GOVERNMENT OF MADHYA PRADESH

DEPARTMENT OF URBAN ADMINISTRATION & DEVELOPMENT

INTEGRATED STANDARD SCHEDULE OF RATES

(VOLUME III)

ROADS AND BRIDGES

IN FORCE FROM
10th MAY, 2012

COMMISSIONER
URBAN ADMINISTRATION AND DEVELOPMENT
PALIKA BHAWAN, SHIVAJI NAGAR, NEAR 6 No. STOP,
BHOPAL, MADHYA PRAEDSH
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FOREWORD

India is part of the global trend of increasing urbanisation. The urban population in India has increased by 5 times as compared to the overall population growth of 2.5 times during last 5 decades. As per 2001 census, 27.8% of India's population lived in 4378 towns/ cities. This share increased to 31.16% in Census 2011. Urbanization in Madhya Pradesh has also expanded rapidly. As per provisional figures of Census 2011, in Madhya Pradesh, 27.63% of the population lives in towns and cities.

Cities hold tremendous potential as engines of socio-economic development, creating jobs and generating wealth through economies of scale. They need to be sustained and augmented through the high urban productivity for country's economic growth. For cities to become growth oriented and productive, it is essential to achieve a world class urban system. This, in turn, depends on attaining efficiency and equity in the delivery and financing of urban infrastructure.

74th Constitutional Amendment Act created a focus on improving and strengthening Urban infrastructure and Services in Urban Local Bodies. With the availability of substantial funds from various sources and with our own increased revenues, availibility of development funds is no longer a major constraint. However, tapping these sources effectively is a major concern.

While preparing Detailed Project Reports, accurate Cost estimation is one of the most important and challenging aspects. Till 31st May 2011, in the absence of Departmental Schedule of Rates, Urban Local Bodies had to depend on Schedule of Rates of various Works Departments of the State Government such as MP Public Health Engineering Department, MP Public Works Department, Water Resource Department etc. for civil works and Madhya Pradesh State Electricity Board for electrical works. The infrastructure and maintenance works done by our Urban Local Bodies are town specific as well as need specific. The SoRs of these departments do not contain many such items.

Looking to the problems faced by the ULBs in cost estimation, Department of Urban Administration and Development decided to develop its own Integrated Standard Schedule of Rates for all Building and other Infrastructure works keeping in view the current and future requirements of the Urban Local Bodies and to provide them effective tool for preparing accurate cost estimates. The Department prepared and adopted its first Integrated Standard Schedule of Rates in four volumes along with related specifications, on 1st June 2011.

The prices are ever changing. To accommodate the annual price rise, Department intends to update the ISSR annually. We are extremely happy that the Department, with

the able assistance of Project Utthan, Madhya Pradesh Urban Services for the Poor (MPUSP), a DFID assisted programme, has not only successfully completed the task of ISSR preparation but also has updated the ISSR well within time.

To complete this task, a Working Group was formed which deliberated about the new items and revisions required by Urban Local Bodies to carry out the infrastructure development and construction works smoothly.

An Output Review Panel was also constituted to review the process outputs and finalize various reports including Rate Analysis for various items under Integrated Standard Schedule of Rates.

The updated ISSR has been prepared in four parts i.e. Volume - 1 Water Supply, Sewerage & Tube well works, Volume - 2 Building works, Volume - 3 Roads & Bridges works, Volume - 4 Municipal Electrical works. Specifications for various works have also been illustrated in four separate volumes.

All the volumes of the ISSR along with the applications are also available on the Website of UADD (mpurban.gov.in). This will help the Urban Local Bodies in preparing cost estimates reflecting prevailing market values and hence, avoid high tender rates.

I extend my sincere thanks to all the members of Working Group and the Output Review Panel for taking keen interest in completing the voluminous job of updation & completion of ISSR well in time.

I am sure that this Updated Integrated Standard Schedule of Rates will be quite useful for all the Urban Local Bodies of Madhya Pradesh to prepare accurate cost estimates in Detailed Project Reports.

(Sanjay Kumar Shukla)
Commissioner
Urban Administration and Development
Government of Madhya Pradesh
Bhopal

MEMBERS OF WORKING GROUP

1.	Shri Ashok Khare, Chief Engineer, Directorate of Urban Administration and Development, Bhopal	Chairman
2.	Shri S.K. Sogani, Superintending Engineer, UADD, Indore	Member
3.	Shri J.M. Dagaonkar Superintending Engineer, Municipal Corporation, Ujjain	Member
4.	Shri H.K. Jain Superintending Engineer, Municipal Corporation, Indore	Member
5.	Shri Pawan Sharma, Executive Engineer, UADD, Jabalpur	Member
6.	Shri S.K. Devgan Deputy City Engineer, Municipal Corporation, Bhopal	Member
7.	Shri B.K. Sonwani, Executive Engineer, UADD, Sagar	Member
8.	Shri A.G. Khan, Executive Engineer, UADD, Bhopal	Member
9.	Shri Alok Chokse, Executive Engineer, UADD, Rewa	Member
10.	Shri Pradeep Nigam, Executive Engineer, UADD, Indore	Member
11.	Shri Anand Singh, Executive Engineer, Directorate of UAD	Member
12.	Shri Kamlesh Bhatnagar, Engineer, Project Utthan, Municipal Support Unit, MPUSP, Urban Administration and Development, Bhopal	Member
13.	Shri Rakesh Rawat, Assistant Engineer, Municipal Council, Vidisha	Member
14.	Shri P.P. Kaithwas, Assistant Engineer, Municipal Council, Neemuch	Member
15.	Shri Suresh Sejkar, Executive Engineer, Directorate of Urban Administration and Development, Bhopal	Member Secretary

MEMBERS OF OUTPUT REVIEW PANEL

1.	Shri Ashok Khare, Chief Engineer, Directorate of Urban Administration and Development, Bhopal	Chairman
2.	Shri M.J.S Tulsi, Deputy Director (Engineering), Project Utthan, Municipal Support Unit, MPUSP, Urban Administration and Development, Bhopal	Convener
3.	Shri Kamlesh Bhatnagar, Engineer, Project Utthan, Municipal Support Unit, MPUSP, Urban Administration and Development, Bhopal	Member

INDEX

GENERAL NOTES

1 The SOR of UADD Department 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 given below

VOLUME - I
WATER SUPPLY, SEWERAGE AND TUBE WELL WORKS

1	Cast Iron Pipes and Specials with with Socket & Spigot lead joints.
2	Cast Iron Tyton Pipes with Tyton Joints.
3	Cast Iron Pipes and Specials with flanged joints.
4	Ductile Iron Pressure Pipes and Special with Tyton joints.
5	Unplasticized PVC Pipes & Fittings for potable water supply.
6	Cast Iron Valves.
7	Galvanised Iron Pipes, Specials and Gun Metal/Brass Metal Fittings.
8	HDPE Pipes, MDPE Pipe & Specials and Zero Velocity Valves.
9	GRP Pipes and Specials.
10	Asbestos Cement Pressure Pipe and Cast Iron Fittings.
11	Salt Glazed Stoneware Pipes.
12	Unplasticized Non-Pressure Polyvinyl Chloride (PVC-U) Pipes, DWC Pipes for use in underground sewerage system.
13	Reinforced Cement concrete Pipes.
14	Sewer Appurtenances.
15	Civil Works for Water Supply & Sewerage works.
16	Miscellaneous.
17	Drawings for Water Supply & Sewerage.
18	Drilling of Tube Wells.

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. Works
10	Steel work
11	Flooring
12	Roofing and Ceiling
13	Finishing
14	Repair to Building
15	Dismantling & Demolishing
16	Pile work
17	Aluminium work
18	Water proofing
19	Horticulture & Landscaping
20	Form Work

21	Hire Charges of Machine
22	Rainwater Harvesting, Recycle and Reuse wastewater
23	Building Water Supply
24	Building Drainage
25	Sanitary Installation

VOLUME - III

ROAD & BRIDGES WORKS

ROAD	
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
12	Survey & Investigation, Preparation of D.P.R. and other Miscellaneous items
BRIDGE	
13	Foundations
14	Sub-Structure
15	Super-Structure
16	River Training and Protection works
17	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/Pannel/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	Pump Sets with G.I. Pipe
18	Solar street light system
19	Supply of materials

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.

4 The mode of measurements shall be as per provisions contained in the relevant chapters and in specifications/relevant IS codes.

5 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.

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

7 Hard Rock available from excavation, shall be used for conversion into coarse aggregates or for other construction material and shall be issued to the contractor on the rate as decided by competent authority.

8 **Cement :-**

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

8.2 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.

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

8.4 When the strength of concrete required upto M-30, then O.P.C. 33 grade conforming to IS 269-1989 or P.P.C. conforming to IS : 1489-1991 may be used.

8.5 When the strength of concrete required is more than M-30, the O.P.C. 43 grade conforming to IS : 8112-1989 shall be used.

8.6 For prestressed concrete works where the strength of concrete required is more than M-30, then O.P.C. 53 grade cement conforming to IS : 12269-1987 shall be used.

8.7 In specific cases requiring higher grade of strength, use of Ordinary Portland Cement (OPC) should be invariably ensured.

8.8 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.

8.9 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.

8.10 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.

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

9 **Steel :-**

9.1 Steel used for reinforcement shall conform as per under :-
(a) Mild Steel and medium tensile steel bars shall conform to IS : 432 (Part-I),
(b) Hot rolled deformed bars shall conform to IS : 1139,
(c) Cold twisted bars shall conform to IS : 1786,
(d) Hard drawn steel wire fabric shall conform to IS : 1566 and
(e) Rolled steel made from structural steel shall conform to IS : 226.

9.2 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.

9.3 Only such steel obtained from main producers of steel i.e. SAIL, IISCO, TISCO or such steel rolling mills 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.

9.4 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.

9.5 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.

10 If any item of work is found not upto the prescribed standard but the Engineer-in-charge is of the opinion that the same is structurally adequate and can be accepted at a reduced rate, then in such case, the Engineer-in-charge shall submit proposal for the same, supported by an analysis in justification thereof, through proper channel to the Superintending Engineer UADD to obtain his approval expeditiously (ordinarily within 15 days). The approved analysis along with orders of the Superintending Engineer should be appended to the final bill of the contractor.

11 In case of any contradiction in the provisions of the specifications and this schedule of rates, the decision of Chief Engineer, UADD will be of precedence.

12 (a) Rates of items would apply for work order/piece work system also.
(b) Rates payable for any work to be done departmentally then rates should be reduced by 10.434% (contractor profit percentage 10% + T&P charge 2%) i.c. 100x12/115 = 10.434%.

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

14 **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.

15 Latest I.S. Codes with upto date amendments shall be applicable.

16 **Concrete Work : -**

16.1 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 produce as continuous production unit, such as ready mix concrete plant. The frequency of sampling may be agreed upon mutually by suppliers and purchasers.

16.2 **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.

16.3 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 subject to an upper limit of 1:1½ and a lower limit of 1:2 V2	60
M7.5	625		45
M10	480		34
M15	330		32
M20	250		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 lower. Granded coarse aggregate shall be used.

16.4 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.

17 **Best** shall mean that in the opinion of the concerned Engineer-in-Charge, there is no superior material or article or class of workmanship obtainable in the market.

18 The labour only 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. The labour rates adopted for preparation of S.O.R. are inclusive of provision for weekly holiday.

Extra Notes For Road Work

1 The girth of trees shall be measured at 1.00 meter (One meter) above ground level.

2 Rates of site clearance include jungle clearance levelling and dressing.

3 All wood obtained from the tree shall be property of the government and shall be handed over to Engineer in charge.

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

5 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.

6 The rates for completed items in the schedule of rates also include the following.
   1 10% for contractor profit
   2 2% for T&P
   3 3% for over head charges

7 The labour rate only provided in the Schedule of Rates includes the cost of all labour, including necessary handling of the materials at site of work, all workmanship unless otherwise specified.

8 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 UADD specifications of road & bridge & 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 inal bill. Actual consumption of materials like bitumen,cement & steel 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.

The contractor shall have to establish a field laboratory at the site of work, if the amount of contract exceeds Rs.25.00 lakhs.In other cases, testing of construction materials should be got done from any of the tests laboratories of the various Government Departments, Government/Semi Govt. under takings and Technical Institutes, Engineering College, Polytechnic, I.T.I, recognized and authorized lab.

8.1 The work should not be accepted in any case, if the contractor fails to observe the instructions of the department, regarding testing of materials.

8.2 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. The frequency for CBR Test is one test per 500 cum or part there of. The frequency for deleterious material is also one test per 500 cum or part thereof.

8.3 If tests are not conducted to the prescribed frequency, the Engineer in- Charge should reject that part of the work.

9 Specification of UADD Department for road & bridge and specification for road & bridge published by I.R.C. of MORTH works shall be applicable.

10 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.

As Per MORTH Table No.500-28

TABLE - PER CENT REDUCTION IN VOLUME OF AGGREGATES

S.No.	Standard size of aggregates	Percentage reduction in volume computed by stack measurements to arrive at the volume to be paid for
1	75 mm and 63 mm	12.50
2	45 mm and 26.5 mm	10.00
3	22.4 mm, 13.2 mm, 11.2 mm and 6.7 mm	5.00
4	Fine aggregate	5.00

11 For construction of reinforced earth retaining wall, back filling shall be paid separately as per Chapter-3 "Earth work, erosion control and drainage"

12 For WBM Grade-I and Grade-II broken stone can be used, for WBM Grade-III crushed stone shall be used.

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

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

15 The surface regularity 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 indicated in the table below of the specifications. For checking, specifications UADD or MORTH clause 902 shall apply.

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

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

17 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.

18 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.)

19 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.

20 For items of BUSG (Built-Up Spray Grout), surface dressing and seal coat type-A, the aggregates shall be stacked at site, measured and recorded in M.B. prior to their use on work. No separate payment shall be made for stacking and payment for these items. These items shall be regulated as per SOR items.

21 Where laying of open graded premix carpet (OGPC) or seal coat Type-B with mechanical mixing is not feasible, use of other Mixers are a must for open graded premix carpet or seal coat Type 'B' using bitumen/emulsion, but this can be used only with prior approval of chief engineer UADD.

22 Rates for the items of semi-dense bituminous concrete, dense bituminous macadam and bituminous concrete are based on the assumption that the bitumen at the rate of 5%, 4.25% and 5% respectively would be required. In case, lesser or more bitumen is required as per the job mix formula. Difference of bitumen shall be paid or deducted as per actual consumption of quantity of bitumen.

23 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.

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

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

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

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

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

29 Reflective sign board should not be installed on M.D.R. and on any other road having traffic intensity less than 450 commercial vehicles per day without prior approval of the competent authority for sanction.

Extra Notes for Bridge Works :-

1 **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.

2 **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.

3 **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.

4 **Definitions**

(a) Major Bridge : Having total length between abutments at cap level 60 M. and 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.

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 (4th Revision)

(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 UADD/MORTH/PWD B&R.

(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 clause 1705 of specifications.

6 **Masonry Work**

(i) All the stone masonry work shall be strictly as per detailed specifications given in "Specification for Road & Bridge works" of UADD/MORTH/PWD B&R.

(ii) In place of stone headers, precast or cast-in-situ concrete headers may be permitted with following condition :

(a) If the cement is supplied departmentally and the cost of cement is recoverable from the contractor due allowance for the actual quantity of cement consumed in the use of cement concrete headers shall be permitted in cement consumption statement 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 uncaused 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 uncaused Random Rubble Masonry.

7 The measurement of rock excavation are to be done as per clause specified in the volume "Specification of Road and Bridge works" of UADD/updated MORTH specification. All serviceable rock excavated shall be issued to the contractor at the rate decided by competent authority for Technical sanction.

CHAPTER-1			
CARRIAGE OF MATERIALS			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
	Loading and unloading of stone boulder / stone aggregates / sand / kanker / moorum. (Placing tipper at loading point, loading with front end loader, dumping, turning for return trip, excluding time for haulage and return trip)		
	(Volume to be computed as per provisions of IS:1200)		
1.1	Transportation of metal		
i)	For a lead upto 1 Km.	cum	73.00
ii)	For a lead upto 2 Km.	cum	81.00
iii)	For a lead upto 3 Km.	cum	88.00
iv)	For a lead upto 4 Km.	cum	95.00
v)	For a lead upto 5 Km.	cum	102.00
vi)	Beyond 5 Kms. and upto 10 Kms. (Add for every 1 Km)	cum	6.00
vii)	Beyond 10 Kms. and upto 20 Kms. (Add for every 1 Km)	cum	5.00
viii)	Beyond 20 Kms. and upto 50 Kms. (Add for every 1 Km)	cum	4.00
ix)	Beyond 50 Kms. (Add for every 1 Km)	cum	3.00
1.2	Transportation rate of different other material in comparison with 20 mm metal. (i.e. @ Rs. 48.81 Per Cum)		**Rate as % of metal**
a)	Marble, Kota Stone	cum	18%Above
b)	Masonry Stone	cum	18 % Above
c)	Rubble	cum	18 % Above
d)	Loose moorum/sand/earth/surkhi.	cum	As Metal
e)	Excavated Earth	cum	25 % Above
f)	Excavated ordinary rock measured	cum	100 % Above
g)	Cement	Tonne	11 % Below
h)	Steel	Tonne	11 % Below
i)	Timber/ ballies /planks/scantalies.etc	cum	14 % Above
j)	Coal /fuel ,Iron work / steel / G.I.Sheets / pipes / lime / machinary etc.	Tonne	11 % Below
k)	150mm dia ballies	cum	14 % Above
l)	Tar/paints/Bitumen etc.	cum	As Metal
1.3	Transportation by trucks on hire		
i)	Loading of trucks	cum	26.00
ii)	Unloading of trucks and stacking.	cum	26.00
iii)	Trucks hired for full load excluding loading/unloading and stacking for items not covered above for distances :		
	a) Upto 15 Kms.	cum	50.00
	b) Beyond 15 Kms. and upto 50 Kms. add extra over a) above	cum	31.00
	c) Beyond 50 Kms. add extra over b) above.	cum	28.00
1.4	Unloading and stacking etc. at the railway yard from wagons.		
a)	Cement	M.T.	43.00
b)	Iron/steel/G.I. Sheet/pipes/machinary	M.T.	37.00

CHAPTER- 2
SITE CLEARANCE

Notes for Specification :-

1 The work include cutting removing & disposing and 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 incorporation in the work. From the complete area of road land.

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 All branchs of trees extending above the roadway shall be trimmed as directed by Engineer.

5 All materials arising from clearing and grubbing operations shall be the property of Government and shall be disposed of by the contractor as here in after provided or directed by the Engineer in charge.

6 Pipe line, sewers, cables, shall be protected from injury or damage.

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

8 Site clearance shall be done as per MORTH clause 200

9 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.

