer: Traffic Signs Formula: 9	9	9.00	each
			Total :	9.00	each
3	08.04	Reinforced Cement Concrete M15 Boundary pillars of standard design, fixed in position including finishing but excluding painting			
		Refer: Traffic Signs Formula: 131	131	131.00	each
			Total :	131.00	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: $a*r*2*n$	$16.000*1.200*2*1.000$	38.40	sqm
			Total :	38.40	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	08.11/i	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 90 cm equilateral triangle			
		Refer: Traffic Signs Formula: 288	288	288.00	each
			Total :	288.00	each
6	08.11/iv	Retro- reflectorised Traffic signs Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing) 80 mm x 60 mm rectangular			
		Refer: Traffic Signs Formula: 6	6	6.00	each
			Total :	6.00	each
7	08.14	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes.)			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: TCS-01 Formula: $((l+6)/9)*l*wc+(nc*l*wid_mar)$	$((4525.000+6)/9)*3.000*0.100)+$ $(2.000*4525.000*0.150)$	1,508.53	sqm
		Refer: TCS-02 Formula: $((l+6)/9)*l*wc+(nc*l*wid_mar)$	$((7870.000+6)/9)*3.000*0.100)+$ $(2.000*7870.000*0.150)$	2,623.53	sqm
		Refer: TCS-03 Formula: $((l+6)/9)*l*wc+(nc*l*wid_mar)$	$((270.000+6)/9)*3.000*0.100)+$ $(2.000*270.000*0.150)$	90.20	sqm
			Total :	4,222.27	sqm
8	08.15/c/v	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming to IRC-79 and the drawings.) 120x120 -Road Delineator			
		Refer: Traffic Signs Formula: 542	542	542.00	each
			Total :	542.00	each
9	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: 200	200	200.00	Rm
			Total :	200.00	Rm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
10	08.20/ii	Road Markers/Road stud with lense reflector Providing & fixing of road stud 100x100 mm, die-cast in aluminium , resistance to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30mm upto a depth of 60mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973 Light Reflecting Lense Type			
		Refer: Traffic Signs Formula: 1869	1869	1,869.00	nos
			Total :	1,869.00	nos
11	08.22	Lighting on Bridges Providing & fixing lighting on Bridges, mounted on steel hollow circular poles of standard specification, 5 m high fixed on parapets with cement concrete, 20 m apart and fitted with sodium vapour lamp			
		Refer: Traffic Signs Formula: 212	212	212.00	nos
			Total :	212.00	nos
12	08/nsc/4/a	Overhead Signs Providing and erecting overhead signs with a corrosion resistant 2mm thick aluminium alloy sheet reflectorised with high intensity retro-reflective sheeting of encapsulated lense type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.7 over a designed support system of aluminium alloy or galvanised steel trestles and trusses of sections and type as per structural design requirements and approved plans A)Truss and Vertical Support with Base plate on foundation column.			
		Refer: Overhead Signs Formula: $(p \cdot (a/p^2 + r^2) \cdot wt + q \cdot ((a/p) + (a/p - 1)) \cdot ws + ht \cdot wp^2) \cdot n$	$(1.000 \cdot (16.000/1.000^2 + 1.200^2) \cdot 0.010 + 1.560 \cdot ((16.000/1.000) + (16.000/1.000 - 1)) \cdot 0.004 + 5.500 \cdot 0.049^2) \cdot 1.000$	1.08	Ton
			Total :	1.08	Ton



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
13	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: $a*r*2*n$	$16.000*1.200*2*1.000$	38.40	sqm
			Total :	38.40	sqm
14	08/nsc/6	Rumble Strips Provision of 15 nos rumble strips covered with premix bituminous carpet, 15-20 mm high at center, 250 mm wide placed at 1 m center to center at approved locations to control speed, marked with white strips of road marking paint.			
		Refer: Traffic Signs Formula: 1160	1160	1,160.00	sqm
			Total :	1,160.00	sqm
15	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



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
16	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
17	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
18	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
19	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height			
		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



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
20	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
21	16.09	Mild steel railing complete as per drawing and Technical Specifications			
		Refer: Railing Formula: 8984	8984	8,984.00	Rm
			Total :	8,984.00	Rm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.			
		Refer: Passenger Shelter Formula: $((sw_in*sw_ht*2)+(w_pass*sw_ht*2)+(bw_in*bw_ht)+(l_pass*bw_ht)+(col_l*fcol_h*6)+(l_pass*roof_w)-(2*win_n*win_l*win_h))*n$	$((1.875*3.830*2)+(2.000*3.830*2)+(5.800*2.350)+(6.000*2.350)+(0.250*2.650*6)+(6.000*1.530)-(2*2.000*1.250*0.900))*6.000$	396.41	sqm
			Total :	396.41	sqm
2	10.16	Cement Plaster 12mm Thick in Cement Morter 1:3			
		Refer: Passenger Shelter Formula: $((sw_in*sw_ht*2)+(w_pass*sw_ht*2)+(bw_in*bw_ht)+(l_pass*bw_ht)+(col_l*fcol_h*6)+(l_pass*roof_w)-(2*win_n*win_l*win_h))*n$	$((1.875*3.830*2)+(2.000*3.830*2)+(5.800*2.350)+(6.000*2.350)+(0.250*2.650*6)+(6.000*1.530)-(2*2.000*1.250*0.900))*6.000$	396.41	sqm
			Total :	396.41	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: $(((a+0.25*2)*(b+0.25*2)*df*col_n)+((l+2*0.1)*(w+2*0.1)*db))*n$	$(((0.750+0.25*2)*(0.750+0.25*2)*0.750*6.000)+((13.500+2*0.1)*(0.500+2*0.1)*0.300))*6.000$	59.45	cum
			Total :	59.45	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: $((l*w*wbtm_thk)+(l*fw_wall*wtop_thk))*n$	$((13.500*0.500*0.150)+(13.500*0.250*0.150))*6.000$	9.11	cum
			Total :	9.11	cum




SI No	SOR Ref No	Description	Calculation	Quantity	Unit
5	14.03/a	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications PCC M15 Grade			
		Refer: Passenger Shelter Formula: (l_pass-2*w_wall)*(w_pass-2*w_wall) *pcc_thk*n	(6.000-2*0.125)*(2.000-2*0.125) *0.100*6.000	6.04	cum
			Total :	6.04	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*6.000	4.16	cum
			Total :	4.16	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*6.000)*120.000/1000	0.50	MT
			Total :	0.50	MT
8	14/nsc2	Brick Flat Soling at Foundation			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Passenger Shelter Formula: $((l_{pass}-2*w_{wall})*(w_{pass}-2*w_{wall}))+ (a*b*col_n)*n$	$((6.000-2*0.125)*(2.000-2*0.125))+ (0.750*0.750*6.000))*6.000$	80.63	Sqm
			Total :	80.63	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: $((l*w_{wall}*wall_h)+(sw_l*2*w_{wall}*sw_h)+(bw_l*4*w_{wall}*bw_h)+(rail_l*w_{wall}*rail_h))*n-(win_l*w_{wall}*win_h*2*n)$	$((13.500*0.125*0.550)+(1.500*2*0.125*2.130)+(2.650*4*0.125*0.950)+(9.500*0.125*0.450))*6.000-(1.250*0.125*0.900*2*6.000)$	19.43	cum
			Total :	19.43	cum
10	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complet eas per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m			
		Refer: Passenger Shelter Formula: $((col_l*col_w*col_h*col_n*0.5)+(col_l*col_w*bcol_h*col_n*0.5)+(sb_l*sb_w*sb_thk*2)+(sb_a*sb_w*sb_thk*4)+(l_{pass}*roof_w*roof_thk)+(l_{pass}*fchj_w*roof_thk)+(l_{pass}*bchj_w*roof_thk)+(bch_l*bch_w*bch_thk))*n$	$((0.250*0.250*2.650*6.000*0.5)+(0.250*0.250*2.100*6.000*0.5)+(1.530*0.250*0.350*2)+(3.000*0.250*0.350*4)+(6.000*1.530*0.110)+(6.000*0.680*0.110)+(6.000*0.450*0.110)+(5.000*0.500*0.075))*6.000$	24.91	cum
			Total :	24.91	cum
11	16.03	HYSD bar reinforcement in super-structure complete as per drawing and technical specifications			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Passenger Shelter Formula: $((col_l * col_w * fcol_h * col_n * 0.5) +$ $(col_l * col_w * bcol_h * col_n * 0.5) +$ $(sb_l * sb_w * sb_thk * 2) +$ $(sb_a * sb_w * sb_thk * 4) +$ $(l_pass * roof_w * roof_thk) +$ $(l_pass * fchj_w * roof_thk) +$ $(l_pass * bchj_w * roof_thk) +$ $(bch_l * bch_w * bch_thk)) * n * srf / 1000$	$((0.250 * 0.250 * 2.650 * 6.000 * 0.5) +$ $(0.250 * 0.250 * 2.100 * 6.000 * 0.5) +$ $(1.530 * 0.250 * 0.350 * 2) +$ $(3.000 * 0.250 * 0.350 * 4) +$ $(6.000 * 1.530 * 0.110) +$ $(6.000 * 0.680 * 0.110) +$ $(6.000 * 0.450 * 0.110) +$ $(5.000 * 0.500 * 0.075))$ $* 6.000 * 100.000 / 1000$	2.49	MT
			Total :	2.49	MT

