



GOVERNMENT OF CHHATTISGARH
PUBLIC WORKS DEPARTMENT

SCHEDULE OF RATES
FOR **ROAD WORKS**



With Effect From 1ST January, 2015

Issued by
ENGINEER-IN-CHIEF
P.W.D., CHHATTISGARH, RAIPUR



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**OFFICE OF THE ENGINEER IN CHIEF,
PUBLIC WORKS DEPARTMENT CHHATTISGARH (RAIPUR)**

No. 1638/WORK

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SCHEDULE OF RATES FOR ROAD WORKS

PREAMBLE

The **Schedule of rates** published by PWD is an important document, as this does not only serve as an useful tool for estimation, evaluation & execution of govt. works by P.W.D. people - but also referred to as an authority by other govt., semi government & private entities like builders, architects and consultants.

The last schedule of rates (SOR) for Road works was published in 2013, and was in force from 15-05-2013. Since then, the department has registered considerable changes in the prices of labour, materials, POL and machineries. Apart from it, the MORT&H has revised the **Specifications for Road & bridge Works** (February 2013). The Indian road congress has also ammended various codes in general & IRC-37 in particular. In the light of all these, the prevailing SOR needed revision .

It is a matter of great pleasure that the new **SOR For Road Works** is Coming in to force from 01st January 2015.

While some new items like Microsurfacing, RAP, use of bitumen grade VG 40 and oil based emulsions have been introduced, some other items (like SDBC, BM, OGPC etc.) which are not finding place in the revised MORT&H specification are also kept in this SOR , as the IRC-37 still permits their use in village and town roads. Nomenclature and description of several items have been modified in the light of above.

Considerable efforts have been made to incorporate the above changes, but there always remain scope for betterment. Suggestions in this regard shall be highly welcomed.

Though every possible care has been taken in preparing this SOR but in a work like this, the chances of typographical and other errors can not be ruled out. It will be appreciated, if these could be brought to notice.

I sincerely express my gratitude and thanks to S/Shri D.K. Agrawal Chief Engineer PWD Raipur & K.K. Pipri who have taken immense pain in inspiring and guiding their entire team for making this document comprehensive and unique.

I would also commend S/Shri A.K. Chakraborti (Superintendent Engineer), P.K. Agrawal (Executive Engineer), U.S. Verma (Assistant Engineer), P.K. Gupta (Assistant Engineer) & Hasan Ansari (Data Entry Operator) for their continuous untiring efforts in the above mission.

The work has been made possible with the sincere efforts of several persons & institutions. It is not possible here to name them all, but we sincerely acknowledge with thanks the help & cooperation extended by them.

This **SOR** is available on the department website (www.cg.nic.in/pwdraipur) also.

Raipur
27/12/2014



Er. D.K. Pradhan
E-in-C PWD, Chhattisgarh

INDEX

S.No.	Particulars	Page
1.	GENERAL NOTES	1-5
2.	CHAPTER-1- CARRIAGE AND SUPPLY OF MATERIAL	6-7
3.	CHAPTER-2- SITE CLEARANCE	8-10
4.	CHAPTER-3- EARTH WORK, EROSION CONTROL AND DRAINAGE	11-14
5.	CHAPTER-4- SUB-BASES, BASE COURSE (NON-BITUMINOUS) AND SHOULDERS	15-18
6.	CHAPTER-5- BASES AND SURFACE COURSES (BITUMINOUS)	19-25
7.	CHAPTER-6- CEMENT CONCRETE PAVEMENTS	26-27
8.	CHAPTER-7- GEOSYNTHETICS AND SUB-SURFACE DRAIN	28
9.	CHAPTER-8- TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES	29-38
10.	CHAPTER-9- PIPE CULVERTS	39-40
11.	CHAPTER-10- MAINTENANCE OF ROADS	41-42
12.	CHAPTER-11- HORTICULTURE	43-44
13.	CHAPTER-12- ARBORICULTURE & ROAD BEAUTICATION	45-46
14.	USEFUL STANDARD TABLES	47-87
15.	ROAD MAP OF CHHATTISGARH STATE	88

