GOVERNMENT OF MADHYA PRADESH

URBAN DEVELOPMENT & HOUSING DEPARTMENT

INTEGRATED STANDARD SCHEDULE OF RATES

[VOLUME – 3]
ROAD & BRIDGE WORKS

EFFECTIVE FROM - 2nd August 2021

DIRECTORATE
URBAN ADMINISTRATION AND DEVELOPMENT
PALIKA BHAWAN, SHIVAJI NAGAR, NEAR 6 No. STOP
BHOPAL, MADHYA PRADESH 462016

PREFACE

Directorate, Urban Administration and Development under Urban Development and Housing Department, Government of Madhya Pradesh is the State Headquarter for the Urban Local Bodies of the state. Urban Local Bodies undertake various Infrastructure Works such as Water Supply, Sewerage, Tube Well, Building Works, Road Construction, Bridge, Culvert Construction and Electrical works from time to time. An Integrated Standard Schedule of Rates (ISSR) in 4 volumes for (i) Water Supply, Sewerage and Tube well works (ii) Building Works (iii) Road and Bridge Works (iv) Electrical works was issued by the Directorate, Urban Administration and Development, Bhopal on 01st June 2011 and the same was revised on 10th May 2012.

With the increase in Labour and Commodity Rates, implementation of Integrated Taxation, Goods and Services Tax (GST) and prevalence of new useful products in the market, it has become important to revise the Integrated Standard Schedule of Rates.

Due care has been taken to frame this Integrated Standard Schedule of Rates as correctly as possible. It is, however, possible that some errors might have crept in. In case any error or omission is noticed, the same may be brought to the notice of this office.

Effective suggestion for any correction, addition & alteration is always welcome for any further betterment to this schedule of Rates for Water Supply, Sewerage and Tube well works, Building works, Road and Bridge works and Electrical works.

This Integrated Standard Schedule of Rates is available on the departmental website www.mpurban.gov.in and shall be effective from 02-08-2021.

Bhopal, 02nd August 2021

(G.P. Katare)
Engineer-in-chief
Urban Administration & Development
Madhya Pradesh, Bhopal

MEMBERS OF WORKING COMMITTEE

1.	Mr. G.P. Katare, Engineer-in-Chief, Directorate Urban Administration and Development.	Chairman
2.	Mr. Deepak Ratnawat, Engineer-in-Chief, Madhya Pradesh Urban Development Company Ltd.	Guest Member
3.	Mr. Hans Kumar Jain, Chief Engineer, Directorate Urban Administration and Development.	Vice Chairman
4.	Mr. Suresh Sejkar, Superintending Engineer, Directorate Urban Administration and Development.	Member Secretary
5.	Mr. Rajeev Goswami, Superintending Engineer, Directorate Urban Administration and Development.	Member
6.	Mr. Gajanand Chauhan, Superintending Engineer, UADD, Indore.	Member
7.	Mr. G.S. Saluja, Superintending Engineer, Directorate Urban Administration and Development.	Member
8.	Mr. J.P. Para, Superintending Engineer, Municipal Corporation, Gwalior.	Member
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10.	Mr. Alok Chouksey, Superintending Engineer, UADD, Bhopal.	Member
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17.	Mr. L.L. Tiwari, Executive Engineer, UADD, Sagar.	Member
18.	Mr. Rakesh Rawat, Executive Engineer, Directorate Urban Administration and Development.	Member
19.	Mr. Ravi Chaturvedi, Executive Engineer, Directorate Urban Administration and Development.	Member
20.	Mr. Jeevendra Singh, Executive Engineer, Directorate Urban Administration and Development.	Member

Special Thanks to:

- Mr. Nikhil Singh, Assistant Engineer, Directorate Urban Administration and Development.
- Ms. Gazal Khanna, Assistant Engineer, Municipal Corporation, Indore
- Mr. Kuldeep Raghuvanshi, Assistant Engineer, Municipal Council, Khurai
- Mr. Avinash Agrawal, Sub Engineer, Directorate Urban Administration and Development.
- Mr. Chandrakishor Suryawanshi, Sub Engineer, Directorate Urban Administration and Development.

INDEX

GENERAL NOTES

1 The ISSR of UADD consists of 4 Volumes

VOLUME - I Water Supply, Sewerage & Tube Well Works
VOLUME - II Building Works
VOLUME - III Road & Bridge Works
VOLUME - IV Electrical Works

2 The contents of each Volume are as given below

VOLUME - I
WATER SUPPLY, SEWERAGE AND TUBE WELL WORKS

1	Cast Iron Socket & Spigot Pipes and Specials with lead joints.
2	Cast Iron Socket & Spigot Pipes and Specials with Tyton Joints.
3	Cast Iron Pipes and Specials with flanged joints.
4	Ductile Iron Pressure Pipes and Specials with Tyton joints
5	Unplasticized PVC Pipes, PVC-O Pipes & Fittings for potable water supply.
6	Galvanised Iron Pipes, Specials and Gun Metal/Brass Metal Fittings.
7	HDPE Pipes, MDPE Pipe & Specials
8	M.S. Pipes & Specials
9	Asbestos Cement Pressure Pipe and Cast Iron Fittings.
10	Salt Glazed Stoneware Pipes.
11	Unplasticized Non-Pressure Polyvinyl Chloride (PVC-U) Pipes, DWC Pipes.
12	Reinforced Cement concrete Pipes.
13	Bar Wrapped Steel Cylinder Pipes (BWSC)
14	Sluice Gate & Valves
15	Water Hammer Devices
16	Pumps
17	Sewer Appurtenances.
18	Civil Works for Water Supply & Sewerage works.
19	Miscellaneous.
20	Construction of Tube Wells, Chlorination system & Trenchless work
21	Intake Well
22	Water Treatment Plant, Sewage Treatment Plant & Chlorination System
23	Ground Service Reservoir & Sumps Tanks
24	Reinforced Cement Concrete Elevated Service Reservoir (ESR)
25	List of IS Codes for Water Supply & Sanitary Engineering
26	Drawings for Water Supply & Sewerage.

VOLUME - II
BUILDING WORKS

1	Carriage of Material
2	Earth work
3	Mortars
4	Concrete work
5	Reinforced Cement Concrete
6	Brick work
7	Stone work
8	Marble work
9	Wood Work & P.V.C. Work
10	Steel work
11	Flooring
12	Roofing
13	Finishing
14	Repair to Building works

15	Dismantling & Demolishing
16	Pile work
17	Aluminum work
18	Water proofing
19	Form Work
20	Rain Water Harvesting, Recycle and Reuse of waste water
21	Building Water Supply
22	Building Drainage
23	Sanitary Installation

VOLUME - III

ROAD & BRIDGE WORKS

ROAD WORKS	
1	Carriage of Material
2	Site Clearance
3	Earth work, Erosion control and Drainage
4	Sub-Bases, Bases (Non-Bituminous) and Shoulders
5	Bases and Surface courses (Bituminous)
6	Cement Concrete Pavements
7	Geosynthetics and Reinforced Earth
8	Traffic Signs, Marking & other Road Appurtenances
9	Supply of Material
10	Maintenance of Roads
11	Horticulture & Landscaping
BRIDGE WORKS	
12	Foundations
13	Sub-Structure
14	Super-Structure
15	River Training and Protection works
16	Repair and Rehabilitation

VOLUME - IV

ELECTRICAL WORKS

PART – 1 – INTERNAL ELECTRIFICATION

1	Wiring in surface /concealed rigid P.V.C. conduit system.
2	Wiring in surface /concealed rigid Steel conduit system.
3	Wiring in surface rigid P.V.C. casing capping system
4	Wiring in existing/conduit/P.V.C. casing capping system
5	Sub Mains in surface/concealed rigid steel conduit system.
6	Rewiring in existing conduit.
7	Control switch gear/Bus bar.
8	MCCB's, Isolators, MCB's, MCB-DB and fixing.
9	Accessories/Panel/Lamp/Telephone wires/Fens/Luminaries.
10	Miscellaneous
11	Earthing
12	Dismantiling of Civil and Electrical Works.

PART – 2 – EXTERNAL ELECTRIFICATION

13	External Electrification and Over head lines
14	Power Cable & laying
15	Transformers & Fire Extinguishers
16	High Mast
17	G.I. Pipe and Pump Sets
18	Solar street light system
19	Supply and fixing of LED Lights.

20	Energy Saving and Protection solutions for Buildings.
21	Diesel Generator Set

A. LIST OF UNITS USED

S.No.	Units	Abbreviation Symbol
1	Length (Running Meter)	Rmt/ Meter
2	Area (Square Meter)	Sqm
3	Volume (Cubic Meter)	Cum
4	Volume (Cubic Centimeter)	Cucm
5	Volume (Litre)	Ltr.
6	Weight (Metric Tonne)	MT
7	Weight Kilogram	Kg
8	Quantity (Numbers)	Each/No
9	Quantity (Lump Sum)	LS
10	Time (Hour)	Hr.

B. LIST OF ABBREVIATIONS

UADD	Urban Administration & Development Directorate
CPWD	Central Public Works Department
MoRTH	Ministry of Road Transport and Highways
CPHEEO	Central Public Health & Environmental Engineering Organization.
IRC	Indian Road Congress
IS	Indian Standard Published by the Bureau of Indian Standards
CRRI	Central Road Research Institute
AASHTO	American Association of State Highway and Transportation Officials
BOQ	Bill of Quantities
PCC	Plain Cement Concrete
RCC	Reinforced Cement Concrete
PSC	Prestressed concrete
HYSD	High Yield Strength Deformed Bars
WC	Water Cement Ratio
CBR	California Bearing Ratio
WBM	Water Bound Macadam
UCS	Unconfined Compressive Strength
RE	Reinforced Earth

3 Rate for completed items include the cost of followings: -

3.1 Material,labour, templates, tools, hire and running charges of plant/machinery required to complete the work,unless specified otherwise.

3.2 All lead & lift of all material required for execution of work inclusive of charges like duties, tax, royalty, insurance etc.

3.3 Provision for erection and removal of centering, form works, scaffolding, benching ladders and all other applications etc.,required for the proper execution of the work unless otherwise specified.

3.4 Provision for covering necessary to protect the work/structure from inclement weather etc.and damage arising from falling materials, rain,fire etc shall be the responsibility of contractor.

3.5 Curing wherever required including arrangement of water and also including its lead or lift whatsoever.

3.6 Care shall be taken to ensure suitable mitigation measures against noise and dust, pollution and damages to the environment whether temporary or permanent and shall be taken as incidental to work.

3.7 Traffic management, signage, signalling arrangement, barricading, and lighting arrangement shall be in accordance with section 100 of the specifications and shall be considered as incidentals to work.

3.8 Adequate precautions shall be taken for safety of personnel, road users and existing services, which, during execution, shall be considered as incidentals to work.

4 The rates for completed items in the schedule of rates also include the following.

1 10% for contractor profit

2 5% for T&P & overhead charges

5 The mode of measurements shall be as per provisions in the relevant items and as per specifications/ relevant IS codes.

6 All materials shall conform to the relevant prevailing Indian Standard Specifications. All material before use in works shall require approval of the Engineer in charge, who will get them sampled, tested as per relevant IS code at contractor's cost and samples so approved shall be kept in the office of the concerned Engineer-in-charge till finalization of the work.

7 Material obtained from excavation shall be the property of the Urban Local body (Municipal Corporation, Municipal Council & Nagar Parishad).

8 Rubble available from excavation of hard rock shall be the property of the contractor subject to recovery of Rs. 75/- per cum of the quality of the rock excavated.

9 **Cement :-**

9.1 Where contract provides for cement to be arranged by the Contractor himself, only I.S.I. Marked cement as per IS 269 for 33 grade cement, IS 8112 for 43 grade cement, IS 12269 for 53 grade cement, IS 1489 for Portland Pozzolana cement, shall be allowed to be used in the work subject to the prescribed tests.

9.2 Make of cement shall be got approved by the Engineer-in-charge. The engineer in charge shall get cement tested as per relevant IS codes, at the cost of the contractor, before use in work.

9.3 Pozzolona cement is now being widely produced all over the country. This may be used in structures as per provisions of IS code.

9.4 When the strength of concrete required upto M-20, then O.P.C. 33 grade conforming to IS 269-1989 or P.P.C. conforming to IS : 1489 may be used.

9.5 When the strength of concrete required is between M-20- and M-30, the O.P.C. 43 grade conforming to IS : 8112 shall be used.

9.6 When the strength of concrete required above M-30 then, use of Ordinary Portland Cement (OPC) 53 grade conforming to IS 1489 should be invariably used. They are used for construction of chimneys, flyovers and Bridges etc.

9.7 The arrangement for necessary equipment and testing shall have to be made by the contractor himself at site, as decided by the Engineer-in-Charge. All expenses shall be borne by the contractor.

9.8 Any lot of cement brought to site by the contractor, would be permitted to be used in the work only after the satisfactory results of the tests, under the supervision of the Engineer-in-Charge or his authorised representative. The record of the test results shall be maintained in register mentioned in subsequent para.

9.9 A duplicate register as prescribed by the competent authority of technical authority shall be maintained at the site of the work. Extract certified copies of the entries for each month shall be submitted to the Engineer-in-Charge by the Contractor.

9.10 The original register shall also be submitted to the Engineer-in-Charge on completion of the work by the Contractor.

10 **Steel :-**

10.1 Steel used for reinforcement shall conform as per under :-

(a) Mild Steel and medium tensile steel bars & Hard Drawn steel wire shall conform to IS : 432 : 1982.

(b) High strength deformed bars & wires shall conform to IS : 1786 - 2008.

(c) Hard drawn steel wire fabric shall conform to IS : 1566 -1982.

10.1.1 Structural steel shall conform to Grade A of IS 2062 - 2011.

10.2 All reinforcement shall be free from loose mill scales, loose rust and coats of paints, oil, mud or other coatings which may destroy or reduce bond.

10.3 Only such steel obtained from main producers of steel as having licence from the B.I.S. to manufacture such steel for reinforcements, shall be allowed to be used in the work. The make of the steel shall be approved by engineer-in-charge.

10.4 The Contractor shall have to produce Test Certificate in the proforma prescribed /approved by B.I.S. from the manufacturer for every batch of steel brought to the site of work.

10.5 Before commencement of use of steel, from any batch brought to site the of the work by the contractor, the Engineer-in-Charge shall arrange to get samples tested for nominal mass, tensile strength, bend test and rebend test from any Laboratory of his choice at the cost of Contractor. The selection of test specimens and frequency shall be as per relevant I.S. specification of the steel used.

11 **Interpretations**

11.1 Wherever any reference is made to any Specifications / Indian Standard, it shall be taken as reference to the latest edition with all amendments issued thereto.

11.2 In the event of any variation between the CPWD/ MoRTH specifications (adopted) and the Indian Standard, the former shall taken precedence over the later.

11.3 **Precedence of specification in SOR** : In case of any contradiction in the provisions to the Specifications (adopted) and this document the provisions of this document would take precedence.

11.4 **Type error in BOQ** : In case of any discrepencies (Type Error) in rates of any SOR item included in BOQ and that provided in this SOR, provision of SOR shall taken precedence.

11.5 The Engineer-in-Chief , UADD, Bhopal shall be the sole deciding Authority as to the meaning, interpretation and implications of various provisions in this schedule of rates. His decision shall be final and binding on all concerned.

12 **Safety** :- The contractor shall be fully and solely responsible for making all the safety arrangements pertaining to the work. The contractor shall be fully responsible and liable in all respects for any accidents and subsequent legal action initiated by any party including the department.

13 **Concrete Work : -**

13.1 Testing of Concrete :- The concrete shall be sampled in accordance with the norms specified in IS 456. The frequency of sampling is given below.

Quantity of Concrete in the Work m^3	Number of Samples
1 - 5	1
6 - 15	2
16 - 30	3
31 - 50	4
51 and above	4 plus one additional sample for each additional $50m^3$ or part thereof.

Note:

(i) At least one sample shall be taken from each shift.

(ii) Where concrete is produced at continuous production unit, such as ready mix concrete plant. The frequency of sampling may be agreed upon mutually by suppliers and purchasers.

13.2 **Test specimen**

Three test specimen shall be made for each sample for testing at 28 days. Additional samples may be required for various purposes such as to determine the strength of concrete at 7 days or at the time of striking the formwork, or to determine the duration of curing, or to check the testing error. Additional samples may also be required for testing samples cured by accelerated methods as described in IS 9103. The specimen shall be tested as described in IS 516.

13.3 Nominal mix concrete may be used for concrete for M-20 or lower. The proportions of material for nominal mix concrete shall be in accordance with the table given below: -

Grade of Concrete	*Total Quantity of Dry Aggregates by Mass per 50 kg of cement, to be taken as the Sum of the Individual Masses of Fine and Coarse Aggregates, Kg. Max*	*Proportion of Fine Aggregate to Coarse Aggregate (by Mass)*	*Quantity of Water per 50 kg of Cement, max Ltr.*
(1)	*(2)*	(3)	*(4)*
M5	800	Generally 1:2 but	60
M7.5	625	subject to an upper	45
M10	480	limit of 1:1½ and	34
M15	330	a lower limit of	32
M20	250	1:2½	30

Note:-

The proportions of the fine to coarse aggregate should be adjusted from upper limit to lower limit progressively as the grading of fine aggregate become finer and the maximum size of coarse aggregate becomes larger. Graded coarse aggregates shall be used.

13.4 Design mix concrete is preferred to nominal mix. If design mix concrete can not be used for any reason on the work for grades of M-20 or lower. Nominal mixes may be used with the permission of Engineer in charge, which, however, is likely to involve a higher cement content.

14 With reference to quality of materials and workmanship the word **"Best"** When used shall mean that in the opinion of the Engineer-in-Charge, there is no superior material or article or class of workmanship obtainable in the market.

15 The labour rates provided in the Schedule of Rates includes the cost of all labour including necessary handling of the materials at site of work and all workmanship.

16 All aplicability of amendments : Future amendments in the SOR till one calender day prior to the Issuance of NIT last date (Orignal or amended) of financial bid submission, shall be applicable in the bid document prepared on the basis of this SOR unless a contrary condition is provided in the bid document.

17 At present GST payable to the contractor is @ 12% of the amount of work done. GST Rate may change according to the Govt. of Madhya Pradesh Finance Department Revision from time to time but it will be inforced after due sanction from the M.P. Urban Development Department.

18 The girth of trees shall be measured at 1.00 meter (One meter) above ground level. All wood obtained from the tree cutting shall be property of the Urban Local body and shall be handed over to Engineer in charge.

19 The contractor shall have to establish a field laboratory at the site of work, if the amount of contract exceeds Rs. 2.00 crores. In other cases, testing of construction materials/samples should be got done from any of the testing laboratories of the Government Works Departments, Technical Institutes, or NABL accrediated testing laboratory. Contractor shal bear the cost of such testing charges.

20 The work should not be accepted in any case, if the contractor fails to observe the instructions of the department, regarding testing of materials. Before making any payment, it will be the responsibility of the officers making payment to assure that all tests as per prescribed frequencies, have been carried out, and found as per requirement.

21 Dismantling of utilities will be done under the supervision of concerned departments with prior information to the users.

Extra Notes For Road Works :-

1 The rates include making arrangement of traffic as per MoRTH clause 112 except for initial treatment to verge, shoulders and construction of diversion.

2 The rates include all cleaning operation. The rates also include provision of coir rope being used for premix carpet and surface dressing for providing support to edges.

3 The rates also include the element of testing of samples of various materials brought by the contractor for use on the work, as well as other necessary tests for items of work as stipulated in the MoRTH specification. Frequency of such tests to be carried out must not be less than the prescribed frequencies. Copies of registers,containing records of tests shall have to be presented along with running account bills.Register (original) shall have to be submitted along with the final bill. Actual consumption of materials like bitumen,cement & steel will have to be worked out in each running bill before making payment. Tests shall have to be conducted by the contractor's Engineer under the supervision of the Engineer-in- Charge or his authorised representatives.

4 For comprehensive items, quantities of aggregates, screenings, granular materials and binding materials etc. indicated in the specifications are loose. No extras on account of any voids or bulkages etc. will be paid separately. Where it is proposed only to supply, transport and stack the mineral then aggregates payment for the same shall be regulated on the basis of volumes to be computed after deductions specified as below. The stacking will have to be in a trapezoidal section having base 1.5 M., top width 0.5 M. and height 0.5 M. The length should be as long as conveniently possible.

5 The use of vibratory roller is essential for all the items where ever compaction/consolidation is to be done unless specified otherwise.

5.1 Metal to be used for all bituminous courses and cement concrete shall be crushed in mechanical crusher.

As per MORTH Table 500:28 (Tolerances for Slurry Seal)	
Description	**Tolerance**
Aggregate Passing 4.75 mm	± 5%
Aggregate Passing 2.36 mm, 1.18 mm and 0.6 mm	± 5%
Aggregate Passing 0.3 mm	± 4%
Aggregate Passing 0.15 mm	± 3%
Aggregate Passing 0.075 mm	± 2%

6 The surface irregularities of the completed sub-grade, sub-base, base courses, widening of surfaces and bituminous courses in the longitudinal and transverse directions shall be within the tolerances as indicated in the table below of the specifications.

As per MORTH Table No. 900.1

TABLE - TOLERANCES IN SURFACE LEVELS

1 Sub grade		+ 20 mm - 25 mm
2 Sub-base + 10 mm		
(a)	Flexible pavement	- 20 mm
(b)	Concrete pavement	+ 6 mm
	[Dry lean concrete or Rolled concrete]	- 10 mm
3 Base-course for flexible pavement		
(a)	Bituminous course	+ 6 mm - 6 mm
(b)	Other than bituminous	+ 10 mm
	(i) Machine laid	- 10 mm
	(ii) Manually laid	+ 15 mm - 15 mm
4 Wearing course for flexible pavement		
(a)	Machine laid	+ 6 mm - 6 mm
(b)	Manually laid	+ 10 mm - 10 mm
5 Cement concrete pavement		+ 5 mm - 6 mm

7 The work of shoulders must precede the work of sub-base and base courses and succeed the bituminous courses and cement concrete pavement.

8 The measurements of rock excavation are to be done as per MORTH clause 301.8. However, if the excavated rock is utilized by conversion into aggregates also, then a deduction at the rate of 45% shall be made from the stacked quantity of aggregates. To compute the volumes of rock excavation size of the stacks should be as large as convenient.

9 Wherever an existing boulder soling or WBM pavement is required to be excavated, it shall be presumed that the following quantities of rubble and coarse aggregates would be available for re-use and issued to the contractor at the rate decided by competent authority for technical sanction.

(a) **Rubble**: - 1 cubic meter of rubble for every cubic meter of excavated boulder soling .

(b) **W.B.M**: - 1 cubic meter of W.B.M for every cubic meter of excavated WBM (Excavated W.B.M should be screened to segregate metal from moorum before re-use.)

10 For each compacted cubic meter items of bituminous, base and surface courses the approximate loose quantities required will be 1.4 cubic meter unless other wise specified.

11 Only cement of required specifications at the rate of 2% by weight of total aggregate will be used as filler for bituminous work wherever filler is to be provided. Lime shall not be used as filler.

12 The pavement camber or cross fall shall be provided as per provisions of IRC-73-1980.

13 In case, lesser or more bitumen is required as per the job mix formula for dense bituminous macadam and bituminous concrete, difference of bitumen shall be paid or deducted as per actual consumption of quantity of bitumen.

14 Bitumen & modified bitumen shall be obtained from reputed oil refineries and emulsion shall be ISI marked only.

15 For narrow and restricted areas, plate compactors shall be used for compaction to achieve the desired density.

16 The actual quantities of materials shall be as per job mix formula for bituminous works.

Extra Notes for Bridge Works :-

1 **Definitions :-**

(a) Major Bridge : Having total length between faces of abutments at cap level 60 M & above.

(b) Medium Bridge : Having total length between faces of abutments at cap level, 6 M. and above but less than 60 M.

(c) Culverts : Having total length less than 6 M.

2 **Foundation :-**

(i) All works below ground level or low water level, whichever is higher but not above soffit level shall be termed as foundation work.

(ii) Low water level shall be the average water level met with at the time of doing the foundation work. The maximum and minimum water levels should be recorded by the Assistant Engineer, just before starting the particular foundation and within a reasonable time at the close of that foundation work, the average of these two levels will be the L.W.L. for that foundation work. In case of major bridges such records will be taken by the Executive Engineer.

3 **Sub Structure :-**

The part of the bridge structure below the
(a)Soffit level of the deck slab/beams and or
(b)Springing level for arch spans, but above the ground level or L.W.L. which ever is higher, shall be taken as sub structure of the bridge part. Complete RCC BOX Section will also be considered as sub-structure.

4 **Super Structure :-**

The work above
(a)Soffit level for deck slabs/beams and
(b)Springing level for arch span, including kerbs, railing, expansion joints, beams, slabs etc. shall be termed as super structure of the bridge part.

5 **Concrete :**

(a) All concrete shall be invariably mixed in mechanical mixers. All concrete except the concrete laid under water, shall be mechanically vibrated.

(b) The rates of both ordinary and controlled concrete of any mix include the cost of preparing and testing concrete cubes as per specifications laid down.

(c) All concrete shall be compacted to produce dense and homogeneous mass with the assistance of vibrators unless otherwise permitted by the Engineer-in-Charge for exceptional cases, such as concreting under water where, vibrators can not be used.

(d) Concrete poured under water shall be provided with 10% additional cement as per "Specifications for Roads & Bridges works" Ministry of Road Transport & Highway.

(e) Finishing of concrete by plastering the surface shall not be done without obtaining written permission from the Executive Engineer. No extra for plastering shall be payable. Light touching up and rubbing the uneven surfaces by carborandum stone shall be done within the specified rates.

(f) The grading, size, quality of coarse aggregates shall be strictly according to the specifications and respective IRC Codes.

(g) The size and quality of aggregate, mixing etc. for plain concrete or R.C.C. work should be as given in "Specification.

(h) A mix leaner than M-15 may be used for non structural parts of the Bridge as specified in Approved design/drawing.

(i) The rates of concreting items include the cost of form work and centering.

(j) Super plasticizer admixtures should be used for the concrete work to improve the workability with reduced water cement ratio and shall be provided as per specifications.

6 **Stone Masonry :-**

(i) All the stone masonry work shall be strictly as per specifications.

(ii) In place of stone headers, precast or cast-in-situ concrete headers may be used, but no extra payment for providing cement concrete, headers shall be payable.

(iii) Generally for all stone masonry subjected to exposure of water flow (e.g. piers, abutments, returns etc.) C.R. Masonry first sort shall be used unless otherwise provided in the approved drawing.

(iv) In case where width of stone masonry is more than one meter, the central portion of stone masonry (Hearting) shall be done with random rubble masonry. Payment for the C.R. Masonry will be limited to 1/2 meter width on either faces and the balance will be paid as Random Rubble Masonry.