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	03.14/Nsc	Construction of Subgrade and Earthen Shoulders Construction of subgrade and earthen shoulders with approved material obtained from Roadway Cutting with all lifts & leads, transporting to site, spreading, grading to required slope and compacted to meet requirement of table No. 300-2			
		Refer: Busbay (2 Lane) Formula: $((2*b+a)*(d+f))*n*sg$	$((2*100.000+15.000)*(5.500+2.500))*6.000*0.500$	5,160.00	cum
			Total :	5,160.00	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) Formula: $((2*b+a)*(d+f))*n*gsb*(1-gsb_per/100)$	$((2*100.000+15.000)*(5.500+2.500))*6.000*0.200*(1-36.860/100)$	1,303.21	Cum
			Total :	1,303.21	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) Formula: $((2*b+a)*(d+f))*n*gsb*(gsb_per/100)$	$((2*100.000+15.000)*(5.500+2.500))*6.000*0.200*(36.860/100)$	760.79	Cum
			Total :	760.79	Cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
4	05.02	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density.)			
		Refer: Busbay (2 Lane) Formula: $((2*b+a)*(d+f))*n*(wmm1+wmm2)$	$((2*100.000+15.000)*(5.500+2.500))$ $*6.000*(0.125+0.125)$	2,580.00	Cum
			Total :	2,580.00	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) Formula: $((2*b+a)*f)*n$	$((2*100.000+15.000)*2.500)*6.000$	3,225.00	sqm
			Total :	3,225.00	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) Formula: $((2*b+a)*(d+f))*n$	$((2*100.000+15.000)*(5.500+2.500))$ $*6.000$	10,320.00	sqm
			Total :	10,320.00	sqm
7	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Busbay (2 Lane) Formula: $((2*b+a)*(d+f))*n$	$((2*100.000+15.000)*(5.500+2.500))$ $*6.000$	10,320.00	sqm
			Total :	10,320.00	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) Formula: $((2*b+a)*(d+f))*n*dbm$	$((2*100.000+15.000)*(5.500+2.500))$ $*6.000*0.100$	1,032.00	cum
			Total :	1,032.00	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) Formula: $((2*b+a)*(d+f))*n*bc$	$((2*100.000+15.000)*(5.500+2.500))$ $*6.000*0.040$	412.80	cum
			Total :	412.80	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: RCC Cover Drain Formula: $(t_width+off*2)*((ht+b_slab_thk)/2)*l$	$(1.750+0.100*2)*((0.900+0.150)/2)*8962.000$	9,174.85	cum
			Total :	9,174.85	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: RCC Cover Drain Formula: $(t_width+off*2)*pcc_thk*l$	$(1.750+0.100*2)*0.100*8962.000$	1,747.59	cum
			Total :	1,747.59	cum
3	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: $(ht*w_thk*2+t_width*b_slab_thk+t_width*t_slab_thk)*l$	$(0.900*0.200*2+1.750*0.150+1.750*0.125)*8962.000$	7,539.28	cum
			Total :	7,539.28	cum
4	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification			
		Refer: RCC Cover Drain Formula: $(ht*w_thk*2+t_width*b_slab_thk+t_width*t_slab_thk)*l*s$	$(0.900*0.200*2+1.750*0.150+1.750*0.125)*8962.000*0.050$	376.96	MT



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
			Total :	376.96	MT
5	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)	(8962.000/2+1)	4,482.00	Rm
			Total :	4,482.00	Rm
6	24/i/b	Galvanised Mild steel J /L hook			
		Refer: RCC Cover Drain Formula: l/15*4*.3	8962.000/15*4*.3	716.96	kg
			Total :	716.96	kg
7	40	Gextextile material (fine net)			
		Refer: RCC Cover Drain Formula: (l/1)*4*(150*150/1000^2)	(8962.000/1)*4*(150*150/1000^2)	806.58	sqm
			Total :	806.58	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	13.01/a/i	Earth work in excavation of foundation for structures as per drawing and technical specification Ordinary soil Depth upto 3 m			
		Refer: Toe Wall 1m Formula: $(b+2*g)*(d+f)*l$	$(0.750+2*0.100)*(0.600+0.100)*270.000$	179.55	cum
			Total :	179.55	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: $(b+2*g)*f*l$	$(0.750+2*0.100)*0.100*270.000$	25.65	cum
			Total :	25.65	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: $(0.5*(c+b)*d)*l$	$(0.5*(0.550+0.750)*0.600)*270.000$	105.30	cum
			Total :	105.30	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: $(0.5*(T+c)*h)*l$	$(0.5*(0.200+0.550)*1.000)*270.000$	101.25	cum
			Total :	101.25	cum




BILL OF QUANTITY (STRUCTURE PART)



Quantity Backup Calculation For Bill : 11. Culvert

SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Foundation			
1	10.20	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork.			
		Refer: Structure Culvert Formula: 904.33	904.33	904.33	cum
			Total :	904.33	cum
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			
		Refer: Structure Culvert Formula: 6521.08	6521.08	6,521.08	cum
			Total :	6,521.08	cum
		Sub Structure			
3	10.06/a	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Sub-Structure			
		Refer: Structure Culvert Formula: 361.66	361.66	361.66	Ton
			Total :	361.66	Ton
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			
		Refer: Structure Culvert Formula: 2505.23	2505.23	2,505.23	cum
			Total :	2,505.23	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
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			
		Refer: Structure Culvert Formula: 3429.71	3429.71	3,429.71	cum
			Total :	3,429.71	cum
6	15.03/f/i	cement concrete for Plain/Reinforced concrete in open foundation complete as per drawing and technical specifications i/c work complete as per drawing and technical specification RCC M25 Grade upto 5m height			
		Refer: Structure Culvert Formula: 4520.71	4520.71	4,520.71	cum
			Total :	4,520.71	cum
7	15.12	Providing weep holes in concrete/Reinforced concrete abutment, wing wall/return wall Complete as per drawing and Technical specifications			
		Refer: Structure Culvert Formula: 1620.00	1620.00	1,620.00	Rm
			Total :	1,620.00	Rm
		Super Structure			
8	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm			
		Refer: Structure Culvert Formula: 1840.20	1840.20	1,840.20	sqm
			Total :	1,840.20	sqm



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
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: Structure Culvert Formula: 73.61	73.61	73.61	cum
			Total :	73.61	cum
10	10.06/b	Steel reinforcement for R.C.C. works including bending, binding and placing in position. A) for Super-Structure			
		Refer: Structure Culvert Formula: 71.1	71.1	71.10	Ton
			Total :	71.10	Ton
11	16.01/a/i	cement concrete Reinforced concrete in super-structure as per drawing and Technical Specification i/c form work complete as per drawing and technical specification RCC Grade M25 For solid slab super-structure Upto 5m Upto 5m			
		Refer: Structure Culvert Formula: 888.71	888.71	888.71	cum
			Total :	888.71	cum
12	16.08	Reinforced concrete railing of M30 Grade complete as per approved drawings and technical specification			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Structure Culvert Formula: 272.64	272.64	272.64	Rm
			Total :	272.64	Rm
13	16.11	Drainage Spouts complete as per drawing and Technical specification			
		Refer: Structure Culvert Formula: 94.00	94.00	94.00	each
			Total :	94.00	each
14	16.17	Mastic asphalt (providing and laying 12mm thick mastic asphalt wearing courses on top of deck slab excluding prime coat with paving grade bitumen meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an approximate spacing of 10cm centre in both direction, pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface, all complete as per clause 515) using Bitumen VG-40 (3/40)			
		Refer: Structure Culvert Formula: 1840.20	1840.20	1,840.20	sqm
			Total :	1,840.20	sqm
		Protection Work			
15	10.02/Nsc	Plain cement concrete M-15 mix with stone aggregate 20mm. Nominal size mechanically mixed and vibrated in foundation depth of 1.5m. below ground / bed level and or 1.5m. above ground/bed level i/c formwork. At Protection			
		Refer: Structure Culvert Formula: 3467.65	3467.65	3,467.65	cum
			Total :	3,467.65	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
16	13.01/a/i/N sc	Earth work in excavation Ordinary soil For Protection Work			
		Refer: Structure Culvert Formula: 16715.87	16715.87	16,715.87	cum
			Total :	16,715.87	cum
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			
		Refer: Structure Culvert Formula: 512.43+3467.65	512.43+3467.65	3,980.08	cum
			Total :	3,980.08	cum
18	17/nsc1	Flexible Apron - Construction of flexible apron 750mm thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall.			
		Refer: Structure Culvert Formula: 3928.64	3928.64	3,928.64	cum
			Total :	3,928.64	cum



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
1	15.05	HYSD bar reinforcement in Sub-structure complete as per drawing and technical specification			
		Refer: Structure Repair and Rehabilitation Formula: 21	21	21.00	MT
			Total :	21.00	MT
		Super Structure			
2	06.02/i	Tack coat Providing and applying tack coat with bitumen emulsion using emulsion pressure distributor m on the prepared bituminous/ granular surface cleaned with mechanical broom. i) On bituminous Surface @ 0.20 - 0.30 kg/sqm			
		Refer: Structure Repair and Rehabilitation Formula: 638	638	638.00	sqm
			Total :	638.00	sqm
3	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: Structure Repair and Rehabilitation Formula: 26	26	26.00	cum
			Total :	26.00	cum
4	08.01	Precast Cement concrete M20 Kerb including fixing at site			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Structure Repair and Rehabilitation Formula: 106	106	106.00	rm
			Total :	106.00	rm
5	16.09	Mild steel railing complete as per drawing and Technical Specifications			
		Refer: Structure Repair and Rehabilitation Formula: 106	106	106.00	Rm
			Total :	106.00	Rm
6	16.17	Mastic asphalt (providing and laying 12mm thick mastic asphalt wearing courses on top of deck slab excluding prime coat with paving grade bitumen meeting the requirement given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 mm nominal size at the rate of 0.005cum per 10 sqm and at an approximate spacing of 10cm centre in both direction, pressed into surface not less than 100 deg. C. protruding 1mm to 4mm over mastic surface, all complete as per clause 515) using Bitumen VG-40 (3/40)			
		Refer: Structure Repair and Rehabilitation Formula: 638	638	638.00	sqm
			Total :	638.00	sqm
7	18.01	Removal of existing cement concrete wearing coat manually or jack hammer including its disposal complete as per drawing and technical specification without causing any detrimental effect to any part of bridge structure			
		Refer: Structure Repair and Rehabilitation Formula: 638	638	638.00	sqm
			Total :	638.00	sqm
8	18.04/a	Sealing of Cracks by Injection process through nipples complete as per technical specification with			



SI No	SOR Ref No	Description	Calculation	Quantity	Unit
		Refer: Structure Repair and Rehabilitation Formula: 35	35	35.00	cum
			Total :	35.00	cum
		Protection Work			
9	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: Structure Repair and Rehabilitation Formula: 140	140	140.00	cum
			Total :	140.00	cum
10	17.02	Filter material underneath pitching in slopes complete as per drawing and Technical specification			
		Refer: Structure Repair and Rehabilitation Formula: 294	294	294.00	cum
			Total :	294.00	cum
11	17.03/a	Pitching on slopes complete as per drawing and Technical specifications Stone			
		Refer: Structure Repair and Rehabilitation Formula: 588	588	588.00	cum
			Total :	588.00	cum
		Miscellaneous Work			
12	08.05	Painting two coat after filling the surface with synthetic enamel paint in all shades on new plastered concrete surface.			
		Refer: Structure Repair and Rehabilitation Formula: 792	792	792.00	sqm
			Total :	792.00	sqm



QUANTITY CALCULATION (STRUCTURE PART)