(For Detail Refer specification Chapter of Site Clearance and MORTH specification of the same)

CHAPTER- 2			
SITE CLEARANCE			
Item No.	**Descriptions**	**Unit**	**Rate 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 for		
i)	Girth from 300 mm to 600 mm	each	136.00
ii)	Girth beyond 600 mm to 900 mm	each	224.00
iii)	Girth beyond 900 mm to 1800 mm	each	465.00
iv)	Girth above 1800 mm	each	906.00
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	31510.00
b)	In area of thorny jungle	hectare	42090.00
2.3	Dismantling of existing structures like culverts, bridges, retaining walls and other structure 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 1000 meter.		
(i)	**Concrete**		
I	By Manual Means		
a)	Lime Concrete, cement concrete grade M-10 and below	cum	192.00
b)	Cement Concrete Grade M-15 & M-20	cum	234.00
c)	Prestressed / Reinforced cement concrete grade M-20 & above	cum	655.00
(ii)	**Tile work/brick masonry**		
a)	In lime mortar	cum	109.00
b)	In cement mortar	cum	150.00
c)	In mud mortar	cum	92.00
d)	Dry brick pitching or brick soling	cum	83.00
(iii)	**Stone Masonry**		
a)	Rubble stone masonry in lime mortar	cum	125.00
b)	Rubble stone masonry in cement mortar.	cum	150.00
c)	Rubble Stone Masonry in mud mortar.	cum	109.00
d)	Dry rubble masonry	cum	100.00
e)	Stone pitching/ dry stone spalls.	cum	92.00
f)	**Boulders laid in wire crates including opening of crates and stacking dismantled materials.**	cum	109.00

Item No.	Descriptions	Unit	Rate Rs
(iv)	**Steel work in all types of sections upto a height of 5 m above plinth level excluding cutting of rivet Including dismembering**	tonne	782.00
(v)	**Scraping of bricks dismantled from brick work including stacking.**		
a)	In lime/Cement mortar	1000 No.	733.00
b)	In mud mortar	1000 No.	262.00
(vi)	**Scraping of Stone from dismantled stone masonry**		
a)	In cement and lime mortar	cum	294.00
b)	In Mud mortar	cum	62.00
(vii)	**Scarping plaster in lime or cement mortar from brick/ stone masonry**	sqm	9.00
(viii)	**Removing all type of hume 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	109.00
b)	Above 600 mm to 900 mm dia	meter	147.00
c)	Above 900 mm dia	meter	252.00
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	358.00
b)	Granular courses	cum	247.00
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	716.00
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	37.00
2.7	Dismantling kerb stone by manual means and disposal of dismantled material with all lifts and up to a lead upto 1000 meter and as per relevant clauses of section-200.	meter	6.00
2.8	Dismantling of kilometer stone including cutting of earth, foundation and disposal of dismantled material with all lifts and lead upto 1000 m and back filling of pit.		
a)	5th KM stone	each	194.00
b)	Ordinary KM Stone	each	116.00
c)	Hectometer Stone	each	23.00

Item No.	Descriptions	Unit	Rate Rs
2.9	Dismantling of barbed wire fencing/ wire mesh fencing including posts, 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	27.00
2.10	Dismantling of CI water pipe line 600 mm dia including disposal with all lifts and lead upto 1000 meter and stacking of serviceable material and unserviceable material separately under supervision of concerned department.	meter	72.00
2.11	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	88.00
2.12	Removal of telephone / Electric poles including excavation and dismantling of foundation concrete and lines under the supervision of concerned department, disposal with all lifts and up to a lead of 1000 meter and stacking the serviceable and unserviceable material separately.	each	90.00
2.13	Dewatering of water caused by springs, tides or river seepage, broken water mains or drains or well or the like.	KL	51.00

CHAPTER- 3
EARTH WORK, EROSION
Notes for Specification :-

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.

2(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 made 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 better 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 surgrade 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.

	Table 1 Density Requirements of Embankment and Sub-Grade Materials.	
	As per MORTH NO. 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 as per table 2.

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	
	As per MORTH NO. 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 Tests During Construction

The quality control tests to be carried out during construction and their frequency shall be as given in Table.

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.

(vi) **CRB test on material to be incorporated in the subgrade on soaked/unsoaked samples [IS : 2720 (part- 16)]:** One CRB test for every 3000 cubic meter atleast or closer as and when required by the Engineer.

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.

(For Detail Refer specification Chapter of Earth work, Erosion and MORTH specification of the same)

CHAPTER-3

EARTH WORK, EROSION CONTROL AND DRAINAGE

Item No.	Descriptions	Unit	Rate Rs
3.1	Excavation for roadway in soil including loading in truck for carrying of cut earth to embankment site with all lifts and lead upto 1000 meters and as per relevant clauses of section-300.	cum	98.00
3.2	Excavation for road way in ordinary rock including loading in a truck and carrying of excavated material to embankment site with in all lifts and leads upto 1000 meters and as per relevant clauses of section-300.	cum	142.00
3.3	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 in all lifts and leads upto 1000 meters and as per relevant clauses of section-300.	cum	232.00
3.4	Excavation for roadway in hard rock (blasting prohibited) with rock breakers including breaking rock, loading in tippers and disposal within 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	502.00
3.5	Excavation for roadway in hard rock with controlled 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 in all lifts and leads upto 1000 meters and as per relevant clauses of section-300.	cum	246.00
3.6	Excavation for roadway in marshy soil with hydraulic excavator including cutting and loading in tippers and disposal with in all lifts and lead upto 1000 meters, trimming of bottom and side slopes in accordance with requirements of lines, grades and cross sections and as per relevant clauses of section-300.	cum	40.00
3.6.1	Excavation for roadway in marshy soil by manually with dressing, treaming of bottom, side slopes in accordance with the requirements of lines, grade and cross sections with including 50m lead and 1.5m lifts.	Cum	84.00
3.7	Scarifying the existing granular road surface to a depth of 50 mm and disposal of scarified material within all lifts and leads upto 1000 meters.	sqm	17.00
3.8	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	15.00

Item No.	Descriptions	Unit	Rate Rs
3.9	Construction of Embankment/Sub grade/ earth shoulders, as per clause 305.1.1 inclusive of operation necessary as per clause 305 & its sub-clauses, Where required but with approved materials obtained from excavation for road construction (vide clause 301.3.11) i/c consolidating the original ground by rolling as directed by the Engineer-in-charge but with a maximum of 6 passes of 8-10 tonne roller & i/c compaction and maintenance of surface during construction to ensure shedding & preventing ponding of water (clause 305.3.7), finishing i/c all lifts but excluding scarifying existing granular/bituminous road surface vide clause 305.6.	cum	234.00
3.10	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	234.00
3.11	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 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	272.00
3.12	Deduct for item No 3.10 if vibratory roller / mortar grader is not used with prior written approval of the not below the rank of Executive Engineer.		
	i) If static roller is used in place of vibratory roller.	cum	16.00
	ii) If mortar grader is not used.	cum	16.00
3.13	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.	meter	42.00
3.14	Construction of aggregate sub surface drain 300 mm width x 450 mm depth with aggregates conforming to table 300-4, excavated material to be utilised in roadway and as per relevant clauses of section-300.	meter	93.00
3.15	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 and compacted 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 with lead of fly ash.		
a)	Upto 25 Kms.	cum	303.00
b)	Beyond 25 Kms. and upto 50 Kms. (Average approx. 13 km)	cum	362.00
c)	Beyond 50 Kms. and upto 100 Kms.	cum	501.00

Item No.	Descriptions	Unit	Rate Rs
3.16	Excavation in all kinds of soil for drainage work by mechanical means (Hydraulic excavator) / manual means over areas (exceeding 30cm in depth. 1.5m in width including disposal of excavated earth, lead upto 50m and lift upto 1.5m, disposed earth to be levelled and neatly dressed.	cum	99.00
3.17	Excavation in rock for drainage work by mechanical means (Hydraulic excavator) / manual means over areas (exceeding 30 cm in depth, 1.5m in width including disposal of excavated earth, lead upto 50 m and lift upto 1.5 m, disposed earth to be levelled and eatly dressed.		
(a)	Ordinary rock	Cum	139.00
(b)	Hard rock (requiring blasting)	Cum	213.00
(c)	Hard rock (blasting prohibited)	Cum	202.00
3.18	Providing and laying non-pressure NP2 class (light duty) R.C.C. pipes with collars jointed with stiff mixture of cement mortar in the proportion of 1:2 (1 cement: 2 fine sand) including testing of joints etc. complete.		
(a)	Size 300 mm dia meter	RM	445.00
(b)	Size 350 mm dia meter	RM	520.00
(c)	Size 400 mm dia meter	RM	593.00
3.19	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.	cum	333.00

CHAPTER- R-4
SUB-BASES, BASES (NON- BITUMINOUS) AND SHOULDERS
Notes for Specification :-

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:-

Table : Grading for Close Granular Sub-base materials

As per MORTH Table 400.1

IS Sieve Designation	Per cent by Weight Passing the IS Sieve		
	Grading I	Grading II	Grading III
75 mm	100	-	-
53 mm	80-100	100	-
26.5 mm	55-90	70-100	100
9.5 mm	35-65	50-80	65-95
4.75 mm	25-55	40-65	50-80
2.36 mm	20-40	30-50	40-65
0.425 mm	10-25	15-25	20-35
0.075 mm	3-10	3-10	3-10
CBR Value (Minimum)	30	25	20

While grading in above table are in recept of close graded grannlar sub base materials, one each maximum partical size of 75 mm, 53mm and 26.5mm, the corresponding grading for the coarse graded materials for each of the three maximum partical sizes are given in table below

Table : Grading for Coarse Graded Granular Sub-base materials

As per MORTH Table 400.2

IS Sieve Designation	Per cent by Weight Passing the IS Sieve		
	Grading I	Grading II	Grading III
75 mm	100	-	-
53 mm		100	
26.5 mm	55-75	50-80	100
9.50 mm			
4.75 mm	30-Oct	15-35	25-45
2.36 mm			
0.425 mm			
0.075 mm (75 micron)	< 10	< 10	< 10
CBR Value (Minimum)	30	25	20

3 Before laying the sub-base the subgrade shall prepared as per clause MORTH 301 or 305. The sub grade shall be prepared be 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 desnity.

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 for Sub Base/Base Courses

As per MORTH Table No. 400.6

S.N	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

As per MORTH Table No. 400.7

IS Sieve Designation	Size Range	IS Sieve Designation	Percent by weight passing
1.	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
2.	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
3.	53 mm to 22.4 mm	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 with Grading I shall be 100 mm while for layer with other Grading i.e. II & III, it 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

As per MORTH Table No. 400.8

IS Sieve Designation	Size Range	IS Sieve Designation	Percent 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. The aggregates shall conform to the physical requirements as given below: -

As per MORTH Table No. 400.10

S.N	Test	Test Method	Requirements
1	*Los Angles Abrasion Value	IS : 2386 (Part 4)	40 percent (Max.)
	Or		
2	*Aggregate Impact Value	IS : 2386 (Part 4) or IS : 5640	30 percent (Max.)
3	Combined Flakiness and Elongation Indices (Total)	IS : 2386 (Part 1)	30 percent (Max.)**

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

** 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.

(v) **The grading requirement of aggregate for wet mix macadam shall be as below:-**

As per MORTH Table No. 400.11

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	0-8

17 Measurement of Payment

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.

18 Rates

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

19 **Test and their minimum frequncy for sub base and base (AS per MORTH Section 900)**

	Tpye of Construction	Test	Frequency(min.)
1	Granular	(a) Gradation	One test per 200 m^3
		(b) Atterberg limits	One test per 200 m^3
		(c) Moisture content prior to	One test per 250 m^3
		(d) Density of compacted layer	One test per 500 m^3
		(e) Deleterious constituents	As required by Engineer in charge
		(f) C.B.R	As required by Engineer in charge
2	Soil sub base	(a) CBR or unconfined compressive strenght test on a set of 3 specimens.	As required by Engineer in charge
		(b) Moisture content prior to	One test per 250 sq. m
		(c) Density of compacted layer	One test per 500 m^2
		(d) Deleterious constituents	As required by Engineer in charge
3	Water Bound	(a) Aggregate impact value	One test per 200 m^3 of aggregate
		(b) Grading	One test per 100 m^3

		(c) Flakiness index and Elongation index	One test per 200 m^3 of aggregate
		(d) Atterberg limit of binding material	One test per 25 m^3 of binding material
		(e) Atterberg limit of portion of aggregate passing 425 micron sieve	One test per 100 m^3 of aggregate
4	Wet mix Macadam	(a) Aggregate impact value	One test per 200 m^3 of aggregate
		(b) Grading	One test per 100 m3 of aggregate
		(c) Flakiness index and Elongation	One test per 200 m^3 of aggregate
		(d) Atterberg limit of binding material	One test per 100 m^3 of binding material
		(e) Atterberg limit of portion of aggregate passing 425 micron sieve	One test per 500 m^3 of aggregate

(For Detail Refer specification Chapter of Sub-Base, Base (Non-Bituminous)
and
MORTH specification of the same)

CHAPTER-4

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

Item No.	Descriptions	Unit	Rate Rs
4.1	Construction of granular sub-base by providing coarse graded material, spreading in uniform layers with on prepared surface, mixing by mix in place method at OMC, and compacting with vibratory roller to achieve the desired density, complete in all respect and as per relevant clauses of section-400.		
i)	for grading- I Material	cum	604.00
ii)	for grading- II Material	cum	614.00
iii)	for grading-III Material	cum	600.00
4.2	Laying and spreading available soil in the subgrade on a prepared surface, pulverising, mixing the spread soil in place with rotavator with 3 % slaked lime having minimum content of 70% of CaO, grading with motor grader and compacting with the road roller at OMC to the desired density to form a layer of improved sub grade complete and as per relevant clauses of section-400. (Lime stabilisation for improving sub-grade)		
(a)	By Mechanical Means	Cum	369.00
(b)	By Manual Means	Cum	352.00
4.3	Providing, laying, spreading and compacting stone aggregates of specific sizes to water bound macadam specification 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-400.		
(i)	Grading- I		
a)	Using Screening Crushable type	cum	899.00
b)	Using Screening Type-A (13.2mm Agg.)	cum	1035.00
(ii)	Grading- II		
a)	Using Screening Crushable type	cum	857.00
b)	Using Screening Type-A (13.2mm Agg.)	cum	913.00
c)	Using Screening Type-B (11.2mm Agg.)	cum	973.00
(iii)	Grading- III		
a)	Using Screening Crushable type	cum	815.00
b)	Using Screening Type-B (11.2mm Agg.)	cum	931.00
4.3.1	Labour rate for laying, spreading and compacting stone aggregates of specific sizes to water bound macadam specification including spreading in uniform thickness,hand packing, rolling with 3 wheeled steel/ 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.	cum	181.00
4.4	Deduction for item No.4.1, 4.2 & 4.3 if vibratory roller / mortar grader is not used with prior written approval by the not below the rank of Executive Engineer.		
	i) If static roller is used in place of vibratory roller.	cum	51.00
	ii) If mortar grader is not used.	cum	51.00

Item No.	Descriptions	Unit	Rate Rs
4.5	Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density and as per relevant clauses of section-400.	cum	951.00
4.5.1	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.	cum	205.00
4.6	Filling of existing 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 including excavation and lead upto 1000 M. and as per relevant clauses of section-400.	cum	94.00
4.7	Filling of existing median and Island above road level with approved material brought from borrow pits including excavation and all leads, spread, sloped and compacted and as per relevant clauses of section-400.	cum	151.00
4.8	Crusher Run Macadam Base (Providing crushed stone aggregate, depositing on a prepared surface by hauling vehicles, spreading and mixing with a motor grader, watering and compacting with a vibratory roller to clause 410 to form a layer of sub-base/Base)		
a)	By Mix in Place Method		
i)	For 53 mm maximum size	cum	833.00
ii)	For 45 mm maximum size	cum	888.00
b)	By Mixing Plant :		
i)	For 53 mm maximum size	cum	1032.00
ii)	For 45 mm maximum size	cum	1089.00
4.8.1	labour rate for crushed stone aggregate, depositing on a prepared surface by hauling vehicles, spreading and mixing with a motor grader, watering and compacting with a vibratory roller to clause 410 to form a layer of sub-base/Base	cum	145.00
4.9	Construction of Sub-base using lime - fly ash admixture with 80% granular soil, free from organic matter/ deleterious material or clayey silts and low plasticity clays having PI between 5 and 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 with lead of fly ash.		
a)	Upto 25 Kms.	cum	450.00
b)	Beyond 25 Kms. and upto 50 Kms.	cum	472.00
c)	Beyond 50 Kms. and upto 100 Kms.	cum	517.00

CHAPTER- R- 5
BASES AND SURFACE COURSES (BITUMINOUS)
Notes for Specification :-

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.

The bitumen primer shall be bitumen emulsion complying with IS: 8887. The viscosity and rate of spray is given below: -

As per MORTH Table No. 500.1

Type of Surface	Kinematic Viscosity or primer at 60^0C (centistokes)	Quantity of liquid Bituminous Material per 10 sq.m. (kg)
Low porosity	30 - 60	6 to 9
Medium porosity	70 - 140	9 to 12
High porosity	250 - 500	12 to 15

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 road 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 relevant Indian Standard (IS). Where penetration grades of bitumen are specified they shall be according to the Indian Standard Specification IS: 73.

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

5 **Bituminous Macadam: -** This work shall consist of construction in a single course having 50mm to 100mm thickness or in multiple coarses of compacted crushed aggregate premixed with a bituminous binder on a previously prepared base.

The physical requirement of coarse aggregate for bituminous macadam,dense graded bituminous macadam, Semi dense bituminous concrete pavement layer and bituminous concrete pavement layer are given in following tables: -

5.1 Physical Requirement For Coarse Aggregate For Bituminous Macadam: -

Table 1 Physical Requirement For Coarse Aggregate For Bituminous Macadam As per MORTH Table No. 500.3

Property	Test	Specification
Cleanliness (dust)	Grain size analysis*	Max 5% passing 0.075 mm sieve
Particle shape	Flakiness and Elongation Index (Combined)**	Max 30 %
Strength[1]	Los Angeles Abrasion Value*** Aggregate Impact Value***	Max 40 % Max 30 %
Durability	Soundness:**** Sodium Sulphate or Magnesium Sulphate	 Max 12% Max 18 %
Water Absorption	Water Absorption*****	Max 2 %
Stripping	Coating and Stripping of Bitumen Aggregate Mixtures******	Minimum retained coating 95 %
Water Sensitivity*******	Retained Tensile Strength	Min 80 %

Notes:-

* = IS 2386 Part I

** = IS 2386 Part I

*** = IS 2386 Part IV

**** = IS 2386 Part V

***** = IS 2386 Part III

****** = IS 6241

******* = The water sensitivity test is only to be carried out if the minimum retained coating in the stripping test is less than 95 %.

[1] = Aggregate may satisfy requirements of either of these two tests.

5.2 Physical Requirement For Coarse Aggregate For Dense Graded Bituminous Macadam

Table 2 Physical Requirement For Coarse Aggregate For Dense Graded Bituminous Macadam As per MORTH Table No. 500.8

Property	Test	Specification
Cleanliness (dust)	Grain size analysis*	Max 5% passing 0.075 mm sieve
Particle shape	Flakiness and Elongation Index (Combined)**	Max 30 %
Strength[1]	Los Angeles Abrasion Value*** Aggregate Impact Value****	Max 35 % Max 27 %
Durability	Soundness:***** Sodium Sulphate or Magnesium Sulphate	 Max 12% Max 18 %
Water Absorption	Water Absorption******	Max 2 %
Stripping	Coating and Stripping of Bitumen Aggregate Mixtures*******	Minimum retained coating 95 %
Water Sensitivity[2]	Retained Tensile Strength	Min 80 %

Note: -

* = IS 2386 Part I

** = IS 2386 Part I

*** = IS 2386 Part IV

**** = IS 2386 Part IV

***** = IS 2386 Part V

****** = IS 2386 Part III

******* = IS 6241

******** = AASHTO T283[2]

[1] = Aggregate may satisfy requirements of either of these two tests.

[2] = The water sensitivity test is only to be carried out if the minimum retained coating in the stripping test is less than 95 %.