CHAPTER -1 CARRIAGE OF MATERIAL

1.0 Transportation By Mechanical means including loading, unloading and stacking

S.No.	Material	Unit	Rate (Rs.)							
			1km	2km	3km	4km	5km	Beyond 5 km upto 10 km (Per Km)	Beyond 10 km upto 20 km (Per Km)	Beyond 20 km upto 50 km (Per Km)
1.1	Excavated Earth	cum	92.87	107.35	121.62	135.42	148.81	12.32	10.49	8.31
1.2	Excavated rock	cum	148.59	171.76	194.59	216.68	238.09	19.71	16.78	13.29
1.3	Sand, stone aggregate below 40 mm	cum	74.30	85.88	97.29	108.34	119.04	9.86	8.39	6.64
1.4	Stone aggregate 40 mm and above	cum	80.76	93.35	105.75	117.76	129.40	10.71	9.12	7.22
1.5	Boulder	cum	87.41	101.03	114.46	127.46	140.05	11.60	9.87	7.82
1.6	Lime, moorum, building, rubbish, Fly Ash	cum	74.30	85.88	97.29	108.34	119.04	9.86	8.39	6.64
1.7	Bricks	1000	198.12	229.01	259.45	280.11	307.79	25.49	21.69	17.18
1.8	Steel/G.I. sheet/Pipes/Fuel wood/ Coal/ Cement/ Bitumen	tonne	66.04	76.34	86.48	96.30	105.82	8.76	7.46	5.91
1.9	Timber	cum	84.91	98.15	111.19	123.82	136.05	11.27	9.59	7.59
1.10	Manure or sludge	cum	80.76	93.35	105.75	117.76	129.40	10.71	9.12	7.22
1.11	Brick Tiles	1000	118.87	137.41	155.67	168.07	184.67	15.29	13.01	10.31
1.12	Cement, stone blocks, G.I.. C.I., A.C., & C.C., pipes below 100mm dia and other heavy materials	tonne	66.04	76.34	86.48	96.30	105.82	8.76	7.46	5.91
1.13	Tar bitumen	tonne	74.30	85.88	97.29	108.34	119.04	9.86	8.39	6.64
1.14	Coal	tonne	84.91	98.15	111.19	123.82	136.05	11.27	9.59	7.59
1.15	R.C.C. pipes, A.C. pipes, steel pipe, C.I. pipes & S.W. Pipes									
1.15.1	100 mm dia	100 m	162.39	187.71	212.66	236.80	260.21	21.55	18.34	14.52
1.15.2	125 mm dia	100 m	216.92	250.74	284.07	316.32	347.57	28.78	24.49	19.40
1.15.3	150 mm dia	100 m	270.66	312.85	354.44	394.67	433.68	35.91	30.56	24.21
1.15.4	200 mm dia	100 m	440.27	508.91	576.55	642.00	705.45	58.41	49.71	39.38
1.15.5	250 mm dia	100 m	625.64	723.19	819.31	912.32	1002.48	83.01	70.64	55.96
1.15.6	300 mm dia	100 m	773.31	893.87	1012.68	1127.64	1239.07	102.60	87.32	69.16
1.15.7	350 mm dia	100 m	1082.63	1251.42	1417.75	1578.70	1734.70	143.64	122.24	96.83
1.15.8	400 mm dia	100 m	1476.31	1706.48	1933.29	2152.77	2365.50	195.87	166.69	132.04
1.15.9	450 mm & 500 mm dia	100 m	1804.38	2085.70	2362.92	2631.17	2891.17	239.40	203.74	161.38
1.15.10	600, 700, 750 & 800 mm	100 m	2706.57	3128.55	3544.37	3946.75	4336.76	359.10	305.61	242.07
1.15.11	900 mm dia	100 m	4059.85	4692.82	5316.56	5920.12	6505.14	538.65	458.41	363.11
1.15.12	1000, 1100 & 1200 mm	100 m	5413.14	6257.09	7088.75	7893.50	8673.52	718.20	611.21	484.15
1.15.13	1600 to 1800 mm dia	100 m	6769.50	7824.93	8864.97	9871.36	10846.84	898.16	764.37	605.46
NOTE :	**The rates are inclusive of voids for different types of materials no further deduction shall be made for voids**									

CHAPTER- 2
SITE CLEARANCE

Notes :-

1 The work include cutting removing & disposing all material such as bushes, shrubs, stumps, roots, grass, weeds, top organic soil not exceeding 150 mm in thickness , rubbish etc. which in the opinion of the Engineer in charge are unsuitable for the work.

2 The work include necessary excavation back filling of pits resulting from uprooting of trees and stumps to required compaction, handling ,salvaging, and disposal of cleared materials.

3 Before starting the work contractor shall submit to the engineer in charge for approval his work plan including the procedure to be followed for disposal of waste material.

4 Pipe line, sewers, cables, shall be protected from damage & it shall be repaired by the contractor at his own cost if damaged.

5 Material obtained by dismantling shall be stacked are disposed as per the direction of Engineer-in-Charge.

6 Rates include labour & equipment for completion of items.

7 Site clearance shall be done as per MORTH clause 200

8 Rates
Rates include labour & equipment for completion of items.
Rates of cutting trees above 300 mm include excavation and back filling to the required compaction handling and disposing of the materials.

(Refer MoRTH specifications for details)

CHAPTER- 2			
SITE CLEARANCE			
Item No.	**Descriptions**	**Unit**	**Rate (In Rs.)**
2.1	Cutting of trees, including cutting of trunks, branches and removal of stumps, roots, stacking of serviceable material with all lifts and up to a lead of 1000 mtrs and earth filling in the depression/pit and as per relevant clauses of section-200.		
i)	Girth from 300 mm to 600 mm	Each	207.00
ii)	Girth beyond 600 mm to 900 mm	Each	342.00
iii)	Girth beyond 900 mm to 1800 mm	Each	707.00
iv)	Girth above 1800 mm	Each	1378.00
2.2	Clearing and grubbing road land including uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth up to 300 mm, removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable material to be used or auctioned up to a lead of 1000 meter including removal and disposal of top organic soil not exceeding 150 mm in thickness if required and as per relevant clauses of section-200.		
a)	In area of light jungle	Hectare	47725.00
b)	In area of thorny jungle	Hectare	63756.00
2.3	Dismantling of existing structures by manual means comprising of masonry, cement concrete, wood work, steel work, including T&P and scaffolding wherever necessary, sorting the dismantled material, disposal of unserviceable material and stacking the serviceable material with all lifts and lead upto 1000 meter and as per relevant clauses of section-200 in.		
(i)	**Concrete**		
a)	Lime Concrete, cement concrete grade M-10 and below	Cum	293.00
b)	Plain Cement Concrete Grade M-15 & M-20	Cum	357.00
c)	Prestressed / Reinforced cement concrete grade M-20 & above	Cum	1008.00
(ii)	**Tile work/brick masonry**		
a)	In lime mortar	Cum	167.00
b)	In cement mortar	Cum	230.00
c)	In mud mortar	Cum	141.00
d)	Dry brick pitching or brick soling	Cum	128.00
(iii)	**Stone Masonry**		
a)	Rubble stone masonry in lime mortar	Cum	192.00
b)	Rubble stone masonry in cement mortar.	Cum	230.00
c)	Rubble Stone Masonry in mud mortar.	cum	167.00
d)	Dry rubble masonry	Cum	154.00
e)	Stone pitching/ dry stone spalls.	Cum	141.00
f)	Boulders laid in wire crates including opening of crates and stacking dismantled materials.	Cum	167.00
(iv)	Steel work in all types of sections upto a height of 5 m above plinth level including cutting of rivet Including dismembering	Tonne	1257.00
(v)	Scraping of bricks dismantled from brick work including stacking.		

Item No.	Descriptions	Unit	Rate (In Rs.)
a)	In lime/Cement mortar	1000 No.	1109.00
b)	In mud mortar	1000 No.	396.00
(vi)	Scraping of Stone from dismantled stone masonry		
a)	In cement and lime mortar	Cum	445.00
b)	In Mud mortar	cum	94.00
(vii)	Scarping plaster in lime or cement mortar from brick/ stone masonry	Sqm	13.00
(viii)	Removing all type of R.C.C. pipes and stacking within a lead upto 1000 meter including earthwork and dismantling of masonry works around pipes.		
a)	Up to 600 mm dia	Meter	165.00
b)	Above 600 mm to 900 mm dia	Meter	222.00
c)	Above 900 mm dia	Meter	381.00
2.4	Dismantling of flexible pavements and disposal of dismantled materials up to a lead of 1000 meter, stacking serviceable and unserviceable materials separately and as per relevant clauses of section-200.		
a)	Bituminous courses	Cum	420.00
b)	Granular courses	Cum	378.00
2.5	Dismantling of cement concrete pavement i/c breaking to pieces not exceeding 0.02 cum in volume and stock piling at designated locations and disposal of dismantled materials up to a lead upto 1000 meter, stacking serviceable and unserviceable materials separately and as per relevant clauses of section-200.	Cum	749.00
2.6	Dismantling guard rails by manual means and disposal of dismantled material with all lifts and up to a lead upto 1000 meter, stacking serviceable materials and unserviceable materials separately and as per relevant clauses of section-200.	Meter	57.00
2.7	Dismantling kerb stone by manual means and disposal of dismantled material with all lifts and up to a lead upto 1000 meter, stacking serviceable and unserviceable materials separately and as per relevant clauses of section-200.	Meter	9.00
2.8	Dismantling of barbed wire fencing/ wire mesh fencing including posts, (any type) foundation concrete, back filling of pit by manual means including disposal of dismantled material with all lifts and up to a lead of 1000 meter, stacking serviceable material and unserviceable material separately.	Meter	43.00
2.9	Dismantling of CI water pipe line upto 600 mm dia including disposal with all lifts and lead upto 1000 meter and stacking of serviceable material and unserviceable material separately.	Meter	102.00

Item No.	Descriptions	Unit	Rate (In Rs.)
2.10	Removal of cement concrete pipe of sewer gutter upto 1500 mm dia under the supervision of concerned department including disposal with all lifts and up to a lead of 1000 meter and stacking of serviceable and unserviceable material separately but excluding earth excavation and dismantling of masonry works.	meter	98.00
2.11	Removal of telephone pole/ Electric Poles/ traffic poles/ sign Boards etc. 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 meter and stacking the serviceable and unserviceable material separately.	Each	142.00

CHAPTER- 3
EARTH WORK, EMBANKMENT, DRAINAGE

Notes :-

1 The limits of excavation shall be set out true to lines, curves, slopes, grades and sections as shown on the drawings.

2 All materials involved in excavation shall be classified as below.

(a) **Soil :-** This shall comprise topsoil, turf, sand silt, loam, clay, mud, peat, black cotton soil, soft shale or loose moorum, a mixture of these and similar material which yields to the ordinary application of pick, spade and/or shovel, rake or other ordinary digging implement. 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 (a) to be covered under this category.

(b) **Ordinary Rock (not requiring blasting)** This shall include :

(i) Rock types such as laterities, shales and conglomerates, varieties of limestone and sandstone etc., which may be quarried or split with crow bars, also including any rock which in dry state may be hard, requiring blasting but which, when wet, becomes soft and manageable by means other than blasting.

(ii) Macadam surfaces such as water bound and bitumen/tar bound; soling of roads, paths etc. and hard core; compact moorum or stabilised soil requiring grafting tool or pick or both and shovel, closely applied; gravel and cobble stone having maximum dimension in any one direction between 75 and 300 mm.

(iii) Lime concrete, stone masonry in lime mortar and brick work in lime/cement mortar below ground level, reinforced cement concrete which may be broken up with crow bars or picks and stone masonry in cement mortar below ground level.

(iv) Boulders which do not require blasting having maximum dimension in any direction of more than 300 mm, found lying loose on the surface or embedded in river bed, soil, talus, slope wash and terrace material of dissimilar origin.

(c) Hard Rock (requiring blasting)
This shall comprise :
(i) Any rock or cement concrete for the excavation for which the use of mechanical plant and/or blasting is required.

(ii) Reinforced cement concrete (reinforcement cut through but not separated from the concrete) below ground level; and

(iii) Boulders requiring blasting

(d) Hard Rock (blasting prohibited)
Hard rock requiring blasting as described under (c) but where blasting is prohibited for any reason and excavation has to be carried out by chiselling, wedging or any other agreed method.

(e) Marshy Soil
This shall include soils like soft clays and peats excavated below the original ground level of marshes and swamps and soils excavated from other areas requiring continuous pumping or bailing out of water.

3 Precautions for the protection and preservation of any or all existing roadside trees, drains, sewers or other sub-surface drains, pipes, conduits shall be taken.

4 Blasting shall be done only with the written permission of competent authority.

5 Blasting hours shall be announced to the people in vicinity and red danger flag shall be displayed prominently in all direction during the blasting operation. The flag shall be planted 200 m from the blasting side in all directions.

6 Expansive clay exhibiting marked swell and shrinkage properties shall not be used as a fill material.

7 After clearing the site, mark the limits of embankment by fixing pegs and marking toe lines on both sides at regular intervals as guides. The embankment shall be built sufficiently wider (about 300 mm on either side of Roadway) than the specified formation width so that surplus material at the edges may be trimmed to ensure proper compaction of the edges and side slopes.

8 The embankment and subgrade material shall be spread in layers of uniform thickness not exceeding 200 mm compacted thickness over the entire width of embankment.

9 Moisture content of the material shall be checked at the site of placement prior to commencement of compaction if found to be out of agreed limits, the same shall be made good.

10 Where the width of widened portions is insufficient to permit the use of conventional rollers, compaction shall be carried out with the help of small vibratory roller/plate compactors/ power

11 The material satisfying the density requirements given below shall be used for the construction of the embankment and the subgrade.

	Density Requirements of Embankment and Sub-Grade Materials.	
	MoRTH TABLE 300 - 1	
S.No	**Type of work**	**Maximum laboratory dry unit weight when tested as per IS:2720 (Part 8)**
1	Embankments upto 3 meters height, not subjected to extensive flooding.	Not less than 15.2 kN/m³
2	Embankments exceeding 3 meters height or embankments of any height subject to long periods of inundation.	Not less than 16.0 kN/m³
3	Sub-grade and earthen shoulders/ verges/ backfill.	Not less than 17.5 kN/m³

Note:- This table is not applicable for lightweight fill materials, e.g., cinder, fly ash etc.

The Engineer may relax these requirements at his discretion taking into account the availability of materials for construction and other relevant factors.

The materials to be used in sub-grade should also satisfy design CBR at the dry unit weight applicable.

12 Subgrade material when compacted to the density requirements as given below shall yield the design CBR value of the sub-grade.

	Compaction Requirements for Embankment and Sub-grade	
	MoRTH TABLE 300 - 2	
S.No.	**Type of work**	**Relative compaction as percentage of Max. laboratory dry density as per IS:2720 (Part 8)**
1	Sub-grade and earthen shoulders.	Not less than 97
2	Embankments.	Not less than 95
3	Expansive clays. (a) Sub-grade and 500mm portion just below the sub-grade.	Not allowed
	(b) Remaining portion of embankment.	Not less than 90

The Contractor shall at least 7 working days before commencement of compaction 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), appropriate for each of the fill materials he intends to use.

(ii) A graph 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 relationship for light, intermediate and heavy compactive efforts (Light corresponding to IS:2720 (Part 7). Heavy corresponding to IS:2720 (Part 8) and intermediate in between the two) for each of the fill materials he intends to use in the sub-grade

13 QUALITY CONTROL TESTS DURING CONSTRUCTION (As Per MORTH Section 900)

A Borrow Material

The following test on representative samples obtained from selected area from barrow area shall be carried out:-

(i) **Sand content [IS : 2720(part- 4)]:** 2 tests per 3000 cubic meters of soil.

(ii) **Plasticity test [IS : 2720 (part- 5)]:** Each type to be tested, 2 tests per 3000 cubic meter of soil.

(iii) **Density test [IS : 2720 (part- 8)]:** Each type to be tested, 2 tests per 3000 cubic meter of soil.

(iv) **Deleterious content test [IS : 2720 (part- 27)]:** As and when required by the Engineer.

(v) **Moisture content test [IS : 2720 (part- 2)]:** One test for every 250 cubic meters of soil.

B Compaction Control

(i) Measurement of density of compacted layer : - one test per 1000 m^2

(ii) The Determination of density shall be in accordance with IS : 2720 (part-28).

(iii) The location shall be chosen only through random sampling techniques.

(iv) Control shall not be based on the result of any one test but on the mean value of a set of 5-10 density determination.

(v) The number of test in one set of measurements shall be 6 (if non-destructive test are carried out, the number of tests shall be doubled) as long as it is felt that sufficient control over barrow material and the method of compaction is being exercised.

(vi) For earth work in shoulder(earthen) and in the subgrade, at least one density measurement shall be taken for every 500 square meters for the compacted area provided further that the number of tests in each set of measurement shall be atleast 10.In order respects, the control shall be similar to that described earlier.

14 Measurement

14.1 Excavation for roadway shall be measured by taking cross-section at suitable intervals in the original position before the work starts and after its completion and computing the volumes in cum.

14.2 Where cross sectional measurements could not be taken due to irregular configuration of rock or where the rock is admixed with the other classes of materials, the volumes shall be computed on the basis of stacks of excavated rubble after making 35 per cent deduction there form. When volumes are calculated in this manner for excavated material other than rock, deduction made will be to the extent of 16 per cent of stacked volumes.

15 Rates

Rates include labour material, equipment and all operation required for the completion of items.

(Refer MoRTH specifications for details)

CHAPTER-3			
EARTH WORK, EMBANKMENT AND DRAINAGE			
Item No.	**Descriptions**	**Unit**	**Rate (In Rs)**
3.1	Excavation for roadway in soil by manual means including loading in tippers and disposal with all lifts and lead upto 1000 meters and as per relevant clauses of section-300.	Cum	119.00
3.2	Excavation for road way in ordinary rock by manual means including loading in tippers and disposal with all lifts and leads upto 1000 meters and as per relevant clauses of section-300.	Cum	185.00
	Item No.3.1 & 3.2 can be executed only after prior writen approval by C.E.		
3.3	Excavation for roadwork in soil with hydraulic excavator including cutting and loading in tippers, trimming bottom and side slopes, in accordance with requirements of lines, grades and cross sections, and transporting to the embankment location with all lifts and lead upto 1000m as per relevent clauses of section-300 of specification.	Cum	65.00
3.4	Excavation for roadway in ordinary rock with hydraulic excavator including cutting and loading in tippers, transporting to embankment site with in all lifts and lead upto 1000 m, trimming bottom and side slopes in accordance with requirements of lines, grades and cross sections as per relevent clauses of section-300 of specification.	Cum	112.00
3.5	Excavation for roadway in hard rock (blasting prohibited) with rock breakers including breaking rock, loading in tippers and disposal with all lifts and lead upto 1000 meters, trimming bottom and side slopes in accordance with requirements of lines, grades and cross sections and as per relevant clauses of section-300.	Cum	575.00
3.6	Excavation for roadway in hard rock (requiring blasting) by drilling, blasting and breaking, trimming of bottom and side slopes in accordance with requirements of lines, grades and cross sections, loading and disposal of cut road with all lifts and leads upto 1000 meters and as per relevant clauses of section-300.	Cum	396.00
3.7	Excavation for roadway in marshy soil with hydraulic excavator including cutting and loading in tippers and disposal with all lifts and lead upto 1000 meters trimming of bottom and side slopes in accordance with requirements of lines, grades and cross sections as per relevant clauses of section-300.	Cum	96.00
3.8	Scarifying the existing granular road surface to a depth of 50mm and disposal of scarified material with all lifts and leads upto 1000 meters.	Sqm	13.00
3.9	Scarifying the existing bituminous road surface by mechanical means to a depth of 50 mm and disposal of scarified material with in all lifts and lead upto 1000 meters.	Sqm	22.00

Item No.	Descriptions	Unit	Rate (In Rs)
3.10	Construction of Embankment/Sub grade/ earth shoulders, as per clause 305 & its sub-clauses, Where required but with approved materials having CBR>7 obtained from the excavation of road construction (vide clauses 3.1-3.7) consolidating the original ground by rolling as directed by Engineer in charge but with a maximum of 6 passes of 8-10 tonnes vibratory rollers and maintenance of surface during construction to ensure shedding of water & preventing ponding, shaping & dressing, finishing etc. complete as per clause 305 but excluding scarifying existing granular/bituminous road surface.	Cum	76.00
3.11	Construction of embankment with approved material having CBR>7 obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting by vibratory rollers to meet requirement of table 300-1, 300-2 and as per relevent clauses of section-300.	Cum	154.00
3.12	Construction of Embankment/Sub grade/ earth shoulders, as per clause 305 & its sub-clauses, Where required but with approved materials/soil like morrum CBR value not less then 7% i/c all lead & lifts i/c excavation, cost of watering, compaction by vibratory roller/ heavy pneumatic type roller and maintenance of surface during construction to ensure shedding & preventing ponding of water (clause 305.3.6) shaping & dressing (clause 305.3.7), finishing etc. complete but excluding scarifying existing granular/bituminous road surface vide clause 305.6.	Cum	410.00
3.13	Construction of embankment with fly ash conforming to table 1 of IRC: SP: 58 - 2001 obtained from coal or lignite burning thermal power stations as waste material, spread with motar grader and compacted with vibratory roller in layer of 200mm thickness each at OMC, all as specified in IRC: SP: 58-2001 and as per approved plans and as per relevant clauses of section-300.	Cum	131.00
	The above rate is for an initial lead of fly ash upto 10 Kms. If the lead of the Fly ash is more than 10 Kms. the same shall be measured and paid extra as per item 1.6 of Chapter 1 "Carriage of Material".		
3.14	Back filling behind the facing element in reinforced earth walls with approved material/selected soil having CBR >12 (Unless specified otherwise in the contract) obtained from excavation of borrow pits i/c all lifts & leads i/c grading to required slope & camber using mortar grader and compacting using vibratory roller of 80 to 100 kN static weight to meet compection requirement of Table No. 300.2 of MORTH specification.	Cum	327.00
3.15	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 vibratory roller at OMC to the desired density to form a layer of improved sub grade complete and as per relevant clauses of section-300. (Lime stabilisation for improving sub-grade)		

Item No.	Descriptions	Unit	Rate (In Rs)
(a)	By Mechanical Means	Cum	312.00
(b)	By Manual Means	Cum	307.00
3.16	Deduct for item No 3.10 to 3.15 if vibratory roller / motor grader is not used.		
	i) If static roller is used in place of vibratory roller/ pneumatic tyre roller.	Cum	23.00
	ii) If motor grader is not used.	Cum	23.00
3.17	Construction of unlined surface drains of average cross sectional area 0.40 sqm in soil to specified lines, grades, levels and dimensions to the requirement of clause 301 and 309. Excavated material to be used in embankment within a lead of 50 meter and as per relevant clauses of section-300.	Cum	48.00
3.18	Excavation for pipe laying by mechanical / manual means (exceeding 30 cm in depth) including disposal of excavated earth with all lift and lead upto 50 m, disposed earth to be levelled and neatly dressed.		
(a)	All kinds of soils	Cum	151.00
(b)	Ordinary rock	Cum	261.00
(c)	Hard rock (requiring blasting)	Cum	405.00
(d)	Hard rock (blasting prohibited)	Cum	559.00
3.19	Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes collar jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement: 2 fine sand).		
(a)	Size 300 mm dia meter	RM	710.00
(b)	Size 450 mm dia meter	RM	1104.00
(c)	Size 600 mm dia meter	RM	1465.00
3.20	Providing and laying non-pressure NP3 class (Medium duty) R.C.C. pipes collar jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement: 2 fine sand).		
(a)	Size 300 mm dia meter	RM	937.00
(b)	Size 450 mm dia meter	RM	2020.00
(c)	Size 600 mm dia meter	RM	3084.00

Notes :-

1 Material to be used for the work shall be natural sand, moorum, gravel, crushed stone, or combination thereof depending upon the grading required.

2 Material shall be free from organic or other deleterious constituents and conform to one of the three grading as give below:-

Grading for Granular Sub-base materials
MoRTH Table 400 - 1

IS Sieve	Per cent by Weight Passing the IS Sieve		
	Grading I	Grading II	Grading III
75 mm	100	-	-
53 mm	80-100	100	100
26.5 mm	55-90	70-100	55 - 75
9.5 mm	35-65	50-80	-
4.75 mm	25-55	40-65	10 - 30
2.36 mm	20-40	30-50	-
0.425 mm	10-15	10 - 15	-
0.075 mm	< 5	< 5	< 5

Physical Requirement for Material for Granular Sub-base
MoRTH Table 400 - 2

Aggregate Impact Valuve (AIV)	IS : 2386 (Part 4) or IS : 5640	40 Maximum
Liquid Limit	IS : 2720 (Part 5)	Maximum 25
Pliasticity Index	IS : 2720 (Part 5)	Maximum 6
CBR at 98% dry denisty (at IS : 2720 - Part 8)	IS : 2720 (Part 5)	Maximum 30 unless otherwise specified in the contract

3 Before laying the sub-base the subgrade shall prepared as per clause MORTH 301 or 305. The sub grade shall be prepared by removing vegetation etc, lightly sprinkeled with water if necessary and rolled with two passes of 80 -100 kN smooth wheeled roller.

4 Sub base material shall be spread on the prepared subgrade in required slope.

5 Moisture content of the loose sub base material shall be checked as per IS 2720 (Part-2).

5.1 If moisture contents found as per requirement then rolling shall be done. If the thickness of the completed layer does not exceed 100 mm, a smooth wheeled roller of 80 to 100 kN weight may be used. For a compacted single layer upto 225 mm the compaction shall be done with the help of a vibratory roller of minimum 80 to 100 kN static weight with plain drum or pad footdrum or heavy pneumatic tyred roller of minimum 200 to 300 kN weight.

6 Rolling shall commence at the lower edge and proceed towards the upper edge longitudinally for portions having unidirectional crossfall and shall commence at the edges and progress towards the centre for portions having crossfall on both sides.

7 Each pass of the rooler shall uniformly overlap not less than one-third of the track made in the preceding pass.

8 During rolling, the grade and camber shall be checked.

9 The speed of the roller shall not exceed 5 km per hour.

10 Rolling shall be continued till the denstiy achieved is at least 98 per cent of the maximum dry density.

11 Shoulder in a hard/paved/earthen are bick or stone block edging on either side of the pavement.

Carriageway is divide into separate lanes by median and at junctions and traffic is channelised by islands.

12 In WBM sub-base coarse aggregates shall be either crushed or borken stone, crushed slag, overburnt, brick aggregates or any other naturally occuring aggregates such as kankar and laterite of suitable quality.