Repair & Rehabilitation Quantity Calculation



SUMMARY QTY. REPAIR & REHABILITATION NH37

ITEM NO.	Description	Unit	MINOR BRIDGE		
			CH._8.541KM_6mX4 m-3 cell_RCC Box Bridge	CH._12.505KM_3mX3 m-3 cell_RCC Box Bridge	TOTAL
1	Grouting using Concrete	cum	20.000	15.000	35
2	Removal of existing wearing coat	sqm	373.200	265.200	638
3	Laying of wearing Course (Bituminous Concrete)	cum	14.928	10.608	26
4	Laying of wearing Course (Mastic Asphalt)	sqm	373.200	265.200	638
5	Laying of wearing Course (Tack Coat)	sqm	373.200	265.200	638
6	Repairing of kerb below railing	m	62.200	44.200	106
7	Repairing of railing	metre	62.200	44.200	106
8	Reinforcement HYSD	Ton	12.440	8.840	21
	PROTECTION WORK				
9	Slope pitching	cum	362.791	225.139	588
10	Filter blanket	cum	181.396	112.569	294
11	Toe wall	cum	81.844	57.844	140
	MISCELLANEOUS				
12	Painting on concrete surface	sqm	487.354	304.179	792



ESTIMATE OF QUANTITY FOR REPAIRING AND REHABILITATION WORK OF BRIDGE

Chainage= 8.541 Km

SPAN =3 x 6m x 4m_ Box

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
1	Grouting using Concrete						
		cum	1	20.000			20.000
Total							20.000
2	Removal of existing wearing coat						
		sqm	1	31.100	12.000		373.200
Total							373.200
3	Laying of wearing Course (Bituminas Concrete)						
		cum	1	31.100	12.000	0.040	14.928
Total=							14.928
4	Laying of wearing Course (Mastic Asphalt)						
		sqm	1	31.100	12.000		373.200
Total=							373.200
5	Laying of wearing Course (Tack Coat)						
		sqm	1	31.100	12.000		373.200
Total=							373.200
6	Replacrement of kerb below railing						
		cum	2	31.100			62.200
Total=							62.200
7	Replacement of RCC Railing						
		metre	2	31.100			62.200
Total							62.200
7a	Reinforcement						
		ton					12.440
Total							12.440



8	Painting						
	Kerb below railing	sqm	2	31.100	1.400		87.080
	Deck bottom	sqm	3	6.700	13.000		261.300
	Side of Deck Slab	sqm	3	6.700	0.700		14.070
	Railing post	sqm	34	0.800		1.000	27.200
	Railing beam	sqm	4	0.785		31.100	97.704
						Total=	487.354

9	Pitching with Stone Blanket						
	A1 side	cum	2	302.33		0.30	181.396
	A2 side	cum	2	302.33		0.30	181.396
						Total	362.79

10	Toe Wall						
	A1 side	cum	2	34.102	0.600		40.922
	A2 side	cum	2	34.102	0.600		40.922
						Total	81.84

11	Filter Blanket PCC(M15) below pitching						
	A1 side	cum	2	302.33		0.15	90.698
	A2 side	cum	2	302.33		0.15	90.698
						Total=	181.40



ESTIMATE OF QUANTITY FOR REPAIRING AND REHABILITATION WORK OF BRIDGE

Chainage= 12.505 Km

SPAN =3 x 3m x 3m_ Box

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
1	Grouting using Concrete						
		cum	1	15.000			15.000
Total							15.000
2	Removal of existing wearing coat						
		sqm	1	22.100	12.000		265.200
Total							265.200
3	Laying of wearing Course (Bituminas Concrete)						
		cum	1	22.100	12.000	0.040	10.608
Total=							10.608
4	Laying of wearing Course (Mastic Asphalt)						
		sqm	1	22.100	12.000		265.200
Total=							265.200
5	Laying of wearing Course (Tack Coat)						
		sqm	1	22.100	12.000		265.200
Total=							265.200
6	Replacrement of kerb below railing						
		m	2	22.100			44.200
Total=							44.200
7	Replacement of RCC Railing						
		metre	2	22.100			44.200
Total							44.200
7a	Reinforcement						
		ton					8.840
Total							8.840



8	Painting					
	Kerb below railing	sqm	2	22.100	1.400	61.880
	Deck bottom	sqm	3	3.700	13.000	144.300
	Side of Deck Slab	sqm	3	3.700	0.700	7.770
	Railing post	sqm	26	0.800	1.000	20.800
	Railing beam	sqm	4	0.785	22.100	69.429
Total=						304.179

9	Pitching with Stone Blanket					
	A1 side	cum	2	187.62	0.30	112.569
	A2 side	cum	2	187.62	0.30	112.569
Total						225.14

10	Toe Wall					
	A1 side	cum	2	24.102	0.600	28.922
	A2 side	cum	2	24.102	0.600	28.922
Total						57.84

11	Filter Blanket PCC(M15) below pitching					
	A1 side	cum	2	187.62	0.15	56.285
	A2 side	cum	2	187.62	0.15	56.285
Total=						112.57



Culvert Quantity Calculation



SUMMARY FOR BOX CULVERT			Span(m) x Height(m) =	2.0 X 2.0 M_1 Cell_F_Width- 13m_NC	2.0 X 2.0 M_1 Cell_F_Width- 13m_SE-4.7%	2.0 X 2.0 M_1 Cell_F_Width- 15m_NC	2.0 X 2.0 M_1 Cell_F_Width- 15m_SE-3.6%	2.0 X 2.0 M_1 Cell_F_Width- 15m_SE-4.6%	2.0 X 2.0 M_1 Cell_F_Width- 15m_SE-7%	2.0 X 3.0 M_1 Cell_F_Width- 13m_NC	2.0 X 3.0 M_1 Cell_F_Width- 15m_NC	2.0 X 3.0 M_1 Cell_F_Width- 15m_SE-3.6%	2.0 X 3.0 M_1 Cell_F_Width- 15m_SE-4.4%	3.0 X 3.0 M_1 Cell_F_Width- 13m_NC
				6	1	13	2	1	1	4	9	1	1	1
SI No.	Description	Unit												
1	Excavation	cum		111.88	107.34	101.65	118.59	120.76	126.02	137.53	148.49	176.69	179.14	147.41
2	PCC-M15	cum		15.88	15.20	13.71	16.77	17.22	18.29	19.16	20.75	24.67	25.11	20.86
3	RCC-Substructure	cum		68.12	64.59	58.47	72.60	75.02	81.01	96.66	105.36	130.30	133.25	106.06
4	Steel	ton		5.45	5.17	4.68	5.81	6.00	6.48	7.73	8.43	10.42	10.66	8.48
5	Weep holes	nos		24.00	24.00	22.00	26.00	39.00	39.00	36.00	39.00	39.00	52.00	36.00
6	Filter media	cum		54.08	50.74	46.85	57.50	60.63	68.46	77.31	83.79	97.17	100.30	78.76
7	Sand Filling in Foundation Trenches	cum		45.66	44.27	41.79	47.58	48.37	50.27	54.90	58.20	67.10	67.88	54.14
8	RCC-Superstructure(up to 5m)	cum		12.12	11.19	17.40	13.99	13.99	13.99	15.91	18.87	15.32	15.32	25.00
9	Steel	ton		0.97	0.90	1.39	1.12	1.12	1.12	1.27	1.51	1.23	1.23	2.00
10	Bituminous Concrete	cum		1.25	1.14	1.46	1.46	1.46	1.46	1.30	1.51	1.51	1.51	1.84
11	Mastic Asphalt	sqm		31.20	28.60	36.40	36.40	36.40	36.40	32.40	37.80	37.80	37.80	46.08
12	Tack Coat	sqm		31.20	28.60	36.40	36.40	36.40	36.40	32.40	37.80	37.80	37.80	46.08
13	RCC M-40 Crash Barrier	m		5.20	5.20	5.20	5.20	5.20	5.20	5.40	5.40	5.40	5.40	7.68
14	Drainage Spout	nos		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
15	750 mm Thick Flexible Apron	cum		76.55	75.60	65.21	75.33	78.17	85.05	86.54	86.54	96.66	98.96	95.18
16	Curtain Wall PCC M-20	cum		70.24	69.77	64.55	69.63	71.06	74.51	75.26	75.26	80.34	81.50	79.60
17	Excavation in Soil	cum		336.69	334.15	306.15	333.42	341.05	359.59	363.59	363.59	390.86	397.04	386.86
18	PCC M-15 Below Curtain Wall	cum		10.38	10.31	9.53	10.29	10.50	11.01	11.12	11.12	11.88	12.05	11.77

SUMMARY FOR BOX CULVERT			Span(m) x Height(m) =	3.0 X 3.0 M_1 Cell_F_Width- 15m_4.7%	3.0 X 4.0 M_1 Cell_F_Width- 15m_NC	3.0 X 4.0 M_1 Cell_F_Width- 15m_SE-4.4%	5.0 X 3.0 M_1 Cell_F_Width- 15m_NC	Total Quantity
				1	4	1	1	47
Sl No.	Description	Unit						
1	Excavation	cum		192.55	222.41	245.12	219.92	6521.08
2	PCC-M15	cum		27.33	30.64	33.58	29.10	904.33
3	RCC-Substructure	cum		147.27	186.42	216.90	171.79	4520.71
4	Steel	ton		11.78	14.91	17.35	13.74	361.66
5	Weep holes	nos		60.00	60.00	75.00	39.00	1620.00
6	Filter media	cum		103.20	130.27	150.36	87.15	3429.71
7	Sand Filling in Foundation Trenches	cum		67.39	76.36	83.06	61.51	2505.23
8	RCC-Superstructure(up to 5m)	cum		24.53	31.94	26.80	54.45	888.71
9	Steel	ton		1.96	2.56	2.14	4.36	71.10
10	Bituminous Concrete	cum		2.15	2.20	2.20	3.44	73.61
11	Mastic Asphalt	sqm		53.76	54.88	54.88	85.96	1840.20
12	Tack Coat	sqm		53.76	54.88	54.88	85.96	1840.20
13	RCC M-40 Crash Barrier	m		7.68	7.84	7.84	12.28	272.64
14	Drainage Spout	nos		2.00	2.00	2.00	2.00	94.00
15	750 mm Thick Flexible Apron	cum		108.54	116.64	129.06	112.32	3928.64
16	Curtain Wall PCC M-20	cum		86.31	90.38	96.62	88.21	3467.65
17	Excavation in Soil	cum		422.85	444.66	478.11	433.03	16715.87
18	PCC M-15 Below Curtain Wall	cum		12.76	13.36	14.29	13.04	512.43

ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =13 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	4.600	14.000	0.830	53.45
	Shear Key	cum	2	4.800	1.720	0.820	13.54
	Return Wall II	cum	4	4.350	4.300	0.600	44.89
						Total	111.88

2	PCC-M15						
	Box culvert	cum	1	3.600	10.760	0.150	5.81
	Shear Key	cum	2	3.800	1.560	0.150	1.78
	Return Wall II	cum	4	3.950	3.500	0.150	8.30
						Total	15.88

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	3.600	13.000	0.380	17.78
	Box Side Wall	cum	2	13.00	2.282	0.300	17.80
	Base slab of return wall II	cum	4	3.850	3.300	0.300	15.25
	Return wall I	cum	4	0.500	2.632	0.250	1.32
	Return wall II	cum	4	3.850	0.275	2.712	11.49
	Shear Key	cum	2	3.600	0.58220		4.19
	Haunch	cum	2	13.000	0.01125		0.29
						Total=	68.12

4	Steel						
	@ 80 Kg per cum of concrete	ton					5.45
						Total	5.45

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 = $12.5/2 =$					6	
	No of weep holes in vertical direction per abutment = $2/1 =$					2	
	No of weep holes in horizontal direction per return wall = $3/2 =$					3	
	No of weep holes in vertical direction per return wall = $2/1 =$					2	
	Total no of Weep holes per abutment = 6×2					12	
	Total no of Weep holes per return wall = 3×2					6	
	Total mtrs of weep holes = $12 \times 2 + 6 \times 4$					Total	24.00

6	Filter media						
	Behind Abutment	cum	2	12.500	0.600	1.982	29.73
	Behind Return Wall	cum	4	4.350	0.600	2.332	24.35
						Total	54.08

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					111.88
	Less for PCC	cum					15.88
	Less for Bottom Slab RCC	cum					17.78
	Less for Shear Key RCC	cum					4.19
	Less for Return Wall-I RCC	cum	4	0.500	0.250	0.300	0.15
	Less for Return Wall-II Base Slab	cum					15.25
	Less for Return Wall-II Stem Wall	cum	4	3.850	0.350	0.380	2.05
	Less for Box above Invert upto EGL	cum	1	2.60	14.000	0.300	10.92
						Total	45.66

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.600	13.000	0.350	11.83
	(+)-Haunch	cum	2	13.00	0.01125		0.29
						Total	12.12



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =13 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					0.97
						Total	0.97
10	Bituminous Concrete						
		cum	1	2.60	12.00	0.04	1.25
						Total	1.25
11	Mastic Asphalt						
		sqm	1	2.60	12.00		31.20
						Total	31.20
12	Tack Coat						
		sqm	1	2.60	12.00		31.20
						Total	31.20
13	RCC M-40 Crash Barrier	m	2	2.60			5.20
						Total	5.20
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	11.340	3.000	0.750	25.52
	DownStream	cum	1	11.340	6.000	0.750	51.03
						Total	76.55
16	Curtain Wall PCC M-20						
	Upstream	cum	1	17.340	1.480		25.66
	DownStream	cum	1	23.340	1.910		44.58
						Total	70.24
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	18.340	2.500	2.150	98.58
	Curtain Wall Downstream	cum	1	24.340	2.850	2.650	183.83
	Flexible Apron Downstream	cum	1	10.340	2.000	0.750	15.51
	Flexible Apron Upstream	cum	1	10.340	5.000	0.750	38.78
						Total	336.69
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	17.340	1.500	0.150	3.90
	DownStream	cum	1	23.340	1.850	0.150	6.48
						Total	10.38



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =12 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	4.600	13.000	0.830	49.63
	Shear Key	cum	2	4.800	1.720	0.820	13.54
	Return Wall II	cum	4	4.280	4.300	0.600	44.17
						Total	107.34

2	PCC-M15						
	Box culvert	cum	1	3.600	9.760	0.150	5.27
	Shear Key	cum	2	3.800	1.560	0.150	1.78
	Return Wall II	cum	4	3.880	3.500	0.150	8.15
						Total	15.20

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	3.600	12.000	0.380	16.42
	Box Side Wall	cum	2	12.00	2.259	0.300	16.26
	Base slab of return wall II	cum	4	3.780	3.300	0.300	14.97
	Return wall I	cum	4	0.500	2.609	0.250	1.30
	Return wall II	cum	4	3.780	0.275	2.689	11.18
	Shear Key	cum	2	3.600	0.58220		4.19
	Haunch	cum	2	12.000	0.01125		0.27
						Total=	64.59

4	Steel						
	@ 80 Kg per cum of concrete	ton					5.17
						Total	5.17

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 = $11.5/2 =$					6	
	No of weep holes in vertical direction per abutment = $2/1 =$					2	
	No of weep holes in horizontal direction per return wall = $3/2 =$					3	
	No of weep holes in vertical direction per return wall = $2/1 =$					2	
	Total no of Weep holes per abutment = 6×2					12	
	Total no of Weep holes per return wall = 3×2					6	
	Total mtrs of weep holes = $12 \times 2 + 6 \times 4$					Total	24.00

6	Filter media						
	Behind Abutment	cum	2	11.500	0.600	1.959	27.03
	Behind Return Wall	cum	4	4.280	0.600	2.309	23.71
						Total	50.74

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					107.34
	Less for PCC	cum					15.20
	Less for Bottom Slab RCC	cum					16.42
	Less for Shear Key RCC	cum					4.19
	Less for Return Wall-I RCC	cum	4	0.500	0.250	0.300	0.15
	Less for Return Wall-II Base Slab	cum					14.97
	Less for Return Wall-II Stem Wall	cum	4	3.780	0.350	0.380	2.01
	Less for Box above Invert upto EGL	cum	1	2.60	13.000	0.300	10.14
						Total	44.27

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.600	12.000	0.350	10.92
	(+)-Haunch	cum	2	12.00	0.01125		0.27
						Total	11.19



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =12 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					0.90
						Total	0.90
10	Bituminous Concrete						
		cum	1	2.60	11.00	0.04	1.14
						Total	1.14
11	Mastic Asphalt						
		sqm	1	2.60	11.00		28.60
						Total	28.60
12	Tack Coat						
		sqm	1	2.60	11.00		28.60
						Total	28.60
13	RCC M-40 Crash Barrier	m	2	2.60			5.20
						Total	5.20
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	11.200	3.000	0.750	25.20
	DownStream	cum	1	11.200	6.000	0.750	50.40
						Total	75.60
16	Curtain Wall PCC M-20						
	Upstream	cum	1	17.200	1.480		25.46
	DownStream	cum	1	23.200	1.910		44.31
						Total	69.77
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	18.200	2.500	2.150	97.83
	Curtain Wall Downstream	cum	1	24.200	2.850	2.650	182.77
	Flexible Apron Downstream	cum	1	10.200	2.000	0.750	15.30
	Flexible Apron Upstream	cum	1	10.200	5.000	0.750	38.25
						Total	334.15
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	17.200	1.500	0.150	3.87
	DownStream	cum	1	23.200	1.850	0.150	6.44
						Total	10.31



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	4.600	16.000	0.830	61.09
	Shear Key	cum	2	4.800	1.720	0.820	13.54
	Return Wall II	cum	4	3.510	3.500	0.550	27.03
						Total	101.65

2	PCC-M15						
	Box culvert	cum	1	3.600	12.760	0.150	6.89
	Shear Key	cum	2	3.800	1.560	0.150	1.78
	Return Wall II	cum	4	3.110	2.700	0.150	5.04
						Total	13.71

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	3.600	15.000	0.380	20.52
	Box Side Wall	cum	2	15.00	2.000	0.300	18.00
	Base slab of return wall II	cum	4	3.010	2.500	0.250	7.53
	Return wall I	cum	4	0.500	2.350	0.250	1.18
	Return wall II	cum	4	3.010	0.225	2.480	6.72
	Shear Key	cum	2	3.600	0.58220		4.19
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	58.47

4	Steel						
	@ 80 Kg per cum of concrete	ton					4.68
						Total	4.68

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 = $14.5/2 =$					7	
	No of weep holes in vertical direction per abutment = $1.7/1 =$					2	
	No of weep holes in horizontal direction per return wall = $3/2 =$					2	
	No of weep holes in vertical direction per return wall = $1.7/1 =$					2	
	Total no of Weep holes per abutment = 7×2					14	
	Total no of Weep holes per return wall = 2×2					4	
	Total mtrs of weep holes = $14 \times 2 + 4 \times 4$					Total	22.00

6	Filter media						
	Behind Abutment	cum	2	14.500	0.600	1.700	29.58
	Behind Return Wall	cum	4	3.510	0.600	2.050	17.27
						Total	46.85

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					101.65
	Less for PCC	cum					13.71
	Less for Bottom Slab RCC	cum					20.52
	Less for Shear Key RCC	cum					4.19
	Less for Return Wall-I RCC	cum	4	0.500	0.250	0.300	0.15
	Less for Return Wall-II Base Slab	cum					7.53
	Less for Return Wall-II Stem Wall	cum	4	3.010	0.250	0.430	1.29
	Less for Box above Invert upto EGL	cum	1	2.60	16.000	0.300	12.48
						Total	41.79

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.600	15.000	0.438	17.06
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	17.40



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.39
						Total	1.39
10	Bituminous Concrete						
		cum	1	2.60	14.00	0.04	1.46
						Total	1.46
11	Mastic Asphalt						
		sqm	1	2.60	14.00		36.40
						Total	36.40
12	Tack Coat						
		sqm	1	2.60	14.00		36.40
						Total	36.40
13	RCC M-40 Crash Barrier	m	2	2.60			5.20
						Total	5.20
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	9.660	3.000	0.750	21.74
	DownStream	cum	1	9.660	6.000	0.750	43.47
						Total	65.21
16	Curtain Wall PCC M-20						
	Upstream	cum	1	15.660	1.480		23.18
	DownStream	cum	1	21.660	1.910		41.37
						Total	64.55
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	16.660	2.500	2.150	89.55
	Curtain Wall Downstream	cum	1	22.660	2.850	2.650	171.14
	Flexible Apron Downstream	cum	1	8.660	2.000	0.750	12.99
	Flexible Apron Upstream	cum	1	8.660	5.000	0.750	32.48
						Total	306.15
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	15.660	1.500	0.150	3.52
	DownStream	cum	1	21.660	1.850	0.150	6.01
						Total	9.53