GENERAL NOTES

1)		SOR-2015 has been prepared on the basis of the "Standard Data Book for Analysis of Rates" of MoRT&H, published by Indian Roads Congress. Some items, which do not find place in the Standard Data Book for Analysis of Rates, have also been included in the new SOR , as these are required and had been provided in the previous SOR , looking to the necessity of execution.
2)	(a)	"Specifications" would refer to the "Specifications for Road and Bridge works" (V th Revision) published by the Indian roads Congress in April 2013, on behalf of the Government of India, Ministry of Road Transport & Highways.
	(b)	"Clause" would refer to the clauses of the Specifications referred to, in note (a) above.
	(c)	"Engineer-in-Charge" would refer to the Executive Engineer of the division concerned.
	(d)	"Table" would refer to the table of the aforesaid Specifications.
3)		The rates of all items include element of setting out and carrying out the work in narrow or part width of road, where directed.
4)		In the absence of any stipulation to the contrary, unit rates for different items of works are for completing the works to the specifications i/c full compensation for all operations detailed in the relevant sections of the specifications under "Rates". The rates are to be considered as the full inclusive rate for the finished work covering all labour, material, royalties, lease, rent, wastage, temporary work, plant, equipment, overhead charges and profit, unless specified otherwise.
5)		Mode of measurements shall be as per provisions contained in the relevant clauses of the specifications, unless specified otherwise.
6)		The rates are inclusive of the element of hire and running charges of all types of plant, machinery and equipment required to complete the work, unless specified otherwise. Royalty, octroi-duty, commercial and all other taxes are included in the rates.
7)	(i)	The rates include making arrangement of traffic as per Clause No.112 except for initial treatment to verge, shoulders and construction of diversion.
	(ii)	The rates do not include the work of boring and trial pits, which are to be measured and paid separately.
8)	(i)	Cost of drums would be charged extra in case of supply of bitumen in packed drums at Rs.150/- each and Rs.400/- each for the drum of bitumen and emulsion respectively, if these materials are supplied by the department.
	(ii)	Bitumen and modified bitumen shall be obtained from approved Govt. petroleum refineries.
	(iii)	Only VG-30 grade bitumen will be used in all bituminous works, unless specified otherwise.

	(iv)	“When Commercial Vehicles exceed 2000 per day per lane and the highest daily mean temperature exceeds 40°C. VG-40 or modified bitumen of equivalent stiffness are recommended for Bituminous Concrete and top layers of Dense Bituminous Macadam”, as per note under Table-4 (selection criteria for grade modified bitumen) of IRC: 111-2009.	
9)	A. Theoretical consumption of bitumen has been worked out on the basis of the following compacted densities of mix for preparation of SOR :		
	(i)	for Bituminous Macadam	2.20 gm/cc
	(ii)	for Dense Bituminous Macadam	2.30 gm/cc
	(iii)	for Bituminous Concrete	2.36 gm/cc
	B. During construction, if the density of mix obtained by job mix formula for items mentioned in 8)A above are found less than the densities mentioned above, proportionate cost of bitumen, at basic rate mentioned in SOR shall be recovered from the contractor.		
10)	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 tests for items of work as stipulated in the specifications as per clause-903 and its sub-clauses of "Specifications for Road and Bridge works"of MORT&H (V th revision). Frequency of such tests to be carried out must not be less than the prescribed frequencies. Copies from Registers containing records of tests shall have to be presented along with running account bills. A record of actual consumption of materials like , bitumen, cement, steel etc. be maintained at site and copy submitted along with each running bill and the same should be cross checked with theoretical consumption before making payment. Register (original) shall have to be submitted along with the final bill. Tests shall have to be conducted for the contractor's material by his Engineers under the supervision of the Engineer-in-Charge or his authorized representatives in the field laboratory established by the contractor. However, the Engineer-in-Charge may direct to carry out tests in the departmental laboratory or any approved laboratory for which the testing charges will be paid by the contractor or may be deducted from bills. Before making any payment, it will be the responsibility of the officer making payment to ensure that all tests as per prescribed frequencies, have been carried out and the results are well within the scope of permissible limits.		
11)	The Section-900 of the specifications mentions " as required " against frequencies of some of the tests. To stave off disputes the following frequencies are specified :-		
	(a)	Deleterious constituents.	One test per 500 Cum. or part thereof.
	(b)	C.B.R.	----- do -----
12)	It will not be obligatory on the part of the Engineer-in-Charge to provide any assistance in obtaining lease/permits for extraction of minor minerals. The contractor will not be entitled to any excuse, whatsoever, on account of any delays in obtaining minor minerals to be used on the work.		