The coarse aggregate shall be spread uniformly and evenly upon the prepared subgrade/sub base/ base to proper profile. The thickness of each compacted layer is not more than 100 mm for Grading 1 and 75 mm for Grading 2 and 3. Immediately following the spreading of the coarse aggregate, rolling shall be started with three wheeled power rollers of 80 to 100 kN capacity or tandem or vibratory rollers of 80 to 100 kN static weight. After the coarse aggregate has been rolled, screenings to completely fill the interstices shall be applied gradually over the surface. Dry rolling shall be done while the screenings are being spread so that vibrations of the roller cause them to settle into the voids of the coarse aggregate.

After the screenings have been applied,the surface shall be copiously sprinkled with water swept and rolled.After the application of screenings in the binding material where it is required to be used shall be applied successively in to or more thin layers at a slow,and uniform rate.

13 **The Physical Requirement of Coarse Aggregate for water bound macadam for Sub Base/Base Courses are given below: -**

Physical Requirement of Coarse Aggregate for Water Bound Macadam (MoRTH Table No. 400 - 8)

S.No	**Test**	**Test Method**	**Requirements**
1	*Los Angles Abrasion Value	IS : 2386 (Part 4)	40 percent (Max.)
	Or		
	*Aggregate Impact Value	IS : 2386 (Part 4) or IS : 5640**	30 percent (Max.)
2	Combined Flakiness and Elongation Indices (Total)***	IS : 2386 (Part 1)	30 percent (Max.)

* Aggregate may satisfy requirements of either of the two tests.

** Aggregate like bricks metal, laterite etc. which get softened in presence of water shall be tested for Impact value under wet conditions in accordance with IS: 5640.

*** The requirement of flakiness index and elongation index shall be enforced only in the case of the crushed broken stone crushed slag.

14 **Grading requirement of coarse aggregate:-**

The coarse aggragate shall be conform to one of the gradings in given table.

Grading requirement of coarse aggregate
(MoRTH Table No. 400 - 9)

Grading	Size Range	IS Sieve Designation	Percentage by weight passing
1	63 mm to 45 mm	75 mm	100
		63 mm	90 - 100
		53 mm	25 - 75
		45 mm	0 - 15
		22.4 mm	0 - 5
2	53 mm to 22.4	63 mm	100
		53 mm	95 - 100
		45 mm	65 - 90
		22.4 mm	0 - 10
		11.2 mm	0 - 5

The compacted thickness for a layer shall be 75 mm.

15 **Grading for sereening:-**

Screening to fill voids in the coares aggregate shall generally consist of the same material as the coarse aggregate. Screening shall conform to the grading as given below: -

Grading for sereening
(MoRTH Table 400 - 10)

Screening Type	Size Range	IS Sieve Designation	Percentage by weight passing
A	13.2 mm	13.2 mm	100
		11.2 mm	95 - 100
		5.6 mm	15 - 35
		180 micron	0 - 10
B	11.2 mm	11.2 mm	100
		5.6 mm	90 - 100
		180 micron	15 - 35

16 **Wet mix Macadam:-**

(i) The wet mix macadam work shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared sub-grade/sub- base/base or existing pavement as the case may be in accordance with the requirements of these Specifications

(ii) The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75 mm.

(iii) When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be upto 200 mm with the approval of the Engineer in charge

(iv) Coarse aggregates shall be crushed stone. If crushed gravel/shingle is used, not less than 90 percent by weight of the gravel/shingle pieces retained on 4.75 mm sieve shall have at least two fractured faces.

(v) The aggregates shall conform to the physical requirements as given below: -

MoRTH Table 400 - 12

S.N	Test	Test Method	Requirements
1	Los Angeles Abrasion value or Aggregate Impact value	IS: 2386(Part 4) 18: 2386 (Part-4) or 18:5640	40 percent (Max.) 40 percent (Max.)
2	Combined Flakiness and Elongation Indices (Total)*	IS : 2386 (Part 1)	35 percent (Max.)

* To determine this combined proportion, the flaky stone from a representative sample should first be separated out. Flakiness index is weight of flaky stone metal divided by weight of stone sample. Only the elongated particles be separated out from the remaining (non-flaky) stone metal. Elongation index is weight of elongated particles divided by total non-flaky particles. The value of flakiness index and elongation index so found are added up.

(vi) **The grading requirement of aggregate for wet mix macadam :-**

MoRTH Table 400 - 13

IS Sieve Designation	Percent by weight passing the IS Sieve
53.00 mm	100
45.00 mm	95 - 100
26.50 mm	-
22.40 mm	60 - 80
11.20 mm	40 - 60
4.75 mm	25 - 40
2.36 mm	15 - 30
600 micron	8 - 22
75 micron	0 - 5

17 **Test and their minimum frequncy for sub base and base (MoRTH Section 900)**

	Tpye of Construction	Test	Frequency(min.)
1	Granular sub base	(a) Gradation	One test per 400 m^3
		(b) Atterberg limits	One test per 400 m^3
		(c) Moisture content prior to compaction	One test per 400 m^3
		(d) Density of compacted layer	One test per 1000 m^3
		(e) Deleterious constituents	As required by Engineer in charge
		(f) C.B.R	As required by Engineer in charge
2	Water Bound Macadam	(a) Aggregate impact value	One test per 1000 m^3 of aggregate
		(b) Grading of aggregate	One test per 250 m^3

		(c) Flakiness index and Elongation index	One test per 500 m^3 of aggregate
		(d) Atterberg limit of binding material	One test per 50 m^3 of binding material
		(e) Atterberg limit of Screenings	One test per 100 m^3 of aggregate
3	Wet mix Macadam	(a) Aggregate impact value	One test per 1000 m^3 of aggregate
		(b) Grading of aggregate	One test per 200 m3 of aggregate
		(c) Combined Flakiness index and Elongation index	One test per 500 m^3 of aggregate
		(d) Density of Compacted Layer	One test of these test per 1000 Sqm.
		(e) Atterberg limit of portion of aggregate passing 425 micron sieve	One test per 200 m^3 of aggregate

18 **Measurement :-**

Granular sub-base shall be measured as finished work in position in cubic meters.

The protection of edges of granular sub-base extended over the full formation as shown in the drawing shall be considered incidental to the work of providing granular sub-base and as such no extra payment shall be made for the same.

Water bound macadam shall be measured as finished work position in cubic meters.

19 **Rates :-**

Rates include charges of material, labour, equipments and machineries required for completion of items

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(Refer MoRTH specifications for details)

CHAPTER-4			
SUB-BASES, BASES (NON- BITUMINOUS) AND SHOULDERS			
Item No.	**Descriptions**	**Unit**	**Rate (In Rs)**
4.1	Construction of **granular sub-base** by providing Coarse graded material (CBR>30), spreading in uniform layers with motor grader on prepared surface, mixing by mix in place method at OMC and compacting with vibratory roller of 80-100 KN Static weight to achieve the desired density, complete in all respect as per relevant clauses of section-400.	Cum	689.00
4.2	**Crusher Run Macadam -** Providing & laying crushed stone aggregate, on a prepared surface , spreading and mixing with a motor grader, watering and compacting with a vibratory roller as per clause 407 of the specifications.		
a)	**By Mix in Place Method**		
i)	For 53 mm maximum size	Cum	1242.00
ii)	For 37.5 mm maximum size	Cum	1249.00
b)	**By Mixing Plant :**		
i)	For 53 mm maximum size	Cum	1322.00
ii)	For 37.5 mm maximum size	Cum	1334.00
4.2.1	Labour only for laying crushed stone aggregate, on a prepared surface, spreading and mixing with a motor grader, watering and compacting with a vibratory roller as per clause 407 of the specifications.	Cum	168.00
4.3	**Water Bound Macadam** - Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam including spreading in uniform thickness, hand packing, rolling with vibratory roller 8-10 tonnes in stages to proper grade and camber, applying and brooming requisite type of screening/ binding materials to fill up the interstices of coarse aggregate, watering and compacting to the required density and as per relevant clauses of section-404 of specifications.		
(i)	**Grading- I (63 to 45mm)**		
a)	Using Screening Type-A (13.2mm Agg.)	Cum	1226.00
b)	Using Screening Type-B (11.2mm Agg.)	Cum	1268.00
(ii)	**Grading- II (53 to 22.4mm)**		
a)	Using Screening Type-B (11.2mm Agg.)	Cum	1251.00
4.3.1	Labour rates for laying, spreading and compacting stone aggregates of specific sizes to water bound macadam including spreading in uniform thickness,hand packing, rolling with vibratory roller 8-10 tonnes in stages to proper grade and camber, applying and brooming requisite type of screening/ binding Materials to fill up the interstices of coarse aggregate, watering and compacting to the required density as per specification.	Cum	261.00

Item No.	Descriptions	Unit	Rate (In Rs)
4.4	Providing, laying, spreading and compacting graded stone aggregate to **wet mix macadam** 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 and as per relevant clauses of section-406 of the specifications.	Cum	1441.00
4.4.1	Labour rate for 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 as per specifications.	Cum	229.00
4.4.2	Deduction if paver is not used for spreading.	Cum	111.00
4.5	Construction of Sub-base using lime - fly ash admixture with granular soil, free from organic matter/ deleterious material or clayey silts and low plasticity clays having PI between 5 to 20 and liquid limit less than 25, 16% flyash and 4% commercial dry lime, slaked at site or pre-slaked with CaO content not less than 50%, fly ash to conform to gradation as per clause 4.3 of IRC: 88-1984, the minimum un-confined compressive strength and CBR value after 28 days curing and 4 days soaking to be 7.5kg/sq, cm and 25% respectively, all as specified in IRC: 88 and as per relevant clauses of section-400 of the specifications.	Cum	364.00
	The above rate is for an initial lead of fly ash upto 25 Kms. If the lead of the Fly ash is more than 25 Kms. the same shall be measured and paid extra as per item 1.6 of Chapter 1 "Carriage of Material".		
4.6	Filling of Median and Island above road level with approved material deposited at site from roadway cutting and excavation for drain and foundation of other structures or borrow pits, spread, graded and uncompacted as per relevant clauses of section-400.	Cum	134.00
4.7	Construction of Hard Shoulder with approved material/selected soil having CBR >12 i/c excavation all lifts & leads i/c grading to required slope & camber of 4% and compacting using vibratory roller of 80 to 100 kN static weight to meet requirement as per relevant clause of 400 of the specifications.	Cum	528.00
4.8	Deduction for item No.4.1 to 4.5 and 4.7 if vibratory roller / motor grader is not used.		
	i) If static roller is used in place of vibratory roller.	Cum	61.00
	ii) If motor grader is not used.	Cum	61.00

CHAPTER- 5
BASES AND SURFACE COURSES (BITUMINOUS)

Notes :-

1 **Prime Coat Over Granular base: -**

Prime Coat Over Granular base work shall consist of the application of a single coat of low viscosity liquid bituminous material to a porous granular surface preparatory to the superimposition of bituminous treatment of mix.

2 **Tack coat : -**

Work of tack coat shall consist of the application of a single coat of low viscosity liquid bituminous material to existing bituminous, cement concrete or primed granular surface preparatory to the superimposition of bituminous mix, when specified in the contract or instructed by the Engineer. The binder used for tack coat shall be bitumen emulsion complying with IS:8887.

3 **Binder**: -The binder shall be appropriate type of bituminous material complying with the IS: 73.

4 **Bitumen Emulsion**

A freely flowing liquid at ordinary temperature in which a substantial amount of bitumen or tar is suspended in a solution of water in a finely divided and stable state. Emulsions contain about 50 to 65 percent of bitumen. Can be used an all climates and are very useful for patch repair on bituminous surfaces. They are cold and can work with wet chipping. When emulsion is spread on the road it “breaks” and changes from brown to black color and the water soaks in or evaporates allowing the bitumen particles to reunite and lie on the surface. Smaller chippings (not more then 6 mm) must be used with emulsions than with hot binder. Before the application of emulsion the road surface should be thoroughly cleaned and slightly damped with water and chipping spread and rolled before application of the emulsion.

5 **Modified Binder**

Modified Binder comprise a base binder, to which is added either natural rubber, crumb or a polymer such as styrene-Butadiene-Styrene (SBS), Ethylene- Vinyl-Acetate (EVA) or Low Density Polyethylene (LDPE). The purpose is to achieve a high performance binder with improved properties, particularly at extremes of temperature.

There are two types of Modified Binder.

A CRMB (Crumb Rubber Modified Binder)

B PMB (Polymer Modified Binder)

Modifid binders are used on roads having heavy traffic of heavy load.

6 **Bituminous Macadam :-**

This work shall consist of construction in a single course having 50 mm to 100 mm thickness or in a multiple course of compacted crushed agreegates premixed with a bituminous binder on a previously prepared base to the requirements of specifications. Since the bituminous macadum is an open-graded mix, there is potential that it may trap water or moisture vapour within the pavement system.Therefore, adjacent layers (shoulder) should have proper drainage quality to prevent Moisture induced damage to the Bituminous Macadum.

The aggregate for bituminous macadam shall be preportioned and blended to produce a uniform mixture complying with the requirement.

Physical Requirement of Coarse Aggregate For Bituminous Macadam

MoRTH Table 500 - 6

Property	Test	Specification
Cleanliness	Grain size analysis	Max 5% passing 0.075 mm micron
Particle shape	Combined flankiness and Elongation Indices	Max 35%
Strength	Los Angeles Abrasion Value or Aggregate Impact Value	Max 40% Max 30%
Durability	Soundness (Sodium or Magnesium) Sodium Sulphate Magnesium Sulphate	5 cycles Max 12% Max 18%
Water Absorption	Water Absorption	Max 2%
Stripping	Coating and Stripping of Bitumen Aggregate Mix	Min. Retained coating 95%
Water Sensitivity	Retained Tensile Strength*	Min. 80%

Aggregate Grading and Bitumen Content for Bituminous Macadem

MoRTH Table No. 500 - 7

Grading	**1**	**2**
Nominal maximum aggregate size*	**40 mm**	**19 mm**
Layer thickness	**80 - 100 mm**	**50 - 75 mm**
IS Sieve size (mm)	**Cumulative % by Weight of total aggregate passing**	
45	100	-
37.5	90 - 100	-
26.5	75 - 100	100
19	-	90 - 100
13.2	35 - 61	56 - 88
4.75	13 - 22	16 - 36
2.36	4 - 19	4 - 19
0.3	2 - 10	2 - 10
0.075	0 - 8	0 - 8
Bitument Content % by weight of total mix	3.3%*	3.4%**

***** The nominal maximum particle size is the largest specified sieve size upon which any of the aggregate is retained .

** Corresponds to specific gravity of aggregates being 2.7. In case aggregate have specific gravity more than 2.7, the minimum bitumen content can be reduced proportionately. Further the region where highest daily mean air temperature is 30º C or lower and lowest daily air temperature is - 10ºC or lower, the bitumen content may be increased by 0.5 percent.

Fine aggregates shall consist of crushed or naturally occuring material, or a combination of the two, passing 2.36 mm sieve and retained on the 75 micron sieve.

The coarse aggregates shall consist of crushed rock, crushed gravel or other hard material retained on the 2.36 mm sieve.

7 **Dense Graded Bituminous Macadam: -**

The Specification describes the design and construction procedure for Dense Bituminous Macadum (DBM) for use mainly, but not exclusively in Base / Binder and Profile Correction courses.

This work shall consist of construction in a single or multiple layes of DBM on a previously prepared base or sub base. The thickness of a single layer shall be 50mm to 100 mm.

Physical Requirement of Coarse Aggregate For Dense Graded Bituminous Macadam

MoRTH Table 500 - 8

Property	Test	Specification
Cleanliness (dust)	Grain size analysis	Max 5% passing 0.075 mm sieve
Particle shape	Combined flankiness and Elongation Indices	Max 35%
Strength[1]	Los Angeles Abrasion Value or Aggregate Impact Value	Max 35% Max 27 %
Durability	Soundness either : Sodium Sulphate or Magnesium Sulphate	Max 12% Max 18%
Water Absorption	Water Absorption	Max 2%
Stripping	Coating and Stripping of Bitumen Aggregate Mix	Minimum retained coating 95%
Water Sensitivity	Retained Tensile Strength**	Min. 80%

Composition of Dense Graded Bituminous Macadam Pavement Layers

MoRTH Table 500 - 10

Grading	**1**	**2**
Nominal Aggregate size	**37.5 mm**	**26.5 mm**
Layer Thickness	**75 - 100 mm**	**50 - 75 mm**
IS Sieve[1] (mm)	**Cumulative % by Weight of total aggregate passing**	
45	100	-
37.5	95 - 100	100
26.5	63 - 93	90 - 100
19	-	71 - 95
13.2	55 - 75	56 - 80
9.5	-	-
4.75	38 - 54	38 - 54
2.36	28 - 42	28 - 42
1.18	-	-
0.6	-	-
0.3	7 - 21	7 - 21
0.15	-	-
0.075	2 - 8	2 - 8
Bitumen content % by mass of total mix[2]	Min 4%*	Min 4.5%**

***** The nominal maximum particle size is the largest specified sieve size upon which any of the aggregate is retained .

** Corresponds to specific gravity of aggregates being 2.7. In case aggregate have specific gravity more than 2.7, the minimum bitumen content can be reduced proportionately. Further the region where highest daily mean air temperature is 30º C or lower and lowest daily air temperature is - 10ºC or lower, the bitumen content may be increased by 0.5 percent.

Note:-

The combined aggregate grading shall not vary from the low limit on one sieve to the high limit on the adjacent sieve.

8 **Bituminous Concrete : -**

This work shall consist of construction of Bituminous concrete for use in wearing and profile correction courses. This work shall consist of construction in a single layer of Bituminous concrete on a previously prepared bituminous bound surface. A single layer shall be 30 mm / 40 mm / 50 mm thick.

Physical Requirement for Coarse Aggregate For Bituminous Concrete

MoRTH Table No. 500 - 16

Property	Test	Specification
Cleanliness (dust)	Grain size analysis	Max 5% passing 0.075 mm sieve
Particle shape	Combined flankiness and Elongation Indices	Max 35%
Strength	Los Angeles Abrasion Value or Aggregate Impact Value	Max 30% Max 24%
Durability	Soundness eirther : Sodium Sulphate or Magnesium Sulphate	Max 12% Max 18%
Polishing	Polished Stone Value	Min. 55
Water Absorption	Water Absorption	Max 2%
Stripping	Coating and Stripping of Bitumen Aggregate Mix	Min. Retained coating 95%
Water Sensitivity	Retained Tensile Strength*	Min. 80%

* If the minimum retained tensile strength falis below 80 percent, use of anti stripping agent is recommended to meet the minimum requirements.

Composition of Bituminous Concrete Pavement Layers

MoRTH Table 500 - 17

Grading	**1**	**2**
Nominal Aggregate size	**19 mm**	**13 mm**
Layer Thickness	**50 mm**	**30 - 40 mm**
IS Sieve (mm)	**Cumulative % by Weight of total aggregate passing**	
26.5	100	-
19	90 - 100	100
13.2	59 - 79	90 - 100
9.5	52 - 72	70 - 88

4.75	35 - 55	53 - 71
2.36	28 - 44	42 - 58
1.18	20 - 34	34 - 48
0.6	15 - 27	26 - 38
0.3	10 - 20	18 - 28
0.15	5 - 13	12 - 20
0.075	2 - 8	4 - 10
Bitumen content % by mass of total mix	Min 5.2 %*	Min 5.4 % **

***** The nominal maximum particle size is the largest specified sieve size upon which any of the aggregate is retained .

** Corresponds to specific gravity of aggregates being 2.7. In case aggregate have specific gravity more than 2.7, the minimum bitumen content can be reduced proportionately. Further the region where highest daily mean air temperature is 30º C or lower and lowest daily air temperature is - 10ºC or lower, the bitumen content may be increased by 0.5 percent.

9 Pre-mixed bituminous materials, including, bituminous macadam, dense bituminous macadam, semi-dense bituminous concrete and bituminous concrete, shall be prepared in a calibrated hot mix plant of adequate capacity.

The approximate mixing, rolling and laying temperature shall be as per MoRTH table 500-2. The difference in temperature between the binder and aggregate should at no time exceed 14^0 C. In order to ensure uniform quality of the mix and better coating of aggregates, the hot mix plant shall be calibrated from time to time.

Mixing, Laying & Rolling Temperatures for Bituminous mixer

MoRTH Table 500 - 2

Bitumen Viscosity Grade	Bitumen Temperature	Aggregate Temperature	Mixed Material Temperatur	Laying Temperature	*Rolling Temperature
VG - 40	160 - 170	160 - 175	160 - 170	150 Min	100 Min
VG - 30	150 - 165	150 - 170	150 - 165	140 Min	90 Min
VG - 20	145 - 165	145 - 170	145 - 165	135 Min	85 Min
VG - 10	140 - 160	140 - 165	140 - 160	130 Min	80 Min

10 Bituminous materials shall be transported in clean insulated vehicles.

11 **Hand Placing of pre mixed bituminous materials:-**

Hand Placing of pre mixed bituminous materials shall only be permitted in the following circumstances: -

(i) For laying regulating courses of irregular shape and varying thickness.
(ii) In confined spaces where it is impracticable for a paver to operate.
(iii) For footways.
(iv) At the approaches to expansion joints at bridges, via-ducts or other structure.
(v) The Mastic asphalt shall be laid, normally in one coat, at a temperature between 175^0 and 120^0C and spread uniformly by hand using wooden floats on prepared and regulated
(vi) For filling of potholes.
(vii) Where directed by the Engineer.

Manual spreading of pre mixed wearing course material or the addition of such material by hand spreading to the paved area, for adjustment of level, will be permitted in the following circumstances: -

(i) At the edges of the layers of material and at gullies and manhole.

(ii) At the approaches to expansion joints of bridges, viaducts or other structure.

(iii) As directed by the Engineer.

12 Except in areas where a mechanical paver cannot access, bituminous materials shall be spread, leveled and tamped by an approved self-propelled paving machine. As soon as possible after arrival at site, the materials shall be supplied continuously to the paver and laid without delay.

13 **Surface Dressing: -**

(i) This work shall consist of the application of one coat or two coats of surface dressing,each coat consisting of a layer of bituminous binder sprayed on a previously prepared, base, followed by a cover of stone chips rolled in to form a wearing course to the requirements of the approved drawing. The binder shall either be bitumen conforming to IS 73 or rapid setting cationic bitumen emulsion conforming to IS: 8887.

(ii) Aggregate (chips) shall be single sized clean ,hard , durable of cubical shape, free from dust and soft or friable matter, organic or other deleterious matter and conforming to one of the grading as per table MoRTH Table 500-21.

MORTH TABLE 500-20 : Recommended Nominal Size of Agreegate (mm)

Type of Surface	Traffic Intensity in Terms of Number of Vehicles Per Day in the lane Under Consideration		
	1000-2000	**200-1000**	**20-200**
Very hard	10	6	6
Hard	13	10	6
Normal	13	10	6
Soft	19	13	13
Very Soft		19	13

MoRTH Table 500-21

IS Sieve Designation (mm)	Cumulative percent by weight of total aggreage passing for the following nominal sizes (mm)			
	19	**13**	**10**	**6**
26.5	100	-	-	-
19	85 - 100	100	-	-
13	0 - 40	85 - 100	100	-
9.5	0 - 7	0 - 40	85 - 100	100
6.3	-	0 - 7	0 - 35	85 - 100
4.75	-	-	0 - 10	-
3.35	-	-	-	0 - 35
2.36	0 - 2	0 - 2	0 - 2	0 - 10
0.6	-	-	-	0 - 2
0.075	0 - 1.5	0 - 1.5	0 - 1.5	0 - 1.5
Minimum 65% by weight of aggregate	Passing 19mm retained 13.0mm	Passing 13.0 mm retained 9.5 mm	Passing 9.5 retained 6.3 mm	Passing 6.3 mm retained 3.35mm

(iii) **Application of binder:-**

After the preparation of Base, Paving grade binder treated to an appropriate temperature or bitumen emulsion shall be sprayed uniformly using mechanical sprayers. During the operation the ratio b/w truck speed and pump revolution shall be maintained constant with the help of automatic control. when work resumes, the binder shall not sprayed on the earlier completed surface. This can be done by covering the completed work with bitumen Impregnated paper. Excessive deposit of bituminous material shall be immediately removed. The spraying temperature for binder are given below :-

Spraying Temperatures for Binders
MORTH

Binder grades	Whirling Spray jets		Slot Jets	
	Min. ^{0}C	Max. ^{0}C	Min. ^{0}C	Max. ^{0}C
Penetration grades				
80/100	180	200	165	175

14 **Mastic Asphalt: -**

Mastic asphalt is an intimate homogeneous mixture of selected well graded aggregates, filler and bitumen is such proportions as to yield a plastic and void less mass, which when applied hot can be trowelled and floated to from a very dense impermeable surfacing.

Requirement for Physical Properties of Binder
MoRTH Table 500 - 39

Property		Test Method	Requirement
Penetration at 25 ^{0}C		IS 1203	15 $\pm$ 5*
Softening point, ^{0}C		IS 1205	55 $\pm$ 10
Loss on heating for 5h at 163^{0}C, % of mass	Max.	IS 1212	2
Solubility in Trichloroethylene, % by mass	Min.	IS 1216	95
As (mineral matter), % by mass	Max.	IS 1217	1

The percentage and grading of the coarse aggregate to be incorporated in the mastic asphalts depending upon the thickness of the finished coarse shall be as per specified in the table.

Grade and Thickness of Mastic Asphalt paving and Grading of Coarse Aggregate

MoRTH Table 500 - 40

Application	Thickness range (mm)	Nominal size of coarse aggregate (mm)	Coarse aggregate content, % by mass of total mix
Roads and Bridges decks	25 - 50	13	40 $\pm$ 10

Heavily stressed areas i.e. junctions and toll plaza	40 - 50	13	45 ± 10
Nominal size of coarse	13 mm		
IS Sieve (mm)	Cumulative % passing by weight		
19	100		
13.2	88 - 96		
2.36	0 - 5		

The fine Agreegate shall be the fraction passing the 2.36 mm and retained on the 0.75mm sieve consisting of crusher run screening, natural sand or a mixture of both.

Filler for mastic asphalt: -

The filler shall be limestone powder passing the 0.075mm sieve and shall have a calcium carbonate content of not less than 80 persent by weight when determined in accordance with IS : 1514. The grading of the fine aggregate inclusive of filler shall be as per table number 17.

Grading of Fine Aggregates (Inclusive Filler)
MoRTH Table 500 - 41

S.No.	IS Sieve	Percentage by weight of aggregate
1	Passing 2.36 mm but retained on 0.60 mm	0 - 25
2	Passing 0.600 mm but retained on 0.212 mm	10 - 30
3	Passing 0.212 mm but retained on 0.075 mm	10 - 30
4	Passing 0.075 mm	30 - 55

15 Compaction after laying the bituminous material shall commence as soon as possible after laying.

16 **Test of Bituminous Construction**

Test and Frequency:- The test and their minimum frequencies for different type of bituminous work shall be as given in table. The Engineer may direct additional testing as required.