5.3 Physical Requirement For Coarse Aggregate For Semi Dense Bituminous Concrete pavement layers

Table 3 Physical Requirement For Coarse Aggregate For Semi Dense Bituminous Concrete pavement layers

As per MORTH Table No. 500.14

Property	Test	Specification
Cleanliness (dust)	Grain size analysis*	Max 5% passing 0.075 mm sieve
Particle shape	Flakiness and Elongation Index (Combined)**	Max 30 %
Strength[1]	Los Angeles Abrasion Value*** Aggregate Impact Value****	Max 35 % Max 27 %
Polishing	Polished Stone value*****	min 55 %
Durability	Soundness:****** Sodium Sulphate or Magnesium Sulphate	 Max 12% Max 18 %
Water Absorption	Water Absorption*******	Max 2 %
Stripping	Coating and Stripping of Bitumen Aggregate Mixtures*********	Minimum retained coating 95 %
Water Sensitivity[2]	Retained Tensile Strength********	Min 80 %

Note: -

* = IS 2386 Part I

** = IS 2386 Part I

*** = IS 2386 Part IV[1]

**** = IS 2386 Part IV[1]

***** = BS 812 Part 114

****** = IS 2386 Part V

******* = IS 2386 Part III

******** = AASHTO T283[2]

********* = IS 6241

[1] = Aggregate may satisfy requirements of either of these two tests.

[2] = The water sensitivity test is only to be carried out if the minimum retained coating in the stripping test is less than 95 %.

5.4 Physical Requirement For Coarse Aggregate For Bituminous Concrete Pavement layers

Table 4 Physical Requirement For Coarse Aggregate For Bituminous Concrete Pavement layers
As per MORTH Table No. 500.17

Property	Test	Specification
Cleanliness (dust)	Grain size analysis*	Max 5% passing 0.075 mm sieve
Particle shape	Flakiness and Elongation Index	Max 30 % (Combined)**
Strength[1]	Los Angeles Abrasion Value*** Aggregate Impact Value****	Max 35 % Max 27 %
Polishing	Polished Stone value*****	Min 55 %
Durability	Soundness:****** Sodium Sulphate or Magnesium Sulphate	 Max 12% Max 18 %
Water Absorption	Water Absorption*******	Max 2 %
Stripping	Coating and Stripping of Bitumen Aggregate Mixtures*********	Minimum retained coating 95 %
Water Sensitivity[2]	Retained Tensile Strength********	Min 80 %

Note: -

* = IS 2386 Part I

** = IS 2386 Part I

*** = IS 2386 Part IV[1]

**** = IS 2386 Part IV[1]

***** = BS 812 Part 114

****** = IS 2386 Part V

******* = IS 2386 Part III

******** = AASHTO T283[2]

********* = IS 6241

[1] = Aggregate may satisfy requirements of either of these two tests.

[2] = The water sensitivity test is only to be carried out if the minimum retained coating in the stripping test is less than 95 %.

6 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.

7 **Composition of Bituminous Mixture:-**

The aggregate for bituminous macadam shall be preportioned and blended to produce a uniform mixture complying with the requirement of table number 5.

The binder content shall be within a tolerance of ± 0.3 % by weight of total mixture when individual specimens are taken for quality control test in accordance with the provision.

Table 5 Composition of Bituminous Macadam

As per MORTH Table No. 500.4

Mix designation nominal aggregate size layer thickness IS Sieve (mm)	Grade - I 40mm 80-100 mm	Grade - II 19mm 50-75 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
Bitumen content % by weight of total mixture[1]	3.1 - 3.4	3.3 - 3.5
Bitumen Grade	35 - 90	35 - 90

8 **Bitumen Penetration Macadam: -**

The Work shall consist of construction of one or more layers of compacted crushed coarse aggregates with alternate applications of bituminous binder and key aggregates in accordance with the requirements of the specification of be used as a base course on road. subect to requirement of the overall approved pavement design. The composition for the quantities of materials used for this work shall be as specified in table number 6.

Table 6 Composition of Penetration Macadam

As per MORTH Table No. 500.6

IS Sieve Designation (mm)	Cumulative percent by weight of total aggregate passing			
	For 50mm compacted thickness		For 75mm compacted thickness	
	Coarse Aggregate	Key Aggregate	Coarse Aggregate	Key Aggregate
63	-	-	100	-
45	100	-	58 - 82	-
26.5	37 - 72	-	-	100
22.4	-	100	5 - 27	50 - 75
13.2	2 - 20	50 - 75	-	-
11.2	-	-	-	5 - 25
5.6	-	5 - 25	-	-
2.8	0 - 5	0 - 5	0 - 5	0 - 5
Approx. Loose Aggregate Quantities cu.m/m²	0.06	0.015	0.09	0.018
Binder quantity (penetration grade)[1] (kg/m²)	5		6.8	

Note: - If cutback bitumen is used, adjust binder quantity such that the residual bitumen is equal to the values in table number 6.

9 **Dense Graded Bituminous Macadam: -**

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. The composition of dense graded bituminous macadam shall be as per table number 7.

Table 7 Composition of Dense Graded Bituminous Macadam Pavement Layers As per MORTH Table No. 500.10

Grading	1	2
Nominal Aggregate size	40 mm	25 mm
Layer Thickness	80 - 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 4.0	Min 4.5
Bitumen grade (pen.)	65 or 90	65 or 90

Note:-

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

2 Determined by the Marshall method.

10 **Semi dense Bituminous Concrete Pavement Layer: -**

This work shall consist of contruction in a single or multiple layers of semi dense bituminous concrete on previously prepared bituminous bound surface. A single layer shall be 25mm to 100mm in thickness. The composition of Semi dense Bituminous Concrete shall be as per table number 8. Aggregate grading and binder content when tested in accordance with IS : 2386 Part 1 the combined grading of the coarse and fine aggregate and added filler shall fall within the limits as shown in table below in table below for grading 1 or 2 as specified in the contract.

Table 8 Composition of Semi dense Bituminous Concrete Pavement Layer
As per MORTH Table No. 500.15

Grading	1	2
Nominal Aggregate size	13 mm	10 mm
Layer Thickness	35 - 40 mm	25 - 30 mm
IS Sieve[1] (mm)	Cumulative % by weight of total aggregate passing	
45	-	-
37.5	-	-
26.5	-	-
19	100	-
13.2	90 - 100	100
9.5	70 - 90	90 - 100
4.75	35 - 51	35 - 51
2.36	24 - 39	24 - 39
1.18	15 - 30	15 - 30
0.6	-	-
0.3	9 - 19	9 - 19
0.15	-	-
0.075	3 - 8	3 - 8
Bitumen content % by mass of total mix [2]	Min 4.5	Min 5.00
Bitumen grade (pen.)	65*	65*

Note:-

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

2 Determined by the Marshall method.

* Only in exceptional circumstances, 80 - 100 penetration grade may be used, as approved by the Engineer.

11 **Composition of Bituminous Concrete Pavement Layers: -**

This work shall consist of contruction in a single or multiple layers of bituminous concrete on a previously prepared bituminous bound surface. A single layers shall be 25mm to 100mm in thickness. This work is used in wearing and profile corrective courses.The composition of Bituminous Concrete shall be as per table number 9. Aggregate grading and binder content when tested in accordance with IS : 2386 Part 1 the combined grading of the coarse and fine aggregate and added filler shall fall within the limits as shown in table below for grading 1 or 2 as specified in the contract.

Table 9 Composition of Bituminous Concrete Pavement Layers
As per MORTH Table No. 500.18

Grading	1	2
Nominal Aggregate size	19 mm	13 mm
Layer Thickness	50 - 65 mm	30 - 45 mm
IS Sieve[1] (mm)	Cumulative % by weight of total aggregate passing	
45	-	-
37.5	-	-
26.5	100	-
19	79 - 100	100
13.2	59 - 79	79 - 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 [2]	5.00 - 6.00	5.00 - 7.00
Bitumen grade (pen.)	65	65

12 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 table number 10. 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.

Table 10 Manufacturing and Rolling Temperatures
As per MORTH Table No. 500.5

Bitumen Penetration	Bitumen Mixing (°C)	Aggregate Mixing (°C)	Mixed Material (°C)	Rolling (°C)	Laying (°C)
35	160-170	160-175	170 Maximum	100 Minimum	130 Minimum
65	150-165	150-170	165 Maximum	90 Minimum	125 Minimum
90	140-160	140-165	155	80 Minimum	115 Minimum

13 Bituminous materials shall be transported in clean insulated vehicles.

Built - Up Spray Grout: -

Built - Up Spray Grout shall consist of a two layer composite construction of compacted crushed coarse aggregate with application of bituminous binder after each layer, and with key aggregate placed on top of the second layer, in accordance with the requirement of these specifications, to serve as a base course and in conformity with the approved drawing, or as directed by the Engineer. The thickness of the coarse shall be 75mm.

The bitumen shall be paving bitumen of penetration grade complying with Indian Standard Specifications for paving Bitumen IS : 73 and where permitted in the agreement an appropriate grade of emulsion complying with IS: 887 may be used. The grading requirements for coarse and key aggregate for built spray grout shall be as per table 11: -

Table 11 Grading requirement for coarse & key aggregate for built-up spray grout As per MORTH Table No. 500.7

IS Sieve Designation (mm)	Cumulative per cent by weight of total aggregate passing	
	Coarse Aggregate	Key Aggregate
53.0	100	-
26.5	40 - 75	-
22.4	-	100
13.2	0 - 20	40 - 75
5.6	-	0 - 20
2.8	0 - 5	0 - 5

14 Laying shall be suspended when free standing water is present on the surface to be covered or during the period of rain fog and dust storms . The surface on which the bituminous work is to be laid shall be cleaned of all loose material by means of mechanical broom or ant other approved method.

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 coarses 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, viaducts or other structure.

(v) The Mastic asphalt shall be laid, normally in one coat, at a temperature between 175^0C and 120^0C and spread uniformly by hand using wooden floats on prepared and regulated surface.

(vi) For filling of potholes.

(vii) Where directed by the Engineer.

Manual spreading of pre mixed wering aourse material or the addition of such material by hand spreading to the paved area, for adjustment of level, such only 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 at bridges, viaducts or other structure.

(iii) As directed by the Engineer.

15 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.

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 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 12: -

Table 12 Grading requirements for Chips for Surface Dressing
As per MORTH Table No. 500.21

IS Sieve Designation (mm)	Cumulative percent by weight of total aggregate passing for the following nominal sizes (mm)			
	19	13	10	6
26.5	100	-	-	-
19.0	85 - 100	100	-	-
13.2	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
0.60	-	-	-	0 - 2
0.075	0 - 1.5	0 - 1.5	0 - 1.5	0 - 1.5
Minimum 65% by weight of aggregate	Passing 19 mm retained 13.2mm	Passing 13.2 mm retained 9.5 mm	Passing 9.5 mm retained 6.3 mm	Passing 6.3 mm retained 3.35mm

(iii) **Rates of Spread for Binder and Chippings: -**

For the purpose of pricing the Bill of Quantities the rates of spread as per table 13: -

Table 13 Nominal Rates of Spread for Binder and Chippings
As per MORTH Table No. 500.20

Nominal Chipping Size mm	Binder (Penetration grade bitumen) (kg/m²)	Chips Cum/m²
19	1.2	0.015
13	1.0	0.010
10	0.9	0.008
6	0.75	0.004

Notes: -

1. These rates of spread are for pricing purpose.
2. For emulsion, these rates of spread are for the residual bitumen and appropriate adjustment must be made to determine the total quantity.
3. Refer to Manual for Construction and Supervision of Bituminous Works for the procedure of determining the rates of spread of binder and chips.

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

The application temperature for the grade of binder used shall be as per table 14 and the rate of spray as per table 13.

Table 14 Spraying Temperatures for Binders
As per MORTH Table No. 500.22

Binder grades	Whirling spray jets		Slot jets	
	Min. °C	Max. °C	Min. °C	Max. °C
Penetration grades				
400/500	160	170	140	150
280/320	165	175	150	160
180/200	170	190	155	165
80/100	180	200	165	175

16 **Seal Coat: -**

(i) Seal coat consist of the application of a seal coat for sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall (camber). The types of seal coat are as below: -

A Liquid seal coat comprising of an application of layer of bituminous binder followed by a cover of stone chips.

B Premixed seal coat comprising of a thin application of fine aggregate premixed with bituminous binder.

(ii) The quantity of bitumen per 10 square meter shall be 9.18kg for A type seal coat and for B type seal coat the bitumen shall be 6.8kg per 10 square meter. Bitumen used shall be as per IS : 73. Where bitumen emulsion of standard IS:8887 is used as a binder the quantities for type A and type B seal coat shall be 15kg and 10.5kg respectively.

(iii) Aggregate for Seal Coat

a Stone Chips for Type A seal coat

The stone chips shall consist of angular fragments of clean, hard and durable rock and free from dust, organic or other deleterious matter. Stone chip shall be 0.6 mm size defined as 100% passing through 11.2mm sieve and retained on 2.36mm sieve. The quantity used for spreading shall be 0.09 cubic meter per 10 square meter area.

b Aggregate for Type B seal coat

The aggregate shall be sand or grit and shall consist of clean,hard, durable , uncoated dry particles. These shall be free from dust, soft or flaky / elongated material, organic matter or other deleterious substances.

The aggregate shall pass 2.36mm sieve and be retained on 180 micron sieve. The quantity used for premixing shall be 0.06 cubic meters per 10 square meters area.

17 **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 trowel led and floated to from a very dense impermeable surfacing.

(i) The physical of binder which shall be a paving grade bitumen meting the requirements given in table number 15.

Table 15 Requirement for Physical Properties of Binder
As per MORTH Table No. 500.29

Property		Test method	Requirement
Penetration at 25 °C		IS 1203	15 ± 5*
Softening point, °C		IS 1205	65 ± 10
Loss on heating for 5h at 163°C, % of mass	Max.	IS 1212	2.0
Solubility in Trichloroethylene, % by mass	Min.	IS 1216	95
Ash (mineral matter), %by mass	Max	IS 1217	1.0

(ii) 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 table no. 16.

Table 16 Grade and Thickness of Mastic Asphalt paving and Grading of Coarse Aggregate

As per MORTH Table No. 500.30

Application	Thickness range (mm)	Nominal size of coarse aggregate (mm)	Coarse aggregate content, % by mass of total mix
Roads and carriageways	25 - 50	13	40 ± 10
Heavily stressed areas i.e. junctions and toll plaza.	40 - 50	13	45 ± 10
Nominal size of coarse aggregate	13 mm		
IS Sieve (mm)	Cumulative % passing by weight		
19	100		
13.2	88 - 96		
2.36	0 - 5		

The aggregate and fine aggregate shall be as per detail given in point number 4 and 6.

(iii) **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.

Table 17 Grading of Fine Aggregates (Inclusive Filler)
As per MORTH Table No. 500.31

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 - 35

18 Compaction after laying the bituminous material shall commence as soon as possible after laying. Compaction shall be done as per clause 501.6.

19 The clause 509.1 of MORTH specifies the construction of Bituminous Concrete, for use in wearing and profile corrective courses. This work shall consist of construction in a single or multiple layers of bituminous concrete on a previously prepared bituminous bound surface 25mm to 100 mm in thickness.

20 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, Semi dense Graded Bituminous Materials and bituminous concrete shall be measured as finished work in cubic meters.

21 Note for SSR item no 5.2 :-

(i) Bitumen emulsion has been provided @ 0.25,0.30,0.35 & 0.40 kg per sqm as per clause 503.8. Payment shall be made with adjustment, plus or minus, for the variation between this quantity and actual quantity approved by the Engineer after preliminary trials referred to in clause No. 503.4.3

22 Note for SSR item no 5.7 :-

(i) Although the rollers are required only for 3 hours as per norms of output, but the same have to be available at site for six hours as the hot mix plant and paver will take six hours for mixing and paving the output of 450 tonnes considered in this analysis. To cater for the idle period of these rollers, their usage rates have been multiplied by a factor of 0.65

(ii) Quantity of Bitumen (Bitumen- 60/70 @ 4.5 % of weight of mix, Modified bitumen CRMB @ 5% of weight of mix & Modified bitumen PMB - 40 @ 5% of weight of mix) has been taken for analysis purpose.The actual quantity will depend upon job mix formula.

(iii) Labour for traffic control, watch and ward and other miscellaneous duties at site including sundries have been included in administrative overheads of the contractor.

(iv) In case SDBC is laid over freshly laid tack coat, provision of broom and 2 mazdoor shall be deleted as the same has been included in the cost of tack coat.

(v) The quantity of Bitumen to be adjusted as per job mix formula.

23 Note for SSR item no 5.15 :-

(i) The rates for 50 mm & 40 mm thick layers may be worked out on pro-rata basis.

(ii) Where tack coat is required to be provided before laying mastic asphalt, the same is required to be measured and paid separately.

(iii) Mix design as per IS code subjected to minimum as per MORTH specification clause 5.15.

24 **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.

Acceptance criteria: - The acceptance criteria for tests on density and Marshall stability be subject to the condition that the mean value is not less then the specified value plus:-

$[1.65-(1.65/(\text{No.of sample})^{05}]$times the standard deviation

25 Control test for bituminous work, & their minimum feruency(As Per MORTH Section 900)

1 Test of Construction:- Prime Coat/Tack Coat/Fog Spray

(a) Test

(i) Quality of binder

(ii) Binder temperature for application

(iii) Rate of spread of binder

(b) Frequency (min.)

(i) Number of samples per lot and test as per IS : 73,IS:217 and IS:8887 as applicable.

(ii) At regular close intervals.

(iii) One test per 500m^2 and not less than two tests per days

2 Test of Construction:- Seal Coat / Surface Dressing

(a) Test

(i) Quality of binder.

(ii) Aggregate impact value / los angeles abrasion value.

(iii) Flakiness index and Elongation index.

(iv) Stripping value of aggregate.

(v) Water absorption of aggregate.

(vi) Water sensitivity of mix.

(vii) Grading of aggregate.

(viii) Soundness(Magnesium and sodium sulphate)

(ix) Polished stone value.

(x) Temperature of binder at application.

(xi) Rate of spread material.

(xii) Percentage of fractured faces.

(b) Frequency (min.)

(i) Same in mentioned under serial No. 1.

(ii) One test per 50 m^2 of aggregate.

(iii) -do-

(iv) Initially one set of 3 representative specimens for each source of supply. Subsequenently when warranted by changes in the quality of aggregate.

(v) -do-

(vi) Initially one set of 3 representative specimens for each source of supply. Subsequenently when warranted by changes in the quality of aggregate. (if required)

(vii) One test per 25 m^2 of aggregate.

(viii) Initially, One determination by each method for each source of supply, then as warranted by changes in the quality of aggregate

(ix) As required.

(x) At regular close intervals.

(xi) One test per 500 m2 of work, and not less then two tests per day.

(xii) When gravel is used, One test per 50 m2 of aggregate.

3 Test of Construction:- Open graded premix surfacing / Close- graded premix surfacing

(a) Test

(i) Quality of binder.

(ii) Aggregate impact value / los angeles abrasion value.

(iii) Flakiness index and Elongation index.

(iv) Stripping value of aggregate.

(v) Water absorption of aggregate.

(vi) Water sensitivity of mix.

(vii) Grading of aggregate.

(viii) Soundness(Magnesium and sodium sulphate)

(ix) Polished stone value.

(x) Temperature of binder at application.

(xi) Binder content

(xii) Rate of spread material.

(xiii) Percentage of fractured faces.