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	4.600	16.000	0.830	61.09
	Shear Key	cum	2	4.800	1.720	0.820	13.54
	Return Wall II	cum	4	4.260	4.300	0.600	43.96
						Total	118.59

2	PCC-M15						
	Box culvert	cum	1	3.600	12.760	0.150	6.89
	Shear Key	cum	2	3.800	1.560	0.150	1.78
	Return Wall II	cum	4	3.860	3.500	0.150	8.11
						Total	16.77

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	3.600	15.000	0.380	20.52
	Box Side Wall	cum	2	15.00	2.252	0.300	20.27
	Base slab of return wall II	cum	4	3.760	3.300	0.300	14.89
	Return wall I	cum	4	0.500	2.602	0.250	1.30
	Return wall II	cum	4	3.760	0.275	2.682	11.09
	Shear Key	cum	2	3.600	0.58220		4.19
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	72.60

4	Steel						
	@ 80 Kg per cum of concrete	ton					5.81
						Total	5.81

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 = $14.5/2 =$					7	
	No of weep holes in vertical direction per abutment = $2/1 =$					2	
	No of weep holes in horizontal direction per return wall = $3/2 =$					3	
	No of weep holes in vertical direction per return wall = $2/1 =$					2	
	Total no of Weep holes per abutment = 7×2					14	
	Total no of Weep holes per return wall = 3×2					6	
	Total mtrs of weep holes = $14 \times 2 + 6 \times 4$					Total	26.00

6	Filter media						
	Behind Abutment	cum	2	14.500	0.600	1.952	33.96
	Behind Return Wall	cum	4	4.260	0.600	2.302	23.54
						Total	57.50

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					118.59
	Less for PCC	cum					16.77
	Less for Bottom Slab RCC	cum					20.52
	Less for Shear Key RCC	cum					4.19
	Less for Return Wall-I RCC	cum	4	0.500	0.250	0.300	0.15
	Less for Return Wall-II Base Slab	cum					14.89
	Less for Return Wall-II Stem Wall	cum	4	3.760	0.350	0.380	2.00
	Less for Box above Invert upto EGL	cum	1	2.60	16.000	0.300	12.48
						Total	47.58

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.600	15.000	0.350	13.65
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	13.99



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.12
						Total	1.12
10	Bituminous Concrete						
		cum	1	2.60	14.00	0.04	1.46
						Total	1.46
11	Mastic Asphalt						
		sqm	1	2.60	14.00		36.40
						Total	36.40
12	Tack Coat						
		sqm	1	2.60	14.00		36.40
						Total	36.40
13	RCC M-40 Crash Barrier	m	2	2.60			5.20
						Total	5.20
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	11.160	3.000	0.750	25.11
	DownStream	cum	1	11.160	6.000	0.750	50.22
						Total	75.33
16	Curtain Wall PCC M-20						
	Upstream	cum	1	17.160	1.480		25.40
	DownStream	cum	1	23.160	1.910		44.24
						Total	69.63
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	18.160	2.500	2.150	97.61
	Curtain Wall Downstream	cum	1	24.160	2.850	2.650	182.47
	Flexible Apron Downstream	cum	1	10.160	2.000	0.750	15.24
	Flexible Apron Upstream	cum	1	10.160	5.000	0.750	38.10
						Total	333.42
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	17.160	1.500	0.150	3.86
	DownStream	cum	1	23.160	1.850	0.150	6.43
						Total	10.29



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	4.600	16.000	0.830	61.09
	Shear Key	cum	2	4.800	1.720	0.820	13.54
	Return Wall II	cum	4	4.470	4.300	0.600	46.13
						Total	120.76

2	PCC-M15						
	Box culvert	cum	1	3.600	12.760	0.150	6.89
	Shear Key	cum	2	3.800	1.560	0.150	1.78
	Return Wall II	cum	4	4.070	3.500	0.150	8.55
						Total	17.22

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	3.600	15.000	0.380	20.52
	Box Side Wall	cum	2	15.00	2.322	0.300	20.90
	Base slab of return wall II	cum	4	3.970	3.300	0.300	15.72
	Return wall I	cum	4	0.500	2.672	0.250	1.34
	Return wall II	cum	4	3.970	0.275	2.752	12.02
	Shear Key	cum	2	3.600	0.58220		4.19
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	75.02

4	Steel						
	@ 80 Kg per cum of concrete	ton					6.00
						Total	6.00

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 = $14.5/2 =$					7	
	No of weep holes in vertical direction per abutment = $2/1 =$					3	
	No of weep holes in horizontal direction per return wall = $3/2 =$					3	
	No of weep holes in vertical direction per return wall = $2/1 =$					3	
	Total no of Weep holes per abutment = 7×3					21	
	Total no of Weep holes per return wall = 3×3					9	
	Total mtrs of weep holes = $21 \times 2 + 9 \times 4$					Total	39.00

6	Filter media						
	Behind Abutment	cum	2	14.500	0.600	2.022	35.18
	Behind Return Wall	cum	4	4.470	0.600	2.372	25.45
						Total	60.63

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					120.76
	Less for PCC	cum					17.22
	Less for Bottom Slab RCC	cum					20.52
	Less for Shear Key RCC	cum					4.19
	Less for Return Wall-I RCC	cum	4	0.500	0.250	0.300	0.15
	Less for Return Wall-II Base Slab	cum					15.72
	Less for Return Wall-II Stem Wall	cum	4	3.970	0.350	0.380	2.11
	Less for Box above Invert upto EGL	cum	1	2.60	16.000	0.300	12.48
						Total	48.37

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.600	15.000	0.350	13.65
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	13.99



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.12
						Total	1.12
10	Bituminous Concrete						
		cum	1	2.60	14.00	0.04	1.46
						Total	1.46
11	Mastic Asphalt						
		sqm	1	2.60	14.00		36.40
						Total	36.40
12	Tack Coat						
		sqm	1	2.60	14.00		36.40
						Total	36.40
13	RCC M-40 Crash Barrier	m	2	2.60			5.20
						Total	5.20
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	11.580	3.000	0.750	26.06
	DownStream	cum	1	11.580	6.000	0.750	52.11
						Total	78.17
16	Curtain Wall PCC M-20						
	Upstream	cum	1	17.580	1.480		26.02
	DownStream	cum	1	23.580	1.910		45.04
						Total	71.06
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	18.580	2.500	2.150	99.87
	Curtain Wall Downstream	cum	1	24.580	2.850	2.650	185.64
	Flexible Apron Downstream	cum	1	10.580	2.000	0.750	15.87
	Flexible Apron Upstream	cum	1	10.580	5.000	0.750	39.68
						Total	341.05
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	17.580	1.500	0.150	3.96
	DownStream	cum	1	23.580	1.850	0.150	6.54
						Total	10.50



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	4.600	16.000	0.830	61.09
	Shear Key	cum	2	4.800	1.720	0.820	13.54
	Return Wall II	cum	4	4.980	4.300	0.600	51.39
						Total	126.02

2	PCC-M15						
	Box culvert	cum	1	3.600	12.760	0.150	6.89
	Shear Key	cum	2	3.800	1.560	0.150	1.78
	Return Wall II	cum	4	4.580	3.500	0.150	9.62
						Total	18.29

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	3.600	15.000	0.380	20.52
	Box Side Wall	cum	2	15.00	2.490	0.300	22.41
	Base slab of return wall II	cum	4	4.480	3.300	0.300	17.74
	Return wall I	cum	4	0.500	2.840	0.250	1.42
	Return wall II	cum	4	4.480	0.275	2.920	14.39
	Shear Key	cum	2	3.600	0.58220		4.19
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	81.01

4	Steel						
	@ 80 Kg per cum of concrete	ton					6.48
						Total	6.48

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 = $14.5/2 =$					7	
	No of weep holes in vertical direction per abutment = $2.2/1 =$					3	
	No of weep holes in horizontal direction per return wall = $3/2 =$					3	
	No of weep holes in vertical direction per return wall = $2.2/1 =$					3	
	Total no of Weep holes per abutment = 7×3					21	
	Total no of Weep holes per return wall = 3×3					9	
	Total mtrs of weep holes = $21 \times 2 + 9 \times 4$					Total	39.00

6	Filter media						
	Behind Abutment	cum	2	14.500	0.600	2.190	38.11
	Behind Return Wall	cum	4	4.980	0.600	2.540	30.36
						Total	68.46

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					126.02
	Less for PCC	cum					18.29
	Less for Bottom Slab RCC	cum					20.52
	Less for Shear Key RCC	cum					4.19
	Less for Return Wall-I RCC	cum	4	0.500	0.250	0.300	0.15
	Less for Return Wall-II Base Slab	cum					17.74
	Less for Return Wall-II Stem Wall	cum	4	4.480	0.350	0.380	2.38
	Less for Box above Invert upto EGL	cum	1	2.60	16.000	0.300	12.48
						Total	50.27

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.600	15.000	0.350	13.65
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	13.99



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/22/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.12
						Total	1.12
10	Bituminous Concrete						
		cum	1	2.60	14.00	0.04	1.46
						Total	1.46
11	Mastic Asphalt						
		sqm	1	2.60	14.00		36.40
						Total	36.40
12	Tack Coat						
		sqm	1	2.60	14.00		36.40
						Total	36.40
13	RCC M-40 Crash Barrier	m	2	2.60			5.20
						Total	5.20
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	12.600	3.000	0.750	28.35
	DownStream	cum	1	12.600	6.000	0.750	56.70
						Total	85.05
16	Curtain Wall PCC M-20						
	Upstream	cum	1	18.600	1.480		27.53
	DownStream	cum	1	24.600	1.910		46.99
						Total	74.51
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	19.600	2.500	2.150	105.35
	Curtain Wall Downstream	cum	1	25.600	2.850	2.650	193.34
	Flexible Apron Downstream	cum	1	11.600	2.000	0.750	17.40
	Flexible Apron Upstream	cum	1	11.600	5.000	0.750	43.50
						Total	359.59
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	18.600	1.500	0.150	4.19
	DownStream	cum	1	24.600	1.850	0.150	6.83
						Total	11.01



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/23/0 (W =13 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	6.300	14.000	0.870	76.73
	Shear Key	cum	2	6.500	1.680	0.780	17.04
	Return Wall II	cum	4	4.240	4.300	0.600	43.76
						Total	137.53

2	PCC-M15						
	Box culvert	cum	1	5.300	10.840	0.150	8.62
	Shear Key	cum	2	5.500	1.503	0.150	2.48
	Return Wall II	cum	4	3.840	3.500	0.150	8.06
						Total	19.16