17 **Measurement**

(i) Prime coat & Tack coat shall be measured in terms of surface area of application in square meters.

(ii) Bituminous macadam shall be measured as finished work in cubic meters.

(iii) Dense, Bituminous Macadam and bituminous concrete shall be measured as finished work in cubic meters.

(Refer MoRTH Specifications for details)

Chapter - 5			
BASES AND SURFACE COURSES (BITUMINOUS)			
Item No.	**Descriptions**	**Unit**	**Rates (in Rs.)**
5.1	Providing and applying **primer coat** with cationic bitumen emulsion (SS1 grade) on prepared surface of granular Base including clearing of road surface and spraying primer at the rate of 0.75 kg/sqm using mechanical/Manual means and as per relevant clauses of section-502.	Sqm	33.00
5.2	Providing and applying **tack coat** with cationic bitumen emulsion (RS-1) using emulsion pressure distributor on the prepared bituminous/granular surface cleaned with mechanical broom and as per relevant clauses of section-503.		
i)	@ 0.25 kg per sqm (normal bituminous surfaces)	Sqm	12.00
ii)	@ 0.30 kg per sqm (dry & hungry bituminous surfaces/granular surfaces treated with primer)	Sqm	14.00
iii)	@ 0.35 kg per sqm (Non-bituminous surfaces) cement concrete	Sqm	16.00
iv)	@ 0.40 kg per sqm (Non-bituminous surfaces) granular base not primed.	Sqm	18.00
5.2.1	Labour rate for applying tack coat with bitumen emulsion on the prepared bituminous/granular surface cleaned by manually and as per relevant clauses of section-503.	sqm	3.00
5.3	Providing and laying **bituminous macadam** with hot mix plant using crushed aggregates of specified grading premixed with bituminous binder, transported to site, laid over a previously prepared surface with mechanical paver finisher to the required grade, level and alignment and rolled as per clauses 501.6 and 501.7 to achieve the desired compaction complete in all respects and as per relevant clauses of section-504.		
i)	for Grading I (80-100mm thickness) bitumen content 3.3% (VG-30)	Cum	5231.00
ii)	for Grading II(50-75mm thickness) bitumen content 3.4% (VG-30)	Cum	5293.00
5.4	Providing and laying **levelling course/profile corrective course** with bituminous macadam with hot mix plant using crushed aggregates of grading-1 premixed with bituminous binder (VG-30) @ 3.1%, transported to site, laid over a previously prepared surface with mechanical paver finisher to the required grade, level and alignment and rolled as per clauses 501.6 and 501.7 to achieve the desired compaction complete in all respects and as per relevant clauses of section-500.	Cum	5029.00
5.5	Providing, laying and rolling of built-up-spray grout layer over prepared base consisting of a two layer composite construction of compacted crushed coarse aggregates. key stone chips spreader may be used with application of bituminous binder after each layer, and with key aggregates placed on top of the second layer to serve as a Base conforming to the line, grades and cross-section specified, the compacted layer thickness being 75 mm and as per relevant clauses of section-506.	sqm	248.00

Item No.	Descriptions	Unit	Rates (in Rs.)
5.6	Providing and laying **dense bituminous macadam** with hot mix plant batch using crushed aggregates of specified grading, premixed with bituminous binder, transporting the hot mix to work site, laying with mechanical paver finisher to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction complete in all respects and as per relevant clauses of section-505. (Lime or cement will be used as filler)		
i)	for Grading I (75-100mm thickness) bitumen content 4.0% (VG-30)	Cum	6292.00
ii)	for Grading II(50-75mm thickness) bitumen content 4.5% (VG-30)	Cum	6899.00
5.7	Providing and laying **bituminous concrete** with hot mix plant using crushed aggregates of specified grading,premixed with bituminous binder,transporting the hot mix to work site,laying with a mechanical paver finisher to the required grade,level and alignment,rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction in all respects and as per relevant clauses of section-507.(lime or cement will be used as filler).		
i)	for Grading I (50 mm thickness) , bitumen content 5.2% (VG-30)	Cum	7711.00
ii)	for Grading I (50 mm thickness) with CRMB-60	Cum	7852.00
iii)	for Grading I (50 mm thickness) with PMB-40	Cum	7741.00
iv)	for Grading II (30-40 mm thickness), Bitumen content 5.4% (VG-30)	Cum	7945.00
v)	for Grading II (30-40 mm thickness) with CRMB-60	Cum	8012.00
vi)	for Grading II (30-40 mm thickness) with PMB-40	Cum	7866.00
5.8	Providing and laying **surface dressing** in single coat using crushed stone aggregates of specified size on a layer of bituminous binder laid on prepared surface and rolling with 8-10 tonne smooth wheeled steel roller and as per relevant clauses of section-500.		
i)	with 19 mm nominal chipping size & bitumen @1.2kg per sqm.	Sqm	73.00
ii)	with 13 mm nominal chipping size & bitumen @ 1.0 kg per sqm.	Sqm	59.00
5.9	Providing,laying and rolling of open-graded premix surfacing of 20mm thickness composed of 13.2 mm to 5.6mm aggregates using 60/70 grade bitumen 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 excluding primer and tack coat and as per relevant clauses of section-511.	sqm	106.00
5.10	Providing, laying and rolling of open - graded premix surfacing of 20 mm thickness composed of 13.2 mm to 5.6 mm aggregates using cationic bitumen 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 excluding primer and tack coat and as per relevant clauses of section-511.(This item can be excuted only with prior approval of the chief engineer UADD).	Sqm	126.00

Item No.	Descriptions	Unit	Rates (in Rs.)
5.11	Providing, laying and rolling of **close-graded premix surfacing/mixed seal surfacing** material of 20 mm thickness composed of 11.2 mm to 0.09 mm (Type-A) or 13.2 mm to 0.09 mm (Type-B) aggregates using paving bitumen to the 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, and finishing to required level and grade and as per relevant clauses of section-508.		
i)	VG-30 bitumen	Sqm	136.00
ii)	with CRMB-60	Sqm	139.00
iii)	with PMB-40	Sqm	139.00
5.12	Providing and laying seal coat sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall using Type A and B seal coats and as per relevant clauses of section-513 with bitumen.		
i)	Type A (Liquid Seal Coat)	sqm	55.00
ii)	Type B (Premixed Seal Coat with hot mix plant & paver finisher)	sqm	41.00
5.13	Providing and laying **mastic asphalt** wearing course with paving grade bitumen meeting the requirements given in table 500-39, 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 100degree C, protruding 1 mm to 4 mm over mastic surface complete in all respect and as per relevant clauses of section-516.		
a)	25 mm thick mastic	Sqm	514.00
5.14	Providing and laying **slurry seal** consisting of a mixture of fine aggregates, portland cement filler, bituminous emulsion and water on a road surface including cleaning of surface, mixing of slurry seal in a suitable mobile plant, laying and compacting to provide even riding surface and as per relevant clauses of section-516.		
i)	1.5 mm thickness Type - I	Sqm	20.00
ii)	3 mm thickness Type - II	Sqm	33.00
iii)	5 mm thickness Type - III	Sqm	49.00
5.15	**Crack Prevention Courses**		
i)	Providing and laying of a **stress absorbing membrane** over a cracked road surface, with crack width below 6 mm after cleaning with a mechanical broom, using modified binder complying with clause 521, sprayed at the rate of 9 kg per 10 sqm and spreading 5.6 mm crushed stone aggregates @ 0.11 cum per 10 sqm with hydraulic chip spreader, sweeping the surface for uniform spread of aggregates and surface finished to conform to clause 902.	Sqm	57.00

Item No.	Descriptions	Unit	Rates (in Rs.)
ii)	Providing and laying of a **stress absorbing membrane** over a cracked road surface, with crack width 6 to 9 mm after cleaning with a mechanical broom, using modified binder complying with clause 521, sprayed at the rate of 11 kg per 10 sqm and spreading 11.2 mm crushed stone aggregates @ 0.12 cum per 10 sqm, sweeping the surface for uniform spread of aggregates and surface finished to conform to clause 902.	Sqm	68.00
iii)	Providing and laying a single coat of a **stress absorbing membrane** over a cracked road surface, with crack width above 9 mm and cracked area above 50 % after cleaning with a mechanical broom, using modified binder complying with clause 521, sprayed at the rate of 15 kg per 10 sqm and spreading 11.2 mm crushed stone aggregates @ 0.12 cum per 10 sqm, sweeping the surface for uniform spread of aggregates and surface finished to conform to clause 902.	Sqm	91.00
iv)	Providing and laying **bitumen impregnated geotextile** layer after cleaning the road surface, geotextile conforming to requirements of clause 704.3, laid over a tack coat with 1.05 kg per sqm of paving grade bitumen (80-100) penetration and constructed to the requirement of clause 704.4.5.	Sqm	245.00

CHAPTER- 6
CEMENT CONCRETE PAVEMENTS

Notes :-

1 **Dry Lean cement concrete sub-base: -**

1.1 Any of the following type cement may be used with prior approval of engineer in charge:-

(i) Ordinary Portland Cement, 43 Grade IS : 8112

(ii) Portland Slag Cement IS : 455

(iii) Portland Pozzolana Cement (fly ash based) IS : 1489, Part I

If the subgrade soil contains soulble sulpates in a concentration more than 0.5 %, sulphate resistant cement conforming to IS:6909 shall be used.

1.2 The Aggregates of lean concrete shall be as per IS 383. The maximum sizes of coarse aggregate shall be 26.5 mm. The fine aggregate shall consist of clean natural sand or crushed stone sand or a combination of the two .

Combined Gradation for Dry Lean Concrete of Coarse and Fine aggregates

MoRTH Table 600 - 1

Sieve Designation	Percentage by Weight Passing the Sieve
26.50 mm	100
19.0 mm	75 - 95
9.50 mm	50 - 70
4.75 mm	30 - 55
2.36 mm	17 - 42
600 micron	8 - 22
300 micron	7 - 17
150 micron	2 - 12
75 micron	0 - 10

1.3 **Proportioning of Material for the mix**

(i) The mix shall be proportioned with a maximum aggregate cement ratio of 15 :1.

(ii) The right amount of water for the lean concrete in the main work shall be decided so as to ensure full compaction under rolling. While laying in the main work, the leanc concrete shall have a moisture content b/w the optimum and optimum +2%, keeping in view the effectiveness of compaction achieved and to compensate for evaporation losses.

(iii) The minimum cement content in the lean concrete shall not be less than 150 kg/cum of concrete. If this minimum cement content is not sufficient to produce concrete of the specified strength, it shall be increased as necessary without additional cost compensation to the contractor. In case fly ash is blended as part of replacement of cement, the quantity of flyash shall not be more than 20% by weight of cementitious material and content of OPC shall not be less than 120 kg per cum

(iv) The average compressive strength of each consecutive group of 5 cubes made in accordance with MORTH Clause 903.5.1.1 shall not be less than 10 MPa at 7 days. In addition, the minimum compressive strength of any individual cube shall not be less than 7.5 MPa at 7 days. The design mix complying with the above Clauses shall be got approved from the Engineer and demonstrated in the trial length construction.

1.4 The batching plant shall be capable of proportioning the materials by weight. The batching and mixing shall be carried out preferably in a forced action, central batching and mixing plant having necessary automatic controls to ensure accurate proportioning and mixing. Other types of mixing plant shall be permitted subject to demonstration of their satisfactory performance during the trial length. The type and capacity of the plant shall be got approved by the Engineer before commencement of the trial length.

1.5 The concrete shall be laid by a paver with electronic sensor unless otherwise specified. The equipment shall be capable of laying the material in one layer in an even manner without segregation, so that after compaction the total thickness is as specified. The paving machine shall have high amplitude tamping bars to give good initial compaction to the sub-base.The laying of a two-lane road sub-base may preferably be done in full width or lane by lane. Preferably the lean concrete shall be placed and compacted across the full width of two lane carriageway, by constructing it in one go.In roads with carriage way more than 2 lanes, a longitudinal Joint shall be Provided.

1.6 The sub-base of lean concrete shall be overlaid with cement concrete pavement only after 7 days after sub-base construction.

1.7 The compaction shall be carried out immediately after the material is laid and levelled.

1.8 Double drum smooth-wheeled vibratory rollers of minimum 80 to 100 kN static weight are suitable for rolling dry lean concrete.

1.9 **Curing** : As soon as the lean concrete surface is compacted, curing shall commence. One of the following two methods shall be adopted :

(a) The curing shall be done by spraying with liquid curing compound. The curing compound shall be white pigmented or transparent type with water retention index of 90 per cent when tested in accordance with BS 7542. Curing compound shall be sprayed immediately after rolling is complete. As soon as the curing compound has lost its tackiness, the surface shall be covered with wet hessian.

(b) Curing shall be done by covering the surface by gunny bags/hessian, which shall be kept continuously moist for 7 days by sprinkling water.

1.10 **Measurements**

The unit of measurement for dry lean concrete pavement shall be the cubic meter of concrete placed, based on the net plan areas for the specified thickness.

1.11 **Rates**

The rate payable for dry lean concrete sub-base include carrying out required operations including material, equipment, mixing, transport, placing, compacting, finishing, curing, testing etc.

2 **Cement Concrete Pavement**

2.1 Cement

Any of the following types of cement capable of achieving the design strength may be used with prior approval of the Engineer, but the preference should be to use at least the 43 Grade or higher.

(i) Ordinary Portland Cement, 43 Grade IS : 8112
(ii) Ordinary Portland Cement, 53 Grade IS : 12269
(iii) Portland slag Cement IS : 455
(iv) Portland Pozzolana Cement (fly ash based) IS : 1489 Part 1

If the Soil around Concrete pavement has soulble salts like sulphates in excess of 0.5% the cement used shall be sulphate resistant shall confirm to IS:12330.

2.2 **Admixture** : Admixture conforming of IS 6925 and IS 9103 shall be permitted to improve workability of the concrete or extension of setting time.

2.3 Aggregates for pavement concrete shall be natural material complying with IS:383 but with a Los Angeles Abrasion Test result not more than 35 percent. The maximum size of coarse aggregate shall not exceed 31.5mm.

Combined Gradation of Coarse and Fine aggreegate for Pavement Quality Concrete MoRTH Table 600 - 3

Sieve Designation	Percentage by Weight Passing the Sieve
31.50 mm	100
26.5 mm	85 - 95
19.0 mm	68 - 88
9.5 mm	45 - 65
4.75 mm	30 - 55
600 micron	8 - 30
150 micron	5 - 15
75 micron	0 - 5

2.4 The dowel bars shall be mild steel bars conforming to IS 432 of Grade I. Tie bar shall be HYSD bars confirming to IS 1786 and grade of Fe 500 or plain bars confirming to IS 432 of grade I. The steel shall be coated with epoxy paint for construction against corrosion.

2.5 **Proportioning of Concrete**

After approval by the Engineer of all the materials to be used in the concrete, the Contractor shall submit the mix design based on weighed proportions of all ingredients for the approval of the Engineer. The mix design shall be submitted at least 30 days prior to the paving of trial length and the design shall be based on laboratory trial mixes using the approved materials and methods as per IS:10262 (Recommended Guidelines for Mix Design).

The cement content shall not be less than 360 kg per cu.m. of concrete for Ordinary Portland cement

2.6 **Separation Membrane : -**

A separation membrane shall be used between the concrete slab and the sub-base. Separation membrane shall be impermeable PVC sheet 125 micron thick transparent or white in colour laid flat with minimum creases. Before placing the separation membrane, the sub-base shall be swept clean of all the extraneous materials using air compressor. Wherever overlap of plastic sheets is necessary, the same shall be at least 300 mm and any damaged sheathing shall be replaced at the Contractor's cost. The separation membrane may be nailed to the lower layer with concrete nails.

2.7 **Joints: -**

2.7.1 Joints are two categories of joints for concrete pavement:

(i) Transverse joints, and

(ii) Longitudinal joints.

Joints are made at the time the pavement is constructed. Joints are formed by placing within the concrete strips of metal or wood, or impregnated fiber, of a thickness of joints required, embedded close under the pavement surface.

2.7.2 **Transverse joints have two categories :**

(a) Expansion joints, and

(b) Contraction joints.

Contraction and Expansion joints are made in concrete pavements to keep the stresses caused by changes in the volume of the concrete due to hardening and drying, or due to temperature changes, and thus formation of crack occur and ultimate failure of the slab. Shrinkage may be caused either by the initial heat of hydration of cement and subsequent cooling, or by changing moisture conditions through the depth of the slab as it dries out. Temperature changes may be seasonal or daily and there will usually be a difference in the temperature between the top and the bottom of the slab.

Expansion joints should also be provided at intersections of pavements with structure or other pavements. The joints filling may be assumed to be compressed up to 50 per cent of its thickness and therefore the expansion joints gap should be twice the allowable expansion in the concrete, the usual width is 20 to 25 mm.

2.7.3 **Longitudinal Joints:-**

These shall be of the plain butt type and shall be formed by placing the concrete against the slab concrete earlier. The face of the slab concreted earlier, shall be painted with bitumen before placing of fresh concrete on the other side.

2.8 **Dowel Bars and Tie Bars: -**

Mild steel bars for dowels shall conform to the requirements of IS : 432 of Grade I and Tie bar shall be HYSD bar confirming to IS 1786 of Fe 500 Grade. These bar shall be provided as per approved drawing and shall be supported on cradle so as not to be displaced during construction operation.

2.9 **Batching and Mixing: -**

Batching and mixing of the concrete shall be done at a central batching and mixing plant with automatic controls, located at a suitable place which takes into account sufficient space for stockpiling of cement, aggregates and stationary water tanks, unless otherwise specified.

2.10 **Frequency of Quality Control Tests for Paving Quality Concrete**

(i) Strength of concrete	IS:516	2 cubes and 2 beams per 150 m^3 or part thereof (one for 7 day and other for 28 days strength) or minimum 6 cubes and 6 beams per day's work whichever is more.
(ii) Core strength on hardened concrete	IS:516	As per the requirement of the Engineer; only in case of doubt.
(iii) Workability of fresh concrete-Slump Test	IS:1199	One test per each dumper load at both Batching plant site and paving site initially when work starts. Subsequently sampling may be done from alternate dumper.
(iv) Thickness determination		From the level data of concrete pavement surface and sub-base at grid points of 5/6.25 m x 3.5 m.
(v) Thickness measurement for trial length		3 cores per trial length.

(vi) Verification of level of string line in the case of slip form paving and steel forms in the case of fixed form paving		String line or steel forms shall be checked for level at an interval of 5.0 m or 6.25 m. The level tolerance allowed shall be 2 mm. These shall be got approved 1-2 hours before the commencement of the concreting activity.

2.11 All precautions and care shall be taken to construct pavement having uniform thickness.

2.12 **Measurement**

Cement concrete pavement shall be measured as a finished work in square meters with specified thickness. The unit for measurement for concrete pavement shall be the cubic meter of concrete placed.

2.13 **Rates**

Rate for complete item include charges of labour, material, equipment, required for completion of items.

(Refer MoRTH Specifications for details)

CHAPTER-6			
CEMENT CONCRETE PAVEMENTS			
Item No.	**Descriptions**	**Unit**	**Rate (in Rs.)**
6.1	Construction of **Dry lean cement concrete** Sub-base over a prepared sub-grade with coarse and fine aggregate conforming to IS: 383, the size of coarse aggregate not exceeding 26.5mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per MORTH Specifications Table 600-1, cement content not to be less than 150 kg/cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, laid with paver with electronic sensor/mechanical paver, compacting with 8-10 tonnes vibratory roller, finishing and curing and as per relevant clauses of section-601.	cum	3017.00
6.1.1	Deduct from Item No.6.1 above if paver with Electronic sensor/ mechanical paver, is not used and laying is done by any other method. **(Note :- The acceptance criteria regarding level, thickness, surface regularity, texture finish, strength of concrete and all other quality control measures shall be the same as in case of machine laid work.) This item is to be executed with Prior written permission of Engineer-in-charge**	cum	211.00
6.1.2	Deduct from Item No.6.1 above if static roller is used in place of vibratory roller	Cum	302.00
6.2	Construction of dowel jointed, plain cement concrete pavement in M-30 grade concrete over a prepared sub base with 43 or higher grade cement, coarse and fine aggregate conforming to IS:383 maximum size of coarse aggregate not exceeding 25 mm, mixed in a batching and mixing plant as per approved mix design, transported to site, laid with a fixed form or slip form paver with spreading the concrete by shovels, rakes compacted using needle, screed and plate vibrator and finished in a continuous operation including provision of contraction, expansion, and longitudinal joints, joint filler, separation membrane, sealant primer, joint sealant, debonding strip, placing of dowel bar,tie rod admixtures as approved, curing compound, finishing to lines and grades as per approved drawings as per IRC-15 2011 and as per relevant clauses of section-602 of specifications complete excluding cost of steel in dowel ber & tie rod etc.	cum	5583.00

Item No.	Descriptions	Unit	Rate (in Rs.)
6.3	Construction of dowel jointed, plain cement concrete pavement in M-40 grade concrete over a prepared sub base with 43 or higher grade cement, coarse and fine agreegate conforming to IS:383 maximum size of coarse aggregate not exceeding 25 mm, mixed in a batching and mixing plant as per approved mix design, transported to site, laid with a fixed form or slip form paver with electronic sensor, spread, compacted and finished in a continuous operation including provision of contraction, expansion, construction and longitudinal joints, joint filler, separation membrane, sealant primer, joint sealant, debonding strip, placing of dowel bar and tie rod, admixtures as approved, curing compound, finishing to lines and grades as per approved drawings as per IRC-15 2011 and as per relevant clauses of section-602 of of MORTH specifications complete but excluding cost of steel in dowel bar & tie rod etc..	cum	5677.00
6.4	Add extra in Item No.- 6.2 & 6.3 above for the cost of steel in dowel bar and tie bar etc. required as per design.		
6.4.1	Mild Steel dowel bars confirming to IS 432, grade I	MT	47300.00
6.4.2	HYSD tie bars of Fe 500 grade confirming to IS 1786,	MT	49500.00
6.5	Providing and laying Cement Concrete grade M-10 Nominal mix 1:3:6 with 40 mm graded crushed stone aggregate, spreading the concrete by shovels mixing shall be in mechanical mixer, compacting by use of pin/plate/screed vibrators including form work by strong steel girders fixed by spikes.	Cum	3890.00
6.6	Providing and laying Cement Concrete grade M-20 (Nominal mix 1:1.5:3) with 20 mm graded crushed stone aggregate, mixing shall be in mechanical mixer, laying with paver compacting by use of pin, plate / screed vibrators including form work by strong steel girders fixed by spikes, separation membrane 125 micron thick, i/c cutting of joints @ 4 to 5 m interval & filling it with hot applied bituminous sealant (without dowel bars). (max. thickness 20cm)	Cum	5420.00
6.7	Deduct from Item No.6.2, 6.3 and 6.6 above if paver with electronic sensor is not used and laying, compaction is done by any other method **(Note :- The acceptance criteria regarding level, thickness, surface regularity, texture finish, strength of concrete and all other quality control measures shall be the same as in case of machine laid work.)** **This item is to be executed with Prior written permission of Engineer-in-charge**	cum	391.00
6.8	Providing and laying stone-set pavement including preparation of 100mm thick compacted Granular Sub-base as per Clause of section 401 and base 75mm thick compacted water bound macadam grading 2 as per Clause 404. The stone set pavement shall consist of 150mm thick hammer dressed stones in the herring one or stretched bond pattern, on the bedding sand of 40mm over the WBM base bounded by edge stone using suitable compacting device. The gaps are to be filled with sand / stone dust	Sqm	561.00

Item No.	Descriptions	Unit	Rate (in Rs.)
6.9	Construction of Base/sub-base using cement, sand, fly ash and coarse aggregates proportioned as per table 4 of IRC: 74/1979 and with water content ratio, slump and compressive strength as defined in the said table, mix prepared in a batching and mixing plant and compacted with a vibratory roller 8-10 tonnes capacity within the time limit laid down vide clause 7.6.3 of IRC: 74-1979, construction joints properly formed at the end of day's work, cured for 14 days, all as specified in IRC: 74-1979 and as per approved plans.	Cum	2517.00
6.10	Deduct from Item No.6.9 above if paver with electronic sensor is not used and laying, compaction is done by any other method. **(Note :- The acceptance criteria regarding level, thickness, surface regularity, texture finish, strength of concrete and all other quality control measures shall be the same as in case of machine laid work.)** **This item is to be executed with Prior written permission of Engineer-in-charge**	cum	176.00

CHAPTER- 7
GEOSYNTHETICS AND REINFORCED EARTH

Notes :-

1 Geosynthetics is a general classification for all synthetic materials used in geotechnical engineering application. It includes geotextiles, geogrids, geonets, geomembranes and geocomposites.

2 (i) The paving fabric will be a nonwoven heat set material consisting of at least 85 per cent by weight polyolefins, polyesters or polyamides.

(ii) The paving fabric shall be resistant to chemical attack, rot and mildew and shall have no tears or defects which will adversely alter its physical properties.

(iii) The fabric shall be specifically designed for pavement applications and be heart bonded only on one side to reduce bleed-through of tack coat during installation.

(iv) The fabric shall meet the physical requirements.

Table 700-16 Physical Requirement for Paring fabrics

Property	Units	Standard Requirements	Test Method
Grab Tensile Strength	N	450	ASTM D 4632
Elongation	%	≥ 50	ASTM D 4632
Mass Per Unit Area	gm/m²	140	ASTM D 3776
Asphalt Retention	Kg/10 sq.m	10*	ASTM D 6140
Melting Point	°C	150	ASTM D 276
Surface Texture	-	Heat bonded on One side only	Visual Inspection

Note : * the product asphalt retention property must meet MARV provided by the manufacturer.

(v) Heavy duty paving fabrics should be used in areas experiencing unusually high impact forces or heavy loads such as airport runways and taxiways.

3 Tack coat shall be spread by means of a calibrated distributor spray bar. Hand spraying, squeeze and brush application may be used only in locations where the distributor truck cannot be reach.

4 Paving fabric placement

(i) The paving fabric shall be placed onto the tack coat using mechnical or manual laydown equipment capable of providing a smooth installation with a minimum amount of wrinkling or folding.

(ii) The paving fabric shall be placed prior to the tack coat cooling and losing tackiness.

(iii) Paving fabric shall not be installed in areas where the overlay asphalt tapers to a thickness of less 40 mm.

5 Geogrid -

The work covers the use of geogrids in sub-base of pavement, erosion control of slopes,reinforced soil slopes and reinforced soil walls including supplying and laying as per design,drawing and these specifications.

The use of geogrids as a component for reinforced soil slopes and walls shall be as per Section 3100.