13)	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 aggregates for use in pavement courses, the quantities indicated in the specifications shall be supplied but payment for the same shall be regulated on the basis of volumes to be computed after deductions specified in Clause 520.5 of MoRT&H specifications for Road and Bridge Works (Vth Revision). The stacking will have to be in a trapezoidal section having base 1.50 M., top width 0.50 M. and height 0.50 M. The length should be as long as conveniently possible.
14)	For items Granular Sub-base (mix-in-place method), W.B.M., Surface Dressing, Open Graded Premix Surfacing (by manual means) and Seal Coat type-A & Seal Coat type B (by manual means) the aggregates shall be stacked at site by the contractor which will be recorded in the Measurement Book and 100% check will be affected by the Sub-Divisional Officer prior to their use on work. No separate payment shall be made for stacking as the same is deemed to be included in the rates of these items.
15)	Metal to be used for all bituminous courses and cement concrete shall be crushed in mechanical crushers.
16)	If any work is found to be sub-standard, but the Engineer-in-Charge is of the opinion that the same can be accepted at a reduced rate, then the Engineer-in-Charge shall submit proposals for the same, supported by an analysis, i.e. justification of such reduction, through a D.O. letter to the Superintending Engineer concerned, 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.
17)	Rotavator or similar approved equipment capable of mixing the material to the desired degree is compulsory for mixing the graded material.
18)	The Design C.B.R. for Sub-grade soil (500 mm below the Sub-base) shall not be less than 8%. The CBR for borrow material for construction of embankment should have minimum CBR of 5% .
19)	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 900-1 of the Specifications. For checking, Specifications Clause 902 shall apply. Failure to rectify the same, will call for similar action as provided for in note 15 above.
20)	The work of shoulders must precede the work of Sub-base and Base courses and succeed the Bituminous courses and Cement Concrete pavement.
21)	The rates for shoulders includes the operation of cleaning and scrapping of deleterious material and preparing of surface with required cross fall before laying of material for construction of shoulders.

22)	Rates for the items of Dense Bituminous Macadam, Bituminous Concrete and Semi Dense Bituminous Concrete are based on the bitumen percentage in these items. Additional bitumen required as per job mix formula shall be deemed to be taken into account and be accommodated in the tender rates by the contractor. No separate payment shall be made on this account.	
23)	Some bituminous items, like Semi-Dense Bituminous Concrete and Leveling Course/Profile Corrective Course have been deleted in MoRT&H's "Specifications for Road and Bridge works" (Vth Revision), but these items have been kept in the SOR. Execution of such items, which do not find place in "Specifications for Road and Bridge works" (Vth Revision), but are present in "Specifications for Road and Bridge works" (IVth Revision), shall be as per norms of "Specifications for Road and Bridge works" (IVth Revision). These items shall not be used for works in National Highways.	
24)	Use of cement of required specifications at the rate of 2% by weight of total aggregate as filler for Bituminous Concrete and Dense Bituminous Macadam is mandatory. Lime shall not be used as filler.	
25)	a)	Rates of items would also apply for work order/piece work system.
	b)	Rates payable for any work to be done departmentally on work order/piece work may either be at-par or below rates in this SOR.
26)	Rates for Transportation in Chapter No. 1 of "Carriage of Materials" include :-	
	i)	Loading and unloading into transport vehicle with incidental leads up to 100 M. at each place and all lifts.
	ii)	Stacking at suitable places as directed by the Engineer-in-Charge, the weights of the container of any material shall be ignored.
27)	The measurement of excavation is to be done as per Clause 301.8. For rock excavation, where cross sectional measurements are not possible due irregular configuration, or where the rock is admixed with other classes of materials, the volume shall be computed on the basis of stack measurements of excavated rubble allowing a deduction of 35% therefrom. For stack measurement of excavated material other than rock, a deduction of 16% of stack volume shall be made.	
28)	Rubble obtained from excavation of hard rock shall be used for conversion into coarse aggregates or for other constructions and shall be issued to the contractor at Rs.250 per cubic meter of rock excavated. 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 excavated rock.	
29)	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 indicated against each :-	
	a)	Rubble :- 1 Cubic meter of rubble for every cubic meter of excavated boulder soling @Rs.200 per cubic meter of soling.
	b)	Coarse Aggregate: - 1.10 Cubic meter for every cubic meter of excavated WBM @ Rs.250 per cubic meter of excavated WBM. (Excavated WBM should be screened to segregate metal from moorum before re-use).
30)	The Contractor will carry out dismantling of utilities under the supervision of the concerned department with prior information to the users.	

31)	The actual quantities of materials shall be as per job mix formula for bituminous works.	
32)	The pavement camber or cross fall shall be provided as per provisions of IRC:73.	
33)	The Prime coat must be used over granular surface before the use of tack coat.	
34)	The girth of trees shall be measured at 1.00 meter (One meter) above ground level.	
35)	Rates of site clearance include jungle clearance leveling and dressing.	
36)	All wood obtained from the tree cutting shall be the property of the Government and shall be deposited at P.W.D. store as directed by Engineer-in-Charge.	
37)	In case of any contradiction in the provisions of the Specifications and this Schedule of Rates, the provisions of the SOR would take precedence.	
38)	The Basic rates of bituminous materials considered in this SOR are as follows :	
	(a) Bitumen VG-40	Rs. 51616.00 per M.T.
	(b) Bitumen VG-30	Rs. 48937.00 per M.T.
	(c) Bitumen VG-10	Rs. 47976.00 per M.T.
	(d) Bitumen Emulsion - Cationic (Grade- RS confirming to IS:8887)	Rs. 47347.00 per M.T.
	(e) Bitumen Emulsion - Cationic (Grade- MS confirming to IS:8887)	Rs. 50239.00 per M.T.
	(f) Bitumen Emulsion - Cationic (Grade- SS confirming to IS:8887)	Rs. 65657.00 per M.T.
	(g) Bitumen Emulsion - Cationic (Grade- SS-1, ASTM)	Rs. 50658.00 per M.T.
	(h) CRMB-60	Rs. 50295.00 per M.T.