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	5.300	13.000	0.420	28.94
	Box Side Wall	cum	2	13.00	3.000	0.350	27.30
	Base slab of return wall II	cum	4	3.740	3.300	0.300	14.81
	Return wall I	cum	4	1.300	3.370	0.300	5.26
	Return wall II	cum	4	3.740	0.275	3.490	14.36
	Shear Key	cum	2	5.300	0.53820		5.70
	Haunch	cum	2	13.000	0.01125		0.29
						Total=	96.66

4	Steel						
	@ 80 Kg per cum of concrete	ton					7.73
						Total	7.73

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 = $12.4/2 =$					6	
	No of weep holes in vertical direction per abutment = $2.7/1 =$					3	
	No of weep holes in horizontal direction per return wall = $4.5/2 =$					3	
	No of weep holes in vertical direction per return wall = $2.7/1 =$					3	
	Total no of Weep holes per abutment = 6×3					18	
	Total no of Weep holes per return wall = 3×3					9	
	Total mtrs of weep holes = $18 \times 2 + 9 \times 4$					Total	36.00

6	Filter media						
	Behind Abutment	cum	2	12.400	0.600	2.700	40.18
	Behind Return Wall	cum	4	5.040	0.600	3.070	37.13
						Total	77.31

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					137.53
	Less for PCC	cum					19.16
	Less for Bottom Slab RCC	cum					28.94
	Less for Shear Key RCC	cum					5.70
	Less for Return Wall-I RCC	cum	4	1.300	0.300	0.300	0.47
	Less for Return Wall-II Base Slab	cum					14.81
	Less for Return Wall-II Stem Wall	cum	4	3.740	0.350	0.420	2.20
	Less for Box above Invert upto EGL	cum	1	2.70	14.000	0.300	11.34
						Total	54.90

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.700	13.000	0.445	15.62
	(+)-Haunch	cum	2	13.00	0.01125		0.29
						Total	15.91



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/23/0 (W =13 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.27
						Total	1.27
10	Bituminous Concrete						
		cum	1	2.70	12.00	0.04	1.30
						Total	1.30
11	Mastic Asphalt						
		sqm	1	2.70	12.00		32.40
						Total	32.40
12	Tack Coat						
		sqm	1	2.70	12.00		32.40
						Total	32.40
13	RCC M-40 Crash Barrier	m	2	2.70			5.40
						Total	5.40
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	12.820	3.000	0.750	28.85
	DownStream	cum	1	12.820	6.000	0.750	57.69
						Total	86.54
16	Curtain Wall PCC M-20						
	Upstream	cum	1	18.820	1.480		27.85
	DownStream	cum	1	24.820	1.910		47.41
						Total	75.26
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	19.820	2.500	2.150	106.53
	Curtain Wall Downstream	cum	1	25.820	2.850	2.650	195.01
	Flexible Apron Downstream	cum	1	11.820	2.000	0.750	17.73
	Flexible Apron Upstream	cum	1	11.820	5.000	0.750	44.33
						Total	363.59
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	18.820	1.500	0.150	4.23
	DownStream	cum	1	24.820	1.850	0.150	6.89
						Total	11.12



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/23/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	6.300	16.000	0.870	87.70
	Shear Key	cum	2	6.500	1.680	0.780	17.04
	Return Wall II	cum	4	4.240	4.300	0.600	43.76
						Total	148.49

2	PCC-M15						
	Box culvert	cum	1	5.300	12.840	0.150	10.21
	Shear Key	cum	2	5.500	1.503	0.150	2.48
	Return Wall II	cum	4	3.840	3.500	0.150	8.06
						Total	20.75

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	5.300	15.000	0.420	33.39
	Box Side Wall	cum	2	15.00	3.000	0.350	31.50
	Base slab of return wall II	cum	4	3.740	3.300	0.300	14.81
	Return wall I	cum	4	1.300	3.370	0.300	5.26
	Return wall II	cum	4	3.740	0.275	3.490	14.36
	Shear Key	cum	2	5.300	0.53820		5.70
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	105.36

4	Steel						
	@ 80 Kg per cum of concrete	ton					8.43
						Total	8.43

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 = $14.4/2 =$					7	
	No of weep holes in vertical direction per abutment = $2.7/1 =$					3	
	No of weep holes in horizontal direction per return wall = $4.5/2 =$					3	
	No of weep holes in vertical direction per return wall = $2.7/1 =$					3	
	Total no of Weep holes per abutment = 7×3					21	
	Total no of Weep holes per return wall = 3×3					9	
	Total mtrs of weep holes = $21 \times 2 + 9 \times 4$					Total	39.00

6	Filter media						
	Behind Abutment	cum	2	14.400	0.600	2.700	46.66
	Behind Return Wall	cum	4	5.040	0.600	3.070	37.13
						Total	83.79

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					148.49
	Less for PCC	cum					20.75
	Less for Bottom Slab RCC	cum					33.39
	Less for Shear Key RCC	cum					5.70
	Less for Return Wall-I RCC	cum	4	1.300	0.300	0.300	0.47
	Less for Return Wall-II Base Slab	cum					14.81
	Less for Return Wall-II Stem Wall	cum	4	3.740	0.350	0.420	2.20
	Less for Box above Invert upto EGL	cum	1	2.70	16.000	0.300	12.96
						Total	58.20

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.700	15.000	0.458	18.53
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	18.87



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/23/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.51
						Total	1.51
10	Bituminous Concrete						
		cum	1	2.70	14.00	0.04	1.51
						Total	1.51
11	Mastic Asphalt						
		sqm	1	2.70	14.00		37.80
						Total	37.80
12	Tack Coat						
		sqm	1	2.70	14.00		37.80
						Total	37.80
13	RCC M-40 Crash Barrier	m	2	2.70			5.40
						Total	5.40
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	12.820	3.000	0.750	28.85
	DownStream	cum	1	12.820	6.000	0.750	57.69
						Total	86.54
16	Curtain Wall PCC M-20						
	Upstream	cum	1	18.820	1.480		27.85
	DownStream	cum	1	24.820	1.910		47.41
						Total	75.26
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	19.820	2.500	2.150	106.53
	Curtain Wall Downstream	cum	1	25.820	2.850	2.650	195.01
	Flexible Apron Downstream	cum	1	11.820	2.000	0.750	17.73
	Flexible Apron Upstream	cum	1	11.820	5.000	0.750	44.33
						Total	363.59
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	18.820	1.500	0.150	4.23
	DownStream	cum	1	24.820	1.850	0.150	6.89
						Total	11.12



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/23/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	6.300	16.000	0.870	87.70
	Shear Key	cum	2	6.500	1.680	0.780	17.04
	Return Wall II	cum	4	4.990	5.150	0.700	71.96
						Total	176.69

2	PCC-M15						
	Box culvert	cum	1	5.300	12.840	0.150	10.21
	Shear Key	cum	2	5.500	1.503	0.150	2.48
	Return Wall II	cum	4	4.590	4.350	0.150	11.98
						Total	24.67

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	5.300	15.000	0.420	33.39
	Box Side Wall	cum	2	15.00	3.252	0.350	34.15
	Base slab of return wall II	cum	4	4.490	4.150	0.400	29.81
	Return wall I	cum	4	1.300	3.622	0.300	5.65
	Return wall II	cum	4	4.490	0.325	3.642	21.26
	Shear Key	cum	2	5.300	0.53820		5.70
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	130.30

4	Steel						
	@ 80 Kg per cum of concrete	ton					10.42
						Total	10.42

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 =14.4/2 =					7	
	No of weep holes in vertical direction per abutment =3/1 =					3	
	No of weep holes in horizontal direction per return wall =4.5/2 =					3	
	No of weep holes in vertical direction per return wall =3/1 =					3	
	Total no of Weep holes per abutment = 7 x 3					21	
	Total no of Weep holes per return wall = 3 x 3					9	
	Total mtrs of weep holes = 21 x 2 + 9 x 4					Total	39.00

6	Filter media						
	Behind Abutment	cum	2	14.400	0.600	2.952	51.01
	Behind Return Wall	cum	4	5.790	0.600	3.322	46.16
						Total	97.17

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					176.69
	Less for PCC	cum					24.67
	Less for Bottom Slab RCC	cum					33.39
	Less for Shear Key RCC	cum					5.70
	Less for Return Wall-I RCC	cum	4	1.300	0.300	0.300	0.47
	Less for Return Wall-II Base Slab	cum					29.81
	Less for Return Wall-II Stem Wall	cum	4	4.490	0.450	0.320	2.59
	Less for Box above Invert upto EGL	cum	1	2.70	16.000	0.300	12.96
						Total	67.10

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.700	15.000	0.370	14.99
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	15.32



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/23/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.23
						Total	1.23
10	Bituminous Concrete						
		cum	1	2.70	14.00	0.04	1.51
						Total	1.51
11	Mastic Asphalt						
		sqm	1	2.70	14.00		37.80
						Total	37.80
12	Tack Coat						
		sqm	1	2.70	14.00		37.80
						Total	37.80
13	RCC M-40 Crash Barrier	m	2	2.70			5.40
						Total	5.40
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	14.320	3.000	0.750	32.22
	DownStream	cum	1	14.320	6.000	0.750	64.44
						Total	96.66
16	Curtain Wall PCC M-20						
	Upstream	cum	1	20.320	1.480		30.07
	DownStream	cum	1	26.320	1.910		50.27
						Total	80.34
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	21.320	2.500	2.150	114.60
	Curtain Wall Downstream	cum	1	27.320	2.850	2.650	206.33
	Flexible Apron Downstream	cum	1	13.320	2.000	0.750	19.98
	Flexible Apron Upstream	cum	1	13.320	5.000	0.750	49.95
						Total	390.86
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	20.320	1.500	0.150	4.57
	DownStream	cum	1	26.320	1.850	0.150	7.30
						Total	11.88



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/23/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	6.300	16.000	0.870	87.70
	Shear Key	cum	2	6.500	1.680	0.780	17.04
	Return Wall II	cum	4	5.160	5.150	0.700	74.41
						Total	179.14

2	PCC-M15						
	Box culvert	cum	1	5.300	12.840	0.150	10.21
	Shear Key	cum	2	5.500	1.503	0.150	2.48
	Return Wall II	cum	4	4.760	4.350	0.150	12.42
						Total	25.11