Geogrids shall be either made from high tenacity polyester yarn jointed at cross points by weaving, knitting or bonding process with appropriate coating or from polypropylene or polyethylene or any other suitable polymeric material by an appropriate process. Geogrids manufactured by extrusion process are integrally jointed, mono or bi-directionally oriented or stretched meshes, in square, rectangular, hexagonal or oval mesh form. The geogrids manufactured by weaving/knitting/bonding process shall be formed into a stable network such that ribs, filaments or yarns retain their dimensional stability relative to each other including selvages.

The geogrid for erosion control application shall have the minimum tensile strength of 4 kN/m, when tested as per ASTM D5035 (Minimum Average Roll Value in Machine Direction). The aperture opening size shall be minimum 20 mm x 20 mm and average grid thickness shall be minimum 1.0 mm. Geogrid for erosion control application shall be UV stabilized. The geogrid shall have ultraviolet stability of 70 percent after 500 hrs exposure as per ASTM D 4355.

6 Measurement

(i) The fabric of geotextile/ geocomposite shall be measured in sq. meters of plan area of actual use.

7 Rates

The cost of Geosynthetic material for fabrication of Gabions/Mattresses shall be all inclusive of supply, transportation and storage

8 Reinforced Earth Retaining wall :-

1.The specification and construction details shall be as per section 3100 of MoRTH Specification.

2.Drainage arrangement shall be made as per approved design and drawings.

3.The quantity of filler media shall be calculated as per approved design and specifications and shall be paid separately.

4.Excavation for foundation, foundation concrete and cement concrete grooved seating in the foundation for seating of bottom most facia panel and capping beam to be calculated as per design and paid separately.

5. Length of reinforcing strips will vary with the height of wall and will be as per approved design and drawings.

6.The type of reinforcing elements to be adopted shall be as per approved design and specifications. Reinforcing elements and their accessories are to be ascertained from reputed firms in the field of earth reinforcement.

7.The earth fill material shall be clean, free draining, granular with high friction and low cohesion, non-corrosive, coarse grained with not 10 per cent of particles passing 75 micron sieve, free of any deleterious matter, chlorides, salts, acids, alkalies, mineral oil, fungus and microbes and shall be of specified PH value.

8.Capping beam is to be paid separately as per approved design.

9.The cost of reinforced earth retaining wall shall include following:

(i) Excavation for foundation including backfilling.
(ii) Foundation concrete as per approved design.
(iii) Cost of facia panels and their erection .
(iv) Cost of reinforcing elements including their fixing and joining with the facia panels.
(v) Drainage arrangement including filter media as per approved design and drawings.
(vi) The compacted earth filling to be retained shall form part of embankment.

(Refer MoRTH Specifications for the details)

CHAPTER-7			
GEOSYNTHETICS AND REINFORCED EARTH			
Item No.	**Descriptions**	**Unit**	**Rate (In Rs.)**
	Laying Paving Fabric Beneath a Pavement Overlay		
7.1	Providing and laying paving fabric with physical requirements as per table 700-16 over a tack coat of paving grade Bitumen VG-10, laid at the rate of 1 kg per sqm over thoroughly cleaned and repaired surface to provide a water resistant membrane and crack retarding layer. Paving fabric to be free of wrinkling and folding and to be laid before cooling of tack coat, brooming and rolling of surface with pneumatic roller to maximise paving fabric contact with pavement surface as per relevant clauses of section-700 of specifications.	sqm	138.00
	Laying Boulder Apron in Crates of Synthetic Geogrids		
7.2	Providing, preparing and laying of geogrid crated apron 1 m x 5 m, 600 mm thick including excavation and backfilling with baffles at 1 meter interval, made with geogrids having characteristics as per clause 703.2, joining sides with connectors/ring staples, top corners to be tie tensioned, placing of suitable cross interval ties in layers of 300 mm connecting opposite side with lateral braces and tied with polymer braids to avoid bulging, constructed as per clause 703.3. filled with stone with minimum size of 200 mm and specific gravity not less than 2.65, packed with stone spalls, keyed to the foundation recess in case of sloping ground and laid over a layer of geotextile to prevent migration of fines as per approved design and as per relevant clauses of section-700 & 2500 of specifications.	cum	2740.00
	Reinforced Earth Retaining Wall		
7.3	Reinforced Earth Retaining Walls have four main components as under : a) Excavation for foundation, foundation concrete and cement concrete grooved seating in foundation concrete for facing elements (facia material), b) Facia material and its placement, c) Assembling, joining with facing elements and laying of reinforcing elements d) Earthfill with specified material as per specification to be retained by the wall .		
(i)	Facing elements of RCC	sqm	1321.00
(ii)	Assembling, joining and laying of reinforcing elements.		
A	With reinforcing element of steel / Aluminium strips / polymeric strips.		
	Type 1 Galvanised carbon steel strips	meter	355.00
	Type 2 Copper Strips	meter	323.00
	Type 3 Aluminium Strips	meter	292.00
	Type 4 Stainless steel strips	meter	292.00
	Type 5 Glass reinforced polymer/fibre reinforced polymer/polymeric strips	meter	386.00
B	With reinforcing elements of synthetic geogrids	sqm	206.00

CHAPTER- 8
TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES

Notes :-

1 (i) The colour, configuration, size, location and dimensions of different road traffic signs shall be in conformity with the Code of Practice for Road Signs IRC: 67-2012.

(ii) The language of inscription and font for informatory signs shall also be in conformity with the Code of Practice for Road Signs IRC: 67:2012

2 The signs shall be either reflectorised or non-reflectorised as directed by the engineer in charge.

3 The sign board shall be so constructed as to hold these in a proper and permanent position against the normal storm wind loads. Sign shall be fixed over sheeting and fixed to the post properly.The traffic signs shall be mounted on support post which may be of GI Pipe confirming to IS:1239, Rectangular hollow section confirming to IS:4923 or square hollow section confirming to IS:3589.

4 Normally signs with an area upto 0.90 sqm can be mounted on a single post and for greater area two or more supports shall be provided.

5 Concrete for footings shall be of minimum M-15 grade. & reinforcement steel shall be as per IS:1786. bolts, nuts and washers shall be as per IS:1367. Field welding shall not be permitted. Plate and support sections for sign posts shall conform IS : 226 and IS : 2062.

6 Sign panels shall be fabricated on aluminium sheet, aluminium composite panel, fibre glass sheeting, or sheet moulding compound. Aluminum sheets used for sign boards shall be of smooth, hard and corrosion resistant aluminium alloy conforming to IS:736-Material Designation 24345 or 1900. Aluminium Composite Material (ACM) sheets shall be sandwiched construction with a thermoplastic core of Low Density Polyethylene (LOPE) between two thick skins/sheets of aluminium with overall thickness and 3 mm or 4 mm (as specified in the Contract), and aluminium skin of thickness 0.5 mm and 0.3 mm respectively on both sides.Specifications of ACM shall be as per MORTH table 800·1

7 Shoulder mounted ground sings with a maximum side dimension not exceeding,600 mm shall not be less than 1.5 mm thick with Aluminium and 3 mm thick with Aluminium Composite Material. All other signs be at least 2 mm thick with Aluminium and 4 mm thick with Aluminium Composite Material.All other Signs be at least 2mm thick with aluminium and 4 mm thick with Aluminium Composite Material.

8 The retro-ref/ective sheeting used on the sign shall consist of the white or coloured sheeting having a smooth outer surface which has the property of retro-reflection over its entire surface.It shall be weather-resistant and show colour fastness. It shall be new and unused and shall show no evidence of cracking, scaling, pitting, blistering, edge lifting or curling.The Minimum co-efficient of retro-reflection (determined in accordance with ASTM D: 4956-09) shall be as per table 800-2, 800-3, 800-4, 800-5 and 800-6.

9 The Regulatory/Prohibitory and warning signs shall be provided with white background and red border. The legend/ symbol for these signs shall be in black colour. The Mandatory sign shall be provided with Blue background and white Symbol/letter.

10 A certificate in original shall be given by the sheeting manufacturer that its offered retroreflective sheeting has been tested for various parameters such as co-efficient of retroreflection, day/night time colour and luminance, shrinkage, flexibility, linear removal, adhesion,impact resistance, specular gloss and fungus resistance; the tests shall be carried out by a Government Laboratory in accordance with various ASTM procedures and the results must show that the sheeting has passed the requirements for all the above mentioned parameters.A copy of the test reports shall be attached with the certificate.

11 Cautionary and mandatory signs generally fabricated through process of screen printing. In regard to informatory signs either the message could be printed over the reflective or cut letters of non-reflective black sheeting used for the purpose which must be bonded well on the base sheeting.

12 Support and all component of signs except the reflectorised portion and posts, shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy/ fibre glass/ powder coated paint. The portion of mild steel post below ground should be painted with protective paint.

13 The messages and borders shall either be screen-printed or of cut-outs. Cut-outs messages and borders, wherever used, shall be made out of retro-reflective sheeting except those in black shall be of non-reflective sheeting or opaque in case of durable transparent overlay.

14 Overhead signs shall be design to withstand a wind loading of 150 kg/sqm normal to the face of sign and 30 kg/sqm transvers to the face of the sign in addition to the dead load of the structure walkway loading of 250 kg concentrated live load shall also be considered for the design of the overhead sign structure.

15 Overhead signs shall provide a vertical clearance of not less than 5.5 m over the entire width of the pavement and shoulders. The verticals clearance to overhead sign need not be greater than 300mm in excess of minimum clearance of other structure.

16 The minimum lateral clearance outside the usable roadway shoulder for expressway signs mounted at the road side or for overhead sign supports either to the right or left side of the roadway shall be 1.80 m.

17 In no case should there be more than three signs displayed at any one location, including regulatory or warning signs, either on the overhead structure or on its support.

18 Thermoplastic material shall be applied hot either by screeding or extrusion process & the pavement temperature shall not be less than 10^{0} C during application of thermoplastic material. Thermoplastic paint shall be applied in intermittent or continuous lines of uniform thickness of at least 2.5mm unless specified otherwise. Where arrows or letters are to be provided, thermoplastic compound may be hand-sprayed.

19 Road delineators shall confirm to Recommended practices of road delineators IRC:79

20 Road Markings shall be of ordinary road marking paint hot applied thermoplastic compound, reflectrorised paint or cold applied reflective Paint.

21 The boundary stone shall be as per design & specification in IRC 25, the arrangement of letters and script shall be as per IRC : 26.

22 The fencing barbed wire shall be galvanised iron Post or RCC Post or GI Post and shall conform to IS : 1239.

23 The railing shall be of tubular steel in conformance to IS : 1239.

24 The concrete barriers shall be constructed with M-20 grade concrete and with High Yield Strength deformed bars.

25 **Measurement**

(i) The measurement of standard cautionary, mandatory and information signs shall be in numbers of different types of signs supplied and fixed, while for direction and place identification signs, these shall be measured by area in square meters.

(ii) Aluminium or steel overhead sign structure will be measured for payment by the specific unit (each) complete in place or for each component of the overhead sign structure as indicated in the bill of quantities and the detailed drawings(s).

(iii) Flat sheet aluminium signs with retro-reflective sheeting thereon shall be measured for payment by the square meter for each thickness, complete in place.

(iv) The painted markings shall be measured in sq. meters of actual area marked (excluding the gaps, if any).

(v) In respect of markings like directional arrows and lettering, etc., the measurement shall be by numbers.

(vi) All barriers will be measured by linear meters of completed and accepted length in place, corresponding end to end along the face of concrete barriers including approach and departure ends.

(vii) Metal beam railing barriers will be measured by linear meter of completed length as per plans and accepted in place. Terminals/anchors of various types shall be paid for by numbers.

(viii) No measurement for payment shall be made for projections or anchors beyond the end posts except as noted above. Furnishing and placing anchor bolts and/or devices for guard rail posts on bridges shall be considered incidental to the construction and the costs there or shall be included in the price for other items of construction.

(IX) The measurement of reflective road marker/ solar powdered road studs shall be in numbers of different types of markers supplied and fixed.

(X) The measurement of road delineators shall be in numbers of different types of road delineators supplied and fixed.

25 Rates

Rate for complete item include charges of labour, material, equipment, required for completion of items.

(Refer MoRTH specifications for details)

CHAPTER-8			
TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES			
Item No.	**Descriptions**	**Unit**	**Rate (In Rs.)**
	Cast in Situ Cement Concrete M 20 Kerb		
8.1	Construction of cement concrete mountable/ barrier type kerb / kerb with channel in M 20 grade laid with kerb laying machine, all complete as per design approved by Engineer-in-Charge..	Cum	5487.00
	Precast Kerb.		
8.2	Providing and laying at or near ground level Pre-cast kerb stone of M-25 grade in position to the required line, level and curvature jointed with cement mortar 1:3 (1 cement: 3 coarse sand) thickness of joints except at sharp curve shall not to more than 5mm) including making drainage opening wherever required complete as per direction of Engineer-in-charge.	Cum	5509.00
	Printing new letters		
8.3	Printing new letter of any shade with synthetic enamel paint black or any other approved colour to give an even shade including cost of paint etc. complete and as per relevant specifications		
i)	Hindi (Letters commas and the like not to be measured and paid. Half letter shall be counted as half)	Per cm height per letter	7.00
ii)	English and Roman letters	Per cm height per letter	4.00

Item No.	Descriptions	Unit	Rate (In Rs.)
	Retro - reflectorised Traffic signs (Type -IV)		
8.4	Providing and fixing of retro-reflectorized cautionary, mandatory and informatory sign board as per IRC 67-2012 made of high intensity Micro Prismatic Grade Sheeting (Type IV) vide IRC : 67-2012 clause 6.7.3.2 & clause 801.3.3 of MORT&H firxed over Aluminium composite material sheet with thermoplastic core of Low density Polyethylene (LDPE) between two thick skins/sheets of aluminium with overall thickness of 4mm and aluminium skin of thickness 0.3 mm on both side, the ACM shall conform to Table 6.1 of IRC : 67-2012 Table 800-1 of MORT&H specifications and High Intensity Micro Prismatic Grade Sheeting shall conform of Table 6.6 of IRC 67-2012 & table 800.3 of MORT&H specifications. In line with clause 6.8 of IRC : 67-2012 & clause 801.3.7 of MORT&H the messages (legends, numerals, letters etc.) & borders shall be screen printed or of cut out from transparent durable overlay or cut out from the same type of reflective sheeting for cautionary/ mandatory signs. Screen printing shall be processed & finished with materials and in a manner specified by the sheeting manufacturer supported on MS angle iron sign post of size 75mm x 75mm x 6mm fixed to ground by means of properly designed foundation of dimension 450 x 450 x 600 mm with M-15 grade concrete. The ACM sheet shall be fixed to the post with minimum four number breakaway bolts & supported with a back support frame of 25mm x 25mm x 3mm angle. 7 years Warranty for Retro Reflective Sheeting to be provided from the original sheeting manufacturer as per clause 6.9 of IRC : 67-2012 & a certificate of having the sheeting tested for co-efficient of retro-reflection, specular gloss and fungus resistance, dy time colour and luminance, shrinakge, flexibility, linear removal, adhesion, Impact resistance, 3 year outdoor weathering and its having passed this test from an independent test lab as per clause 6.7 of IRC : 67-2012 for the product offered shall be submitted by the contractor.		
i)	90 cm equilateral triangle	Each	3954.00
ii)	60 cm equilateral triangle	Each	2705.00
iii)	60 cm circular	Each	3523.00
iv)	80 cm x 60 cm rectangular	Each	4791.00
v)	60 cm x 45 cm rectangular	Each	3439.00
vi)	60 cm x 60 cm square	Each	4019.00
vii)	90 cm high octagon	Each	6028.00

Item No.	Descriptions	Unit	Rate (In Rs.)
	Retro reflectorized Traffic Signs upto 0.9 sqm size (Type- XI).		
8.5	Providing and fixing directional, informatory and place identification retro-reflectorized sign as per IRC : 67-2012 made of high intensity Micro-Prismatic Grade cube corner sheeting (Type XI) vide IRC : 67-2012 clause 6.7.4.3 & clause 801.3.4.3 fixed over Aluminum composite material sheet with thermoplastic core of Low density polyethylene (LDPE) between two thick skins/sheets of aluminium with overall thickness of 4mm and aluminium skin of thickness 0.3 mm on both side, the ACM shall conform to Table 6.1 of IRC :67-2012 & table 800-1 of MORT&H spcifications and High Intensity Micro Prismatic Grade cube corner sheeting shall conform to Table 6.9 of IRC : 67-2012 & table 800-6 of MORT&H specifications. In line with clause 6.8 of IRC : 67:2012 & clause 801.3.7 of MORT&H, for the directional, informatory, place identification and other sign boards, the messages (legends, letters, numerals etc). and borders shall be cut-out from durable transparent overlay film or cut-out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay material as specified by the sheeting manufacturer and shall be bounded with the sheeting in the manner specified by the manufacturer and should be supported on MS Angle iron sign post of size 75mm x 75mm x 6mm fixed to ground by means of properly designed foundation of dimension 450x450x600mm with M-15 grade concrete. The ACM sheet shall be fixed to the post with four minimum four number breakaway bolts & supported with a back support frame of 25mm x 25mm 3mm angle. 10 rears Warranty for Retro Reflective sheeting from the original sheeting manufacturer as per clause 6.9 of IRC : 67-:2012 & concrete. The ACM sheet shall be fixed to the post with minimum four number breakaway bolts & supported with a back support frame of 25mm x 25mm x 3mm angle. 7 years Warranty for Retro Reflective Sheeting to be provided from the original sheeting manufacturer as per clause 6.9 of IRC : 67-2012 & a certificate of having the sheeting tested for co-efficient of retro-reflection, specular gloss and fungus resistance, dy time colour and luminance, shrinakge, flexibility, linear removal, adhesion, Impact resistance, 3 year outdoor weathering and its having passed this test from an independent test lab as per clause 6.7 of IRC : 67-2012 for the product offered shall be submitted by the contractor from an independent test lab as per clause 6.7 of IRC : 67:2012 for the product offered shall be submitted by the contractor.	sqm	9237.00

Item No.	Descriptions	Unit	Rate (In Rs.)
	Retro reflectorized Traffic Signs with more than 0.9 sqm size (Type- XI).		
8.6	Providing and fixing directional, informatory and place identification retro-relectorized sign as per IRC : 67:2012 made of high intensity Micro-Prismatic Grade cube corner sheeting (Type XI) vide IRC : 67:2012 clause 6.7.4.3 & clause 801.3.4.3 of MORTH fixed over Aluminum composite material sheet with thermpolastic core of Low density polyethylene (LDPE) between two thick skins/sheets of aluminum with overall thickness of 4mm and aluminium skin of thickness 0.3 mm on both side the ACM shall conform to Table 6.1 of IRC : 67:2012 & table 800-1 of MORT&H specifications and High Intensity Micro Prismatic Grade cube corner sheeting shall conform to shall conform to Table 6.9 of IRC : 67:2012 & table 800-6 of MORT&H specifications. In line with clause 6.8 of IRC : 67:2012 & clause 801.3.7 of MORT&H. For the directional, informatory, place identification and other sign boards, the messages (legends, letters, numerals etc) and boarders shall be cut-out from durable transparent overlay film or cut-out from the same reflective sheeting only, Cut-outs shall be from durable transparent overlay materials a specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer and should be supported on MS Angle Iron sign post of size 75mmx75mmx6mm fixed to ground by means of properly designed foundation of dimension 450x450x600mm with M15 grade concrete. The ACM sheet shall be fixed to the post with four minimum four number breakaway bolts & supported with a back support frame of 25mmx25mmx3mm angle. 10 years Warranty for Retro Reflective sheeting from the original sheeting manufacturer as per clause 6.9 of IRC : 67:2012 & aconcrete. The ACM sheet shall be fixed to the post with minimum four number breakaway bolts & supported with a back support frame of 25mm x 25mm x 3mm angle. 7 years Warranty for Retro Reflective Sheeting to be provided from the original sheeting manufacturer as per clause 6.9 of IRC : 67-2012 & a certificate of having the sheeting tested for co-efficient of retro-reflection, specular gloss and fungus resistance, dy time colour and luminance, shrinakge, flexibility, linear removal, adhesion, Impact resistance, 3 year outdoor weathering and its having passed this test from an independent test lab as per clause 6.7 of IRC : 67-2012 for the product offered shall be submitted by the contractor from an independent test lab as per clause 6.7 of IRC :67:2012 for the product offered shall be submitted by the contractor.	sqm	9627.00

Item No.	Descriptions	Unit	Rate (In Rs.)
	Retro Reflectorized Traffic signs sheeting on existing boards (Type XI)		
8.7	Providing and pasting on existing sign boards with high intensity Micro-Prismatic Grade cube corner Sheeting (Type XI) vide clause IRC:67:2012 clause 6.7.4.3 & clause 801.3.4.3 of MoRTH with messages (legends, numerals, letters etc.,) & borders for the informatory & other sign boards shall be cut out from durable transparent overlay film or cut out from the same reflective sheeting only. Cut-outs shall be from durable transparent overlay materials as specified by the sheeting manufacturer and shall be bonded with the sheeting in the manner specified by the manufacturer and as directed by Engineer-in-Charge. Sheet shall be fixed on the existing board by de-greasing either by acid or hot alkaline etching and all scale/ dirt removed to obtain smooth plain surface before application of high intensity grade cube corner retro reflective sheeting (Type XI) all complete. 10 years Warranty for Retro Reflective Sheeting from the original sheeting manufacturer as per clause 6.9 of IRC:67:2012 & aconcrete. The ACM sheet shall be fixed to the post with minimum four number breakaway bolts & supported with a back support frame of 25mm x 25mm x 3mm angle. 7 years Warranty for Retro Reflective Sheeting to be provided from the original sheeting manufacturer as per clause 6.9 of IRC : 67-2012 & a certificate of having the sheeting tested for co-efficient of retro-reflection, specular gloss and fungus resistance, dy time colour and luminance, shrinakge, flexibility, linear removal, adhesion, Impact resistance, 3 year outdoor weathering and its having passed this test from an independent test lab as per clause 6.7 of IRC : 67-2012 for the product offered shall be submitted by the contractor. as per clause 6.7 of IRC:67:2012 for the product offered shall be submitted by the contractor.	Sqm	5273.00
	Painting on New Concrete surfaces :-		
8.8	Painting two coats on concrete surface after filling the surface with synthetic enamel paint in all shades as per relevant clauses of section-800 & I.R.C.-67 including cost of paint etc. complete.	sqm	54.00
	Painting on Old Concrete work		
8.9	Painting one or more coat to give an even shade on old concrete work with synthetic enamel paint in all shades as per relevant clauses of section-800 & I.R.C.-67 including cost of paint etc. complete.	sqm	45.00
	Painting on steel surfaces		
8.10	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 as per relevant clauses of section-800 & I.R.C.- 67 including cost of paint etc. complete.	sqm	52.00

Item No.	Descriptions	Unit	Rate (In Rs.)
	Painting on Roads on New work		
8.11	Painting lines, dashes, arrows etc on roads in two coats on new work with ready mixed road marking paint conforming to IS:164 on bituminous surface, including cleaning the surface of all dirt, dust and other foreign matter, demarcation at site and traffic control as per relevant clauses of section-800 & I.R.C.-67 including cost of paint etc. complete.	sqm	94.00
	Painting on Roads on Old Work		
8.12	Painting lines, dashes, arrows etc on roads in two coats on old work with ready mixed road marking paint confirming to IS: 164 on bituminous surface, including cleaning the surface of all dirt, dust and other foreign matter, demarcation at site and traffic control as per relevant clauses of section-800 of specifications including cost of paint etc.	sqm	66.00
	Road Marking with Hot Applied Thermoplastic Compound with Retro-Reflectorising Glass Beads		
8.13	Providing and applying 2.5 mm including reflectorising glass beds @ 250 gms per sqm area thick road marking strips (retro- reflective) of specified shade/ colour using hot thermoplastic material by fully/ semi automatic thermoplastic paint applicator machine fitted with profile shoe, glass beads dispenser, propane tank heater and profile shoe heater, driven by experienced operator on road surface including cost of material, labour, T&P, cleaning the road surface of all dirt, seals, oil, grease and foreign material etc. complete as per direction of Engineer-in-charge and as per clause 803 of MORTH.	sqm	614.00
	Road Markers/ Road studs with Lense Reflector.		
8.14	Providing and fixing single mould twin shanked molded Road Markers/Road Stud made of poly carbonate or ABS body and shall support a load of 13635 Kg tested in accordance to ASTM D 4280 and complying to specifications of Section-5 of IRC:35:2015 and clause 804 of MORTH. As per clause 804.2.2 of MoRTH and Section-5 of IRC:35-2015, the reflecting panels shall consist of number of lenses containing single or dual prismatic cubes capable of providing total internal reflection of the light entering the lens face. The slope or retro-reflecting surface should be 35 +/- 5 degree to base. The reflective marker shall be fixed to the road surface using the epoxy/ adhesives and the procedure recommended by the manufacturer. No nails shall be used to affix the markers so that they do not pose safety hazard on the road. The contractor shall submit a two year replacement warranty for satisfactory field performance including stipulated retro-reflectance of the reflecting panel.	each	415.00

Item No.	Descriptions	Unit	Rate (In Rs.)
	Road Delineators		
8.15	Supplying and installation road delineators (road way indicators), as per MoRT&H Clause 506. The structure shall be made in roll forming process having height of 80-100 cm above the ground level, width not less than 100 mm and shall extend not more than 300mm below the ground while being installed, buried or pressed in to the ground in confirmation with IRC : 79:1981, are as direction by the Engineer painted black with powder coat of minimum 40 microns thickness for protection against corrosion, on top of which Type XI retro reflective sheeting shall be pasted on both sides complying to IRC : 79:1981. The delinator should consist of minimum, retro reflective unit exposed are of 330 cm2 white colour, full cube corner micro prismatic non metallic retro reflective sheeting on each side conforming with IRC 67:2012 and meeting the coefficient of retro reflection values as per ASTM D 4956 (Type XI) table specification. The delinator shall have grooves across the length to make the reflective sheets Vandal proof.	each	784.00
	Boundary Pillars		
8.16	Providing reinforced cement concrete M20 grade boundary pillars of standard design as per IRC:25-1967, fixed in position including finishing and lettering but excluding painting) as per clause 807 of the specifications.	each	606.00
	Tubular Steel Railing on Medium Weight steel channel		
8.17	Providing, fixing and erecting 50 mm dia M.S. pipe (medium class) railing in 3 rows duly painted on medium weight steel channels (ISMC series) 100 mm x 50 mm, 1.8 m height, 1.2 meters high above ground, 2 m centre to centre, complete as per approved drawings as per relevant clauses of section-800 of specifications.	meter	1486.00
	Tubular Steel Railing on Precast RCC posts.		
8.18	Providing, fixing and erecting 50 mm dia M.S. pipe (medium class) railing in 3 rows on precast M20 grade RCC vertical posts1.8 meters high (1.2 m above GL) with 3 holes 50 mm dia for pipe, fixed 2 meters centre to, complete as per approved drawing as per relevant clauses of section-800 of specifications.	meter	1164.00
	Reinforced Cement Concrete Crash Barrier		
8.19	Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-20 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 as per relevant clauses of section-800 of specifications.	meter	3458.00