(b) Frequency (min.)

(i) Same in mentioned under serial No. 2.
(ii) Same in mentioned under serial No. 2.
(iii) -do-
(iv) Same in mentioned under serial No. 2.
(v) Same in mentioned under serial No. 2.
(vi) Same in mentioned under serial No. 2.
(vii) Same in mentioned under serial No. 2.
(viii) Same in mentioned under serial No. 2.
(ix) As required.
(x) At regular close intervals.
(xi) One test per 500 m2 ,not less then two tests per day.
(xii) Regular control through checks of layer thickness.
(xiii) Same in mentioned under serial No. 2.

4 Test of Construction:- Bituminous Macadam

(a) Test

(i) Quality of binder.
(ii) Aggregate impact value / los angeles abrasion value.
(iii) Flakiness index and Elongation index.
(iv) Stripping value
(v) Water sensitivity of mix.
(vi) Grading of aggregate.
(vii) Water absorption of aggregate.
(viii) Soundness(Magnesium and sodium sulphate)
(ix) Percentage of fractured faces.
(x) Binder content and aggregate grading
(xi) Control of temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling.
(xii) Rate of spread mixed material.
(xiii) Density of compacted layer.

(b) Frequency (min.)

(i) Same in mentioned under serial No. 1.
(ii) Same in mentioned under serial No. 2.
(iii) Same in mentioned under serial No. 2.
(iv) Same in mentioned under serial No. 2.
(v) -do-
(vi) Two test per day plant both on the individual constituents and mixed aggregate from the dryer.
(vii) Same in serial No. 2.
(viii) Same in mentioned under serial No. 2.
(ix) Same in mentioned under serial No. 2.
(x) Periodic,subject to minimum to two tests per day per plant.
(xi) At regular close intervals.
(xii) Regular control through checks of layer thickness.
(xiii) One test per 250 m2 ,of area.

5 Test of Construction:- Bituminous Penetration Macadam / Built-up Spray-Grout

(a) Test

(i) Quality of binder.
(ii) Aggregate impact value / los angeles abrasion value.
(iii) Flakiness index and Elongation index.
(iv) Stripping value
(v) Water absorption of aggregate.
(vi) Water sensitivity of mix.
(vii) Aggregate grading
(viii) Soundness(Magnesium and sodium sulphate)
(ix) Percentage of fractured faces.
(x) Temperature of binder at application.
(xi) Rate of spread of binder

(b) Frequency (min.)

(i) Same in mentioned under serial No. 1.
(ii) One test per 200 m2 ,of aggregate.
(iii) -do-
(iv) Same in mentioned under serial No. 2.
(v) Same in mentioned under serial No. 2.
(vi) Same in mentioned under serial No. 2.
(vii) One test per 200 m3 ,of aggregate.
(viii) Same in mentioned under serial No. 2.
(ix) Same in mentioned under serial No. 2.
(x) At regular close intervals.
(xi) Same in mentioned under serial No. 2.

6 Test of Construction:- Dense Bituminous Macadam /semi Dense Bituminous Concrete /Bituminous Concrete

(a) Test

(i) Quality of binder.
(ii) Aggregate impact value / los angeles abrasion value.
(iii) Flakiness index and Elongation index.
(iv) Stripping value
(v) Water absorption of aggregate.
(vi) Water sensitivity of mix.
(vii) Aggregate grading
(viii) Soundness(Magnesium and sodium sulphate)
(ix) Percentage of fractured faces.
(x) Temperature of binder at application.
(xi) Rate of spread mixed material.
(xii) Stability of mix
(xiii) Water sensitivity of mix.(Retained tensile strength)
(xiv) Control of temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling.
(xv) Control of binder content and grading of the mix.
(xvi) Rate of spread of mixed material
(xvii) Density of compacted layer.

(b) Frequency (min.)

(i) Same in mentioned under serial No. 1.
(ii) Same in mentioned under serial No. 2.
(iii) -do-
(iv) Same in mentioned under serial No. 2.
(v) Same in mentioned under serial No. 2.
(vi) Same in mentioned under serial No. 2.
(vii) As required.
(viii) As required.
(ix) As required, for semi Dense Bituminous Concrete /Bituminous Concrete.
(x) Same in mentioned under serial No. 2.
(xi) One set of tests on individual contituents and mixed aggregate form the dryer for each 400 tonnes of mix subject to a minimum of two tests per plant per day.
(xii) For each 400 tonnes of mix produced, a set 3 Marshall specimens to be prepared and tests for stability , flow value, density and void content subject to minimum of two sets being tested per plant per day.
(xiii) Same in mentioned under serial No. 2.
(xiv) As required for the Bituminous Concrete
(xv) At regular close intervals.
(xvi) One test for each 400 tonnes mix subjects toa minimum of two tests per day.
(xvii) Regular control through checks on the weight of mixed material and layer thickness.

7 Test of Construction:- Mastic Asphalt

(a) Test

(i) Quality of binder.
(ii) Aggregate impact value / los angeles abrasion value.
(iii) Flakiness index and Elongation index.
(iv) Stripping value
(v) Water sensitivity of mix.
(vi) Grading of aggregate.
(vii) Water absorption of aggregate.
(viii) Soundness(Magnesium and sodium sulphate)
(ix) Percentage of fractured faces.
(x) Binder content and aggregate grading
(xi) Control of temperature of binder and aggregate for mixing and of the mix at the time of laying and rolling.
(xii) Rate of spread of mixed material
(xiii) Hardness number

(b) Frequency (min.)

(i) Same in mentioned under serial No. 1.
(ii) Same in mentioned under serial No. 2.
(iii) -do-
(iv) -do-
(v) -do-
(vi) Two test per day plant both on the individual constituents and mixed aggregate from the dryer.
(vii) Same in mentioned under serial No. 2.
(viii) Same in mentioned under serial No. 2.
(ix) Same in mentioned under serial No. 2.
(x) Periodic,subject to minimum to two tests per day per plant.
(xi) At regular close intervals.
(xii) Regular control through checks on the weight of mixed material and layer thickness.
(xiii) One test for each 400 tonnes mix subjects toa minimum of two tests per day.

8 Test of Construction:- Slurry seal

(a) Test

(i) Quality of binder.
(ii) Film stripping test

(b) Frequency (min.)

(i) Same in mentioned under serial No. 1.
(ii) Initially one set of 3 representative specimens for each source of supply. For each source of supply, then as warranted by changes in the quality of aggregate.

9 Test of Construction:- Cold mix

(a) Test

(i) Quality of binder.
(ii) Aggregate impact value / los angeles abrasion value.
(iii) Flakiness index and Elongation index.
(iv) Stripping value
(v) Water sensitivity of mix.
(vi) Grading of aggregate.
(vii) Percentage of fractured faces.
(viii) Water absorption of aggregate.
(ix) Soundness(Magnesium and sodium sulphate)
(x) Percentage of fractured faces.
(xi) Binder content and aggregate grading
(xii) Mix stability

(b) Frequency (min.)

(i) Same in mentioned under serial No. 1.
(ii) Same in mentioned under serial No. 2.
(iii) -do-
(iv) -do
(v) -do
(vi) Two test per day plant both on the individual constituents and mixed aggregate from the dryer.
(vii) Two test per day per plant
(viii) Same in mentioned under serial No. 2.
(ix) Same in mentioned under serial No. 2.
(x) When gravel is used, One test per 50 m2 of aggregate.
(xi) Periodic,subject to minimum to two tests per day per plant.
(xii) For each 400 tonnes of mix produced, a set 3 Marshall specimens to be prepared and tests for stability , flow value, density and void content subject to minimum of two sets being tested per plant per day.

26 **Type of Binder and their use**

General: -

Penetration - Is a measure of hardness of consistency and therefore of primary importance as an indication of suitability for any particular construction on condition. This test is probably the most important of all tests of bitumens. Penetration is measured by a standard penetrometer. Penetration is the distance measured in units of 1/10 mm that a standard blunt-point needle will Penetrate a sample at 25 deg. C . When the needle is loaded with 100 grams applied for 5 seconds.

The higher the penetration number the softer the bitumen. The lower the penetration, the higher will be the melting point and lower the ductility; in other words, the harder the bitumen the higher will be the melting point, but the ductility will be less, for the bitumen becomes more brittle the harder it is. The harder the bitumen the quicker it sets; a soft bitumen takes comparatively a longer time to set.

Viscosity: - Is a liquid is the property that retards flow so that higher the viscosity the slower is the flow of the liquid. The viscosity of the binder should be selected according to the intensity of the traffic on the road, and also the temperature in which the work is to be carried out. Low viscosity binder can be laid cold and high viscosity binder has to be laid hot and is used in warmer weather. A more viscous binder id specified for the more heavily trafficked roads to resist distortion under the intense traffic and should be laid warm or hot within a few hours of manufacture.

26.1 **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 finally 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 partials to reunite and lie on the surface. Emulsions are more easily applied then hot binder. The performance, however, is affected to a much greater degree by adverse weather. Become of relatively thin film of binder that remains on the road, 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 the emulsion has “Broken”.

26.2 **Bitumen Cut Back**

cutbacks are softened bitumen (solid bitumen thinned with a volatile distillate such as petrol, kerosene, diesel oil or tar oil), which can be used whiteout heating or required only light heating.

Cutback bitumen is used for cold mix specification, as it will coat chipping in drum mixer.

26.3 **Bitumen 60/70 (60/70 is penetration number)**

This bitumen is used in very hot localities where a slightly harder grade is required.

26.4 **Bitumen 80/100 (80/100 is penetration number)**

Standard grade for surface paintings; premixing; grouting is graded aggregate dense surface and seal coats.

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)

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

(For Detail Refer specification Chapter of Bases and Surface Courses and MORTH specification of the same)

Chapter - 5			
BASES AND SURFACE COURSES (BITUMINOUS)			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
5.1	Providing and applying primer coat with bitumen emulsion 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	26.00
5.2	Providing and applying tack coat with bitumen emulsion 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	9.00
ii)	@ 0.30 kg per sqm (dry & hungry bituminous surfaces/granular surfaces treated with primer)	sqm	11.00
iii)	@ 0.40 kg per sqm (Non-bituminous surfaces) granular base not primed.	sqm	14.00
iv)	@ 0.35 kg per sqm (Non-bituminous surfaces) cement concrete pavement.	sqm	13.00
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	2.00
5.2.2	Providing and applying tack coat with bitumen emulsion grade 60/70 for BUSG @ 5 kg/10 sqm. area using emulsion pressure distributor on the prepared bituminous/granular surface cleaned with mechanical broom and as per relevant clauses.	sqm	27.00
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 3.25%	cum	5565.00
ii)	for Grading II(50-75mm thickness) bitumen content 3.4%	cum	5726.00
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 @ 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	5396.00
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	242.00
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-507. (Only cement will be used as filler)		

Item No.	Descriptions	Unit	Rate Rs
i)	for Grading I (80-100mm thickness)	cum	7161.00
ii)	for Grading II(50-75mm thickness)	cum	7178.00
5.7	Providing and laying semi dense 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 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-508. (Only cement will be used as filler).		
i)	for Grading I (35-40 mm thickness) with 60/70 bitumen	cum	7822.00
ii)	for Grading I (35-40 mm thickness) with CRMB-60	cum	6872.00
iii)	for Grading I (35-40 mm thickness) with PMB-40	cum	6817.00
iv)	for Grading II (25-30 mm thickness) with 60/70 bitumen	cum	8391.00
v)	for Grading II (25-30 mm thickness) with CRMB-60	cum	7376.00
vi)	for Grading II (25-30 mm thickness) with PMB-40	cum	7314.00
5.8	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-509.(Only cement will be used as filler).		
i)	for Grading I (50-65 mm thickness) with 60/70 bitumen	cum	8223.00
ii)	for Grading I (50-65 mm thickness) with CRMB-60	cum	7551.00
iii)	for Grading I (50-65 mm thickness) with PMB-40	cum	7488.00
iv)	for Grading II (30-45 mm thickness) with 60/70 bitumen	cum	8226.00
v)	for Grading II (30-45 mm thickness) with CRMB-60	cum	7554.00
vi)	for Grading II (30-45 mm thickness) with PMB-40	cum	7491.00
5.9	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-510.		
i)	with 19 mm nominal chipping size & bitumen @1.2kg per sqm.	sqm	77.00
ii)	with 13 mm nominal chipping size & bitumen @ 1.0 kg per sqm.	sqm	64.00
5.10	Providing,laying and rolling of open-graded premix surfacing of 20mm thickness composed of 13.2mm 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 hot mix plant, laying with paver finisher 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	117.00
5.11	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 cold mix plant or concrete mixer laying with laying manually 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	113.00

Item No.	Descriptions	Unit	Rate Rs
5.12	Providing, laying and rolling of open - graded premix surfacing of 20 mm thickness composed of 13.2 mm to 5.6 mm 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 concrete mixer or cold mix plant laying with paver finisher 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	98.00
5.13	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 penetration grade 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-512.		
	Type-A or Type-B aggregate		
i)	with 60/70 bitumen	sqm	150.00
ii)	with CRMB-60	sqm	138.00
iii)	with PMB-40	sqm	137.00
5.14 (A)	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	58.00
ii)	Type B (Premixed Seal Coat with hot mix plant & paver finisher)	sqm	45.00
5.14 (B)	Providing and laying seal coat sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall using Type-B (without hot mix plant/paver finisher) seal coats and as per relevant clauses of section-513 with bitumen.(This item can be excuted only with prior approval of the chief engineer UADD).	sqm	29.00
5.15	Providing and laying 25 mm thick mastic asphalt wearing course with paving grade bitumen meeting the requirements given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine-grained hard stone chipping of 13.2 mm nominal size at the rate of 0.005cum per 10 sqm and at an approximate spacing of 10 cm center to center in both directions, pressed into surface when the temperature of surfaces not less than 1000C, protruding 1 mm to 4 mm over mastic surface complete in all respect and as per relevant clauses of section-515.	sqm	503.00
5.16	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)	5 mm thickness	sqm	46.00
ii)	3 mm thickness	sqm	31.00
iii)	1.5 mm thickness	sqm	19.00
5.17	Crack Prevention Courses		

Item No.	Descriptions	Unit	Rate Rs
i)	Stress Absorbing Membrane (SAM) crack width less than 6 mm (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	50.00
ii)	Stress Absorbing Membrane (SAM) with crack width 6 mm to 9 mm (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	60.00
iii)	Stress Absorbing Membrane (SAM) crack width above 9 mm and cracked area above 50 % (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	80.00
iv)	Case - IV : Bitumen Impregnated Geotextile (Providing and laying a 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	262.00
5.18	Labour only for Laying and rolling of Bituminous courses i/c primer and tack coat (excluding cost of bitumen & metal) with a smooth wheeled roller 8-10 tonne capacity i/c hire charges & running expenses, finished to required level and grades and as per relevant clauses of section-500.		
i)	20mm Open Graded Premix Carpet	sqm	18.00
ii)	75mm Built-up Spray Grout	sqm	23.00
5.19	Pot-hole repaired of existing bituminous roads with hot-mix bituminous material (Bitumen content 4% by weight of total mix) and aggregates conforming to specification clause no. 504 as required by site condition, including cleaning of surface, cutting edges of pot-hole/patches vertically in rectangular or square shape, and compaction by means of rollers or Vibrating Compactor /Impact Tampers, excluding tack coat.	tonne	2612.00
5.20	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 specification clause no. 508 or 512 as required by site condition, including cleaning of surface, cutting edges of pot-hole/patches vertically in rectangular or square shape, and compaction by means of rollers excluding tack coat.	tonne	2815.00

CHAPTER- R- 6
CEMENT CONCRETE PAVEMENTS

Notes for Specification :-

1 **Lean 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 IS : 269

(ii) Portland Slag Cement IS : 455

(iii) Portland Pozzolana Cement IS : 1489

1.2 The Aggregates of lean concrete shall be as per IS 383. The maximum sizes of coarse aggregate shall be 25 mm. The fine aggregate shall consist of clean natural sand or crushed stone sand or a combination of the two be as per IS 383.

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.

(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.

(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 completion 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 the road, by constructing it in one go or in two lanes paved forward simultaneously.

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 considered to be 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 initial 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 for three days.

(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 for payment

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, 33 Grade IS : 269
(ii) Ordinary Portland Cement, 43 Grade IS : 8112
(iii) Ordinary Portland Cement, 53 Grade IS : 12269
(iii) Portland Pozzolana Cement IS : 1489 Part 1

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 limits of deleterious materials shall not exceed the requirements set out in IS : 269.

2.4 Mild steel bars for dowels and tie bars shall conform to the requirements of IS : 432, IS 1139, IS 1786 the dowel bars shall conform to Grade S 240 and tie bar to Grade S 415 of I.S.

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 350 kg per cu.m. of concrete the maximum cement content shall however not exceed 425 kg per cu.m of concrete.

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 main clauses;**

(a) Expansion joints, and

(b) Contraction joints.

Contraction joints are also required but they are replaced by either (a) or (b). These joints are made at right angle to the road length and extend the width of pavement.

Contraction and Expansion joints are made in concrete pavements to keep the stresses caused by changes in the volume of the concrete due either to shrieked during hardening and drying, or to temperature changes, and thus premed the formation of crack and ultimate failure of the slab. Shrinkage may be caused either by the initial heat of hydration of cement and sub sequent 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.

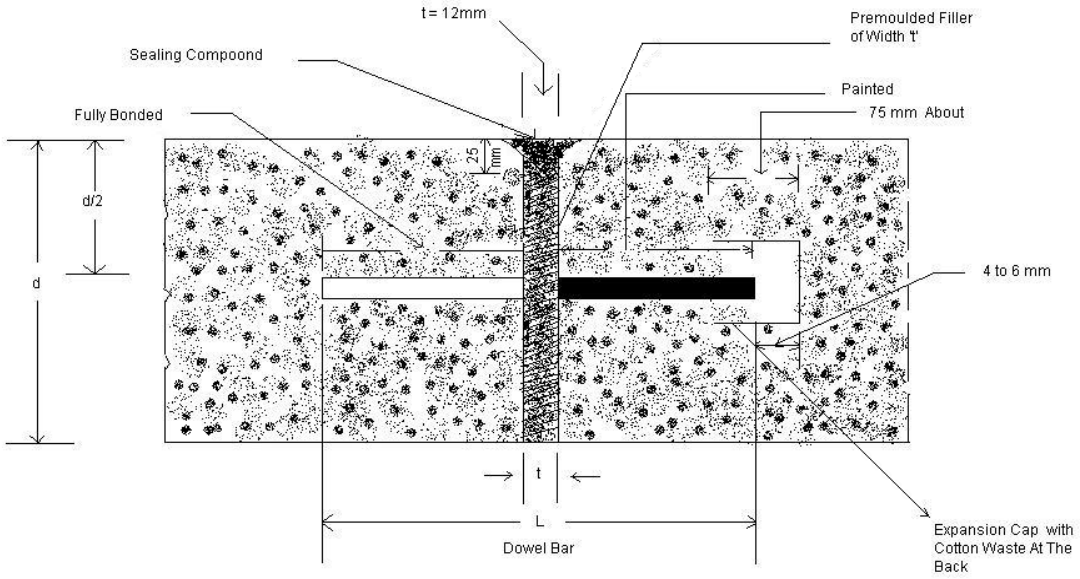
2.7.3 **Longitudinal Joints:-**

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.