CHAPTER- 1
CARRIAGE AND SUPPLY OF MATERIALS

Item No.	Descriptions	Unit	Rate (Rs.)
	(Volume to be computed as per provisions in clause 520)		
1.1	Transportation of metal i/c loading & unloading		
i)	For a lead upto 1 Km.	Cum.	92.00
ii)	Beyond 1 Kms. and upto 10 Kms.(Add extra for every 1 Km.)	Cum.	4.00
iii)	Beyond 10 Kms. and upto 20 Kms. (Add extra for every 1 Km.)	Cum.	3.00
iv)	Beyond 20 Kms. and upto 50 Kms. (Add extra for every 1 Km.)	Cum.	2.80
v)	Beyond 50 Kms. (Add extra for every 1 Km.)	Cum.	2.60
1.2	Transportation of different other material i/c loading & unloading		
		Rate as %age of metal transportation rates	
a)	Flag Stone/cut stone	Cum.	40% above
b)	Masonry stones	Cum.	75% above
c)	Rubble	Cum.	15% above
d)	Loose moorum/sand/earth/surkhi/cement/stone dust/hot mix asphalt material	Cum.	10% below
e)	Excavated/compacted ordinary & other soil measured as per clause 301.8, 304.4 and 305.8	Cum.	20% above
f)	Excavated ordinary rock measured as per clause 304.4	Cum.	90% above
g)	Coal/fuel wood/Iron work/steel/G.I. Sheets/ pipes/ lime/machinery etc.	M.T.	7.5% below
h)	More than 100 mm dia ballies	R.M.	1.5% of metal
i)	Upto 100 mm diameter ballies	R.M.	0.75% of metal
j)	Tar/paints/bitumen etc.	M.T.	5% above
k)	Hume pipe		
	i) Upto 1000mm dia	R.M.	80% of metal
	ii) Above 1000mm dia	R.M.	110% of metal
1.3	Transportation by trucks on hire		
i)	Trucks hired for full load excluding loading/unloading and stacking for items not covered above for distances:		
	a) Up to 10 kms.	Per Km.	60.00
	b) Beyond 10 Kms. and up to 50 Kms. add extra over a) above	Per Km.	43.00
	c) Beyond 50 Kms. add extra over b) above.	Per Km.	39.00

Item No.	Descriptions	Unit	Rate (Rs.)
ii)	Loading of trucks (by manual means)	Cum.	115.00
iii)	Unloading of trucks and stacking (by manual means)	Cum.	115.00
1.4	Hire charges for machineries : (only working hours to be paid and idle hours not to be paid)		
i)	Tractor with trolley	Hour	300.00
ii)	Tractor with ripper	Hour	350.00
iii)	Tractor mounted water tanker	Hour	450.00
iv)	Truck mounted water tanker	Hour	823.00
v)	Crane for lifting		
	a) 40 T capacity	Hour	664.00
	b) 80 T capacity	Hour	996.00
vi)	Hydraulic excavator of 1.0 Cum bucket	Hour	1014.00
vii)	Road rollers :		
	(a) Smooth wheeled roller 8 T	Hour	359.00
	(b) Tandem Road roller	Hour	891.00
	(c) Pneumatic Road roller	Hour	968.00
	(d) Vibratory roller	Hour	1200.00
viii)	Tipper	Hour	500.00
ix)	Truck	Hour	290.00
x)	Paver Finisher Mechanical	Hour	800.00
1.5	Supply of mineral aggregate like broken stone/crushed stone (crushed in mechanical crusher) as per clause 520 at road site including all lead and stacking etc. complete.		
i)	75 mm standard size broken stone	Cum.	821.00
ii)	63 mm standard size broken stone	Cum.	893.00
iii)	45 mm standard size broken stone	Cum.	952.00
iv)	45 mm standard size Crushed stone	Cum.	1083.00
v)	22.4 mm standard size Crushed stone	Cum.	1140.00
vi)	13.2 mm standard size Crushed stone	Cum.	1030.00
vii)	11.2 mm standard size Crushed stone	Cum.	1030.00
viii)	6.7 mm standard size Crushed stone	Cum.	589.00
1.6	Supply of fine aggregate and filler material as per clause 520 including all lead and stacking etc. complete		
i)	Crusher stone dust	Cum.	534.00
ii)	Sand/Shingle/Kanker/Laterite	Cum.	652.00
iii)	Moorum	Cum.	340.00
1.7*	Supplying, transporting and stacking of hot premixed bituminous macadam using crushed aggregate of grading-2 conforming to clause 504 with binder content 3.4% by weight of mix, transported from hot mix plant to site, inclusive of all leads.	MT	2892.00

Note :- * This item to be executed with prior permission of Chief Engineer.