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	5.300	15.000	0.420	33.39
	Box Side Wall	cum	2	15.00	3.308	0.350	34.73
	Base slab of return wall II	cum	4	4.660	4.150	0.400	30.94
	Return wall I	cum	4	1.300	3.678	0.300	5.74
	Return wall II	cum	4	4.660	0.325	3.698	22.40
	Shear Key	cum	2	5.300	0.53820		5.70
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	133.25

4	Steel						
	@ 80 Kg per cum of concrete	ton					10.66
						Total	10.66

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 =14.4/2 =					7	
	No of weep holes in vertical direction per abutment =3/1 =					4	
	No of weep holes in horizontal direction per return wall =4.5/2 =					3	
	No of weep holes in vertical direction per return wall =3/1 =					4	
	Total no of Weep holes per abutment = 7 x 4					28	
	Total no of Weep holes per return wall = 3 x 4					12	
	Total mtrs of weep holes = 28 x 2 + 12 x 4					Total	52.00

6	Filter media						
	Behind Abutment	cum	2	14.400	0.600	3.008	51.98
	Behind Return Wall	cum	4	5.960	0.600	3.378	48.32
						Total	100.30

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					179.14
	Less for PCC	cum					25.11
	Less for Bottom Slab RCC	cum					33.39
	Less for Shear Key RCC	cum					5.70
	Less for Return Wall-I RCC	cum	4	1.300	0.300	0.300	0.47
	Less for Return Wall-II Base Slab	cum					30.94
	Less for Return Wall-II Stem Wall	cum	4	4.660	0.450	0.320	2.68
	Less for Box above Invert upto EGL	cum	1	2.70	16.000	0.300	12.96
						Total	67.88

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	2.700	15.000	0.370	14.99
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	15.32



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/23/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.23
						Total	1.23
10	Bituminous Concrete						
		cum	1	2.70	14.00	0.04	1.51
						Total	1.51
11	Mastic Asphalt						
		sqm	1	2.70	14.00		37.80
						Total	37.80
12	Tack Coat						
		sqm	1	2.70	14.00		37.80
						Total	37.80
13	RCC M-40 Crash Barrier	m	2	2.70			5.40
						Total	5.40
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	14.660	3.000	0.750	32.99
	DownStream	cum	1	14.660	6.000	0.750	65.97
						Total	98.96
16	Curtain Wall PCC M-20						
	Upstream	cum	1	20.660	1.480		30.58
	DownStream	cum	1	26.660	1.910		50.92
						Total	81.50
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	21.660	2.500	2.150	116.42
	Curtain Wall Downstream	cum	1	27.660	2.850	2.650	208.90
	Flexible Apron Downstream	cum	1	13.660	2.000	0.750	20.49
	Flexible Apron Upstream	cum	1	13.660	5.000	0.750	51.23
						Total	397.04
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	20.660	1.500	0.150	4.65
	DownStream	cum	1	26.660	1.850	0.150	7.40
						Total	12.05



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/33/0 (W =13 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	6.640	14.000	0.870	80.88
	Shear Key	cum	2	6.840	1.680	0.780	17.93
	Return Wall II	cum	4	4.710	4.300	0.600	48.61
						Total	147.41

2	PCC-M15						
	Box culvert	cum	1	5.640	10.840	0.150	9.17
	Shear Key	cum	2	5.840	1.503	0.150	2.63
	Return Wall II	cum	4	4.310	3.500	0.150	9.05
						Total	20.86

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	5.640	13.000	0.420	30.79
	Box Side Wall	cum	2	13.00	3.000	0.420	32.76
	Base slab of return wall II	cum	4	4.210	3.300	0.300	16.67
	Return wall I	cum	4	0.900	3.420	0.250	3.08
	Return wall II	cum	4	4.210	0.275	3.540	16.39
	Shear Key	cum	2	5.640	0.53820		6.07
	Haunch	cum	2	13.000	0.01125		0.29
						Total=	106.06

4	Steel						
	@ 80 Kg per cum of concrete	ton					8.48
						Total	8.48

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 = $12.5/2 =$					6	
	No of weep holes in vertical direction per abutment = $2.7/1 =$					3	
	No of weep holes in horizontal direction per return wall = $4.5/2 =$					3	
	No of weep holes in vertical direction per return wall = $2.7/1 =$					3	
	Total no of Weep holes per abutment = 6×3					18	
	Total no of Weep holes per return wall = 3×3					9	
	Total mtrs of weep holes = $18 \times 2 + 9 \times 4$					Total	36.00

6	Filter media						
	Behind Abutment	cum	2	12.500	0.600	2.700	40.50
	Behind Return Wall	cum	4	5.110	0.600	3.120	38.26
						Total	78.76

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					147.41
	Less for PCC	cum					20.86
	Less for Bottom Slab RCC	cum					30.79
	Less for Shear Key RCC	cum					6.07
	Less for Return Wall-I RCC	cum	4	0.900	0.250	0.300	0.27
	Less for Return Wall-II Base Slab	cum					16.67
	Less for Return Wall-II Stem Wall	cum	4	4.210	0.350	0.420	2.48
	Less for Box above Invert upto EGL	cum	1	3.84	14.000	0.300	16.13
						Total	54.14

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	3.840	13.000	0.495	24.71
	(+)-Haunch	cum	2	13.00	0.01125		0.29
						Total	25.00



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/33/0 (W =13 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					2.00
						Total	2.00
10	Bituminous Concrete						
		cum	1	3.84	12.00	0.04	1.84
						Total	1.84
11	Mastic Asphalt						
		sqm	1	3.84	12.00		46.08
						Total	46.08
12	Tack Coat						
		sqm	1	3.84	12.00		46.08
						Total	46.08
13	RCC M-40 Crash Barrier	m	2	3.84			7.68
						Total	7.68
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	14.100	3.000	0.750	31.73
	DownStream	cum	1	14.100	6.000	0.750	63.45
						Total	95.18
16	Curtain Wall PCC M-20						
	Upstream	cum	1	20.100	1.480		29.75
	DownStream	cum	1	26.100	1.910		49.85
						Total	79.60
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	21.100	2.500	2.150	113.41
	Curtain Wall Downstream	cum	1	27.100	2.850	2.650	204.67
	Flexible Apron Downstream	cum	1	13.100	2.000	0.750	19.65
	Flexible Apron Upstream	cum	1	13.100	5.000	0.750	49.13
						Total	386.86
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	20.100	1.500	0.150	4.52
	DownStream	cum	1	26.100	1.850	0.150	7.24
						Total	11.77



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/33/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	6.640	16.000	0.870	92.43
	Shear Key	cum	2	6.840	1.680	0.780	17.93
	Return Wall II	cum	4	5.700	5.150	0.700	82.19
						Total	192.55

2	PCC-M15						
	Box culvert	cum	1	5.640	12.840	0.150	10.86
	Shear Key	cum	2	5.840	1.503	0.150	2.63
	Return Wall II	cum	4	5.300	4.350	0.150	13.83
						Total	27.33

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	5.640	15.000	0.420	35.53
	Box Side Wall	cum	2	15.00	3.329	0.420	41.95
	Base slab of return wall II	cum	4	5.200	4.150	0.400	34.53
	Return wall I	cum	4	0.900	3.749	0.250	3.37
	Return wall II	cum	4	5.200	0.325	3.769	25.48
	Shear Key	cum	2	5.640	0.53820		6.07
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	147.27

4	Steel						
	@ 80 Kg per cum of concrete	ton					11.78
						Total	11.78

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 = $14.5/2 =$					7	
	No of weep holes in vertical direction per abutment = $3/1 =$					4	
	No of weep holes in horizontal direction per return wall = $4.5/2 =$					4	
	No of weep holes in vertical direction per return wall = $3/1 =$					4	
	Total no of Weep holes per abutment = 7×4					28	
	Total no of Weep holes per return wall = 4×4					16	
	Total mtrs of weep holes = $28 \times 2 + 16 \times 4$					Total	60.00

6	Filter media						
	Behind Abutment	cum	2	14.500	0.600	3.029	52.70
	Behind Return Wall	cum	4	6.100	0.600	3.449	50.49
						Total	103.20

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					192.55
	Less for PCC	cum					27.33
	Less for Bottom Slab RCC	cum					35.53
	Less for Shear Key RCC	cum					6.07
	Less for Return Wall-I RCC	cum	4	0.900	0.250	0.300	0.27
	Less for Return Wall-II Base Slab	cum					34.53
	Less for Return Wall-II Stem Wall	cum	4	5.200	0.450	0.320	3.00
	Less for Box above Invert upto EGL	cum	1	3.84	16.000	0.300	18.43
						Total	67.39

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	3.840	15.000	0.420	24.19
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	24.53



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/33/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					1.96
						Total	1.96
10	Bituminous Concrete						
		cum	1	3.84	14.00	0.04	2.15
						Total	2.15
11	Mastic Asphalt						
		sqm	1	3.84	14.00		53.76
						Total	53.76
12	Tack Coat						
		sqm	1	3.84	14.00		53.76
						Total	53.76
13	RCC M-40 Crash Barrier	m	2	3.84			7.68
						Total	7.68
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	16.080	3.000	0.750	36.18
	DownStream	cum	1	16.080	6.000	0.750	72.36
						Total	108.54
16	Curtain Wall PCC M-20						
	Upstream	cum	1	22.080	1.480		32.68
	DownStream	cum	1	28.080	1.910		53.63
						Total	86.31
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	23.080	2.500	2.150	124.06
	Curtain Wall Downstream	cum	1	29.080	2.850	2.650	219.63
	Flexible Apron Downstream	cum	1	15.080	2.000	0.750	22.62
	Flexible Apron Upstream	cum	1	15.080	5.000	0.750	56.55
						Total	422.85
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	22.080	1.500	0.150	4.97
	DownStream	cum	1	28.080	1.850	0.150	7.79
						Total	12.76



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/34/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	8.320	16.000	0.930	123.80
	Shear Key	cum	2	8.520	1.620	0.720	19.88
	Return Wall II	cum	4	5.460	5.150	0.700	78.73
						Total	222.41

2	PCC-M15						
	Box culvert	cum	1	7.320	12.960	0.150	14.23
	Shear Key	cum	2	7.520	1.418	0.150	3.20
	Return Wall II	cum	4	5.060	4.350	0.150	13.21
						Total	30.64

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	7.320	15.000	0.480	52.70
	Box Side Wall	cum	2	15.00	4.000	0.460	55.20
	Base slab of return wall II	cum	4	4.960	4.150	0.400	32.93
	Return wall I	cum	4	1.700	4.450	0.300	9.08
	Return wall II	cum	4	4.960	0.325	4.530	29.21
	Shear Key	cum	2	7.320	0.47520		6.96
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	186.42