Tie bar shall be used at longitudinal joints and they shall be the dimensions and at spacings shown on the approved drawing. Tie bar shall be supported so as not to be displaced during construction operation. Tie bars shall be bounded in the slabs across longitudinal joints, and whilst casting the first slabs, they may be bent so that one end of them lies along the forms. After removal of the forms, bars shall be straightened so that they extend into the concrete placed on the other side of the joints.

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

Mild steel bars for dowels and tie bars shall conform to the requirements of IS : 432, IS 1139, IS 1786 the dowel bars shall conform to Grade S 240 and tie bar to Grade S 415 of I.S. These bar shall be provided as per approved drawing.



Expansion joint (Drawing not to be scaled)

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 **Table : Frequency of Quality Control Tests for Paving Quality Concrete**

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.

(For Detail Refer specification Chapter of Cement Concrete Pavement and MORTH specification of the same)

CHAPTER-6			
CEMENT CONCRETE PAVEMENTS			
Item No.	**Descriptions**	**Unit**	**Rate 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 25mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per table of MORTH Specifications 600-1, cement content not to be less than 200 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-603.	cum	2715.00
6.1.1	Deduct for cost of cement per cum of concrete if cement is issued by agency other then Contractor.	cum	1254.00
6.2	Deduct from Item No.6.1 above if paver with Electronic sensor, vibratory roller are not used and laying, compaction is done by any other method. .	cum	190.00
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, 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 2002 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	4792.00
6.3.1	Deduct for cost of cement per cum of concrete if cement is issued by agency other then Contractor.	cum	2728.00
6.3.2	Labour with required mechines for item No. 6.3	cum	217.00
6.4	Deduct from Item No.6.3 above if paver with electronic sensor is not used and laying, compaction is done by any other method (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.)	cum	335.00
6.5	Construction of dowel jointed, plain cement concrete pavement in M-30 grade concrete over a prepared sub base with 43 grade cement 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 2002 and as per relevant clauses of section-602 of specifications complete but excluding cost fo steel in dowel ber & tie rod etc.	cum	4698.00
6.5.1	Deduct for cost of cement per cum of concrete if cement is issued by agency other then Contractor.	cum	2634.00

Item No.	Descriptions	Unit	Rate Rs
6.5.2	Labour rate with required machines for complition of item no. 6.5.	cum	216.00
6.5.3	Deduct from Item No.6.5 above if paver with electronic sensor is not used and laying, compaction is done by any other method (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.)	cum	329.00
6.6	Providing and laying stone-set pavement including preparation of 100mm thick compacted Granular Sub-base as per Clause of section 400 and base 75mm thick compacted water bound macadam grading 2 as per Clause 405.3. 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	340.00
6.7	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, transported to site, laid with paver with electronic sensor 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 and as per relevant clauses of section-600.	cum	2107.00
6.7.1	Deduct for cost of cement per cum of concrete if cement is issued by agency other then Contractor.	cum	941.00
6.8	Deduct from Item No.6.7 above if paver with electronic sensor, vibratory roller are not used and laying, compaction is done by any other method. .	cum	147.00
6.9	Providing and laying reinforced cement concrete pipe 300mm dia NP-4 for service ducts.		
	Providing and laying of a reinforced cement concrete pipe duct, 300 mm dia, across the road (new construction), extending from drain to drain in cuts and toe of slope to toe of slope in fills, constructing head walls in cement mortar 1:3 at both ends, providing a minimum fill of granular material over top and sides of RCC pipe as per IRC:98-1997, bedded on a 0.3 m thick layer of granular material free of rock pieces, outer to outer distance of pipe at least half dia of pipe subject to minimum 450 mm in case of double and triple row ducts, joints to be made leak proof, invert level of duct to be above higher than ground level to prevent entry of water and dirt, all as per IRC: 98 - 1997 and approved drawings		
6.9.1	Single row for one utility service	meter	1230.00
6.9.1.1	Labour for 6.9.1.	meter	18.00
9.6.2	Double row for one utility service	meter	2270.00
9.6.2.1	Labour for 6.9.2.	meter	29.00
6.9.3	Triple row for one utility service	meter	3319.00
6.9.3.1	Labour for 6.9.3.	meter	51.00
6.10	Providing and laying Cement Concrete grade M-10 Nominal mix with 20 mm graded crushed stone aggregate, laid with a fixed form / slip form paver with spreading the concrete by shovels mixing shall be in mechanical mixer, compacting by use of pin plate and screed vibrators including form work by strong steel girders fixed by spikes.	Cum	3046.00
6.10.1	Deduct for cost of cement per cum of concrete if cement is issued by agency other then Contractor.	Cum	1380.00

Item No.	Descriptions	Unit	Rate Rs
6.10.2	Deduct from Item No.6.10 above if paver with electronic sensor is not used and laying, compaction is done by any other method (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.)	Cum	213.00
6.10.3	Labour rate with required mechines item no 6.10	Cum	976.00
6.10.4	Providing and laying cement concrete grade 1:3:6 with 40mm graded crushed stone aggregate, (M-10 nominal mix) including the cost of centering and shuttering. Compacting with appropriate method, finishing and curing and as per relevant clauses of section.603.	Cum	2886.00
6.11	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.	Cum	4557.00
6.11.1	Deduct for cost of cement per cum of concrete if cement is issued by agency other then Contractor.	Cum	2540.00
6.11.2	Labour rate with required mechines item no 6.11	Cum	769.00
6.11.3	Deduct from Item No.6.11 above if paver with electronic sensor is not used and laying, compaction is done by any other method (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.)	Cum	319.00
6.12	Add extra in Item No.- 6.3 & 6.5 above for the cost of stell in dowel bar and tie rod etc. required as per design.		
6.12.1	**Mild Steel dowel bars**	MT	47850.00
6.12.2	**Tor steel tie rod**	MT	52800.00

CHAPTER- R- 7
GEOSYNTHETICS AND REINFORCED
Notes for Specification :-

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.

Property	Units	Standard Requirements	Test Method
Tensile Strength	Kg	36.3	ASTM D 4632
Elongation	%	50	ASTM D 4632
Asphalt Retention	Kg/10 sq.m.	10	Texas DOT 3099
Melting Point	°C	150	ASTM D 276
Surface Texture	-	Heat bonded on One side only	Visual Inspection

(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 and brush application may be used in locations of fabric overlap.

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 (i) In Protection work mattresses constructed with Geogrids or Geonets shall be used for thickness of 300 mm or above.

(ii) Mattresses constructed with Geogrids or Geonets shall be used for thickness of 30 mm or above as shown in the drawings. While adopting a particular size for gabions or mattresses, width of the roll of geogrid/geonet may be kept in view to minimize wastage of the geosynthetic in cutting off pieces. The mesh opening may vary depending on functional requirement but shall have aperture between 35 mm and 100 mm. The mesh/net shall have following characteristics:

Aperture: - Rectangular, square or oval shaped (and not in diamond, round or polygonal shape).

Colour: - Black

Mechanical Properties :- Peak strength not less than 10 kN/m at maximum longation of 15 per cent. Not more than 5 per cent elongation at half peak load.

Stands/Fabric: - Integral joints with junction strength of 100 per cent of plain.

Form: - Strands as measured by GRI-GG3 standards. Material shall have ISO 9002 certification

Life: - At least 8 years in case of continuous exposure and 5 years for buried applications (defined as capable of retaining at least 75 per cent of its original strength after the life span stated).

6 Measurement

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

9 Rates

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

The contract rate per cubic meter of crate fill shall consist of cost of boulders and their transportation.

The contract rate for excavation including backfilling of trenches, seating trench upto 15 cm (included in rate), shall include cost of all labour, tools and plant for completion of the work to these Specifications.

The cost of making a crate shall include preparation of box of geogrid/geonet, tensioning and staking arrangements, tying, internal crossbraids, etc., for forming of the crates in an engineered manner and filling the crate by laying boulders. The cost shall include transportation of material from store to site.

10 Note For Item no 7.3

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

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

3.The quantity of filler media shall be calculated as per approved design and specifications and shall be priced separately. The rate for same to be adopted from chapter 15.

4.Excavation for foundation including foundation concrete and groove in the foundation for seating of bottom most facia panel and capping beam to be calculated as per design and priced separately. The rates for excavation and foundation concrete shall be taken from the chapter 12 & 13 in bridge section.

5.The earth fill to be retained is not included in this analysis. The same is to be worked out and provided separately complete as per clause 305.

6.For compaction of Earthwork, attention is invited to clause 3105.5 of MoRTH Specification.

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

8.The type of reinforcing elements to be adopted shall be as per approved design and specifications.

9.The market rate for supply of reinforcing elements and their accessories are to be ascertained from reputed firms in the field of earth reinforcement.

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

11.Capping beam is to be priced separately as per approved design. The rate for cement concrete shall be taken from the chapter of sub-structure in bridge section.
12.The cost of reinforced earth retaining wall shall include following:

(i) Excavation for foundation including backfilling.
(ii) Foundation concrete as per approved design.
(iii) Cost of facial panels and their erection .
(iv) Cost of reinforcing elements including their fixing and joining with the facial panels.
(v) Drainage arrangement including filter media as per approved design and drawings.

13. The compacted earth filling to be retained shall form part of embankment.

For Detail Refer specification chapter of Geosynthetics & Reinforced and MORTH Specification of the same

CHAPTER-7			
GEOSYNTHETICS AND REINFORCED EARTH			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
7.1	Laying Paving Fabric Beneath a Pavement Overlay (Providing and laying paving fabric with physical requirements as per table 704-2 over a tack coat of paving grade Bitumen 80-100 penetration, 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	144.00
7.2	Laying Boulder Apron in Crates of Synthetic Geogrids (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 704.2, 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 704.3. 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 as per relevant clauses of section-700 & 2500 of specifications.	cum	2515.00
7.3	Construction of Reinforced Earth Retaining Wall including excavation for foundation, foundation concrete and cement concrete grooved sealing in foundation for facing elements and placement, assembling, joining and laying of reinforcing element complete. The above item shall be payable only after back filling behind the wall is completed by granular material duly watered, rolled and completed. (Back filling behind the facing element shall be paid separately as per Chapter-R-3 item No.3.11)		
(i)	Assembling, joining and laying of reinforcing elements.		
A	With reinforcing element of steel / Aluminium strips / polymeric strips.		
Type 1	1.Galvanised carbon steel strips	meter	376.00
Type 2	2.Copper Strips	meter	337.00
Type 3	3.Aluminium Strips	meter	321.00
Type 4	4.Stainless steel strips	meter	321.00
Type 5	5.Glass reinforced polymer/fibre reinforced polymer/polymeric strips	meter	417.00
B	With reinforcing elements of synthetic geogrids	sqm	196.00
(ii)	Facing elements of RCC	sqm	1049.00

CHAPTER- R- 8
TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES

Notes for Specification :-

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

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 mild steel sheeting and fixed to MS post by welding and to the RC or GI posts by bolts and washers properly.

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 M15 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 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.

7 Support and component of signs except the reflectorised portion and GI posts, shall be thoroughly descaled, cleaned, primed and painted with two coats of epoxy paint. The portion of mild steel post below ground should be painted with three coats of red lead paint.

8 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.

9 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.

10 In General, overhead signs shall provide a vertical clearance of not less than 5.5 m over the entire width of the pavement and shoulders .

11 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.

12 For outside of an unmountable kerb the minimum lateral clearance shall be of 1.80 m.

13 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.

14 Layout, colour of road markings shall be in accordance with the code of practice for Road markings with paints, IRC : 35.

15 Marking shall be done by machine are manually.

16 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.

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

18 The fencing barbed wire shall be galvanised iron and shall conform to IS : 278 and M.S. posts shall conform to IS : 226.

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

20 The concrete barriers shall be constructed with M-20 grade concrete and with Higher Yield Strength.

21 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) No measurement for payment will be made for excavation or backfilling performed in connection with this construction.

9 Rates

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

For Detail Refer specification Chapter of Traffic Signs, Markings and MORTH Specification of the same

CHAPTER-8			
TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
8.1	Construction of cement concrete kerb with top and bottom width 115 and 165 mm respectively, 250 mm high in M 20 grade PCC on M-10 grade foundation 150 mm thick, foundation having 50 mm projection beyond kerb stone, kerb stone laid with kerb laying machine, foundation concrete laid manually, all complete and as per clause 408 of specifications.		
A.	Using Concrete Mixer	meter	187.00
B	Using Concrete Batching and Mixing Plant	meter	189.00
8.1.1	labour rate for cement concrete kerb with top and bottom width 115 and 165 mm respectively, 250 mm high in M 20 grade PCC on M-10 grade foundation 150 mm thick, foundation having 50 mm projection beyond kerb stone, kerb stone laid with kerb laying machine, foundation concrete laid manually, all complete and as per clause 408 of specifications.	meter	25.00
8.2	Printing new letter and figures 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 clauses of section-800 & I.R.C.-67.		
i)	Hindi Matras commas and the like not to be measured and paid. (For Half letter shall be counted as half)	Per cm height per 10 letter	5.00
ii)	English and Roman	Per cm height per 10 letter	3.00
8.3	Providing and fixing of retro- reflectorised cautionary, mandatory and informatory sign as per IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 1.5 mm thick supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm (height from crown level of the road and bottom of the sign board shall not be less than 1.5 m.) firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing including painting of vertical post as per specification.		
i)	90 cm equilateral triangle	each	3715.00
ii)	60 cm equilateral triangle	each	2488.00
iii)	60 cm circular	each	3291.00
iv)	80 cm x 60 cm rectangular	each	4537.00
v)	60 cm x 45 cm rectangular	each	3209.00
vi)	60 cm x 60 cm square	each	3778.00
vii)	90 cm high octagon	each	5752.00

Item No.	Descriptions	Unit	Rate Rs
8.4	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorised sign asper IRC:67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75x75x6 mm (height from crown level of the road and bottom of the sign board shall not be less than 1.5 m.) firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60 cm, 60 cm below ground level as per approved drawing including painting of vertical post as per specification.	sqm	7983.00
8.5	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro- reflectorised sign asper IRC :67 made of encapsulated lens type reflective sheeting vide clause 801.3, fixed over aluminium sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75 mm x 75 mm x 6 mm (height from crown level of the road and bottom of the sign board shall not be less than 1.5 m.) , 2 Nos. firmly fixed to the ground by means of properly designed foundation with M 15 grade cement concrete45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing including painting of vertical post as per specification.	sqm	13831.00
8.6	Painting two coats after filling the surface with synthetic enamel paint in all shades on new plastered concrete surfaces and as per relevant clauses of section-800 & I.R.C.-67 including cost of paint etc. complete.	sqm	44.00
8.6.1	Labour rate excluding the cost of material for Item No.- 8.6	sqm	17.00
8.7	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	42.00
8.8	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.		
i)	Over 10 cm in width	sqm	70.00
8.8.1	Labour rate excluding the cost of material for Item No.- 8.8 (i)	sqm	44.00
ii)	Up to 10 cm in width	sqm	61.00
8.8.2	Labour rate excluding the cost of material for Item No.- 8.8 (ii)	sqm	36.00
8.9	Painting Lines, Dashes, Arrows etc on Roads in Two Coats on Old Work (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.		
i)	Over 10 cm in width	sqm	48.00
ii)	Up to 10 cm in width	sqm	61.00
8.9.1	Labour rate excluding the cost of material for Item No.- 8.9 (i)	sqm	33.00

Item No.	Descriptions	Unit	Rate Rs
8.10	Road Marking with Hot Applied Thermoplastic Compound with Reflectorising Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorising glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35 .The finished surface to be level, uniform and free from streaks and holes and as per relevant clauses of section-800.	sqm	900.00
8.11	Providing reinforced cement concrete M15grade kilometer stone of standard design as per IRC:8-1980, fixing in position including painting and printing etc as per relevant clauses of section-800 of specifications.		
i)	5th kilometer stone (precast)	each	3010.00
8.11.1	Labour for fixing painting and printing of reinforced cement concrete M15 grade 5th k.m stone (precast) as per item 8.11.(i)	each	378.00
ii)	Ordinary Kilometer stone (Precast)	each	1696.00
8.11.2	Labour for fixing painting and printing of reinforced cement concrete M15 grade 5th k.m stone (precast) as per item 8.11.(ii)	each	177.00
iii)	Hectometer stone (Precast)	each	411.00
8.11.3	Labour for fixing painting and printing of reinforced cement concrete M15 grade 5th k.m stone (precast) as per item No.- 8.11 (iii)	each	61.00
8.12	Road Delineators (Supplying and installation of delineators (road way indicators, hazard markers, object markers), 80-100 cm high above ground level, painted black and white in 15 cm wide stripes, fitted with 80 x 100 mm rectangular or 75 mm dia circular reflectorised panels at the top, buried or pressed into the ground and confirming toIRC-79 and the drawings as per relevant clauses of section-800 of specifications.	each	292.00
8.13	Providing reinforced cement concrete M15 grade boundary pillars of standard design as per IRC:25-1967, fixed in position including finishing and lettering but excluding painting)	each	448.00
8.13.1	Labour rate for fixing of boundary pillar with lettering as per item No.- 8.13	each	68.00
8.14	G.I Barbed wire Fencing 1.2 meter high (Providing and fixing 1.2 meters high GI barbed wire fencing with 1.8 m angle iron posts 40 mm x 40 mm x 6 mm placed every 3 meters center to center founded in M15 grade cement concrete, 0.6 meter below ground level, every 15th post, last but one end post and corner post shall be strutted on both sides and end post on one side only and provided with 9 horizontal lines and 2 diagonals interwoven with horizontal wires, fixed with GI staples, turn buckles etc complete as per relevant clauses of section-800 of specifications.	meter	225.00
8.14.1	Labour rate only for fixing barbed wire fencing as per item No.- 8.14	meter	16.00
8.15	G.I Barbed wire Fencing 1.8 meter high Providing and fixing 1.8 meters high GI barbed wire fencing with 2.4 m angle iron posts 50 mm x 50 mm x 6 mm placed every 3 meters center to center founded in M15 grade cement concrete, 0.6 meter below ground level, every 15th post, last but one end post and corner post shall be strutted on both sides and end post on one side only and provided with 12 horizontal lines and 2 diagonals interwoven with horizontal wires, fixed with GI staples, turn buckles etc complete as per clause 807 of MORTH specifications.	meter	373.00
8.15.1	Labour rate only for fixing barbed wire fencing as per item No.- 8.15	meter	20.00

Item No.	Descriptions	Unit	Rate Rs
8.16	Tubular Steel Railing on Medium Weight steel channel (ISMC series) 100 mm x 50 mm (Providing, fixing and erecting 50 mm dia GI pipe (medium class) railing in 3 rows duly painted on medium weight steel channels (ISMC series) 100 mm x 50 mm, 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	1536.00
8.17	Tubular Steel Railing on Precast RCC posts, 1.2 m high above ground level (Providing, fixing and erecting 50 mm dia GI 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	1137.00
8.17.1	Labour rate for erecting 15 mm dia GI pipe railing in 3 rows on precast m20 grade RCC vertical posts Item No.- 8.17	meter	8.00
8.18	Reinforced Cement Concrete Crash Barrier (Provision of an Reinforced cement concrete crash barrier at the edges of the road, approaches to bridge structures and medians, constructed with M-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.		
i)	M 20 grade concrete	meter	2895.00
8.19	Metal Beam Crash Barrier		
a)	Type - A, "W" : Metal Beam Crash Barrier (Providing and erecting a "W" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 70 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 1.8 m high, 1.1 m below ground/road level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150 x 75 x 5 mm, 330 mm long complete as per clause 810 of specifications	meter	4354.00
b)	Type - B, "THRIE" : Metal Beam Crash Barrier (Providing and erecting a "Thrie" metal beam crash barrier comprising of 3 mm thick corrugated sheet metal beam rail, 85 cm above road/ground level, fixed on ISMC series channel vertical post, 150 x 75 x 5 mm spaced 2 m centre to centre, 2 m high with 1.15 m below ground level, all steel parts and fitments to be galvanised by hot dip process, all fittings to conform to IS:1367 and IS:1364, metal beam rail to be fixed on the vertical post with a space of channel section 150 x 75 x 5 mm, 546 mm long complete as per clause 810 of specifications.	meter	6227.00
8.20	Road Markers/Road Stud with Lense Reflector (Providing and fixing of road stud 100x 100 mm, dia cast in aluminium, resistant to corrosive effect of salt and grit, fitted with lense reflectors, installed in concrete or asphaltic surface by drilling hole 30 mm upto a depth of 60 mm and bedded in a suitable bituminous grout or epoxy mortar, all as per BS 873 part 4:1973)	each	713.00
8.20.1	Labour rate for fixing road stud as per Item No.- 8.20	each	4.00