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.	197.00
ii)	Girth beyond 600 mm to 900 mm	Each.	353.00
iii)	Girth beyond 900 mm to 1800 mm	Each.	684.00
iv)	Girth above 1800 mm	Each.	1295.00
2.2	Clearing Grass and Removal of Rubbish (clearing grass and removal of rubbish up to a distance of 50 meters outside the periphery of the area)	Hectare.	13438.00
2.3	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 meters 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.	40680.00
B	In area of thorny jungle	Hectare.	54484.00
2.4	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 up to 1000 meters and as per relevant clauses of section-200 in		
(i)	Lime / Cement Concrete		
A	Lime Concrete, cement concrete grade M-10 and below	Cum.	294.00
B	Cement Concrete Grade M-15 & M-20	Cum.	348.00
C	Pre-stressed / Reinforced cement concrete grade M-20 & above	Cum.	908.00
(ii)	Brick / Tile work		
A	In lime mortar	Cum.	187.00
B	In cement mortar	Cum.	240.00
C	In mud mortar	Cum.	165.00
D	Dry brick pitching or brick soling	Cum.	154.00
(iii)	Stone Masonry		
A	Rubble stone masonry in lime mortar	Cum.	208.00
B	Rubble stone masonry in cement mortar.	Cum.	240.00
C	Rubble Stone Masonry in mud mortar.	Cum.	187.00
D	Dry rubble masonry	Cum.	176.00

Item No.	Descriptions	Unit	Rate (Rs.)
E	Stone pitching/ dry stone spalls.	Cum.	165.00
F	Boulders laid in wire crates including opening of crates and stacking dismantled materials.	Cum.	187.00
(iv)	Wood work wrought framed and fixed in frames of trusses upto a height of 5 m above plinth level.	Cum.	374.00
(v)	Steel work in all types of sections up to a height of 5 m above plinth level excluding cutting of rivet.		
A	Including dismembering	Tone.	1143.00
B	Excluding dismembering.	Tone.	851.00
C	Extra over item No(V) A and(V) B for cutting rivets.	Each.	8.00
(vi)	Scraping of bricks dismantled from brick work including stacking.		
A	In lime/Cement mortar	1000No.	941.00
B	In mud mortar	1000No.	336.00
(vii)	Scraping of Stone from dismantled stone masonry		
A	In cement and lime mortar	Cum.	378.00
B	In Mud mortar	Cum.	80.00
(viii)	Scraping plaster in lime or cement mortar from brick/ stone masonry	Sqm.	12.00
(ix)	Removing all type of hume pipes and stacking within a lead up to 1000 meters including earthwork and dismantling of masonry works around pipes.		
A	Up to 1000 mm dia	Meter.	400.00
B	Above 1000 mm dia	Meter.	531.00
2.5	Dismantling of flexible pavements and disposal of dismantled materials up to a lead of 1000 meters, stacking serviceable and unserviceable materials separately and as per relevant clauses of section-200.		
A	Bituminous courses	Cum.	542.00
B	Granular courses	Cum.	390.00
2.6	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 meters, stacking serviceable and unserviceable materials separately and as per relevant clauses of section-200.	Cum.	1104.00
2.7	Dismantling guard rails by manual means and disposal of dismantled material with all lifts and up to a lead upto 1000 meters, stacking serviceable materials and unserviceable materials separately and as per relevant clauses of section-200.	Meter.	59.00
2.8	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.	11.00
2.9	Dismantling kerb stone channel 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.	17.00

Item No.	Descriptions	Unit	Rate (Rs.)
2.10	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	5 th KM stone	Each.	291.00
B	Ordinary KM Stone	Each.	171.00
C	Hectometer Stone	Each.	34.00
2.11	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 meters, stacking serviceable material and unserviceable material separately.	Meter.	38.00
2.12	Dismantling of CI water pipe line 600 mm dia including disposal with all lifts and lead up to 1000 meters and stacking of serviceable material and unserviceable material separately under supervision of concerned department.	Meter.	95.00