Item No.	Descriptions	Unit	Rate (In Rs.)
	Traffic Cone		
8.20	Red fluorescent with white reflective sleeve traffic cone made of low density polyethylene (LDPE) material with a square base of 390 x 390 x 35 mm and a height of 770 mm, 4 kg in weight, as per specifications	each	446.00
	Barricading (1.6m high)		
8.21	Providing and fixing 1.6m high barricading during construction with 0.63mm thick GI sheets of TATA/ JINDAL or equivalent make in double row fixed with 75mm dia. wooden ballies or 50mm dia. MS pipe buried in existing road sufficiently including painting with yellow and black bands by synthetic enamel paint as per the traffic norms and as directed by the Engineer.	Rmt	576.00
	Barricading (2.0m high)		
8.22	Providing and erecting 2.00 metre high temporary barricading at site; each panel of size 2.50mx2.00m made of 40x40x6mm angle iron or 50x50x3mm hollow MS tube posts/horizontal members/bracings covered with 1.63mm thick MS sheet. The sheet shall be fixed with 30x5mm MS flat by suitable welding/riveting. The panels shall be made so that gap of 50cm above the ground is available making overall height as 2.5m. MS channel ISLC 75 @ 5.70 kg/m, 50cm long shall be provided at the bottom having oval shaped holes of size 50x25mm at both ends with 50cm long MS angle 40x40x6mm bracing. Suitable arrangement shall be made to fix the barricading to avoid from overturning by providing 250mm long expansion fasteners at both ends. The work shall be executed as per drawing/ direction of Engineer-in-Charge which includes writing and painting, arrangement for traffic diversion such as traffic signals during construction at site for day and night, glow lamps, reflective signs, marking, flags, caution tape as directed by the Engineer-in-Charge. The barricading provided shall be retained in position at site continuously i/c shifting of barricading from one location to another location as many times as required during the execution of the entire work till its completion. Rate include its maintenance for damages, painting, all incidentals, labour materials, equipments and works required to execute the job. The barricading shall not be removed without prior approval of Engineer-in-Charge. (Note :- One time payment shall be made for providing barricading from start of work till completion of work i/c shifting. The barricading provided shall remain to be the property of the contractor on completion of the work).	Rmt	2541.00
8.23	Providing & placing 85 mm thick Hydraulically pressed M 40 cement concrete heavy duty covers with slots including steel reincorcement for ingress of water.	Sqm	887.00
8.24	Providing and fixing 30 mm thick White sand stone over 20 mm (average) thick base of cement mortar 1:5 (1 cement :5 coarse sand) with joints finished flush.	Sqm	535.00
8.25	Providing and fixing 40 mm thick White sand stone over 20 mm (average) thick base of cement mortar 1:5 (1 cement :5 coarse sand) with joints finished flush.	Sqm	612.00

Item No.	Descriptions	Unit	Rate (In Rs.)
8.26	Providing and fixing 40mm thick red stone slab over drains including Pointing in cement mortar 1:3 (1 cement : 3 sand)	Sqm	430.00
8.27	Providing and fixing red stone slab (dasa) 80 mm to 100 mm thick including poitning in CM 1:3 (Base mortar shall be paid separately)	cum	7609.00

CHAPTER-9			
SUPPLY OF MATERIAL			
Item No.	**Descriptions**	**Unit**	**Rate (In Rs.)**
9.1	Supply of mineral aggregate like broken stone/crushed stone /stone dust/ moorum at road site including all lead and stacking etc. complete.		
a	63mm standard size broken stone	cum	569.00
b	45mm standard size broken stone	cum	569.00
c	40mm standard size crushed stone	cum	639.00
d	26.5mm standard size crushed stone	cum	698.00
e	22.4mm standard size crushed stone	cum	714.00
f	13.2mm standard size crushed stone	cum	817.00
g	11.2mm standard size crushed stone	cum	659.00
h	6.7mm standard size crushed stone	cum	626.00
i	Crusher stone dust	cum	198.00
j	Moorum with CBR not less than 7	cum	345.00

CHAPTER- 10
MAINTENANCE OF ROADS

Notes :-

1 For repair of rain cuts fresh material (as per Sub-section 301) shall be placed in layers not exceeding 250 mm loose thickness and compacted so as to match with the benching at a moisture content close to the optimum. The area affected by the rain cuts shall be cleared of all loose soil and benched before laying of fresh material. The width shall be 300 mm and height shall be 150 to 300 mm.

2 The work of maintenance of earthen 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 equipments or to strip excess soil from the shoulder surface as per the requirements of this specification.

3 The material used in meintenance operation shall be of a standard not less than those specified for the original construction.

4 **Pot-hole and patch repair**

(i) Each pot-hole and patch repair area shall be inspected and all loose material removed.

(ii) In the preparation of the area for pot hole and patch repair the area for repair shall be cut/trimmed either with jack hammers or with hand tools suitable for the purpose, such that the defective material responsible for the failure is all removed and such that the excavation is of a regular shape. The edges of the excavation shall be cut vertically. The area shall be completely cleaned by any sutable method.

(iii) Layers below the level of the bituminous connection shall be replaced and compected.

(iv) The area for bituminous construction shall be tacked or primed with emulsion depending upon whether the lower area is bituminous or granular in nature. The side, however, are to be painted with hot tack coat material using the brush.

(v) The mixture to be used in bituminous patching shall be either a hot mix or a cold mix.

(vi) The bituminous mixture shall be placed in layers of thickness not more than 100 mm (loose) and shall be compacted in layers with roller/plate compactor/hand roller/rammer to the compaction as per specification.

(vii) While placing the final layer, the mix shall be spread slightly proud of the surface so that after rolling, the surface shall be flush with the adjoining surface.

(viii) If the area is large, the spreading and levelling shall be done using hand shovels and wooden straight edges.

5 **Cement Concrete Road (Repair of Joint Grooves with Epoxy Mortar or Epoxy Concrete)**

(i) The work shall consist of repair of spalled joint grooves of contraction joints, longitudinal joints and expansion joints is a concrete pavement using epoxy mortar or exposy concrete.

(ii) Spalled or broken edges shall be shaped neatly with a vertical cut in the shape of rectangle. The depth of the cut shall be the minimum to effect repair. After shaping the spalled area, it shall be cleaned and primed.

(iii) The epoxy mortar/concrete is then applied using hand tools like trowels, straight edges, brushes etc.

(iv) The repaired edge shall be in line with the joint groove and shall be flush with the concrete slabs.

(v) The epoxy mixes set in 2-3 hours time, it is desirable to divert the traffic for 12 hours.

6 Crack filling

(i) Crack filling shall be carried out using a binder of a suitable viscosity, normally a slow-curing bitumen emulsion.

(ii) For wider cracks, in excess of an average of 3 mm in width the application of emulsion may be preceded by an application of crusher dust.

(iii) If dust is to be used it shall be place in the cracks before the application of binder and the cracks filled to a level approximately 5 mm below road surface level.

(Refer MORTH Specifications for details)

CHAPTER-10			
MAINTENANCE OF ROADS			
Item No.	**Descriptions**	**Unit**	**Rate (in Rs.)**
10.1	Pot-hole repair of existing bituminous roads with hot-mix bituminous material (Bitumen content 4% by weight of total mix) and aggregates conforming to specification to clause no. 507 or as required by site condition, including cleaning of surface, cutting edges of pot-hole or patches vertically in rectangular or square shape, and compaction by means of rollers or Vibrating Compactor /Impact Tampers, excluding tack coat.	MT	2423.00
10.2	Patch repairs or profile correction by paver of existing bituminous roads with hot-mix bituminous material (Bitumen content 4% by weight of total mix) and aggregates conforming to clause no. 508 or as required by site condition, including cleaning of surface, cutting edges of patches vertically in rectangular or square shape, and compaction by means of rollers excluding tack coat.	MT	2540.00
10.3	**Crack Filling** (Filling of crack using slow - setting bitumen emulsion and applying crusher dust in case crack are wider than 3mm, as per relevant clauses of section-3000.	meter	3.00
10.4	**Dusting** Applying crusher dust to areas of road where bleeding of excess bitumen has occurred, as per relevant clauses of section-3000.	sqm	8.00
10.5	**Reseding of old Joints by Sealant** (Removal of existing sealant and re sealing of contraction, longitudinal or expansion joints in concrete pavement with fresh sealant material, as per relevant clauses of section-3000.	meter	30.00
10.6	**Repair of joint Grooves with Epoxy Mortar** Repair of spalled joint grooves of contraction joints, longitudinal joints and expansion joints in concrete pavements using epoxy mortar or epoxy concrete, as per relevant clauses of section-3000.	meter	1470.00

CHAPTER- 11
HORTICULTURE & LANDSCAPING

Notes :-

1 In case where unsuitable soil is met with, it shall be either removed or replaced with good earth.

2 Weeds or other vegetation which appear on the ground are to be uprooted and removed and disposed off.

3 Generally the depth of trenching is 30cm for grassing in good soil.

4 The trenched ground shall, after rough dress, be flooded with water by making small kiaries to enable the soil to settle down.

5 Trenching shall consist of the following operations

(i) The whole plot shall be divided into narrow rectangular strips of about 1.5 m width.

(ii) These strips shall be sub-divided lengthwise into about 1m long sections.

(iii) Such sections shall be excavated serially and excavated soil deposited in the adjacent section preceding it.

(iv) In excavating and depositing care shall be taken that the top soil with all previous plant growth including roots, get buried in the bottom layer of trenched area, the dead plants so buried incidentally being formed into humus.

(v) The excavated soil shall be straight away dumped into the adjoining sections so that double handling otherwise involved in dumping the excvated stuff outside and in back filling in the trenches with leads is practically eliminated.

6 GRASSING

(i) The soil shall be suitably moistened and then the operation of planting grass shall be commenced.

(ii) Dead grass and weeded shall not be planted.

(iii) Watering of the lawn shall be done for 30days.

7 **RENOVATION OF LAWNS**

The area shall be first weeded out of all undersirable growth. The entire grass shall be scrapped (cheeled) without damaging roots and level of the grounds. Slight irregularities in surface shall be levelled off and the area shall then be forked so as to aerate the roots of the grass without, however up-rooting them.

8 **DIGGING HOLES FOR PLANTING TREES**

(i) Holes of circular shape in ordinary soil shall be excavated to the dimensions described in the items and excavated soil broken to clods of size not exceeding 75mm shall be stacked outside the hole, stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth met with during excavation shall be separated out and unserviceable material shall be removed. Useful material, if any, shall be stacked properly and separately. Good earth in quantities as required to replace such discarded stuff shall be brought and stacked at site by the contractor which shall be paid for separately.

(ii) The tree holes shall be manured at the specified rate shall be uniformly mixed with the excavated soil in the specified proportion, the mixture shall be filled in to the hole up to the level of adjoining ground and then watered and enable the soil to subside the refilled soil.

(iii) Where holes are dug in (a) Hard soil (b) Ordinary rock or (c) Hard rock, the above soils occuring independently over in conjunction with each other and /or ordinary soil in any hole, the different excavated soil shall be stacked separately.

(iv) Sufficient quantity of good soil to replace the solid volume of stones, brick bats, unsuitable earth and other rubbish, all roots and other undesirable growth, ordinary and hard stacks shall be brought and stacked at site but the supply and stacking of such shall be paid for separately.

9 Rates :-

The rate include the cost of all the labour and material required for the completion of items.

CHAPTER-11
HORTICULTURE & LANDSCAPING

Item No.	Description	Unit	Rate (in Rs)
11.1	Planting permanent hedges including digging of trenches, 60 cm wide and 45 cm deep, refilling the excavated earth mixed with compost/manure, (compost/manure will be paid separately) and supplying and planting hedge plants (lemon, doranta, Red ive, clerodendron, pedilanthus etc at 30 cm apart including watering and maintenance for 3 months) .	Meter	247.00
11.2	Planting of Trees and their Maintenance for one Year (Planting of trees by the road side (Avenue trees) in 0.60 m dia holes, 1 m deep dug in the ground, mixing the soil with decayed farm yard/sludge mannure, planting the saplings, backfilling the trench, watering, fixing the tree guard and maintaining the plants for one year)	Each	724.00
11.3	Edging with 2nd class bricks laid dry length wise including excavation, refilling, consolidating with hand packing and spreading surplus earth within a lead of 50 m.	Meter	32.00
11.4	Supplying, stacking and spreading of good earth for plantation at site including royalty and carriage (earth measured in stacks will be reduced by 20% for payment.	Cum	292.00
11.5	Supplying and stacking sludge at site including royalty and carriage up to 1 km (sludge measured in stacks will be reduced by 8% for payment).	cum	213.00
11.6	Supplying, stacking and spreading compost/manure from approved source, (manure measured in stacks will be reduced by 8% for payment)	Cum	207.00
11.7	Mixing & spreading earth and manure in proportion as specified or directed.	Cum	15.00
11.8	Uprooting rank vegetation and weeds by digging the area to a depth of 30 cm removing all weeds and other growth with roots by forking repeatedly, breaking clods, rough dressing, flooding with water, uprooting fresh growths after 10 to 15 days and then fine dressing for planting new grass, including disposal of all rubbish with all leads and lifts.	sqm	26.00
11.9	Grassing with 'Doob' grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing.**(if needed good earth shall be paid separately).**		
11.9.1	In rows 15 cm apart in either direction.	100 sqm	5725.00
11.9.2	In rows 7.5 cm apart in either direction.	100 sqm	5981.00
11.9.3	In rows 5 cm apart in either direction.	100 sqm	6243.00

Item No.	Description	Unit	Rate (in Rs)
11.10	Providing and laying Selected type of Grass turf with earth 50mm to 60mm thickness on existing ground prepared with proper level and ramming with required tools wooden and than rolling the surface with light roller, making the surface smoothen and light watering the same, as per direction of Engineer-in-Charge.	sqm	99.00
11.11	Providing and Laying Mexican/Zyosia carpet grass Turf with earth 50mm to 60mm thickness on existing ground prepared with proper level and ramming with tools wooden (Durmuth) and then rolling the surface with light roller make the surface smoothen and light watering with sprinkler and maintenance for 30 days or more till the grass establishes properly, as per direction of Engineer-in-Charge.	Sqm	310.00
11.12	Digging holes in ordinary soil and refilling the same with the excavated earth mixed with manure or sludge in the ratio of 2:1 by volume (2 parts of stacked volume of earth after reduction by 20% : 1 part of stacked volume of manure after reduction by 8%) flooding with water, dressing including removal of rubbish and surplus earth, if any with all leads and lifts (cost of manure, sludge or extra good earth if needed to be paid for separately) :		
11.12.1	Holes 120 cm dia and 120 cm deep.	Each	141.00
11.12.2	Holes 60 cm dia and 60 cm deep.	Each	61.00
11.12.3	Holes 45 cm dia, and 45 cm deep.	Each	19.00
11.12.4	Holes 30 cm dia, and 30 cm deep.	Each	9.00
11.13	Providing and planting different variety of plants of approved quality and sizes as mentioned including making pits of required size at site, refilled with B.C. Soil mixture manuring and pesticide etc. complete (to be paid separately) including watering and 90 days maintenance from the date of final bill as per direction of Engineer-in-Charge complete in all respect (B.C. Mixture paid separately).		

Item No.	Description	Unit	Rate (in Rs)
11.13.1	Shrubs :-		
	Bahunia Tomentosa, Beloperone Species, Caselpinnia Pulcherima, Bird of Paradise, Callandra Emarginata, Callandra Hybrida, Cassia Bi flora, Cassia Laevigata, Cestrum Nocturnum, Dombeya Mastersii, Euphorbia Caracasana, Euphorbia Pulcherima, Excorea bi color, Excorea tri color, Ficuas Blackii, Ficus Reginold, Ficus Panda, Gardenia, Gulphinia, Jasminoides, Hamelia Pattens, Heliconia, Hibiscus Rosasinensis, Hibiscus Verigated, Hibiscus Viceroy, Jatropha Multifida, Largestomia Indica, Malpighia Coccigera, Murraya Exotica, Murraya Koeniggi, Murraya Sambucum, Mussaenda Erythrophylla, Nerium Oleander, Nyctanthus Arbortristis, Plumbego Capensis, Putranjeeva Roxburghii, Tabernaemontana Coronaria, Tabernaemontana Divaricata, Tecoma Gaudi Chaudi, Tecoma Stans, Thevetia Nerifolia, Thuja Compacta and equivalent plants.	Each	80.00
11.13.2	Creeper plants (height:30cm to 45 cm)		
	Allamanda Cathartica, Allamanda Grandiflora, Allamanda Violacea, Begnonia Venustha, Boughan Villas (Variety : Butiana, Lady Mary Bearing, Mahaara, Mohan, Scarlet Queen Variagata, Glabra Formosa, Peruviana Odissi, Partha, Shubhra, Thimma, Spectabillis, L.N. Birla, Refulgens), Clerodendrum Splendens, Clerodendrum Thompsonae, Ipomea Purpurea, Jasminum Grandiflorum, Jasminum Humile (Yellow), Passiflora Caerulea (Rakhi Bel), Petrea Volubilis, Quis Qualis Indica, Tecoma Grandiflora, Veronia Elaegnifolia (Curtain Creeper), Mandvellia, Garlic Creeper, Callimitis	Each	50.00
11.13.3	Ground cover plants height: 30cm-45cm		
	Alpinia Verigated, Alternanthera species, Aspyragus Myerri, Aspyragus Springenii, Aspidistra, Canna (regular, Dwarf), Chlorodendron Inermii, Chlorophytum (Green), Chlorophytum verigated, Coffea Chinensis, Dianella Verigated, Durranta (Goldiana, Green, Verigated), Euphorbia Milli hybrid, Ipomea (Golden leaves), Iresine herbstii, Juniper Prostata, Juniper Africana, Ophiopogon plant, Ophiopogon jaburan, Portulacaria Afra (jade Plant), Schefflera Green, Schefflera verigated, Setcreasea Purpurea, Syngonium (Butterfly) species, Syngonium miniature, Syngonium Dwarf, Syngonium variegated, Tradescantia, Wadelia Trilobata, Zebrina Tradescantia, Pendanas, Spider Lily Black, Spider Lily verigated, Aclypha (Red, Green,Mini), Lantana (Red, Yellow, Purple, White, verigated), Haemalia Mini and similar plants.	Each	50.00
11.13.4	Winter seasonal height: 20-30 cm		
	Any of one from Alyssum, Anemone, Antirrhinium Hybrid, Aster Hybrid, Begonia and its different varieties, Calendula, Carnation,Coleus, Daisy, Dianthus, Fressia, Gazania, Impatiens, Kalanchoe, Marigold Inca, Missam branthemum, Nemasia, Nasturitium, Ornamental Kale, Pansy Hybrid Sakata, Petunia Hybrids such as Bravo, Star and Picotee, Salvia, Stock, Stock, Verbena	Each	42.00
11.13.5	Summer and rainy seasonal plants		

Item No.	Description	Unit	Rate (in Rs)
	Any of one from Celosia, Caladium Hybrid, Cockscomb, Cosmos, Gaillardia, Gomphorena, Kochchea, Portulacca, Sunflower Hybrid, Sunflower Single, Tapiocca Variegated (Manihot Esculenta), Vinca, Zinnia Hybrids.	Each	42.00
11.13.6	Rose Budded of H.T variety and miniature Roses. height: 30cm & above	Each	170.00
11.13.7	Plant Creeper Rose Varieties	Each	212.00
11.13.8	Standard Roses H.T. Variety	Each	382.00
11.14	Transplantation of trees including trimming the branches of full grown trees as per the requirement, giving the wax treatment of the trimmed area of branches, uprooting the tree and transporting the uprooted tree to the specified site of the transplantation as directed by the engineer-in-charge upto 12 km lead including all lifts, transplanting the uprooted tree by digging a required size of pit, filling it with fresh garden soil and manure as per the requirement and maintaing it for a period of 4 months by watering, weeding, manuring etc complete.		
	A) Trees having trunk girth upto 1.0 metre	each	4241.00
	B) Trees having trunk girth more than 1.0 metre upto 1.5 meter	each	6362.00
	C) Trees having trunk girth more than 1.5 mt upto 2.0 metre	each	8483.00
	D) Trees having trunk girth more than 2.0 metre	each	10178.00
	Note 60% of the above rates will be paid after the transplantation and balance 40% shall be paid after the expiry of maintenance period i.e. 4 months. Balance 40% shall not be payable if the tree doesn't survive after the maintenance period		
11.15	Providing & fixing tree guard of specified size with Angle Iron/ Flats and welded mesh or chainlink mesh as per approved design by Engineer in charge including applying approved steel primer.		
11.15.1	Steel work in built up section for construction of tree guard	Kg	67.00
11.15.2	Providing and fixing welded steel square / rectangular mesh of required size & applying a priming coat of approved steel primer.	Kg	85.00
11.15.3	Providing and fixing G.I. chain link mesh of required size made of G.I. wire including strengthening with 2mm dia wire or nuts, bolts & washers as required complete.	Kg	98.00
11.16	Providing and fixing of White Marbles circular/oval in shape (stone) pebbles of size 2"to 2.50" dia in natural colour at site of work including loading, unloading, carriage with all taxes paid etc. and as per direction of Engineer-in-Charge.	kg	22.00
11.17	Providing and fixing of 3 seater stone bench made of 75mm thick stone slab finished by different numbers of ambry stone and two coats of 124 no sealer coat to prevent from weather including fixing on a pedestal (cost of pedestal to be paid separately)etc. complete as per direction of engineer in charge. Size: length 1500mm, width 600mm, legs height 500 mm, back support height 500mm.	Each	9700.00

Item No.	Description	Unit	Rate (in Rs)
11.18	Providing and fixing of stone table made of 75mm thick stone slab finished by different numbers of ambry stone and two coats of 124 no sealer coat to prevent from weather including fixing on a pedestal (cost of pedestal to be paid separately)etc. complete as per direction of engineer in charge. Size: length 1000mm, width 600mm, legs height 750 mm.	Each	7900.00

CHAPTER- 12
FOUNDATIONS

Notes :-

1 For classification of strata in excavation, refer notes given in chapter 3

2 Excavation shall be taken to the width of the lowest step of the footing and the sides shall be left plumb where the nature of soil allows it. Where the nature of soil or the depth of, the trench and season of the year do not permit vertical sides, necessary steps shall be taken for shoring strutting and planking or cut slopes to a safer angle or both with due regard to the safety of personnel and works.

3 Propping shall be 'undertaken when any foundations or stressed zone from an adjoining structure is within a line of 1 vertical to 2 horizontal from the bottom of the excavation.

4 Open Foundation shall be constucted in dry condition and the contractor shall provide for dewatering arrangement to the satisfaction of the engineer.

Where water is met with in excavation due to springs, seepage, or by other reasons, steps shall be taken for bailing/pumping out water, construction of diversion channels, bunds, cofferdams and other necessary works and be made as watertight as is necessary for facilitating construction to be carried out inside them.

If it is determinted beforehand that the foundations cannot be laid dry or the situation is found that the percolation is too heavy for keeping the foundation dry, the foundation concrete shall be laid under water by tremie pipe only. In case of flowing water or artesian springs, the flow shall be stopped or reduced as far as possible at the time of concreting.

5 Pile Foundation :-

(i) The complete sub-surface investigation of strata in which pile foundations are proposed shall be carried out in advance.

(ii) When foundation piles are used, the excavation of each pit shall be substantially completed before beginning pile-driving operations therein. After pile driving operations in a given pit are completed, all loose and displaced materials therein shall be removed to the elevation of the bottom of the footings.

(iii) The placing of concrete shall be continuous from the toe level to the top of the pile. To prevent segregation a tube or termie pipe as appropriate shall be used to place concrete in all piles.

(iv) To ensure compaction by hydraulic static heads, rate of placing concrete in the pile shaft shall not be less than 6 m (length of pile) per hour.

(v) Pile Caps shall be of reinforced concrete. A minimum offset of 150 mm shall be provided beyond the outer faces of the outer most piles in the group. If the pile cap is in contact with earth at the bottom, a levelling course of minimum 150 mm thickness of M 15 nominal mix concrete shall be provided.

(vi) A temporary bench mark shall also be established near the foundation, away from the zones of blow-ups or possible settlement. The bench mark shall be checked regularly with respect to the permanent bench mark established at the bridge site.

6 **MEASUREMENT OF PILE FOUNDATION**

Dimension shall be measured nearest to a cm. Measurement of length on completion shall be along the axis of pile and shall be measured from top of shoe to the bottom of pile cap.