Item No.	Descriptions	Unit	Rate Rs
8.21	Traffic Cone (Provision of 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, placed at 1.5 m interval, all as per BS 873)	each	186.00
8.22	Portable Barricade in Construction Zone (Installation of a steel portable barricade with horizontal rail 300 mm wide, 2.5 m in length fitted on a 'A' frame made with 45 x 45 x 5 mm angle iron section, 1.5 m in height, horizontal rail painted (2 coats) with yellow and white stripes, 150 mm in width at an angle of 45 Degrees, 'A' frame painted with 2 coats of yellow paint, complete as per IRC:SP:55-2001)	each	2353.00
8.23	Permanent Type Barricade in Construction Zone		
a)	With Steel Components (Construction of a permanent type barricade made of steel components, 1.5 m high from road level, fitted with 3 horizontal rails 200 mm wide and 4 m long on 50 x 50 x 5 mm angle iron vertical support, painted with yellow and white strips, 150 mm in width at an angle of 450, complete as per IRC:SP:55-2001)	each	3776.00
8.23.1(a)	Labour rate for Construction of a permanent type barricade made of steel components, 1.5 m high from road level, fitted with 3 horizontal rails 200 mm wide and 4 m long on 50 x 50 x 5 mm angle iron vertical support, painted with yellow and white strips, 150 mm in width at an angle of 450, complete as per IRC:SP:55-2001.including charges for welding drilling etc.	each	323.00
b)	With Bricks (Construction of a permanent type barricade made with brick work in mud mortar, 1.5 m high, 4 m long, 600 mm thick, plastered with cement mortar 1:6, painted with yellow and white strips)	each	10002.00
8.23.2	Labour rate for Construction of a permanent type barricade made with brick work in mud mortar, 1.5 m high, 4 m long, 600 mm thick, plastered with cement mortar 1:6, painted with yellow and white strips.	each	1285.00
8.24	Drum Delineator in Construction Zone (Provision of metal drum/empty bitumen drum delineator, 300 mm in diameter, 800 mm high, filled with earth for stability, painted in circumferential strips of alternate black and white 100 mm wide fitted with reflectors 3 Nos of 7.5 cm dia, all as per IRC:SP:55-2001)	each	379.00
8.25	Providing chute drain consisting of NP-2 R.C.C. half round pipe, laid over block of C.C. 1:3:6 (20mm and down aggregate size 450x265mm laid over filter media (measured and paid separately) i/c all false work etc. complete		
(a)	300mm dia	RM	340.00
(b)	450mm dia	RM	508.00

Item No.	Descriptions	Unit	Rate Rs
8.26	Providing & fixing in position precise Reinforced Cement Concrete manhole covers with and without frames confirming to IS-12592(Part I&II) 1991.		
8.26.1	Reinforced Cement Concrete manhole covers with frames		
8.26.1.1	Rectangular shape 600x450mm internal dimensions Precast R.C.C manhole cover and frame LD-2.5	each	989.00
8.26.1.2	Square 450mm shape internal dimensions Precast R.C.C manhole cover and frame LD-2.5	each	843.00
8.26.1.3	Circular Shape 450mm internal dimensions Precast R.C.C manhole cover and frame LD-2.5	each	797.00
8.26.1.4	Square 450x450mm shape internal dimensions Precast R.C.C manhole cover and frame MD-10	each	923.00
8.26.1.5	560 mm dia heavy duty cover with frame	Each	1193.00
8.26.1.6	600 mm dia heavy duty cover with frame	Each	1478.00
8.26.1.7	560 mm dia extra heavy duty cover with frame	Each	1591.00
8.26.1.8	450 mm x 900 mm heavy duty rectangular cover with frame	Each	2237.00
8.26.1.9	560 mm x 900 mm extra heavy duty rectangular cover with frame	Each	3102.00
8.26.2	Reinforced Cement Concrete manhole covers without frames		
8.26.2.1	Rectangular shape 600x450mm internal dimensions Precast R.C.C manhole cover without frame LD-2.5	each	669.00
8.26.2.2	Square 450mm shape internal dimensions Precast R.C.C manhole cover without frame LD-2.5	each	565.00
8.26.2.3	Circular Shape 450mm internal dimensions Precast R.C.C manhole cover without frame LD-2.5	each	541.00
8.26.2.4	Square 450x450mm shape internal dimensions Precast R.C.C manhole cover without frame MD-10	each	632.00
8.26.2.5	560 mm dia heavy duty cover without frame	Each	778.00
8.26.2.6	600 mm dia heavy duty cover without frame	Each	955.00
8.26.2.7	560 mm dia extra heavy duty cover without frame	Each	1022.00
8.26.2.8	450 mm x 900 mm heavy duty rectangular cover without frame	Each	1401.00
8.26.2.9	560 mm x 900 mm extra heavy duty rectangular cover without frame	Each	1505.00
8.27	Providing 85 mm thick Hydraulically pressed precise cement concrete M-40 including steel reinforcements (100kg/cum of concrete) heavy duty covers with slots for ingress of water and arrangement for lifting.	Sqm	892.00
8.28	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	497.00
8.29	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	393.00
8.30	Providing and fixing in cement mortar 1:5 (1 Cement : 5 sand) red stone slab 30mm thick over drains. Pointing work in cement mortar 1:3 (1 cement : 3 sand)	Sqm	328.00
8.31	Providing and fixing red stone slab (dansa) 80 mm to 100 mm thick in cement mortar 1:5 (1 Cement : 5 sand) for road crossings.	cum	7213.00

CHAPTER-9			
SUPPLY OF MATERIAL			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
9.1	Supply of mineral aggregate like broken stone/crushed stone (crushed in mechanical crusher) as per clause 514 at road site including all lead and stacking etc. complete.		
i)	75mm standard size broken stone	cum	361.00
ii)	63mm standard size broken stone	cum	361.00
iii)	45mm standard size broken stone	cum	361.00
iv)	40mm standard size crushed stone	cum	548.00
v)	26.5mm standard size crushed stone	cum	595.00
vi)	22.4mm standard size crushed stone	cum	608.00
vii)	13.2mm standard size crushed stone	cum	690.00
viii)	11.2mm standard size crushed stone	cum	526.00
ix)	6.7mm standard size crushed stone	cum	474.00
9.2	Supply as per clause 514 including all lead and stacking etc. complete.		
i)	Crusher stone dust (clause 507.2.3)	cum	198.00
ii)	Sand/Shingle/Kanker/Laterite	cum	251.00
iii)	Moorum with CBR not less than 20 and P.I. Not exceeding 6.	cum	257.00
9.3	Supply of binding material at road site having P.I. Value less than 6 confirming to clause 404.2.7.	cum	257.00
Note :	In case of suitable binding material having a P.I. Value of less than 6 is not available within reasonable distances. The contractor (at his own cost) may add an admixture of lime to lower down the P.I. to bring it within the above range. A factor of safety of 2 should be applied to the results of laboratory to decide the percentage of lime to be added.		

CHAPTER- R- 10
MAINTENANCE OF ROADS
Notes for Specification :-

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 cutback or 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.

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

(ii) 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.

(iii) 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.

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

(v) During the process of compaction, the surface levels shall be checked using a 3m straight

6 Crack selling

(i) Fog seal for use in maintenance work shall conform to the requirements of MORTH 518.

(ii) Fog seal shall be used for sealing fine hair-cracks with less than 3 mm width.

(iii) The area to be treated with fog seal shall be thoroughly cleaned using compressed air, scrubbers, etc.

(iv) The cracks shall be cleaned with a compressed air jet to remove all dirt, dust, etc.

(v) The fog seal shall be applied at the rate 0.5 - 1.0 litre/sq.m of emulsion using equipment such as, a pressure tank, flexible hose and spraying bar or lance.

(vi) Traffic shall be allowed on to the surface only after the seal has set to a non-tacky and firm condition so that it is not picked up by the traffic.

7 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.

8 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.

9 Measurement

(i) Maintenance of earthen shoulder shall be measured in sq. meters.

(ii) Filling of pot-holes and patch repair shall be measured in sq.m

(iii) The fog seal work shall be measured in sq.meters, calculated from the dimensions of work instructed in the contract or by the Engineer.

(iv) Crack sealing shall be paid by the linear meter of crack as instructed by the Engineer.

(v) Dusting shall be paid for by the square meter of road surface instructed to be dusted by the Engineer.

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

a 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.

b 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.

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

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

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

10 Measurement

Repair of joint grooves shall be measured in linear meters.

11 Rates

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

Maintenance of WBM Road

a Before filling up a pothole, remove all loose material from the pothole upto the firm base, cut the affected area made into a regular rectangular shape with sides of the hole kept vertical. Fill the prepared pothole space with aggregate of the same size and type as used in the original layer and apply screenings and binding material of the same type (if found suitable) as used in original construction over the aggregate and compact by hand rammer. After watering, compact the layer again by hand rammer first and then by a road roller.

b Clean the rutted potion of all loose material and sprinkle with water and shape the rutted portion into a rectangular portion with flat bottom. Fill the prepared rut portion with salvaged material, if found suitable and/or fresh suitable aggregates and roll after addition of screenings, binding material and watering following the standard procedure as per MORTH specification. After rolling, provide a 6 mm sand layer over the finished surface and lightly sprinkle with water.

c Remove any damaged portions at the edges, replace by fresh material and roll.

d Any corrugated surface formed by excess blindage material should be rectified by removing all excess blindage material by dragging or brooming. Where corrugations develop in WBM course itself, a renewal layer of WBM will be required.

e Fine hair cracks on the surface are usually indicative of ravelling taking place later. This tendency for ravelling can be remedied by blending with good binding material and watering the surface. Where ravelling has developed prominently, resurfacing should be carried out.

For Detail Refer specification Chapter of Maintenance of Roads and
MORTH Specification of the same

CHAPTER-10			
MAINTENANCE OF ROADS			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
10.1	Filling Pot- holes and Patch Repairs with (bitumen content 3.7%of mix) open - graded Premix surfacing, 20mm. (Removal of all failed material, trimming of completed excavation to provide firm vertical faces, cleaning of surface, painting of tack coat on the sides and base of excavation as per clause 503, back filling the pot holes with hot bituminous material as per clause 511, compacting, trimming and finishing the surface to form a smooth continuous surface, all as per clause 3004.2)	sqm	122.00
10.2	Crack Filling (Filling of crack using slow - curing bitumen emulsion and applying crusher dust in case crack are wider than 3mm.) As per relevant clauses of section-3000.	meter	3.00
10.3	Dusting (Applying crusher dust to areas of road where bleeding of excess bitumen has occurred.) As per relevant clauses of section-3000.	sqm	5.00
10.4	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	1245.00
10.4.1	Labour rate for Repair of spalled joint grooves of contraction joints, longitudinal joints and expansion joints in concrete pavements using epoxy mortar or epoxy concrete excluding the cost of material only Item No.- 10.4	meter	23.00
10.5	Repair of old Joints 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	19.00
10.6	Filling Pot-holes and Patch Repairs with open-Graded Premix surfacing, upto 20mm thickness.	Sqm	118.00
10.7	Filling Pot-holes and Patch Repairs with Bituminous concrete, upto 40mm thickness.		
(i)	for grading I Material	Cum	301.00
(ii)	for grading II Material	Cum	309.00
10.8	Providing Painting to angle iron post of road sign boards complete with synthetic Enamal paint.		
(i)	Two coats on new Work.	Sqm	54.00
(ii)	Old coat on old work.	Sqm	45.00
10.8.1	Labour rate for painting to angle iron post of road sign boards complete with synthetic Enamal paint as per item No.- 10.8 (i)	Sqm	23.00

CHAPTER- R- 11
HORTICULTURE

Notes for Specifications :-

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

2 Generally the depth of trenching is 30 cm for grassing and 60 cm for regrassing in good soil.

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

4 Weeds or other vegetation which appear on the ground are than uprooted and removed and disposed off and paid.

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 **MEASUREMENT OF TRENCHING**

Length and breadth of the plot shall be taken correct to 0.1 m and depths correct to cm. Cubical contents shall be calculated in cubic meters, correct to two places of decimal. No deduction shall be made nor extra paid for removing stones, brick bats and other foreign matter met with during excavation upto initial lead of 50m and stacking the same.

7 **DIGGING HOLES FOR PLANTING TREES**

(A) In Ordinary soil

(i) Holes of circular shape in ordinary soil shall be excavated to the dimensions described in the items

(ii) Excavate soil broken to clods of size not exceeding 75mm in any direction, 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

(iii) Unserviceable material removed from the site as directed and Useful material, if any, shall be stacked properly and separately

(iv) 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

(v) The tree holes shall be manured with powdered Neam/castor oil cake at the specified rate along with farm yard manure over sludge.

(vi) Above shall be uniformly mixed with the excavated soil after the manure has been broken down to powder in the specified proportion.

(vii) The mixture of manure neam power /caster oil and soil shall be filled in to the hole up to the level of adjoining ground.

(viii) After filling the hole as per point number (vi) profusely watered and enable the soil to subside the refilled soil shall then be dressed evenly with its surface about 50 to 75 mm below the adjoining ground level

(B) IN SOIL OTHER THEN ORDINARY SOIL: -

(i) 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. Excavation in hard rock shall be carried out by chiseling only.

(ii) 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.

(iii) The ordinary soil excavated from the hole and the earth brought from outside shall then be mixed with manure screened through sieve of IS designation 16 mm in the proportion specified in the description of the item and filled with the pit and the same watered and finally dressed.

(iv) The stack measurement of ordinary rock and hard rock shall be reduced by 50% and of soil by 20% to arrive at the excavated volume. This excavation shall be paid for as extra over the rate for holes dug in ordinary soil above, at rate appropriate to particular soil concerned.

8 **TREE GUARD**

(i) The tree guard shall be 600 mm square and 2 meter high above ground level and 25 cm in below ground level.

(ii) The tree guard shall be fabricated with MS angle iron 30x30x3 mm 4 nos. 2.25 vertical and 0.15 meter turn redially at bottom. 25 x 3 mm M.S. Flat 8 nos. 2.25 vertical and three MS Flat iron square (one at bottom, middel and top), bolted together 8 mm dia and 30 mm long M.S. bolts and nuts.

(iii) 3 mm dia steel wire with 10 cm spacing shall be provided by welding around the 0.6 m x 0.6 m square in 2 meter height. The entire tree guard shall be given two coats of synthetic enamel paint of approved brand and manufacturer of required shall over a priming coat of ready mixed steel primer.

9 Rates

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

For Detail Refer specification Chapter of Horticulture and MORTH Specification of the same

	CHAPTER-11		
Item No.	**Descriptions**	**Unit**	**Rate Rs**
11.1	Planting Permanent Hedges including Digging of Trenches (Planting permanent hedges including digging of trenches, 60 cm wide and 45 cm deep, refilling the excavated earth mixed with farmyard manure, supplied at the rate of 4.65 cum per 100 meters and supplying and planting hedge plants at 30 cm apart)	meter	230.00
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	488.00
11.3	Half Brick Circular Tree Guard, in 2nd class Brick, internal diameter 1.25 meters, and height 1.2 meters, above ground and 0.20 meter below ground (Providing Half brick circular tree guard, in 2nd class brick, internal diameter 1.25 meters, and height 1.2 meters, above ground and 0.20 meter below ground, bottom two courses laid dry, and top three courses in cement mortar 1:6 (1 cement 6 sand) and the intermediate courses being in dry honey comb masonry, as per design complete)	each	1236.00
11.3.1	Labour rate for half brick circular tree guard, in 2nd class brick, internal diameter 1.25 meters,and height 1.2 meters,above ground and 0.20 meter below ground, bottom two courses laid dry,and top three courses in cement mortar 1:6 (1cement 6 sand) and the intermediate courses being in dry honey comb masonry,as per design complete.	Each	124.00
11.4	Edging with 2nd class Bricks, laid dry lengthwise (Edging with 2nd class bricks, laid dry lengthwise, including excavation, refilling, consolidation, with a hand packing and spreading nearly surplus earth within a lead of 50 meters)	meter	25.00
11.5	Tree Guard with MS Angle Iron and Steel Wire (Providing and fixing tree guard 0.60 square meter, 2.00 meter high fabricated with MS angle iron 30 x 30 x 3 mm, MS iron 25 x 3 mm and steel wire 3 mm dia welded and fabricated as per design in two halves bolted together)	each tree guard	2179.00
11.5.1	Labour rate for fabrication and fixing of tree guard as per Item No.- 11.5	-do -	171.00
11.6	Uprooting Weeds or other vegetation form any area including removal and disposial.	sqm	137.00

CHAPTER-12			
SURVEY & INVESTIGATION, PREPARATION OF D.P.R. AND OTHER MISCELLANEOUS ITEMS			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
12.1	Survey and investigation and preparation of DPR for road work with chain and compass, auto level, theodolite or total station i/c fixing of permanent benchmark and also fixing of bench mark on all the permanent structures, along the alignment, like boundary wall, electrical poles etc. Also marking of locations of boundary wall, electric poles, telephone poles trees etc. in the road boundary, collection and submission of existing inventory of the road all along the alignment conducting survey@20 meter interval for L-section and for single lane X-section interval will be @ 0.75, 1.25, 1.875, 2.60, 3.75, 4.50, 5.50 and 6.50 meter on both side of centre line for two lane four lane interval for x-section shall be as specified in MORT&H Specifications.		
	Data collected as specified above are required to be submitted in both hard and soft copies, L-section, X-section and plan is required to be submitted in the shape of drawing sheets drawn with the help of auto plotter.		
	Soil samples @ every 500 meter or wherever soil appears to change its properties are required to be collected and soil investigation for LL, PL, swelling index and CBR are to be conducted and result too be submitted along with the project report.		
	Job also includes collection of data for traffic census fixing of RTL getting it approved from Engineer-in-Charge and accordingly submission of pavement design in accordance with relevant clauses of IRC. Preparation of estimate complete and submission of same in eight copies duly spiral binded.		
i)	For single lane road	Km.	7733.00
ii)	For two lane road	Km.	8721.00
iii)	For four lane road	Km.	10606.00
12.2	Performing details survey and investigation and collection of hydraulic data (essential design data as per IRC special publication No.13 guidelines for small bridges and culvert) regarding catchment area, L-section of road and nalla, cross-section of nalla at the point of crossing at upstream and down stream as well as T.P. section result ascertaining and making of HFL/OFL transferring and fixing of pucca bench mark at site etc. complete i/c of all necessary material and labour required for survey work after collection of all data prepare all drawing estimate with computer in eight copies, duly spiral binded.		
a)	For catchment area less then 1.25 Sq.Km.	Each	3825.00
b)	For catchment area 1.25 to 2.50 Sq.Km.	Each	4445.00
c)	For catchment area beyond then 2.50 Sq.Km.	Each	5275.00

CHAPTER- B-1
FOUNDATIONS
Notes for Specifications :-

1 For classification of strata in excavation refer notes given in chapter R-3.

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.