CHAPTER- 3

EARTH WORK, EROSION CONTROL AND DRAINAGE

Item No.	Descriptions	Unit	Rate (Rs.)
3.1 [*]	Excavation in Soil (by Manual Means.) Excavation for roadway in soil using including loading in tipper for carrying of cut earth to embankment site and unloading with all lifts and lead upto 1000 meters as per relevant clauses of section 300.	Cum.	140.00
3.2	Excavation in Soil (by Mechanical Means.) Excavation for roadway in soil using mechanical means including loading in tipper for carrying of cut earth to embankment site and unloading with all lifts and lead upto 1000 meters as per relevant clauses of section 300.	Cum.	95.00
3.3	Excavation 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 as per relevant clauses of section 300.	Cum.	192.00
3.4	Excavation in Hard Rock (requiring blasting) with disposal upto 1000 meters (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 up to 1000 meters as per relevant clauses of section 300.	Cum.	226.00
3.5	Excavation in Hard Rock (blasting prohibited) (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 as per relevant clauses of section-300.	Cum.	294.00
3.6	Excavation in Hard Rock (controlled blasting) with disposal upto 1000 meters (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 up to 1000 meters as per relevant clauses of section-300.	Cum.	336.00
3.7	Excavation in Marshy Soil (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 as per relevant clauses of Section-300.)	Cum.	100.00
3.8	Removal of Unserviceable Soil with Disposal up to 1000 meters including loading and unloading.	Cum.	85.00
3.9	Add extra over item 3.1 to 3.2 & 3.7 to 3.8 above for transportation for disposal beyond 1.0 Km lead.	Cum.	Vide item No. 1.1 & 1.2 of Chapter-1
3.10	Scarifying Existing Granular Surface to a depth of 50 mm (Scarifying the existing granular road surface to a depth of 50 mm and disposal of scarified material within all lifts and leads up to 1000 meters) as per clause 305.4.3.	Sqm.	18.00

Item No.	Descriptions	Unit	Rate (Rs.)
3.11	Scarifying existing bituminous surface to a depth of 50 mm (Scarifying the existing bituminous road surface to a depth of 50 mm and disposal of scarified material with in all lifts and lead up to 1000 meters) as per clause 305.4.3.	Sqm.	23.00
3.12	Construction of embankment with Material Obtained from Borrow Pits/Borrow Area (Construction of embankment with approved material/selected soil having C.B.R.>5 (unless specified otherwise in the contract) obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2)	Cum.	223.00
3.13	Construction of sub-grade with Material Obtained from Borrow Pits/Borrow Area (Construction of sub-grade with approved material/selected soil having C.B.R.>8 (unless specified otherwise in the contract) obtained from borrow pits with all lifts and leads, transporting to site, spreading, grading to required slope and compacting to meet requirement of table 300-2)	Cum.	250.00
3.14	Construction of Embankment with Material Deposited from Roadway Cutting (Construction of embankment with approved materials having C.B.R.>5 (unless specified otherwise in the contract) deposited at site from roadway cutting and excavation from drain and foundation of other structures graded and compacted to meet requirement of table 300-2)	Cum.	80.00
3.15	Compacting Original Ground		
(i)	Compacting Original Ground supporting sub-grade Loosening of the ground upto a level of 500 mm below the subgrade level , watered, graded and compacted in layers to meet requirement of table 300-2 for sub grade construction	Cum.	50.00
(ii)	Compacting Original Ground supporting embankment Loosening, leveling and compacting original ground to facilitate placement of first layer of embankment, scarified to a depth of 150 mm, mixed with water at O.M.C. and then compacted by rolling so as to achieve minimum dry density as given in table 300-2 for embankment construction.	Cum.	28.00
3.16	Surface Drains in Soil (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 meters (average lead 25 meters)	Meter.	44.00
3.17	Surface Drains in Ordinary Rock (Construction of unlined surface drain of average cross sectional area 0.4 sqm in ordinary rock to specified lines, grades, levels and dimensions as per approved design and to the requirement of clause 301 & 309. Excavated material to be used in embankment at site.)	Meter.	89.00
3.18	Sub Surface Drains with Perforated Pipe (Construction of subsurface drain with perforated pipe of 100 mm internal diameter of cement concrete closely jointed, perforations ranging from 3 mm to 6 mm depending upon size of material surrounding the pipe, with 150 mm bedding below the pipe and 300 mm cushion above the pipe, cross section of excavation 450 x 550 mm. Excavated material to be utilized in roadway at site)	Meter.	473.00