7 The rate include the cost of all the labour and material required for the completion of items.

(Refer MoRTH Specifications for details)

CHAPTER-12
FOUNDATIONS

Item No.	Descriptions	Unit	Rate (in Rs.)
12.1	Earth work in excavation of foundation of structures with all lifts & lead upto 1000 meters 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 as per relevant clauses of section 300 & 2100 in.		
I	Soil		
A	By Manual Means		
i)	upto 3 m depth	cum	181.00
ii)	3 m to 6 m depth	cum	214.00
iii)	Above 6 m depth	cum	278.00
B	By Mechanical means Means		
i)	upto 3 m depth	cum	52.00
ii)	3 m to 6 m depth	cum	59.00
iii)	Above 6 m depth	cum	73.00
II	Ordinary rock		
A	By Manual Means		
i)	upto 3 m depth	cum	264.00
ii)	3 m to 6 m depth	cum	329.00
iii)	Above 6 m depth	cum	492.00
B	By Mechanical means		
i)	upto 3 m depth	cum	96.00
ii)	3 m to 6 m depth	cum	104.00
iii)	Above 6 m depth	cum	142.00
III	Hard Rock (requiring Blasting)	Cum	659.00
IV	Hard Rock (Blasting Prohibited)	Cum	780.00
V	Extra rates for quantities of Excavation, executed in/or under water, including pumping out water as required .(The extra percentage rate is applicable in respect of each item but limited to quantities of work executed in these difficult conditions).	Cum	20% of the rate of the item.
12.2	Providing & laying levelling course/annular filling in PCC M-15 nominal mix in foundation as per relevant clauses of section 1500, 1700 and 2100.	cum	4299.00
12.3	Providing Brick masonry in cement mortar 1:3 (1cement :3 sand) with well burnt chimney bricks (crushing strength not less than 40kg /sqcm and water absorption not more than 15%) in foundation complete excluding pointing and plastering, as per drawing and technical specifications and as per relevant clauses of sections 1300.	cum	5140.00
12.4	Providing Stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification and as per relevant clauses of sections 1400 with .		
a)	Coursed rubble masonry(first sort)	cum	3836.00

Item No.	Descriptions	Unit	Rate (in Rs.)
b)	Random Rubble Masonry	cum	3783.00
12.5	Providing and laying Plain/Reinforced cement concrete in open foundation including form work shuttering etc. complete as per drawing and technical specifications and as per relevant clauses of sections 1500, 1700 & 2100 with .		
a)	PCC Grade M15	cum	4744.00
b)	PCC Grade M20	cum	5250.00
c)	PCC Grade M25	cum	5271.00
d)	PCC Grade M30	cum	5326.00
e)	RCC Grade M20	cum	5267.00
f)	RCC Grade M25	cum	5288.00
g)	RCC Grade M30	cum	5342.00
h)	RCC Grade M35	cum	5370.00
12.6	Providing and laying cutting edge of mild steel (weighing 40 kg per meter minimum) for well foundation complete as per drawing and technical specification and as per relevant clauses of sections 1200 & 1900.	tonne	74617.00
12.7	Providing and laying Plain/Reinforced cement concrete in well foundation complete as per drawing and technical specification and as per relevant clauses of sections 1200, 1500 & 1700 for		
A	Well curb		
i)	RCC M20 Grade	cum	5825.00
ii)	RCC M25 Grade	cum	5862.00
iii)	RCC M35 Grade	cum	5996.00
B	Well steining		
i)	PCC M15 Grade	cum	4810.00
ii)	PCC M20 Grade	cum	5323.00
iii)	PCC M25 Grade	cum	5357.00
iv)	PCC M30 Grade	cum	5426.00
v)	RCC M20 Grade	cum	5340.00
vi)	RCC M25 Grade	cum	5374.00
vii)	RCC M30 Grade	cum	5442.00
viii)	RCC M35 Grade	cum	5496.00
C	Bottom Plug		
i)	PCC Grade M20	cum	5456.00
ii)	PCC Grade M25	cum	5682.00
iii)	PCC Grade M30	cum	5723.00
iv)	PCC Grade M35	cum	5818.00
D	Intermediate plug		
I)	PCC Grade M20	cum	5001.00
ii)	PCC Grade M25	cum	5208.00
iii)	PCC Grade M30	cum	5245.00
E	Top plug		
i)	PCC Grade M15	cum	4372.00
ii)	PCC Grade M20 PCC	cum	4839.00
iii)	PCC Grade M25	cum	4870.00

Item No.	Descriptions	Unit	Rate (in Rs.)
iv)	PCC Grade M30	cum	4932.00
F	Well cap		
i)	RCC Grade M20	cum	4838.00
ii)	RCC Grade M25	cum	5243.00
iii)	RCC Grade M30	cum	5253.00
12.8	Sinking well for foundation to levels as per drawing including dredging, dewatering and drop chiselling as may be necessary, including sinking by loading with necessary kentledges and other usual means for the type of work i/c all the needed plant and machinery etc. complete as directed and removal of boulders or tree trunks etc. complete as per drawing and technical specifications. (Note : Depth of sinking shall be reckoned from bed level)		
A	Sandy soil		
i)	upto 3.0 m. depth	cum	267.00
ii)	Beyond 3m upto 10m depth	cum	384.00
iii)	Beyond 10m upto 20m depth		
	Add for every additional meter depth of sinking over the rate of sinking for the previous meter.	cum	507.00
iv)	Beyond 20m upto 30 m		
(a)	Add for every additional meter depth of sinking over the rate of sinking for the previous meter	cum	951.00
(b)	Add cost for Kentledge including supports,loading arrangement and Labour.	cum	1141.00
(v)	Beyond 30 m upto 40 m		
(a)	Add for every additional meter depth of sinking over the rate of sinking for the previous meter	cum	2259.00
(b)	Add cost for Kentledge including supports,loading arrangement and Labour.	cum	2711.00
B	In clayey soil		
i)	upto 3.0 m. depth	cum	388.00
ii)	Beyond 3m upto 10m depth	cum	809.00
iii)	Beyond 10m upto 20m depth		
(a)	Add for every additional meter depth of sinking over the rate of sinking for the previous meter.	cum	1069.00
(b)	Add for dewatering, if required.	cum	1122.00
iv)	Beyond 20m upto 30 m		
(a)	Add for every additional meter depth of sinking over the rate of sinking for the previous meter.	cum	2005.00
(b)	Add for dewatering, if required	cum	2632.00
(c)	Add for Kentledge including supports, loading arrangement and Labour	cum	2507.00
(v)	Beyond 30m upto 40 m		
(a)	Add for every additional meter depth of sinking over the rate of sinking for the previous meter.	cum	4765.00
(b)	Add for dewatering, if required	cum	6003.00
(c)	Add for Kentledge including supports, loading arrangement and Labour	cum	5717.00
C	Soft Rock		
(i)	Depth of Soft Rock strata upto 3m	cum	967.00

Item No.	Descriptions	Unit	Rate (in Rs.)
D	Hard Rock		
(i)	Depth of Soft Rock strata upto 3m	cum	973.00
12.9	Sand filling in wells complete as per drawing and technical specifications as per clause 1209.	cum	1539.00
12.10	Providing steel liner 10 mm thick for curbs and 6mm thick for steining of wells including fabricating and setting out as per detailed drawing and specifications as per sections 1200 and 1900.	tonne	68369.00
12.11	Providing bored cast-in-situ M-35 grade R.C.C. pile (750 mm dia.) excluding reinforcement complete as per drawing and technical specifications and removal of excavated earth with all lifts and lead upto 1000 m. and as per specifications 1100, 1600 and 1700.	meter	6130.00
12.12	Providing bored cast-in-situ M-35 grade R.C.C. pile (1000 mm dia.) excluding reinforcement complete as per drawing and technical specifications and removal of excavated earth with all lifts and lead upto 1000 m and as per specifications 1100, 1600 and 1700.	meter	9985.00
12.13	Providing bored cast-in-situ M-35 grade R.C.C. pile (1200 mm dia.) excluding reinforcement complete as per drawing and technical specifications and removal of excavated earth with all lifts and lead upto 1000 m. and as per specifications 1100, 1600 and 1700.	meter	12685.00
12.14	Providing driven cast-in-place vertical M-35 grade R.C.C. pile (750mm dia.) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	5676.00
12.15	Providing driven cast-in-place vertical M-35 grade R.C.C. piles (1000 mm dia.) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	8291.00
12.16	Providing driven cast-in-place vertical M-35 grade R.C.C. piles (1200 mm dia.) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	10842.00
12.17	Providing driven precast vertical M-35 grade R.C.C. piles (500 mm dia.) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	4550.00
12.18	Providing driven precast vertical M-35 grade R.C.C. piles (750mm dia) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	5272.00
12.19	Providing driven precast vertical M-35 grade R.C.C. piles (1000 mm dia.) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	8529.00

Item No.	Descriptions	Unit	Rate (in Rs.)
12.20	Providing driven precast vertical M-35 grade R.C.C. piles (300 mm x 300 mm) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	4185.00
12.21	Providing driven precast vertical M-35 grade R.C.C. piles (500 mm x 500 mm) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	4522.00
12.22	Providing driven precast vertical M-35 grade R.C.C. piles (750 mm x 750 mm) excluding reinforcement complete as per drawing and & Technical Specification and as per specifications 1100, 1600 and 1700.	meter	6260.00
12.23	Provdiing and laying Cement concrete for reinforced concrete in pile cap complete as per drawing and Technical Specification and as per relevant clauses of sections 1100, 1500 & 1700 with		
(a)	RCC Grade M25	cum	5246.00
(b)	RCC Grade M30	cum	5296.00
(c)	RCC Grade M35	cum	5399.00
12.24	Supplying, fitting and placing HYSD bar reinforcement in foundation complete as per drawing and technical specifications and as per relevant clauses of sections 1600.	tonne	59947.00
12.25	Supplying, fitting and placing Mild steel reinforcement in foundation complete as per drawing and technical specification and as per relevant clauses of sections 1600.	tonne	57698.00
12.26	Taking exploratory boring 100 mm dia at the locations of pier and abutments or for high embankments in approaches in all type of strata as per IRC 78_1983 and section 2400 of specifications.		
	A) Upto 1.0 m below bed level	meter	2450.00
	B)Beyond 1.0 m depth upto 5.0 m	meter	2562.00
	B) Beyond 5.0 mt depth	meter	2673.00
12.27	Providing and laying 1.5 m deep in rock and 1.5 m above rock 25mm dia tor steel dowel bar in foundation including drilling 65mm dia bore hole in rock necessary bending, hooking tying reinforcement in position and grouting etc. complete as per drawing and specifications.	each	963.00

CHAPTER- 13
SUB STRUCTURE

Notes :-

1 Mortar shall be mixed (by mechanical mixer/hand mixing) only in such quantity as required for immediate use.
The mix which has developed initial set shall not be used. Initial sething of mortar with ordinary Portland Cement shall normally occurs in 30 minutes after mixing.

Mortar unused to for more than 30 minutes shall be rejected and removed from site of work.
In case the mortar has stiffened during initial setting time because of evaporation of water, the same can be re-tempered by adding water as frequently to restore the rquisite consistency, but this re-tempering shall not be permitted after 30 minutes.

2 Bricks shall be throughly soaked in a tank filled with water for a minimum one hour prior to being laid. Soaked bricks shall be removed from the tank sufficiently in advance so that they are skin dry at the time of actual laying.

3 Thickness of Brick Masonry Joints shall not exceed 10mm. All joints on exposed faces shall be tooled to give concave finish.

4 Brick masonry shall be kept constantly moist on all faces for a minimum period of seven days.

5 Pointing shall be carried out using mortar not leaner than 1:3 by volume of cement and sand or as shown on the drawing. The mortar shall be filled and pressed into the raked joints before giving the required finish.

6 Plastering shall be done where shown on the drawing. Superficial plastering may be done, if necessary, only in structures situated in fast flowing rivers or in severely aggressive environment.

7 Plastering shall be started from top and worked down. All putlog holes shall be properly filled in advance of the plastering while the scaffoleding is being taken down.

8 Curing shall be commenced as soon as the mortar used for finishing has hardened sufficiently not to be damaged during curing. It shall be kept wet for a period of at least 7 days.

9 In Course Rubble Masonary The face stones shall be hammer dressed on all beds and joints so as to give them rectangular shape. These shall be square on all joints and beds. The bed joints shall be chisel drafted for at least 80 mm back from the face and for at least 40 mm for the side joints. Hearting stones in the hearting or interior filling of the wall face shall consist of flat bedded stone carefully laid, on prepared beds in mortar. The use of chips shall be restricted to the filling of interstices between the adjacent stones in hearting and these shall not exceed 10 per cent of the quantity of masonry. While using chips it shall be ensured that no hollow spaces are left anywhere in the masonry.

10 Random Masonry Hearting or interiror filling of the wall face shall consist of rubble stones not less than 150 mm in any direction,carefully laid,hammered down with a wooden mallet into position and solidly bedded in mortar. The hearting should be laid neatly level with facing and backing.

11 Bond stones shall be the same as for radom rubble masonry, but these, shall be provided at 1.5 meter to 1.8 meter apart clear in every course. All joints shall be full or mortar. These shall not be less than 3 mm thick. Face joints shall be uniform throughout, and a uniform recess of 20 mm depth from face shall be left with the help of a stone plate during the progress of work.

12 The steel used for reinforcement shall be any of the following types:
(i) Mild steel and medium tensile bars conforming to IS 432 (Part 1)
(ii) High strength deformed steel bars conforming to IS 1786

13 Bearing
(i) Bearing plates, bars, rockers, assemblies and other expansion or fixed devices shall be constructed in accordance with the details shown on the drawings.
(ii) The Contractor shall exercise the utmost care in setting and fixing all bearings in their correct positions and ensuring that uniformity is obtained on all bearings surfaces.

(iii) It shall be ensured that the bearings are set truly in level and in exact position as indicated on the drawings so as to have full and even bearing on the seats. Thin mortar pads (not exceeding 12 mm) may be made to meet with this requirement.

(iv) It shall be ensured that the bottoms of girders to be received on the bearings are plane at the locations of these bearings and care shall be taken that the bearings are not displaced while placing the girders.
(v) Eleastomeric Bearings
The term "bearing" in this case refers to an elastomeric bearing consisting of one or more internal layers of elastomer bonded to internal steel laminates by the process of vulcanisation. The bearing shall cater for translation and/or rotation of the superstructure by elastic deformation.
(vi) Cerification of Marking
Bearings shall be transported to bridge site shall be accompanied by an authenticated copy of the certificate to that effect.
An information card giving the following details for the bearings duly certified by the manufacturer shall also be appended :
Name of manufacturer
Date of manufacture
Elastomer grade used
Bearing dimensions
Production batch no.
Acceptance lot no.
Date of testing

(vii) Installation of POT-cum-PTFE Bearings
(a) Care shall be taken during installtion of the bearings to permit their correct functioning in accordance with the design scheme.
(b) To privent contamination, dismantling of the bearings at site shall not be done.
(c) The load shall be transferred onto the bearings only when the bedding material has developed sufficient strength. The props for the formwork shall only be removed after lapse of appropriate time. In special cases, this can be ensured by suitable devices like jacks, etc.

(d) Temporary clamps and shims (introduced to maintain working clearance) shall be removed at an appropriate time, before the bearing is required to permit movement.

(e) Permitted installation tolerance of the bearing form plane of sliding shall be maintained.
(f) Cement based non-shrink grout with air releasing additive and epoxy based grout, whichever is specified shall be first tried at the site. For the proprietary grout mixes, appropriate instructions from the manufacturer shall be followed.

14 CULVERT

(i) The bedding surface shall provide a firm foundation of uniform density throughout the length of the culvert, shall conform to the specified levels and grade.
(i) First Class bedding : Under first class bedding, the pipe shall be evenly bedded on a continuous layer of well compacted approved granular material, shaped concentrically to fit the lower part of the pipe exterior for atleast ten per cent of its over height or as otherwise shown on the drawings. The bedding material shall be well graded sand or another granular material passing 5.6 mm sieve suitably compacted/rammed. The compacted thickness of the bedding layer shall be as shown on the drawings and in no case shall it be less than 75 mm.

(ii) First class bedding can be used for maxium height of fill 4 meter.

(iii) Laying of Pipe - Min dia of pipe shall be 1000 mm.
No pipe shall be laid in position until the foundation has been approved by the competent authority. Where two or more pipes are to be laid adjacent to each other, they shall be separated by a distance equal to at least half the diameter of the pipe Longitudinal slopes of pipe should be minimum of 1:1000.

(iv) The pipes shall be jointed either by collar joint or by flush joint.

A Collar joint

(a) In collar joint shall be of RCC 150 to 200 mm wide and having the same strength as the pipes to be jointed

(b) Caulking space shall be between 13 and 20 mm according to the diameter of the pipe.

(c) Caulking material shall be slightly wet mix of cement and sand in the ratio of 1:2 rammed with caulking irons.

(d) Before caulking, the collar shall be so placed that its center coincides with the joint and an even annular space is left between the collar and the pipe.

B Flush Joint

(a) Flush joint may be internal flush joint or external flush joint.

(b) In either case, the ends of the pipes shall be specially shaped to form a self centering joint with a jointing space 13 mm wide.

(c) The jointing space shall be filled with cement mortar, 1 cement to 2 sand, mixed sufficiently dry to remain in position when forced with a trowel or rammer.

(d) Care shall be taken to fill all voids and excess mortar shall be removed.

(vi) All joints shall be made with care so that their interior surface is smooth and consistent with the interior surface of the pipes. After finishing, the joint shall be kept covered and damp for at least four days.

(v) Backfilling

(a) Trenches shall be backfilled immediately after the pipes have been laid and the jointing material has hardened.

(b) The backfill soil shall be clean, free from boulders, large roots, excessive amounts of sods or other vegetable matter, and lumps and shall be approved by the Engineer.

(c) Backfilling upto 300 mm above the top of the pipe shall be carefully done and the soil thoroughly rammed, tamped or vibrated in layers not exceeding 150 mm, particular care being taken to thoroughly consolidate the materials under the haunches of the pipe.

(d) Approved pneumatic or light mechanical tamping equipment can be used.

15 MEASUREMENT

R.C.C. pipe culverts shall be measured along their centre between the inlet and outlet ends in linear meters.

Selected granular material and cement concrete for pipe bedding shall be measured as laid in cubic meters. Ancillary works like headwalls, etc., shall be measured as provided for under the respective sections.

16 The rate include the cost of all the labour and material required for the completion of items.

(Refer MoRTH Specifications for the details)

CHAPTER-13			
SUB-STRUCTURE			
Item No.	**Descriptions**	**Unit**	**Rate (in Rs.)**
13.1	Brick masonry work in 1:3 (1cement :3 sand) with well burnt chimney bricks (crushing strength not less than 40kg /sqcm and water absorption not more than 15%) in sub-structure complete excluding pointing and plastering, as per drawing and technical specifications.	cum	4841.00
13.2	Pointing with cement mortar (1:3) on brick work in substructure as per technical specifications and as per relevant clauses of sections 1300.	sqm	51.00
13.3	Plastering with cement mortar (1:3) on brick work in sub-structure as per Technical specifications.	sqm	106.00
13.4	Stone masonry work in cement mortar 1:3 for substructure complete as per drawing and Technical Specifications and as per relevant clauses of sections 1400 in.		
a)	Coursed rubble masonry (first sort)	cum	3782.00
b)	Random Rubble Masonry	cum	3624.00
13.5	Providing and laying Plain/Reinforced cement concrete in sub-structure as per drawing and technical specifications and as per relevant clauses of sections 1500, 1700 & 2200		
A	PCC Grade M15	cum	4823.00
B	PCC Grade M20	cum	5328.00
C	PCC Grade M25	cum	5362.00
D	PCC Grade M30	cum	5431.00
E	RCC Grade M20	cum	5428.00
F	RCC Grade M25	cum	5462.00
G	RCC Grade M30	cum	5531.00
H	RCC Grade M35	cum	5585.00
13.6	Supplying, fitting and placing HYSD bar reinforcement in sub-structure complete as per drawing and technical specifications and as per relevant clauses of sections 1600.	tonne	60087.00
13.7	Supplying, fitting and placing Mild steel reinforcement complete in sub-structure as per drawing and technical specification and as per relevant clauses of sections 1600.	tonne	57026.00
13.8	Providing weep holes in Brick masonry/Plain/Reinforced concrete abutment, wing wall/return wall with 100 mm dia AC/PVC/HDPE pipe, extending through the full width of the structure with slope of 1V :20H towards drawing foce. Complete as per drawing and Technical specifications and as per clause 2706 of specifications.	meter	173.00
13.9	Providing, laying and compaction Back filling behind abutment, wing wall & return wall with Granular material **(CBR>7)** complete as per drawing and Technical specification and as per appendix 6 of IRC-78	cum	460.00

Item No.	Descriptions	Unit	Rate (in Rs.)
13.10	Providing and laying of Filter media with granular materials/stone crushed aggregates satisfying the requirements laid down in clause 2504.2.2. of MORTH specifications to a thickness of not less than 600 mm with smaller size towards the soil and bigger size towards the wall and provided over the entire surface behind abutment, wing wall and return wall to the full height compacted to a firm condition complete as per drawing and technical specification.	cum	1211.00
13.11	Supplying, fitting and fixing in position true to line and level sliding plate bearing with PTFE surface sliding on stainless steel complete including all accessories as per drawing and Technical Specifications and BS: 5400, section 9.1 & 9.2 (for PTFE) and as per relevant clauses of sections 2000.	per tonne capacity	249.00
13.12	Supplying, fitting and fixing in position true to line and level sliding plate bearing with stainless steel plate sliding on stainless steel plate with mild steel matrix complete including all accessories as per drawing and Technical Specifications and as per relevant clauses of sections 2000.	per tonne capacity	247.00
13.13	Supplying, fitting and fixing in position true to line and level POT-PTFE bearing consisting of a metal piston supported by a disc or unreinforced elastomer confined within a metal cylinder, sealing rings, dust seals, PTFE surface sliding against stainless steel mating surface, completre assembly to be of cast steel/fabricated structural steel, metal and elastomer elements to be as per IRC: 83 part-I & II respectively and other parts conforming to BS: 5400, section 9.1 & 9.2 complete asper drawing and approved technical specifications and as per relevant clauses of sections 2000.	per tonne capacity	137.00
13.14	Supplying, fitting and fixing in position true to line and level elastomeric bearing conforming to IRC: 83 (Part-II) section IX and clause 2005 of MoRTH specifications complete including all accessories as per drawing and Technical Specifications.	cubic centimetre	0.78
13.15	Providing and fixing in position bituminous paper bearing for slabs as per approved drawing and confirming to IS:1398.	Sqm	43.00
13.16	Providing and Laying Reinforced cement concrete pipe (NP4) for culverts in including fixing collar with cement mortar 1:2 excluding excavation bedding, protection works, backfilling, concrete and masonry works in head walls and parapets as per relevant clauses of section-2900.		
(a)	1000 mm dia	meter	7758.00
(b)	1200 mm dia	meter	10644.00
13.17	Providing first class bedding below hume pipes with granular material as per clause 2904 of specifications.	cum	706.00
13.18	Providing concrete craddle bedding in M-15 grade concrete as per clause 2900 and as per section 1700 and 2900.	cum	4744.00

CHAPTER- 14
SUPER -STRUCTURE

Notes :-

1 The expansion joints shall be designed and duly got approved by the Engineer. It shall cater for expected movement and rotation of the structure at the joints and provide smooth riding surface. It shall also be easy for inspection, maintenance and replacement.

2 Expansion joints shall be robust, durable, water-tight and replaceable. Site fabricated expansion joints shall be prohibited. Expansion joints shall be obtained by the Engineer either directly or through the Contractor from approved manufacturers and be of proven type.

3 For bridges with prestressed concrete superstructure, with individual span length more than 20 m or built with innovative design/construction elastomeric expansion joints of slab seal or strip seal type shall be provided.

4 For solid slab type of bridges of spans less than 10 meters continuous surfacing may be provided across the expansion gaps, supported on a 20 mm thick plate placed and fixed at the level of the deck slab.

5 For bridges other than those mentioned in point number 3 above with spans above 10 meters, and alternative specification of sliding steel plate joint or filled joints with copper plates may also be adopted if approved by the Engineer, apart from elastomeric expansion joint of slab seal or strip seal type.

6 Vehicular traffic shall not be allowed over expansion joints after its construction for such period as may be determined by the Engineer.

7 Proprietary type joints offered by the Contractor in lieu of the type specified shall comply in all respects with the manufacturer's specifications and meet the required range of movements and rotations and be fit for the purpose of ensuring satisfactory long term performance in the bridge.

8 Concrete

(a) All concrete shall be invariably mixed in mechanical mixersor to be proposed in batching plant as per the requirement. All concrete except the concrete laid under

(b) Ther rates of both ordinary and controlled concrete of any mix include the cost of preparing and testing concrete cubes as per specification.

(c) All concrete shall be compacted to produes dense and homogeneous mass with the assistance of vibrators unless otherwise permitted by the Engineer-in-charge for exceptional cases, such as concreting under water where, vibrators can not be used.

9 Centring

(a) For super structure only steel form work will be accepted. The thickness of steel plate shall not be less than 3 mm. The form work shall be adequately stiffened by brackets and angles in such a manner that it is free from distoration during handling and vibration of concrete. No extra for form work shall be payable

(b) Centering made up of steel trusses below soffit shall not be supported in recess made in sub-structure. The contractor may provide steel trusses supported on suitably designed bracket, anchored to the pier/pier-cap. Providing safe centering shall be solely contractor's responsibility. The contractor shall remove all bolts, anchors protruding beyond the pier/pier-cap after removal of centering. No extra for centering shall be payable.

10 Expansion joint

Expansion joint shall cater for expected movement and rotaion of the structure at the joint and provide smooth riding surface .It shall also be easy for inspection maintenance and replacement.

(a) Steel plate sliding expansion joint: -

(i) In this type of buried joint, the wearing coat shall be made continuous over the joint. The other alternative shall be to keep a gap in the wearing coat which is filled up with a seal and filler, to be provided in extremely hot areas.

(ii) Materials for steel plates shall conform to section 1900 of MORTH specification for Road and Bridge. The exposed matallic components shall be galvanised or coated with approved anti-corrosive paint. The thickness shall be 20 mm or so for obtaining satisfactory performance.

(iii) Plates shall be placed to the line, grade and expansion gap given in the approved drawing.

(b) Filler joints:-

(b-1) The components of filler joint shall be:-

(i) Minimum 2mm thick corrugated copper plate placed slighty below the wearing coat.
(ii) 20mm thick compressible fiber board to protect the edge.
(iii) 20mm thick pre-moulded joint filler filling the gap upto the level of the wearing coat, sealed with a joint sealing compound.

(b-2) (i)The material used for filling expansion joint shall be bitumen impregnated felt, elastomer or any other suitable material, as per approved drawing.
(ii)The joint filler shall consist of large pieces and assembly of small pieces to make up to the required size shall be avoided.

11 MEASUREMENT

The expansion joint shall be measured in running meters. For filled joints, the rate per running meter shall include the cost of sealant for the depth provided in this drawing.