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.

2 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 to keep the foundation trenches when so required where cofferdams are required, these shall be carried to adequate depths and heights, be safely designed and constructed 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.

3 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.

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

(ii) Reinforcement shall be provided as per design

(iii) Cement
For cement refer general instructions of the SOR

(iv) Fine aggregate
Fine aggregate shall consist of natural sand, crushed stone sand, crushed gravel sand stone dust. Aggregate most of which passes through 4.75 mm IS sieve is known as fine aggregate.

(v) Coarse Aggregate
For termite concreting, coarse aggregate having nominal size more than 20 mm should not be used. Natural rounded shingle of appropriate size may also be used as coarse aggregate. It helps to give high slump with less water cement ratio.

(vi) The placing of concrete shall be a continuous process 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.

(vii) 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.

4 **Pile Cap**

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 100 mm thickness of M 15 nominal mix concrete shall be provided.

5 A temporary bench mark shall also be established near the well 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 The well shall as far as possible be sunk true and vertical through all types of strata.

Sinking or loading of the well with kentlege shall be commenced only after the steining has been cured for at least 48 hours or as specified in the drawings.

7 No well shall be permitted to be place in pre-dredged hole.

8 The well shall be sunk by excavating material uniformly from inside the dredge shole. Use of water jetting, expolsives and divers may be adopted for sinking of wells through difficult strata with prior approval of the Engineer.

9 Normally dewatering of well should not be permitted as a means for sinking the well. It also shall never be resorted to if there is any danager of sand blowing under the well.

Dewatering shall however be have to be done when well is to be founded into rock. Pneumatic sinking may have to be resorted to where obstacles such as tree trunks, large size boulders, etc. are met at the bottom or when there is hard strata which cannot be removed by open dredging.

The necessity for pneumatic sinking shall be decided by the Engineer.

10 **Tolerances in well sinking**

The permissible tilt and shift shall not exceed 1 (horizontal) in 80 (vertical) and the shift at the well base shall not be more than 150 mm in any resultant direction.

For the well steining and well cap the permissible tolerances shall be as follows :

(a) Variation in dimensions : + 50 mm - 10 mm
(b) Misplacement from speicified position in plan : 15 mm
(c) Surface irregularities measured with 3 m straight edge : 5 mm
(d) Variation of levels at the top : ± 25 mm

11 **MEASUREMENT OF WELL FOUNDATION**

(i) The cutting edge shall be measured in tonnes based on the net weight of metal used in it.

(ii) The concrete in curb, well steining and well cap shall be measured in cubic meters in each of the items. The reinforcements shall be measured in tonnes separately in each of the items.

(iii) The measurement for well sinking shall be made in running meters for different depths and in different types of strata (for example, predominantly sand/clay soil, soft rock, hard rock, etc) as specified in the drawing. The depth of sinking shall be measured from the level specified in the drawing. If no level has beeen specified in the appoved drawing, sinking shall be measured from the low water level or from the level at which the cutting edge was laid, whichever is higher.

(iv) The quantity of concrete in bottom and top plug shall be measured in cubic meters.

(v) The quantity of sand filling shall be measured in cubic meters.

(vi) Pneumatic sinking, where required shall be paid as a seprate item and shall be measured in cubic meters of material to be excavated.

12 **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.

13 The rate include the cost of all the labour and material required for the completion of items.
For Detail Refer specification Chapter of Foundations and MORTH Specification of the same

CHAPTER-13			
FOUNDATIONS			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
13.1	Earth work in excavation of foundation of structures as per drawing and technical specification, including setting out, construction of shoring and bracing, removal of stumps and other deleterious matter, dressing of sides and bottom and backfilling with approved material etc. and as per relevant clauses of section 300 & 2100 in		
I	Soil		
i)	upto 3 m depth	cum	136.00
ii)	3 m to 6 m depth	cum	158.00
iii)	Above 6 m depth	cum	204.00
II	Ordinary rock/ Large boulder each more than 0.03 cum. Volume		
i)	Depth upto 3 m from av. Ground level	cum	371.00
III	Hard rock (requiring blasting)	cum	497.00
IV	Hard rock (blasting prohibited, with writen permission of S.E.)	cum	577.00
V	Marshy soil upto 3 m. depth by manual means	cum	250.00
VI	Marshy soil upto 3 m depth by Mechanical Means	cum	79.00
VII	Extra rates for quantities of rock cutting works, 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).	Metre depth	20% of the rate of the item.
13.2	Providing & Filling Annular Space Around Footing in Rock with Lean cement concrete M-10 nominal mix in foundation with crushed stone aggregate 40 mm nominal size and as per relevant clauses of sections 1500, 1700 and 2100.	cum	3095.00
13.3	Providing Plain cement concrete M-10 nominal mix (with 40mm maximum size of aggregate) in foundation as per relevant clauses of sections 1500, 1700 and 2100.	cum	3095.00
13.4	Providing Brick masonry work in foundation complete excluding pointing and plastering, as per drawing and technical specifications and as per relevant clauses of sections 1300 in following cement mortar: -		
(a)	Cement mortar1:2 (1cement :2 sand)	cum	4303.00
(b)	Cement mortar1:3 (1cement :3 sand)	cum	4065.00
(c)	Cement mortar1:4 (1cement :4 sand)	cum	3859.00
(d)	Cement mortar1:6 (1cement :6 sand)	cum	3574.00
13.4.1	Labour rate for brick masonry work in foundation complete excluding pointing and plastering, as per drawing and technical specifications and as per relevant clauses of sections 1300 as per item no.13.4 (a),(b),(c) and (d).	cum	549.00
13.5	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 .		

Item No.	Descriptions	Unit	Rate Rs
a)	Coursed rubble masonry(first sort)	cum	2895.00
b)	Random Rubble Masonry	cum	2773.00
13.5.1	Labour rate for stone masonry work in cement mortar 1:3 in foundation complete as drawing and Technical Specification and as per relevant clauses of sections 1400 as per item 13.5 (a) and (b).	cum	708.00
13.6	Providing and laying Plain/Reinforced cement concrete (mixed in concrete mixture) 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 with 40 mm maximum size of aggregate	cum	3692.00
b)	PCC Grade M20 with 40 mm maximum size of aggregate	cum	4259.00
c)	PCC Grade M25 with 40 mm maximum size of aggregate	cum	4282.00
d)	PCC Grade M30 with 40 mm maximum size of aggregate	cum	4339.00
e)	RCC Grade M20 with 20 mm maximum size of aggregate	cum	4277.00
f)	RCC Grade M25 with 20 mm maximum size of aggregate	cum	4300.00
g)	RCC Grade M30 with 20 mm maximum size of aggregate	cum	4357.00
h)	RCC Grade M35 with 20 mm maximum size of aggregate	cum	4390.00
13.6.1	Labour rate for laying Plain/Reinforced cement concrete (mixed in concrete mixture) 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 as per item 13.6 (a) to (h) including the charges for required machine and formwork.	cum	642.00
13.7	Providing and laying cutting edge of mild steel weighing 40 kg per meter for well foundation complete as per drawing and technical specification and as per relevant clauses of sections 1200 & 1900.	tonne	68455.00
13.8	Providing and laying Plain/Reinforced cement concrete (mixed in concrete mixture), 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 with 20 mm maximum size of aggregate	cum	4731.00
ii)	RCC M25 Grade with 20 mm maximum size of aggregate	cum	4768.00
iii)	RCC M35 Grade with 20 mm maximum size of aggregate	cum	4902.00
B	Well steining		
i)	PCC M15 Grade with 40 mm maximum size of aggregate	cum	3743.00
ii)	PCC M20 Grade with 40 mm maximum size of aggregate	cum	4317.00
iii)	PCC M25 Grade with 40 mm maximum size of aggregate	cum	4352.00
iv)	PCC M30 Grade with 40 mm maximum size of aggregate	cum	4420.00
v)	RCC M20 Grade with 20 mm maximum size of aggregate	cum	4336.00
vi)	RCC M25 Grade with 20 mm maximum size of aggregate	cum	4371.00
vii)	RCC M30 Grade with 20 mm maximum size of aggregate	cum	4439.00
viii)	RCC M35 Grade with 20 mm maximum size of aggregate	cum	4493.00
C	Bottom Plug		
i)	PCC Grade M20 with 40 mm maximum size of aggregate	cum	4363.00
ii)	PCC Grade M25 with 40 mm maximum size of aggregate	cum	4588.00

Item No.	Descriptions	Unit	Rate Rs
iii)	PCC Grade M30 with 40 mm maximum size of aggregate	cum	4629.00
iv)	PCC Grade M35 with 40 mm maximum size of aggregate	cum	4724.00
D	Intermediate plug		
I)	Grade M20 PCC with 40 mm maximum size of aggregate	cum	4000.00
ii)	Grade M25 PCC with 40 mm maximum size of aggregate	cum	4206.00
iii)	Grade M30 PCC with 40 mm maximum size of aggregate	cum	4242.00
E	Top plug		
i)	Grade M15 PCC with 40 mm maximum size of aggregate	cum	3403.00
ii)	Grade M20 PCC with 40 mm maximum size of aggregate	cum	3925.00
iii)	Grade M25 PCC with 40 mm maximum size of aggregate	cum	3956.00
iv)	Grade M30 PCC with 40 mm maximum size of aggregate	cum	4018.00
F	Well cap		
i)	RCC Grade M20 with 20 mm maximum size of aggregate	cum	3848.00
ii)	RCC Grade M25 with 20 mm maximum size of aggregate	cum	4256.00
iii)	RCC Grade M30 with 20 mm maximum size of aggregate	cum	4268.00
13.9	Sinking of 6 m external diameter well (other than pneumatic method of sinking) through all types of strata namely sandy soil, clayey soil and rock as shown against each case, complete as per drawing and technical specifications. Depth of sinking is reckoned from bed level.		
A	Sandy soil		
i)	upto 3.0 m. depth	cum	2923.00
ii)	Beyond 3m upto 10m depth	cum	4215.00
iii)	Beyond 10m upto 20m depth	cum	5567.00
iv)	Beyond 20m upto 30 m	cum	12530.00
(v)	Beyond 30 m upto 39 m	cum	28184.00
B	In clayey soil		
i)	upto 3.0 m. depth	cum	4217.00
ii)	Beyond 3m upto 10m depth	cum	9349.00
iii)	Beyond 10m upto 20m depth	cum	12964.00
iv)	Beyond 20m upto 30 m	cum	30397.00
(v)	Beyond 30m upto 39 m	cum	59073.00
C	Soft rock		
i)	Depth of soft rock strata upto 3m	cum	11947.00
D)	Hard Rock		
i)	Depth in hard rock strata upto 3 m	cum	13769.00

Item No.	Descriptions	Unit	Rate Rs
13.10	Sand filling in wells complete as per drawing and technical specifications as per clause 1209.	cum	1059.00
13.11	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	63397.00
13.12	Providing bored cast-in-situ M-35 (mixed in concrete mixture) grade R.C.C. pile excluding reinforcement complete as per drawing and technical specifications and removal of excavated earth with all lifts and lead upto 1000 m. (Pile diameter-750 mm) and as per specifications 1100, 1600 and 1700.	meter	5450.00
13.13	Providing bored cast-in-situ M-35 (mixed in concrete mixture) grade R.C.C. pile excluding reinforcement complete as per drawing and technical specifications and removal of excavated earth with all lifts and lead upto 1000 m. (Pile diameter-1000 mm) and as per specifications 1100, 1600 and 1700.	meter	8779.00
13.14	Providing bored cast-in-situ M-35 (mixed in concrete mixture) grade R.C.C. pile excluding reinforcement complete as per drawing and technical specifications and removal of excavated earth with all lifts and lead upto 1000 m. (Pile diameter-1200 mm) and as per specifications 1100, 1600 and 1700.	meter	10964.00
13.15	Providing driven cast-in-place vertical M-35 (mixed in concrete mixture) grade R.C.C. pile excluding reinforcement complete as per drawing and & Technical Specification (Pile diameter - 750 mm)and as per specifications 1100, 1600 and 1700.	meter	4789.00
13.16	Providing driven cast-in-place vertical M-35 grade R.C.C. piles excluding reinforcement complete as per drawing and & Technical Specification (Pile diameter - 1000 mm) and as per specifications 1100, 1600 and 1700.	meter	2287.00
13.17	Providing driven cast-in-place vertical M-35 (mixed in concrete mixture) grade R.C.C. piles excluding reinforcement complete as per drawing and & Technical Specification (Pile diameter - 1200 mm) and as per specifications 1100, 1600 and 1700.	meter	4447.00
13.18	Providing driven precast vertical M-35 (mixed in concrete mixture) grade R.C.C. piles excluding reinforcement complete as per drawing and & Technical Specification (Pile Diameter=500 mm) and as per specifications 1100, 1600 and 1700.	meter	4908.00
13.19	Providing driven precast vertical M-35 (mixed in concrete mixture) grade R.C.C. piles excluding reinforcement complete as per drawing and & Technical Specification (Pile Diameter=750 mm) and as per specifications 1100, 1600 and 1700.	meter	1107.00
13.20	Providing driven precast vertical M-35 (mixed in concrete mixture) grade R.C.C. piles excluding reinforcement complete as per drawing and & Technical Specification (Pile Diameter=1000 mm) and as per specifications 1100, 1600 and 1700.	meter	1705.00

Item No.	Descriptions	Unit	Rate Rs
13.21	Providing driven precast vertical M-35 (mixed in concrete mixture) grade R.C.C. piles excluding reinforcement complete as per drawing and & Technical Specification (Size of pile - 300 mm x 300 mm) and as per specifications 1100, 1600 and 1700.	meter	637.00
13.22	Providing driven precast vertical M-35 (mixed in concrete mixture) grade R.C.C. piles excluding reinforcement complete as per drawing and & Technical Specification (Size of pile - 500 mm x 500 mm) and as per specifications 1100, 1600 and 1700.	meter	867.00
13.23	Providing driven precast vertical M-35 (mixed in concrete mixture) grade R.C.C. piles excluding reinforcement complete as per drawing and & Technical Specification (Size of pile - 750 mm x 750 mm) and as per specifications 1100, 1600 and 1700.	meter	1429.00
13.24	Provdiing and laying Cement concrete (mixed in concrete mixture) 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 M20	cum	3863.00
b)	RCC Grade M25	cum	4253.00
c)	RCC Grade M30	cum	4303.00
d)	RCC Grade M35	cum	4406.00
13.25	Providing and laying Leveling course in PCC M-15 (with 40 mm maximum size of aggregate) below Pile cap as per drawing and as per section 1100 and 1700.	cum	3245.00
13.26	Supplying, fitting and placing un-coated HYSD bar reinforcement in foundation complete as per drawing and technical specifications and as per relevant clauses of sections 1600.	tonne	56994.00
1.26.1	Labour rate for fitting and placing un-coated HYSD bar reinforcement in foundation complete as per drawing and technical specifications and as per relevant clauses of sections 1600.	tonne	1714.00
13.27	Supplying, fitting and placing un-coated Mild steel reinforcement complete in foundation as per drawing and technical specification and as per relevant clauses of sections 1600.	tonne	57161.00
13.27.1	Labour rate for Fitting and placing un-coated Mild steel reinforcement complete in foundation as per drawing and technical specification and as per relevant clauses of sections 1600.	tonne	1873.00
13.28	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	954.00

CHAPTER- B-2
SUB STRUCTURE

Notes for Specifications :-

1 In Mortars Cement shall be proportioned by weight, taking the unit weight of cement as 1.44 tonne per cubic meter. Sand shall be portioned by volume taking into account due

2 Mortar shall be mixed (by power mixer/hand mixing) only such quantity as required for immediate use.
The mix which has developed initial set shall not be used. Initial set of mortar with ordinary Portland Cement shall normally be considered to have taken place 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 as need to restore the rquisite consistency, but this re-tempering shall not be permitted after 30 minutes.

3 Bricks shall be throughly soaked in a tank filled with water for a minimum period of 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.

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

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

6 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.

7 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.

8 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.

9 Wooden screeds 75 mm wide and of the thickness of the plaster shall be fixed vertically 2.5 to 4 meters apart, to act as gauges and guides in applying the plaster.

10 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.

11 Mortar cubes shall be tested in accordance with IS: 2250 for compressive strength, consistency of mortar and its water retentivity. The frequency of testing shall be one sample for every 2 cubic meters of mortar, subject to a minimum 3 samples for a day's work.

12 All brick work shall be measured in cubic meters.

13 Stone shaping and dressing shall be done, & stones shall be sufficiently wetted before laying in mortar. Stone shall be hammer dressed on the face the sides and beds to enable it to come in proximity with the neighbouring stone. The bushing on the exposed face shall be not be more than 40 mm.

14 Sufficient transverse bonds shall be provided by the use of bond stone extending from the front to the back of the wall and in case of thick wall from outside to the interior and vice versa. In the latter case, bond stones shall overlap each other in their arrangement.

15 In case headers are not available, precast headers of M 15 concrete shall be used. Cast-in-situ headers are not permitted.

16 Only rectangular shaped bond stones or headers shall be used. Bond stones shall overlap each other by 150 mm ore more.

17 Bond Stones shall be provided in masonry upto 600 mm thickness and in case of masonry 600 mm thickness a set of two or more bond stones overlapping each other at least by 150 mm shall be provided in a line from face to back.

18 One bond stone or a set of bond stones shall be provided for every 0.50 sq. m of the masonry surface.
Through bond stones shall be provided in masonry upto 600 mm thickness and in case of masonry above 600 mm thickness, a set of two or more bond stones overlapping each other at least by 150 mm shall be provided in a line from face to back.

19 Stones shall break joint on the face for at least half the height of the course and the bond shall be carefully maintained through-out.

20 All quoins and the angles of the opening shall be made from selected stones, carefully squared and bedded and arranged to bond alternately long and short in both directions.

21 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 nearly level with facing and backing.

22 Joints : The face joints shall not be more than 20 mm thick, but shall be sufficiently thick to prevent stone-to-stone contact and shall be completely filled with mortar.

23 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.

24 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 percent of the quantity of masonry. While using chips it shall be ensured that no hollow spaces are left anywhere in the masonry.

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.

25 Stone masonry shall be measured in cubic meter.

26 The steel used for reinforcement shall be any of the following types:
(i) Mild steel and medium tensile bars conforming to IS 43 (Part 1)
(ii) High strength deformed steel bars conforming to IS 1786

27 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.
(iii) 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.

(iv) Bearings shall be handled with care and stored under cover.

(v) When bearing assemblies or plates are shown on the drawings to be place (not embedded) directly on concrete, the concrete bearing area shall be constructed slightly above grade (not exceeding 12 mm) and shall be finished by grinding.

(vi) It shall be ensured that the bearings are set truly 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 ever be made to meet with this requirement.

(vii) 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.
(viii) M.S. bearings sliding on M.S. plates shall not be permitted. For sliding plate bearings stainless, steel surface sliding on stainless steel plate with mild steel matrix shall be used. The other option shall be to provide **Poly Tetra Fluoro Ethylene** surface sliding on stainless steel.
(ix) Some types of bearings which have been successfully used in various bridges in Indian have been covered by these specifications. For innovative types of structures or in special cases, special types of bearings to suit the requirements may have to be provided for which special specifications may be laid down by the Engineer.