Item No.	Descriptions	Unit	Rate (Rs.)
3.19	Aggregate Sub- Surface Drains (Construction of aggregate sub surface drain 300 mm x 450 mm with aggregates conforming to table 300-4, excavated material to be utilized in roadway)	Meter.	101.00
3.20	Construction of RCC open drain		
(i)	Construction of RCC open drain 1.0m x 1.0m inside dimension lined with 150 mm thick RCC M-20 walls, 150 mm thick CC M-20 foundation, over 100 mm thick (Av) leveling course in PCC M-15 including excavation , dressing of sides and bottom, provision of HYSD reinforcement consisting 10 mm dia horizontal bars @ 150 mm c/c and L-shaped 10 mm dia vertical bars @ 150 mm c/c (L=1400 mm) including cutting, bending and binding wire, placing in position, providing shuttering and concreting by using concrete mixer, compaction by vibration etc complete as per drawings and technical specifications.	Meter.	4905.00
(ii)	Construction of RCC open drain 0.60m x 0.60m inside dimension lined with 120 mm thick RCC M-20 walls, 120 mm thick CC M-20 foundation, over 100 mm thick (Av) leveling course in PCC M-15 including excavation , dressing of sides and bottom, provision of HYSD reinforcement consisting 8 mm dia horizontal bars @ 150 mm c/c and L-shaped 8 mm dia vertical bars @ 150 mm c/c (L= 800 mm) including cutting , bending and binding wire, placing in position , providing shuttering and concreting by using concrete mixer, compaction by vibration etc complete as per drawings and technical specifications.	Meter.	2592.00
(iii)	Providing and laying 15 cm (Average) thickness hammer dressed dry stone V-shaped road side surface drains as per MoRT&Hs specifications with all leads and lifts complete. (Refer to Manual for Hill Roads IRC:SP:48)	Sqm.	395.00
3.21	Construction of Rock fill Embankment (Construction of rock fill embankment with broken hard rock fragments obtained from roadway excavation of size not exceeding 300 mm laid in layers not exceeding 500 mm thick including filling of surface voids with stone spalls, blinding top layer with granular material, rolled with vibratory road roller, all complete as per clause 313)	Cum.	48.00
3.22	Embankment Construction with Fly ash/Pond ash available from coal or lignite burning Thermal Plants as waste material. (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.)	Cum.	495.00
3.23	Providing and laying aggregate and sand cover for aggregate drains with all leads and lifts as per clause 309.3.6 (only aggregate crushed in mechanical crusher shall be used and measurement from outer ends of sand cover.)	Cum.	781.00
3.24	Providing Chute drains consisting of NP-2 RCC half round, 300 mm dia pipes , laid over block of C.C. 1:3:6 (20mm and down aggregates) size 450 mm x 265 mm laid over filter media (measured and paid separately) including all false work etc. complete.	Meter.	1681.00

Item No.	Descriptions	Unit	Rate (Rs.)
3.25	Construction of RCC Drain/Cover/Chamber		
(i)	Excavation for drain (Earth work in excavation for drain/chamber 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.)	Cum.	140.00
(ii)	Construction of RCC drain/chamber cover , placing in position, providing shuttering and concreting by using concrete mixer, compaction by vibration etc complete as per drawings and technical specifications excluding reinforcement. with RCC M-20	Cum.	4146.00
(iii)	Supplying, Fitting and Placing un-coated HYSD bar Reinforcement in drain/cover/chamber complete as per Drawing and Technical Specifications.	MT.	56301.00

Note:- * This item to be executed with prior permission of Chief Engineer.

CHAPTER – 4
SUB-BASES, BASES (NON- BITUMINOUS) AND SHOULDERS

Item No.	Descriptions	Unit	Rate (Rs.)
4.1	Granular Sub-base as per Table:- 400-1		
	Construction of granular sub-base by providing graded Material, , carriage of mixed Material to work site, spreading in uniform layers with motor grader on prepared surface watering, rolling and compacting with vibratory power roller at OMC to achieve the desired density, complete as per clause 401		
A	Plant mix method (with Mechanically crushed stone only)		
(a)	For Lower Sub-base with		
(i)	Grading-III Material	Cum.	1423.00
(ii)	Grading-IV Material	Cum.	1458.00
(b)	For Sub-base cum drainage layer or upper sub-base with		
(i)	Grading-V Material	Cum.	1372.00
(ii)	Grading-VI Material	Cum.	1363.00
B	By Mix in place method		
	Disintegrated rock i.e moorum having CBR value not less than 20 and P.I. and L.L. not more than 6 and 20 respectively. (For Village roads only)	Cum.	460.00
4.2	Lime Stabilization for Improving Sub-grade (Laying and spreading available soil in the sub-grade on a prepared surface, pulverizing, 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 as per clause-402.)	Cum.	329.00
4.3	Lime Treated Soil for Sub-Base (Providing, laying and spreading soil on a prepared sub-grade, pulverizing, mixing the spread soil in place with rotavator with 3 % slaked lime with minimum content of 70% of CaO, grading with motor grader and compacting with the road roller at OMC to achieve at least 98%of the max dry density to form a layer of sub base as per clause-402.)	Cum.	488.00
4.4	Cement Flyash Treated Soil Sub-Base/ Base (Providing, laying and spreading soil on a prepared sub-grade, pulverizing, adding the designed quantity of cement and flyash to the spread soil, mixing in place with rotavator, grading with the motor grader and compacting with the road roller at OMC to achieve the desired unconfined compressive strength and to form a layer of sub-base/base as per clause-403.)	Cum.	686.00
4.5	Cement Flyash Treated Crushed Rock or combination as per clause 403.2 and table 400.4 in Sub-base/ Base (Providing, laying and spreading Material on a prepared sub-grade, adding the designed quantity of cement and flyash to the spread Material, mixing in place with rotavator, grading with the motor grader and compacting with the road roller at OMC to achieve the desired unconfined compressive strength and to form a layer of sub-base/base as per clause-403.)		
(i)	For Sub-Base course	Cum.	1688.00
(ii)	For Base course	Cum.	1500.00