4	Steel						
	@ 80 Kg per cum of concrete	ton					14.91
						Total	14.91

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 =14.4/2 =					7	
	No of weep holes in vertical direction per abutment =3.7/1 =					4	
	No of weep holes in horizontal direction per return wall =6/2 =					4	
	No of weep holes in vertical direction per return wall =3.7/1 =					4	
	Total no of Weep holes per abutment = 7 x 4					28	
	Total no of Weep holes per return wall = 4 x 4					16	
	Total mtrs of weep holes = 28 x 2 + 16 x 4					Total	60.00

6	Filter media						
	Behind Abutment	cum	2	14.400	0.600	3.700	63.94
	Behind Return Wall	cum	4	6.660	0.600	4.150	66.33
						Total	130.27

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					222.41
	Less for PCC	cum					30.64
	Less for Bottom Slab RCC	cum					52.70
	Less for Shear Key RCC	cum					6.96
	Less for Return Wall-I RCC	cum	4	1.700	0.300	0.300	0.61
	Less for Return Wall-II Base Slab	cum					32.93
	Less for Return Wall-II Stem Wall	cum	4	4.960	0.450	0.380	3.39
	Less for Box above Invert upto EGL	cum	1	3.92	16.000	0.300	18.82
						Total	76.36

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	3.920	15.000	0.538	31.61
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	31.94



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/34/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					2.56
						Total	2.56
10	Bituminous Concrete						
		cum	1	3.92	14.00	0.04	2.20
						Total	2.20
11	Mastic Asphalt						
		sqm	1	3.92	14.00		54.88
						Total	54.88
12	Tack Coat						
		sqm	1	3.92	14.00		54.88
						Total	54.88
13	RCC M-40 Crash Barrier	m	2	3.92			7.84
						Total	7.84
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	17.280	3.000	0.750	38.88
	DownStream	cum	1	17.280	6.000	0.750	77.76
						Total	116.64
16	Curtain Wall PCC M-20						
	Upstream	cum	1	23.280	1.480		34.45
	DownStream	cum	1	29.280	1.910		55.92
						Total	90.38
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	24.280	2.500	2.150	130.51
	Curtain Wall Downstream	cum	1	30.280	2.850	2.650	228.69
	Flexible Apron Downstream	cum	1	16.280	2.000	0.750	24.42
	Flexible Apron Upstream	cum	1	16.280	5.000	0.750	61.05
						Total	444.66
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	23.280	1.500	0.150	5.24
	DownStream	cum	1	29.280	1.850	0.150	8.13
						Total	13.36



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/34/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	8.320	16.000	0.930	123.80
	Shear Key	cum	2	8.520	1.620	0.720	19.88
	Return Wall II	cum	4	6.380	5.300	0.750	101.44
						Total	245.12

2	PCC-M15						
	Box culvert	cum	1	7.320	12.960	0.150	14.23
	Shear Key	cum	2	7.520	1.418	0.150	3.20
	Return Wall II	cum	4	5.980	4.500	0.150	16.15
						Total	33.58

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	7.320	15.000	0.480	52.70
	Box Side Wall	cum	2	15.00	4.308	0.460	59.45
	Base slab of return wall II	cum	4	5.880	4.300	0.450	45.51
	Return wall I	cum	4	1.700	4.758	0.300	9.71
	Return wall II	cum	4	5.880	0.375	4.788	42.23
	Shear Key	cum	2	7.320	0.47520		6.96
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	216.90

4	Steel						
	@ 80 Kg per cum of concrete	ton					17.35
						Total	17.35

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 =14.4/2 =					7	
	No of weep holes in vertical direction per abutment =4/1 =					5	
	No of weep holes in horizontal direction per return wall =6/2 =					4	
	No of weep holes in vertical direction per return wall =4/1 =					5	
	Total no of Weep holes per abutment = 7 x 5					35	
	Total no of Weep holes per return wall = 4 x 5					20	
	Total mtrs of weep holes = 35 x 2 + 20 x 4					Total	75.00

6	Filter media						
	Behind Abutment	cum	2	14.400	0.600	4.008	69.26
	Behind Return Wall	cum	4	7.580	0.600	4.458	81.10
						Total	150.36

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					245.12
	Less for PCC	cum					33.58
	Less for Bottom Slab RCC	cum					52.70
	Less for Shear Key RCC	cum					6.96
	Less for Return Wall-I RCC	cum	4	1.700	0.300	0.300	0.61
	Less for Return Wall-II Base Slab	cum					45.51
	Less for Return Wall-II Stem Wall	cum	4	5.880	0.500	0.330	3.88
	Less for Box above Invert upto EGL	cum	1	3.92	16.000	0.300	18.82
						Total	83.06

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	3.920	15.000	0.450	26.46
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	26.80



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/34/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					2.14
						Total	2.14
10	Bituminous Concrete						
		cum	1	3.92	14.00	0.04	2.20
						Total	2.20
11	Mastic Asphalt						
		sqm	1	3.92	14.00		54.88
						Total	54.88
12	Tack Coat						
		sqm	1	3.92	14.00		54.88
						Total	54.88
13	RCC M-40 Crash Barrier	m	2	3.92			7.84
						Total	7.84
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	19.120	3.000	0.750	43.02
	DownStream	cum	1	19.120	6.000	0.750	86.04
						Total	129.06
16	Curtain Wall PCC M-20						
	Upstream	cum	1	25.120	1.480		37.18
	DownStream	cum	1	31.120	1.910		59.44
						Total	96.62
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	26.120	2.500	2.150	140.40
	Curtain Wall Downstream	cum	1	32.120	2.850	2.650	242.59
	Flexible Apron Downstream	cum	1	18.120	2.000	0.750	27.18
	Flexible Apron Upstream	cum	1	18.120	5.000	0.750	67.95
						Total	478.11
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	25.120	1.500	0.150	5.65
	DownStream	cum	1	31.120	1.850	0.150	8.64
						Total	14.29



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/53/0 (W =15 m)

Flexible Apron with Curtain Wall

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

1	Excavation						
	Box culvert	cum	1	7.740	16.000	1.020	126.32
	Shear Key	cum	2	7.940	1.530	0.630	15.31
	Return Wall II	cum	4	5.430	5.150	0.700	78.30
						Total	219.92

2	PCC-M15						
	Box culvert	cum	1	6.740	13.140	0.150	13.28
	Shear Key	cum	2	6.940	1.291	0.150	2.69
	Return Wall II	cum	4	5.030	4.350	0.150	13.13
						Total	29.10

SUBSTRUCTURE

3	RCC-Substructure						
	Bottom Slab	cum	1	6.740	15.000	0.570	57.63
	Box Side Wall	cum	2	15.00	3.000	0.570	51.30
	Base slab of return wall II	cum	4	4.930	4.150	0.400	32.74
	Return wall I	cum	4	0.300	3.500	0.250	1.05
	Return wall II	cum	4	4.930	0.325	3.670	23.52
	Shear Key	cum	2	6.740	0.38745		5.22
	Haunch	cum	2	15.000	0.01125		0.34
						Total=	171.79

4	Steel						
	@ 80 Kg per cum of concrete	ton					13.74
						Total	13.74

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 = $14.5/2 =$					7	
	No of weep holes in vertical direction per abutment = $2.7/1 =$					3	
	No of weep holes in horizontal direction per return wall = $4.5/2 =$					3	
	No of weep holes in vertical direction per return wall = $2.7/1 =$					3	
	Total no of Weep holes per abutment = 7×3					21	
	Total no of Weep holes per return wall = 3×3					9	
	Total mtrs of weep holes = $21 \times 2 + 9 \times 4$					Total	39.00

6	Filter media						
	Behind Abutment	cum	2	14.500	0.600	2.700	46.98
	Behind Return Wall	cum	4	5.230	0.600	3.200	40.17
						Total	87.15

7	Sand Filling in Foundation Trenches						
	Total Cutting Volume	cum					219.92
	Less for PCC	cum					29.10
	Less for Bottom Slab RCC	cum					57.63
	Less for Shear Key RCC	cum					5.22
	Less for Return Wall-I RCC	cum	4	0.300	0.250	0.300	0.09
	Less for Return Wall-II Base Slab	cum					32.74
	Less for Return Wall-II Stem Wall	cum	4	4.930	0.450	0.470	4.17
	Less for Box above Invert upto EGL	cum	1	6.14	16.000	0.300	29.47
						Total	61.51

SUPERSTRUCTURE

8	RCC-Superstructure(up to 5m)						
	Top Slab	cum	1	6.140	15.000	0.588	54.11
	(+)-Haunch	cum	2	15.00	0.01125		0.34
						Total	54.45



ESTIMATE OF QUANTITY OF BOX CULVERT

Box Size:- 01/53/0 (W =15 m)

Flexible Apron with Curtain Wall

Item No.	Description	Unit	nos	Length (m)	Breadth (m)	Height (m)	Quantity
9	Steel						
	@ 80 Kg per cum of concrete	ton					4.36
						Total	4.36
10	Bituminous Concrete						
		cum	1	6.14	14.00	0.04	3.44
						Total	3.44
11	Mastic Asphalt						
		sqm	1	6.14	14.00		85.96
						Total	85.96
12	Tack Coat						
		sqm	1	6.14	14.00		85.96
						Total	85.96
13	RCC M-40 Crash Barrier	m	2	6.14			12.28
						Total	12.28
14	Drainage Spout	nos.	2				2.0

PROTECTION WORK

15	750 mm Thick Flexible Apron						
	Upstream	cum	1	16.640	3.000	0.750	37.44
	DownStream	cum	1	16.640	6.000	0.750	74.88
						Total	112.32
16	Curtain Wall PCC M-20						
	Upstream	cum	1	22.640	1.480		33.51
	DownStream	cum	1	28.640	1.910		54.70
						Total	88.21
17	Excavation in Soil						
	Curtain Wall Upstream	cum	1	23.640	2.500	2.150	127.07
	Curtain Wall Downstream	cum	1	29.640	2.850	2.650	223.86
	Flexible Apron Downstream	cum	1	15.640	2.000	0.750	23.46
	Flexible Apron Upstream	cum	1	15.640	5.000	0.750	58.65
						Total	433.03
18	PCC M-15 Below Curtain Wall						
	Upstream	cum	1	22.640	1.500	0.150	5.09
	DownStream	cum	1	28.640	1.850	0.150	7.95
						Total	13.04