28 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.

29 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

30 Seating of Elastomeric Bearing on a Non-Horizontal plane shall be as per MORTH clause 2005.7

31 Installation of POT-cum-PTFE Bearings

(i) Care shall be taken during installtion of the bearings to permit their correct functioning in accordance with the design scheme.

(ii) To privent contamination, dismantling of the bearings at site shall not be done.

(iii) 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.

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

(v) Permitted installation tolerance of the bearing form plane of sliding shall be maintained.

(vi) 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 specially with regard to the following :

(a) Preparation > concrete cleaning, roughening, pre-soaking etc.

(b) Forms > sturdiness, leak proofing, shape, header funnel vents, etc.

(c) Bearing Base > cleaning, etc.

(d) Placement > mixing, consistency, time period, finishing, etc.

(e) Protection > curing, ambient temperature, etc.

32 Seating as per MORTH clause 2006.6.3

33 **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

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 subject to a minimum of 450 mm.

(iv) Longitudinal slopes of pipe should be minimum of 1:1000.

(v) 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.

(vii) 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.

34 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.

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

For Detail Refer specification Chapter of Sub-Structure and
MORTH Specification of the same

CHAPTER-14			
SUB-STRUCTURE			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
14.1	Providing Brick masonry work in 1:3 in sub-structure complete excluding pointing and plastering, as per drawing and technical specifications and as per relevant clauses of sections 1300.	cum	3871.00
14.1.1	Labour rate for brick masonry work in 1:3 in sub-structure complete excluding pointing and plastering, as per drawing and technical specifications and as per relevant clauses of sections 1300.	cum	353.00
14.2	Providing Pointing with cement mortar (1:3) on brick work in substructure as per technical specifications and as per relevant clauses of sections 1300.	10 sqm	35.00
14.3	Providing Plastering with cement mortar (1:3) on brick work in sub-structure as per Technical specifications and as per relevant clauses of sections 1300.	sqm	84.00
14.4	Providing 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)	Random Rubble Masonry	cum	2702.00
b)	Coursed rubble masonry (first sort)	cum	2748.00
14.4.1	Labour rate for 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 for 14.4 (a) and (b) including the cost of scaffolding.	cum	758.00
14.5	Providing and laying Plain/Reinforced cement concrete (mixed in concrete mixture) in sub-structure or complete RCC Box section as per drawing and technical specifications and as per relevant clauses of sections 1500, 1700 & 2200 in (Height above average ground level)		
A	PCC Grade M15 with 40 mm maximum size of aggregate		
a)	Height upto 5m	cum	3743.00
b)	Height beyond 5m and upto 10m	cum	3879.00
B	PCC Grade M20 with 40 mm maximum size of aggregate		
a)	Height upto 5m	cum	4317.00
b)	Height beyond 5m and upto 10m	cum	4474.00
C	PCC Grade M25 with 40 mm maximum size of aggregate		
a)	Height upto 5m	cum	4352.00
b)	Height beyond 5m and upto 10m	cum	4510.00
D	PCC Grade M30 with 40 mm maximum size of aggregate		
a)	Height upto 5m	cum	4420.00
b)	Height beyond 5m and upto 10m	cum	4581.00
E	RCC Grade M20 with 20 mm maximum size of aggregate		
a)	Height upto 5m	cum	4336.00
b)	Height beyond 5m and upto 10m	cum	4494.00
c)	Height above 10m	cum	4691.00
F	RCC Grade M25 with 20 mm maximum size of aggregate		
a)	Height upto 5m	cum	4371.00
b)	Height beyond 5m and upto 10m	cum	4514.00
c)	Height above 10m	cum	4728.00
G	RCC Grade M30 with 20 mm maximum size of aggregate		
a)	Height upto 5m	cum	4439.00
b)	Height beyond 5m and upto 10m	cum	4564.00

Item No.	Descriptions	Unit	Rate Rs
c)	Height above 10m	cum	4742.00
H	RCC Grade M35 with 20 mm maximum size of aggregate		
a)	Height upto 5m	cum	4493.00
b)	Height beyond 5m and upto 10m	cum	4591.00
c)	Height above 10m	cum	4738.00
14.6	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	57086.00
14.6.1	Labour rate for 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	1802.00
14.7	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	56753.00
14.7.1	Labour rate for 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	1482.00
14.8	Providing weep holes in Brick masonry/Plain/Reinforced concrete abutment, wing wall/return wall with 100 mm dia AC 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	131.00
14.9	Providing Back filling behind abutment, wing wall & return wall with Granular Material complete as per drawing and Technical specification and as per relevant clauses 305 of specifications & as per appendix 6 of IRC-78	cum	529.00
14.10	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	753.00
14.11	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	247.00
14.12	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	245.00
14.13	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	135.00

Item No.	Descriptions	Unit	Rate Rs
14.14	Providing and Laying Reinforced cement concrete pipe NP4/prestressed concrete pipe for culverts on first class bedding of granular material in **single row** including fixing collar with cement mortar 1:2 but excluding excavation, protection works, backfilling, concrete and masonry works in head walls and parapets and as per relevant clauses of section-2900.		
a)	450mm dia	meter	1604.00
b)	600mm dia	meter	2448.00
c)	1000 mm dia	meter	5676.00
d)	1200 mm dia	meter	8222.00
14.15	Providing and Laying Reinforced cement concrete pipe NP4 /prestrssed concrete pipe for culverts on first class bedding of granular material in **double row** including fixing collar with cement mortar 1:2 but excluding excavation, protection works, backfilling, concrete and masonry works in head walls and parapets and as per relevant clauses of section-2900.		
a)	450mm dia	meter	3210.00
b)	600mm dia	meter	4880.00
c)	1000 mm dia	meter	11436.00
d)	1200 mm dia	meter	16533.00
14.16	Providing and Laying Reinforced cement concrete pipe NP4 /prestrssed concrete pipe for culverts on first class bedding of granular material in **triple row** including fixing collar with cement mortar 1:2 but excluding excavation, protection works, backfilling, concrete and masonry works in head walls and parapets and as per relevant clauses of section-2900.		
a)	450mm dia	meter	4816.00
b)	600mm dia	meter	7348.00
(a)	1000 mm dia	meter	17175.00
(d)	1200 mm dia	meter	24870.00
14.17	Providing first class bedding below hume pipes with granular material as per clause 2904 of specifications.	cum	489.00
14.18	Providing concrete craddle bedding in M-15 grade concrete as per clause 2900 and as per section 1700 and 2900.	cum	3692.00
14.19	Plain cement concrete 1:3:6 mix with crushed stone aggregate 40 mm nominal size mechanically mixed, placed in foundation and compacted by vibration including curing for 14 days.	cum	3906.00

CHAPTER- B-3
SUPER -STRUCTURE

Notes for Specifications :-

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 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 deck 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 mixers. All concrete except the concrete laid under water, shall be mechanically vibrated.

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

(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 not more than 15 cm. apart 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.

The plates shall be from oil, rust, loose paint etc. before coating

(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.

For Detail Refer specification Chapter of Super-Structure and
MORTH Specification of the same

CHAPTER-15			
SUPER-STRUCTURE			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
15.1	Providing and laying Reinforced/Prestressed cement concrete (mixed in concrete mixture) 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	4432.00
b)	Height beyond 5m and upto 10m	cum	4610.00
c)	Height above 10m	cum	4787.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	4610.00
b)	Height beyond 5m and upto 10m	cum	4787.00
c)	Height above 10m	cum	4964.00
B	RCC Grade M25 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	4883.00
b)	Height beyond 5m and upto 10m	cum	5078.00
c)	Height above 10m	cum	5273.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	5078.00
b)	Height beyond 5m and upto 10m	cum	5273.00
c)	Height above 10m	cum	5469.00
C	RCC Grade M 30 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	4957.00
b)	Height beyond 5m and upto 10m	cum	5155.00
c)	Height above 10m	cum	5354.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	5155.00
b)	Height beyond 5m and upto 10m	cum	5354.00
c)	Height above 10m	cum	5552.00
D	RCC/PSC Grade M35 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	4995.00
b)	Height beyond 5m and upto 10m	cum	5198.00
c)	Height above 10m	cum	5401.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	5198.00
b)	Height beyond 5m and upto 10m	cum	5401.00
c)	Height above 10m	cum	5604.00

Item No.	Descriptions	Unit	Rate Rs
(iii)	For box girder and balanced cantilever		
a)	Height upto 5m	cum	5807.00
b)	Height beyond 5m and upto 10m	cum	6213.00
c)	Height above 10m	cum	6619.00
E	PSC Grade M-40 with 20 mm maximum size of aggregate		
(i)	For solid slab super-structure		
a)	Height upto 5m	cum	5412.00
b)	Height beyond 5m and upto 10m	cum	5628.00
c)	Height above 10m	cum	5845.00
(ii)	For T-beam & slab		
a)	Height upto 5m	cum	5628.00
b)	Height beyond 5m and upto 10m	cum	5845.00
c)	Height above 10m	cum	6061.00
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	5607.00
b)	Height beyond 5m and upto 10m	cum	5839.00
c)	Height above 10m	cum	6070.00
(ii)	For T-beam & slab including launching of precast girders by launching truss upto 40 m span		
a)	Height upto 5m	cum	5839.00
b)	Height beyond 5m and upto 10m	cum	6070.00
c)	Height above 10m	cum	6302.00
(iii)	For cast-in-situ box girder, segmental construction and balanced cantilever		
a)	Height upto 5m	cum	6534.00
b)	Height beyond 5m and upto 10m	cum	6997.00
c)	Height above 10m	cum	7461.00
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	6721.00
b)	Height beyond 5m and upto 10m	cum	7201.00
c)	Height above 10m	cum	7681.00
H	PSC Grade M- 55 with 20 mm maximum size of aggregate		
(i)	For cast-in-situ box girder, segmental construction and balanced cantilever		
a)	Height upto 5m	cum	7087.00
b)	Height beyond 5m and upto 10m	cum	7593.00
c)	Height above 10m	cum	8099.00
15.2	Supplying, fitting and placing HYSD bar reinforcement in super-structure complete as per drawing and technical specifications as per relevant clauses of section 1600 of specifications..	tonne	57776.00
15.3	Providing High tensile steel wires/strands including all accessories for stressing, stressing operations and grouting complete as per drawing and Technical Specifications and as per relevant clauses of section 1800.	tonne	166443.00

Item No.	Descriptions	Unit	Rate Rs
15.4	Providing and laying Cement concrete (mixed in concrete mixture) wearing coat M-30 grade including reinforcement complete as per drawing and Technical Specifications and as per relevant clauses of sections 1500, 1700 and Clause 2702 of specifications..	cum	8324.00
15.5	Providing and laying 12 mm thick mastic asphalt wearing course on top of deck slab excluding prime coat with paving grade bitumen meeting the requirements given in table 500-29, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with bitumen precoated fine grained hard stone chipping of 9.5 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 100 deg. C, protruding 1 mm to 4 mm over mastic surface, all complete as per clause 515 and 2702 of specifications..	sqm	258.00
15.6	Construction of precast RCC railing of M30 Grade (mixed in concrete mixture), 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 MoST specification drawing SD/202 or SD/305)	meter	1437.00
15.7	Construction of RCC railing of M30 Grade (mixed in concrete mixture) 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 and as per relevant clauses of sections 1500, 1600, 1700 and clause 2703 of specifications (as per MoST specification drawing SD/201 or SD/304)	meter	1393.00
15.8	Providing, fitting and fixing mild steel railing complete as per standard drawing No.BD/1-88 and Technical Specification and as per relevant clauses of section 1900 and 2700.	meter	2525.00
15.9	Providing Drainage Spouts complete as per drawing and Technical specification and as per clause 2705 of specifications.	each	979.00
15.10	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	3418.00
15.11	Providing and laying Reinforced cement concrete approach slab in M-25 grade concrete including reinforcement and formwork complete as per drawing and Technical specification and as per relevant clauses of section 1500, 1600, 1700 and clause 2704 of specifications..	cum	7244.00
15.12	Providing and fixing Helical pipes of 600mm dia in voided concrete slabs including 20mm dia tie rod and sealing joints etc. as per section 1700 and 1800.	meter	238.00

Item No.	Descriptions	Unit	Rate Rs
15.13	Providing and laying a burried expansion joint, expansion gap being 20 mm, covered with 12 mm thick, 200 mm wide galvanised wieldable 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 clause 2604.	meter	6608.00
15.14	Filler joint		
i)	Providing & fixing 2 mm thick and 200mm wide corrugated copper plate in expansion joint complete as per drawing & Technical Specification and as per relevant clauses of section 2600.	meter	1999.00
ii)	Providing & fixing 20 mm thick & 25cm deep compressible fibre board in expansion joint complete as per drawing & Technical Specification and as per relevant clauses of section 2600.	meter	274.00
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 and as per relevant clauses of section 2600.	meter	177.00
iv)	Providing and filling joint sealing compound as per drawings and technical specifications with coarse sand and 6% bitumen by weight and as per relevant clauses of section 2600.	meter	16.00
15.15	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	986.00
15.16	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 as per clause 2606 of specifications.	meter	16408.00
15.17	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 section 2600.	meter	7207.00

Item No.	Descriptions	Unit	Rate Rs
15.18	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 and as per relevant clauses of section 2600.	meter	11364.00
15.19	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 for installation and as per relevant clauses of section 2600.	meter	15476.00
15.20	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 for installation and as per relevant clauses of section 2600.	meter	16718.00

CHAPTER- B-4
RIVER TRAINING AND PROTECTION WORKS

Notes for Specifications :-

1 Wire crates shall be made from hot dipped galvanized mild steel wire of diameter not less than 4 mm in annealed condition having tensile strength of 304-450 Mpa conforming to IS : 280. The galvanizing coating shall be heavy coating for soft condition conforming to IS : 4826.

The mesh of the crate shall not be more than 150 mm. Wire crates for shallow or accessible situations sahll be 3 meter x 1.5 meter x 1.25 meter in size.

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. Quarry stone should be used. Round boulders shall not be allowed. The stones subject to marked deterioration by water or weather shall not be accepted.

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, however, be used. The sizes of spalls shall be a minimum of 25 mm and shall be suitable to fill the voids in the pitching.

3 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.

4 Rates

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

(For Detail Refer specification Chapter of River Training & Protection Treatment and MORTH specification of the same)

CHAPTER-16			
RIVER TRAINING AND PROTECTION WORKS			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
16.1	Providing and laying boulders apron/toe wall on river bed for protection against scour with stone boulders weighing not less than 40 kg each complete as per drawing and Technical specification and as per relevant clauses of section 2500.		
a)	Boulder laid dry without wire crates.	cum	838.00
16.2	Providing and laying of boulder apron laid in wire crates made with 4mm dia GI wire conforming to IS: 280 & IS:4826 in 100mm x 100mm mesh (weaved diagonally) including 10% extra for laps and joints laid with stone boulders weighing not less than 40 kg each. and as per relevant clauses of section 2500.	cum	1171.00
16.3	Providing and laying of apron with cement concrete blocks of size 0.5x0.5x0.5 m cast in-situ 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	3766.00
16.4	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	cum	838.00
b)	Cement Concrete blocks of size 0.3x0.3 x0.3 m cast in cement concrete of Grade M15	cum	3766.00
16.5	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	852.00
16.6	Providing and Laying of a geotextile filter between pitching and embankment slopes on which pitching is 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	207.00
16.7	Providing and laying 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	3533.00
b)	Cement Concrete blocks Grade M15	cum	5207.00
16.8	Providing Curtain wall complete as per drawing and Technical specification and as per relevant clauses of section 1400 , 1700 and 2500.		
a)	Stone masonry in cement mortar (1:3)	cum	2895.00
b)	Cement concrete Grade M15	cum	3692.00

Item No.	Descriptions	Unit	Rate Rs
16.9	Construction of flexible apron 1 m thick comprising of loose stone boulders weighing not less than 40 kg beyond curtain wall and as per relevant clauses of section 2500.	cum	879.00
16.10	(Providing and construction of a gabain structure for retaining earth with segments of wire crates of size 7 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	1211.00
16.11	(Providing and constructing gabain 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	1828.00

CHAPTER- B-5
REPAIR AND REHABILITATION

Notes for Specifications :-

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

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

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

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.

5 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.

6 **Epoxy Mortar for Replacement of Spalled Concrete.**

(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.

7 Testing

Epoxy used for the making mortar shall conform to all requirements and testing procedures as laid down in Clause 2803.9 of MORTH specification for Road and Bridge.

8 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.

The grout pump shall be so place as to reduce the waste in cleaning lines.

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.

9 Testing

Percolation test done at the end of grouting operation shall give a value of less than 2 lugions.

10 GUNITING/SHOTCRETE

The gunite is a mixture of cement, sand and water. It comprises 100 parts by weight of cement, 300 parts by weight quartz snad, 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. Sand should preferably have a moisture content between 3 to 6 per cent.

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.

11 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.

4 Rates

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

For Detail Refer specification Chapter of Repair and Rehabilitation and
MORTH Specification of the same

CHAPTER-17			
REPAIR AND REHABILITATION			
Item No.	**Descriptions**	**Unit**	**Rate Rs**
17.1	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(Thickness 75 mm) and as per relevant clauses of section 2800.	sqm	88.00
17.2	Removal of existing asphaltic wearing coat including disposal with all lift and lead upto 1000m and as per relevant clauses of section 2800.	sqm	67.00
17.3	Guniting concrete surface with 25mm thick (Average) cement mortar applied with compressor after cleaning surface and spraying with epoxy complete as per Technical specification and as per relevant clauses of section 2800.	sqm	1144.00
17.4	Providing and inserting nipples with approved fixing compound after drilling holes for grouting as per Technical specifications including subsequent cutting/removal and sealing of the hole as necessary of nipples after completion of grouting with Cement/Epoxy and as per relevant clauses of section 2800.	each	83.00
17.5	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 Grout	kg	82.00
b)	Cement mortar (1:1) Grouting	kg	79.00
17.6	Patching of damaged concrete surface with 25mm thick (Average) polymer concrete and curing compounds, initiator and promoter, available in present formulations, to be applied as per instructions of manufacturer and as approved by the Engineer and as per relevant clauses of section 2800.	sqm	2128.00
17.7	Sealing of crack / porous concrete with Epoxy Grout by injection through nipples complete as per clause 2803.1 and as per relevant clauses of section 2800.	kg	1259.00
17.8	Providing and Applying 10mm thick (Average) epoxy mortar over leached, honey combed and spalled concrete surface and exposed steel reinforcement complete as per Technical specification and as per relevant clauses of section 2800.	sqm	817.00
17.9	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 2807.1., 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 and as per relevant clauses of section 2800.	sqm	280.00

Item No.	Descriptions	Unit	Rate Rs
17.10	Providing and Applying 10mm thick (Average) pre-packed cement based polymer mortar of strength 45 Mpa at 28 days for replacement of spalled concrete as per section 2800.	sqm	133.00
17.1	Providing Eproxy bonding of new concrete to old concrete as per section 2800.	sqm	934.00
17.1	Providing external prestressing with high tensile steel wires/strands including drilling for passage of prestessing steel, all accessories for stressing and stressing operation and grouting complete as per drawing and Technical specification and as per relevant clauses of section 2800.		
(a)	Span assumed: 25 m	per tonne of HT Steel	324722.00