12 The rate include the cost of all the labour and material required for the completion of items.

(Refer MoRTH Specifications for the details)

CHAPTER-14			
SUPER-STRUCTURE			
Item No.	**Descriptions**	**Unit**	**Rate (In Rs.)**
14.1	Providing and laying Reinforced/Prestressed cement concrete in super-structure as per drawing and Technical Specification and as per relevant clauses of sections 1500, 1700 and 2300 in		
A	RCC Grade M20 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	5573.00
b)	Height beyond 5m and upto 10m	cum	5796.00
c)	Height above 10m	cum	6019.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	5796.00
b)	Height beyond 5m and upto 10m	cum	6019.00
c)	Height above 10m	cum	6242.00
B	RCC Grade M25 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	6023.00
b)	Height beyond 5m and upto 10m	cum	6264.00
c)	Height above 10m	cum	6505.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	6264.00
b)	Height beyond 5m and upto 10m	cum	6505.00
c)	Height above 10m	cum	6746.00
C	RCC Grade M 30 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	6106.00
b)	Height beyond 5m and upto 10m	cum	6351.00
c)	Height above 10m	cum	6595.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	6351.00
b)	Height beyond 5m and upto 10m	cum	6595.00
c)	Height above 10m	cum	6839.00
D	RCC/PSC Grade M35 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	6126.00
b)	Height beyond 5m and upto 10m	cum	6375.00
c)	Height above 10m	cum	6624.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	6375.00
b)	Height beyond 5m and upto 10m	cum	6624.00
c)	Height above 10m	cum	6873.00

Item No.	Descriptions	Unit	Rate (In Rs.)
(iii)	For box girder and balanced cantilever		
a)	Height upto 5m	cum	7122.00
b)	Height beyond 5m and upto 10m	cum	7620.00
c)	Height above 10m	cum	8118.00
E	PSC Grade M-40 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	6590.00
b)	Height beyond 5m and upto 10m	cum	6854.00
c)	Height above 10m	cum	7118.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	6854.00
b)	Height beyond 5m and upto 10m	cum	7118.00
c)	Height above 10m	cum	7381.00
F	PSC Grade M-45 with 20 mm maximum size of aggregate		
(i)	For solid slab/voided slab super-structure		
a)	Height upto 5m	cum	7320.00
b)	Height beyond 5m and upto 10m	cum	7622.00
c)	Height above 10m	cum	7925.00
(ii)	For T-beam & slab including launching of precast girders by launching truss upto 40 m span		
a)	Height upto 5m	cum	7622.00
b)	Height beyond 5m and upto 10m	cum	7925.00
c)	Height above 10m	cum	8277.00
(iii)	For cast-in-situ box girder, segmental construction and balanced cantilever		
a)	Height upto 5m	cum	8530.00
b)	Height beyond 5m and upto 10m	cum	9135.00
c)	Height above 10m	cum	9740.00
G	PSC Grade M-50 with 20 mm maximum size of aggregate		
(i)	For cast-in-situ box girder, segmental construction and balanced cantilever		
a)	Height upto 5m	cum	8704.00
b)	Height beyond 5m and upto 10m	cum	9325.00
c)	Height above 10m	cum	9947.00
H	PSC Grade M- 55 with 20 mm maximum size of aggregate For cast-in-situ box girder, segmental construction and balanced cantilever		
a)	Height upto 5m	cum	9071.00
b)	Height beyond 5m and upto 10m	cum	9719.00
c)	Height above 10m	cum	10366.00
14.2	Supplying, fitting and placing HYSD bar reinforcement in super-structure complete as per drawing and technical specifications..	tonne	61136.00
14.3	Providing High tensile steel wires/strands including all accessories for stressing, stressing operations and grouting complete as per drawing and Technical Specifications.	tonne	96421.0

Item No.	Descriptions	Unit	Rate (In Rs.)
14.4	Providing and laying Cement concrete wearing coat M-30 grade excluding cost of reinforcement complete as per drawing and Technical Specifications and as per relevant clauses of sections 1500, 1700 and Clause 2702 of specifications..	cum	5597.00
14.5	Construction of precast RCC railing of M30 Grade aggregate size not exceeding 12 mm, true to line and grade, tolurence of vertical RCC post not to exceed 1 in 500, centre to centre spacing between vertical post not to exceed 2000 mm, leaving adequate space between vertical post for expansion, complete as per approved drawings and technical specification and as per relevant clauses of sections 1500, 1600, 1700 and clause 2703 of specifications (as per MoRTH standard drawing **SD/202** or **SD/305**)	meter	1629.00
14.6	Construction of RCC railing of M30 Grade in-situ with 12 mm nominal size aggregate, true to line and grade, tolurence of vertical RCC post not to exceed 1 in 500, centre to centre spacing between vertical post not to exceed 2000 mm, leaving adequate space between vertical post for expansion, complete as per approved drawings and technical specifications.	meter	1585.00
14.7	Providing, fitting and fixing mild steel railing complete as per drawing and Technical Specification and as per relevant clauses of section 1900 and 2700.	meter	2685.00
14.8	Providing & fitting 100mm dia Galvanised steel Drainage Spouts complete as per clause 2705 of specifications & as directed by Engineer.	Each	1503.00
14.9	Providing PCC M15 (with 40 mm maximum size of aggregate) Grade leveling course below approach slab complete as per drawing and Technical specification and as per relevant clauses of section 1700.	cum	4391.00
14.10	Providing and laying Reinforced cement concrete approach slab in M-30 grade concrete including formwork excluding cost of reinforcement complete as per drawing and Technical specification.	cum	5310.00
14.11	Providing and laying a burried expansion joint, expansion gap being 20 mm, covered with 12 mm thick, 200 mm wide galvanised weldable structural steel plate as per IS: 2062, placed symmetrical to centre line of the joint, resting freely over the top surface of the deck concrete, welding of 8 mm dia. 100 mm long galvanised nails spaced 300 mm c/c along the centre line of the plate, all as specified in the specifications.	meter	6614.00
14.12	Filler joint		
i)	Providing & fixing 2 mm thick and 200mm wide corrugated copper plate in expansion joint complete as per drawing & Technical Specifications.	meter	3331.00
ii)	Providing & fixing 20 mm thick & 25cm deep compressible fibre board in expansion joint complete as per drawing & Technical Specifications.	meter	285.00

Item No.	Descriptions	Unit	Rate (In Rs.)
iii)	Providing and fixing in position 20 mm thick & 300mm deep 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.	meter	153.00
iv)	Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6% bitumen by weight.	meter	23.00
14.13	Providing and laying of asphaltic plug joint to provide for horizontal movement of 25 mm and vertical movement of 2 mm, depth of joint varying from 75 mm to 100 mm, width varying from 500 mm to 750 mm (in traffic direction), covered with a closure plate of 200mm x 6mm of wieldable structural steel conforming to IS: 2062, asphaltic plug to consist of polymer modified bitumen binder, carefully selected single size aggregate of 12.5 mm nominal size and a heat resistant foam caulking/backer rod, all as per approved drawings and specifications and as per relevant clauses of section 2600.	meter	1109.00
14.14	Providing and laying of compression seal joint consisting of steel armoured nosing at two edges of the joint gap suitably anchored to the deck concrete and a preformed chloroprene elastomer or closed cell foam joint sealer compressed and fixed into the joint gap with special adhesive binder to cater for a horizontal movement upto 40 mm and vertical movement of 3 mm. and as per relevant clauses of specifications.	meter	7452.00
14.15	Providing and laying of an elastomeric slab steel expansion joint, catering to right or skew (less than 20 deg., moderately curved with maximum horizontal movement upto 50 mm, complete as per approved drawings and standard specifications to be installed by the manufacturer/supplier or their authorised representative ensuring compliance to the manufacturer's instructions for installation.	meter	16425.00
14.16	Providing and laying of a strip seal expansion joint catering to maximum horizontal movement upto 70 mm, complete as per approved drawings and standard specifications to be installed by the manufacturer/supplier or their authorised representative ensuring compliance to the manufacturer's instructions for installation.	meter	10370.00
14.17	Providing and laying of a modular strip Box steel expansion joint including anchorage catering to a horizontal movement beyond 70 mm and upto 140mm, complete as per approved drawings and standard specifications to be installed by the manufacturer/supplier or their authorised representative ensuring compliance to the manufacturer's instructions.	meter	15492.00
14.18	Providing and laying of a modular strip box seal expansion joint catering to a horizontal movement beyond 140mm and upto 210mm, complete as per approved drawings and standard specifications to be installed by the manufacturer/supplier or their authorised representative ensuring compliance to the manufacturer's instructions.	meter	16738.00

Item No.	Descriptions	Unit	Rate (In Rs.)
14.19	Testing of span of bridge for deflection due to live load with platforms for loading arrangements, apparatus for measurements including unloading etc complete as per approved drawing and as directed by Engineer.	MT	815.00
14.20	Painting on Kerbs with synthetic Enamel Paints with two coats including one coat of primer in alternate bands including cost of Material and labour complete as per drawing and technical specifications.	Sqm.	54.00
14.21	Providing and applying two coats of water based anticarbonation paint coating to concrete members. Coating must be done over one coat of anticarbonation water based primer/sealer.	Sqm.	120.00
14.22	Providing and applying two coats of solvent based thermoplastic aliphatic anticarbonation paint coating for protection of concrete from carbonation distress. Coating must be applied over one coat of solvent based silane-siloxane primer.	Sqm.	185.00

CHAPTER- 15
RIVER TRAINING AND PROTECTION WORKS

Notes :-

1 Wire crates for gabion structure shall be made from hot dipped galvanized mild steel wire of diameter not less than 4 mm in annealed condition having min. tensile strength of 300 Mpa conforming to IS : 280. The galvanizing coating shall be conforming to IS : 4826.

Wire crates built in-situ, shall not be larger than 7.5 meter x 3 meter x 0.6 meter, nor smaller than 2 meter x 1 meter x 0.3 meter. Sides of large crates shall be securely stayed at intervals of not more than 1.50 meter to prevent bulging.

2 The pitching stone shall be sound, hard, durable and fairly regular in shape. Round boulders shall not be allowed. The stones subject to marked deterioration by water or weather shall not be accepted.

3 The size and weight of pitching stone shall conform to clause 5.3.5.1 of IRC : 89. No stone, weighing less than 40 kg shall be used. The sizes of spalls shall be minimum of 25 mm and shall be suitable to fill the voids in the pitching.

4 MEASUREMENT

(i) The earth work in construction of embankment for guide bund shall be measured in cubic meter unless otherwise specified.

(ii) The boulders/cement concrete blocks and wire crates in apron shall be measured in cubic meter.

(iii) The filter and stone pitching shall be mesured separately in cubic meter unless otherwise specified.

(iv) Rubble stone/cement concrete blocks, flooring and cement concrete bedding shall be measured in cubic meter for each class of material.

5 Rates

The rate include the cost of all the labour and material required for the completion of items.

(Refer MoRTH specifications for the details)

CHAPTER-15			
RIVER TRAINING AND PROTECTION WORKS			
Item No.	**Descriptions**	**Unit**	**Rate (In Rs.)**
15.1	Providing and laying of a gabion structure for retaining earth with segments of wire crates of size upto 7.5 m x 3 m x 0.6 m each divided into 1.5 m compartments by cross netting, made from 4 mm galvanised steel wire @ 32 kg per 10 sqm having minimum tensile strength of 300 Mpa conforming to IS:280 and galvanizing coating conforming to IS:4826, woven into mesh with double twist, mesh size not exceeding 100 x 100 mm, filled with boulders with least dimension of 200 mm, all loose ends to be tied with 4 mm galvanised steel wire) and as per specification in section 2500.	cum	1504.00
15.2	Providing and laying gabion structures for erosion control, river training works and protection works with wire crates of size 2 m x 1 m x 0.3 m each divided into 1m compartments by cross netting, made from 4 mm galvanised steel wire @ 32 kg per 10 sqm having minimum tensile strength of 300 Mpa conforming to IS:280 and galvanizing coating conforming to IS:4826, woven into mesh with double twist, mesh size not exceeding 100 mm x 100 mm, filled with boulders with least dimension of 200 mm, all loose ends to be securely tied with 4 mm galvanised steel wire.) and as per specification in section 2500.	cum	2269.00
15.3	Providing and laying of apron with cement concrete blocks of size 0.5x0.5x0.5 m and made with nominal mix of M-15 grade cement concrete with a minimum cement content of 250 kg/cum as per IRC: 21-2000 and as per relevant clauses of section 2500.	cum	4853.00
15.4	Providing and laying Rubble stone/cement concrete flooring complete as per drawing and Technical specifications laid over cement concrete bedding and as per relevant clauses of section 1400, 1700 & 2500.		
a)	Rubble stone laid in cement mortar 1:3	cum	4352.00
b)	Cement Concrete Grade M15	cum	6711.00
15.5	Providing and laying Pitching on slopes laid over prepared filter media including boulder apron laid dry in front of toe of embankment complete as per drawing and Technical specifications and as per relevant clauses of section 2500.		
a)	Stone/Boulder (min. wt. - 40 Kg)	cum	1400.00
b)	Cement Concrete blocks of size 0.3x0.3 x0.3 m cast in cement concrete of Grade M15	cum	4853.00
15.6	Providing and laying Filter material underneath pitching in slopes complete as per drawing and Technical specification and as per relevant clauses of section 2500.	cum	1372.00
15.7	Providing and Laying of a geotextile filter between pitching and embankment slopes on which pitching to be laid to prevent escape of the embankment material through the voids of the stone pitching/cement concrete blocks as well as to allow free movement of water without creating any uplift head on the pitching and as per relevant clauses of section 700.	sqm	219.00

Item No.	Descriptions	Unit	Rate (In Rs.)
15.8	Providing Curtain wall complete as per drawing and Technical specification and as per relevant clauses of section 1400 , 1700 and 2500.		
a)	Coarsed Rubble Stone masonry in cement mortar (1:3)	cum	4987.00
b)	Cement concrete Grade M15	cum	4282.00

CHAPTER- 16
REPAIR AND REHABILITATION

Notes :-

1 **Sealing of Cracks by inection of Epoxy Resin**

(a) **Material :-**

The material for injection shall be suitable two-component low viscosity epoxy resin, having the required characteristics of bonding with concrete and resistance to moisture penetration. Epoxy mortar or polysulphide resin may be used for sealing the surface.

The material for epoxy injection shall conform to the following:

(i) The resin and hardener shall be mixed by weight and the mixing ratio shall generally be between 1 pbw (parts by weight) to 50 pbw subject to manufacturer's recommendation.

(ii) Neither the mixed epoxy adhesives nor their individual component shall contain solvents and

(iii) The components shall be free of lumps or foreign material. The viscosity of the individual

(iv) Consistency of mixed adhesive shall satisfy the requirements given in Table 2800 -1.

Table 2800-1: Consistency of Adhesive

		Standard Version (cps)	low Viscosity Version (cps)
(i)	Viscosity of Mixed Adhesive at 25°C	(200-300)	(100-190)
(ii)	Pot Life of mixed adhesive at 25°C	1 hour ± 15 minutes *	
(iii)	Set time of mixed adhesive at 25°C	3 - 6 hours	

* In the case of two component injection system where resin and hardener get mixed at point of injection pot life at 25°C shall be not greater than 15 minutes ± 10 minutes.

(b) Surfaces, adjacent to cracks or other areas of application shall be cleaned of dirt, dust, grease, oil efflorescence or other foreign matter by brushing/water jetting/sand blasting. Acids and corrosives shall not be permitted for cleaning.

Entry ports shall be provided along the crack at intervals of not more than the thickness of concrete at the location.

Surface seal material shall be applied to the face of the crack between the entry ports. For through cracks, surface seal shall be applied to both faces.

Before proceeding with the injection, the surface seal material must gain adequate strength with respect to concrete strength of the member/injection pressure.

© Epoxy Injection

Injection of epoxy adhesive shall begin at lowest entry port and continue until there is an appereance of epoxy adhesive at the next entry port adjacent to the entry port being pumped.

When epoxy adhesive travel is indicated by apperance at the next adjacent port, injection shall be discontinued on the entry port being pumped and entry port shall be sealed. Thereafter, epoxy injection shall be transferred to next adjacent port where epoxy adhesive has appeared.

Epoxy adhesive injection shall be performed continuously until cracks are completely filled.

2 **Replacement of Spalled Concrete by Epoxy mortor/ Polymer mortor.**

(i) Epoxy primer coat shall be applied with the help of stiff nylon bristle brushes or hard rubber rollers or spray gun according to the nature of surface and extent of work area.

(ii) Before the primer coat is fully cured, epoxy mortar shall be applied by means of trowels and floats.

(iii) The interval between the application of primer coat and epoxy mortar shall be approximately 15/30 minutes depending upon the ambient temperature.

(iv) Seal Coat shall be applied after 24 hours curing, after mild roughening of the surface of the mortar.

(v) Primer Coat, One kg of resin-hardener mix covers an area of 3-6 square meters per coat depending on the finish of the concrete

(vi) Epoxy Mortar. One square meter of surface requires approximately 20-24 kg of epoxy mortar when laid to a thickness of 10mm.

(vii) Seal Coat. 4 to 6 square meters per kg of mix depending on the temperature of application.

(i) Epoxy Mortar

(a) Material

The epoxy resins for use in the mortar shall be obtained from a reputed manufacturer and shall conform to the following:

Pot Life	60 minutes at 30°C
Bond Strength	12 Mpa
Tensile Strength	16 Mpa

The Contractor/user shall carry out tests on the samples to demonstrate that the above requirements are met.

The sand to be used in the mortar shall be graded quartz sand.

(b) Proportioning and Mixing

The resin and hardener shall be first mixed. Thereafter, dry filler shall be added and again mixed thoroughly. The resultant mix shall be free of lumps of dry filler and shall be of uniform colour. For a total weight of 1 kg or less, the components shall be mixed for 3 minutes in a slow speed (400-600 rpm) mixer. The stirrer shall be moved up and down and along the sides until uniform colour without streaks, is obtained. While stirring, it shall be ensured that excessive amount of air is not entrapped. If no power is available, a flat putty knife may be used to reach into the corners of the can and hand mixing done for at least 5 minutes.

© Surface Preparation

Two general methods of surface preparation shall be followed:

a) Mechanical that includes grinding, grit blasting, water blasting and scarification.

b) Chemical that includes acid etching with 15 percent by weight of hydrochloric solution, followed by repeated flushing with high pressure stream of water.

Contaminants, such as oil, grease, tar, asphalt, paint, wax, curing compounds, surface; impregnants like linseed oil or silicons and laitance, loose material and unsound concrete, shall be removed from the surface on which epoxy mortar is to be placed .

(d) Application

The epoxy primer coat which acts as a bonding agent, shall consist of resin and hardener mixed in the proportions as given by the manufacturer. Epoxy bonding agent shall be applied only on a dry surface and shall not be applied when it rains or in standing water. The overlay, whether epoxy or cement based, shall be done within the pot life of the epoxy primer coat. Epoxy primer coat shall be applied with the help of stiff nylon bristle brushes or hard rubber rollers or spray gun, depending upon the nature of surface and extent of work area. As far as possible, the coating shall be uniformly thick.

Before the primer coat is fully cured, epoxy mortar shall be applied by means of trowels and floats. The interval between the application of primer coal and epoxy mortar shall be approximately 15/30 minutes depending upon the ambient temperature.

Seal coat shall be applied 24 hours after curing and mild roughening of the surface of the mortar.

ii Polymer Mortar

(a) Material

The latex acrylic polymer for use in the polymer modified cementitious mortar (PMC) shall be

Pot Life	60 minutes at 30°C
Compressive strength at 28 days	18.20 N/mm2
Flexural strength at 28 days	3.0 N/mm2 to 5.0 N/mm2
Addition to concrete (slant shear)	3.0 N/mm2 to 5.0 N/mm2

The sand to be used in the mortar shall be graded quartz sand and the sand content shall be in accordance with the desired consistency.

(b) Proportioning and Mixing

A dry mortar of quartz sand and cement (OPC) shall be prepared as per the proportions recommended by the manufacturer. The quantity of polymer shall be measured by measuring jars and shall be added to dry mortar. It shall be mixed with trowel or by hand so that no lumps remain in the mixed mortar.

(c) Surface Preparation

Following general methods of surface preparation shall be followed:

a) Mechanical that includes grinding, grit blasting, water blasting and scarification.

b) Chemical that includes acid etching with 15 percent by weight of hydrochloric solution, followed by repeated flushing with high pressure stream of water

Contaminants, such as oil, grease, tar, asphalt, paint, wax, curing compounds, surface; impregnants like linseed oil or silicons and laitance, loose material and unsound concrete, shall be removed from the surface on which epoxy mortar is to be placed .

(d) Application

The polymer bond coat shall consist of a mix of polymer and cement as per recommendations of manufacturer and shall be applied in the same manner as indicated in Clause 2804.1.4 for epoxy primer coat.

The cement and sand shall be dry mixed and then mixed with liquid polymer, adding the required amount of water in prescribed proportions as per manufacturer's recommendation. The mortar shall be mixed till it attains a smooth consistency. The mix shall be applied over the polymer bond coat by hand and finished by trowel.

3 Cement Grouting

The cement grout shall be mechanically mixed using a system of power-driven paddles of high speed centrifugal pump and pump to be used shall permit close control of pressures to allow a flexible rate of injection with minimum clogging of valves and ports.

A continuous supply of grout is preferable to an intermittent one. Consistency of the grout may be determined by trails strating with thin grout i.e. about 40 litres of water per bag of cement and progressively decreasing the water content to about 15 litres per bag of cement.

(a) Material

Grouting shall normally be performed with a mixture of neat Portland cement and water. Other additives and admixtures may be added to improve the impermeability and strength, with the approval of the Engineer. The size of the particles and the consistency of the grout must be suited to the passageways it must follow. Neat grout will not flow freely into holes smaller than about three times the largest cement particle. Except in large cavities where thick mortar can be placed, the sand should all pass the 28-mesh sieve and have a large portion passing the 50-mesh and 100-mesh sieves. The proportions of Ordinary Portland cement to sand will depend upon the size of the spaces to be filled and will vary from a neat grout to about 1:1 mix. The amount of water to be added depends upon the consistency required. Grouts with as little as 16 litres of water per bag of cement could be used and it should seldom be necessary to use more than 35 to 40 litres of water per bag of cement.

Where necessary and approved by the Engineer, additives and admixtures may be added to Portland cement grout mixtures for improving impermeability and strength, delaying the setting time, increasing flowability and minimizing segregation and shrinkage.

(b) Preparation

The surface shall be cleaned with wire brush and compressed air. Thereafter holes of 15 mm dia and 150 mm to 200 mm deep may be drilled along the length of the cracks at a spacing of 500 mm by wet drilling using rotary percussion drills and nipples shall be inserted in these holes.

(c) Proportioning, Mixing and Equipment for Grouting

The cement grout shall be mechanically mixed using a system of power-driven paddles of high speed centrifugal pump. The grout pump to be used shall permit close control of pressures to allow a flexible rate of injection with minimum clogging of valves and ports. The most satisfactory equipment for injecting grout is a pump of the double-acting flexible reciprocating type giving a steady flow. The grout pump shall be so placed as to reduce the waste in cleaning lines. It is preferable to put 50 percent or more of the mixing water into the mixer before adding the dry ingredients and then the remaining water. A continuous supply of grout is preferable to an intermittent one. Consistency of the grout may be determined by trials starting with thin grout i.e. about 40 litres of water per bag of cement and progressively decreasing the water content to about 15 litres per bag of cement.

Where the mixer and pump are combined in one unit, the dry material shall be screened before mixing. If the mixer and pump are in separate units, the grout shall pass through a screen before it enters the pump.

(d) Application

Highest practical pressure within the limits of 100 kPa - 400 kPa should be used in order to force the surplus water from the grout. As the pressure may be distributed hydraulically over cOnsiderable areas, vigilance must be exercised to prevent damage or needless waste of grout. Adequate precaution shall be taken to ensure that leakage of grout does not occur.

Pressure shall be steady to ensure a continuous flow of grout. Grouting shall not be continued till the hole consumes mix at the rate of not less than 30 litres in 20 minutes or until refusal at the grouting pressure of 400 kPa at any hole. Should the grout escape from an adjacent nipple, it should be plugged or capped. Any seam, crack or joint through which grout escapes shall be caulked with epoxy mortar as soon as thick grout appears.

4 GUNITING/SHOTCRETING :-

The gunite is a mixture of cement, sand and water applied through a pressure hose, producing a dense hard layer of concrete used in structural repairs. It comprises 100 parts by weight of cement, 300 parts by weight quartz sand, 35-50 parts by weight water and 2 parts by weight approved quick setting compound. In general, dry mix shotcrete shall be used.

Ordinary Portland cement conforming to IS : 269 shall be used in guniting.

Sand for guniting shall comply with the requirements stipulated in IS : 383. In general, sand should neither be too coarse to increase the rebound nor too fine to increase the slump.

Water/cement ratio for guniting shall fall within the range 0.35 to 0.50 by mass, wet enough to reduce the rebound. Drying shrinkage may be between 0.06 per cent to 0.10 per cent. The quick setting compound shall be added at the nozzle with water just before guniting.

5 MEASUREMENT

(i) Measurement for sealing of cracks and injection shall be made by weight of epoxy consumed in kg for epoxy grouting. For provision of nipples required for grouting, the payment shall be for number of nipples inserted.

(ii) Measurement for sealing of cracks and injection shall be made by weight of cement consumed in kg for cement grouting.

(iii) Measurement for application of epoxy mortar for specified thickness shall be per square meter of surface area of application.

(iv) Measurement for bonding of old and new concrete by epoxy mortar shall be measured in square meter surface area of interface.

(v) Measurement for guniting/shotcreting, shall be per square meter of surface area of application.

(vi) Payment for replacement/rectification of bearings shall be for each number of bearing assembly replaced/rectified.

(vii) Dismantling of wearing coat shall be measured in square meter of area of wearing course dismantled.

(viii) Provision of external prestressing shall be measured in tonnes of H.T. steel strand/wire measured from anchorage to anchorage before stressing.

6 Rates

The rates include the cost of all the labour, scaffolding and material required for the completion of items.

(Refer MORTH Specifications for details)

CHAPTER-16
REPAIR AND REHABILITATION

Item No.	Descriptions	Unit	Rate (in Rs.)
16.1	Removal of existing cement concrete wearing coat including its disposal complete as per Technical specification without causing any detrimental effect to any part of the bridge structure and removal of dismantled material with all lifts and lead upto 1000m.	sqm	129.00
16.2	Removal of existing asphaltic wearing coat including disposal with all lift and lead upto 1000m.	sqm	105.00
16.3	Providing and inserting nipples with approved fixing compound after drilling holes for grouting as per specifications including subsequent cutting/removal and sealing of the hole of nipples after completion of grouting with Cement/Epoxy.	each	127.00
16.4	Sealing of cracks/porous concrete by injection process through nipples/Grouting complete as per Technical specification and as per relevant clauses of section 2800.		
(a)	Cement Mortar (1:1) for sealing of cracks.	Kg	65.00
(b)	Cement Grout for injection	kg	108.00
(c)	Epoxy Grout for injection	Kg	1259.00
16.5	Providing and Applying (10mm thick Average) epoxy mortar (including primer & seal coat) over leached, honey combed and spalled concrete surface and exposed steel reinforcement complete as per Technical specification.	sqm	3914.00
16.6	Patching of damaged concrete surface, (25mm thick average) with polymer modified cementitious mortar to be applied as per instructions of manufacturer and as approved by the Engineer.	Sqm	1419.00
16.7	Guniting concrete surface with 25mm thick (Average) cement mortar 1:3 applied with compressor after cleaning surface and spraying with epoxy complete as per Technical specification and as per relevant clauses of section 2800.	sqm	588.00
16.8	Removal of defective concrete (40mm thick average) cleaning the surface thoroughly, applying the shotcrete mixture mechanically with compressed air under pressure, comprising of cement, sand, coarse aggregates, water and quick setting compound in the proportion as per clause 2807 sand and coarse aggregates conforming to IS: 383 and table 1 of IS: 9012 respectively, water cement ratio ranging from 0.35 to 0.50, density of gunite not less than 2000 kg/cum, strength not less than 25 Mpa and workmanship conforming to clause 2807.6.	sqm	552.00
16.9	Providing and applying polymer modified cementious (PMC) mortar proportion as per manufacturer recommendation flush pointing on stone masonary structures including raking of joints necessary scaffolding etc. complete.	Sqm	580.00
16.10	Providing and applying Epoxy bonding of new concrete to old concrete @ 8.00 Kg/10 sqm min. as per section 2805 of the specifications.	sqm	576.00