Item No.	Descriptions	Unit	Rate (Rs.)
4.6	Making 50 mm x 50 mm Furrows (Making 50 mm x 50 mm furrows, at 45° inclination to the center line of the road and at one meter interval in the existing thin bituminous wearing coarse including sweeping and disposal of excavated material within 1000 meters lead)	Sqm	8.00
4.7	Inverted Choke (Construction of inverted choke by providing, laying, spreading and compacting screening B type/ coarse sand of specified grade in uniform layer on a prepared surface with motor grader and compacting with power roller etc)	Cum	601.00
4.8	Water Bound Macadam (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 as per clause-404.)		
A	Grading- I (63 to 45 mm size aggregate)		
(i)	Using Screening Crushable type such as Moorum or Gravel	Cum	1449.00
(ii)	Using Screening Type-A (13.2mm Agg.)	Cum	1543.00
(iii)	Using Screening Type-B (11.2mm Agg.)	Cum	1619.00
B	Grading- II (53 to 22.4 mm size aggregate)		
(i)	Using Screening Crushable type such as Moorum or Gravel	Cum	1476.00
(ii)	Using Screening Type-B (11.2mm Agg.)	Cum	1647.00
4.9	Crushed Cement Concrete Sub-base / Base (Breaking and crushing of material obtained by breaking damaged cement concrete slabs to size range not exceeding 75 mm as specified in table 400.9 transporting the aggregates obtained from breaking of cement concrete slabs., laying and compacting for sub base/ base course as per clause 405.)	Cum	304.00
4.10	Wet Mix Macadam (Providing, laying, spreading and compacting graded stone aggregate to wet mix macadam specification including premixing the Material with water at OMC in mechanical mix plant carriage of mixed Material by tipper to site, laying in uniform layers with paver in sub- base / base course on well prepared surface and compacting with vibratory roller to achieve the desired density as per clause 406.)	Cum	1434.00
4.11	Construction of Median and Island with Soil Taken from Roadway Cutting (Construction of Median and Island above road level with approved material deposited at site from roadway cutting and excavation for drain and foundation of other structures, spread, graded and compacted as per clause-408.)	Cum	175.00
4.12	Construction of Median and Island with Soil Taken from Borrow Areas (Construction of median and Island above road level with approved material brought from borrow pits, spread, sloped and compacted as per clause-408).	Cum	257.00

Item No.	Descriptions	Unit	Rate (Rs.)
4.13	Construction of Shoulders (Construction of shoulders as per clause 408 with selected soil from borrow pits / borrow areas having CBR not less than 12 and shall have L.L. and P.I. not more than 25% and 6% respectively, inclusive of all leads and lifts, including clearing and scrapping of existing surface, providing required cross fall, compacting, watering rolling and royalty charges etc. complete.		
A	With vibratory roller	Cum	291.00
B	With smooth wheeled roller	Cum	277.00
4.14	Providing paving to shoulders including dressing, leveling to camber and compacting the base etc. with :		
(i)	Hammer dressed 200 mm thick (average) stones, gaps to be filled with spalls hammered and river sand.	Sqm	534.00
(ii)	Bricks (laid in 100 to 112 mm thickness) of crushing strength not less than 70 kg/cm ² when tested to Indian Standards with joints filled with river sand.	Sqm	336.00
4.15	Providing & laying precast interlocking concrete blocks of minimum compressive strength of 300 kg/sq.cm and approved size , shape/ pattern over coarse sand bed of thickness upto 40 mm and joints thick filled with fine sand including leveling with surface vibrator, temping and sweeping etc. complete as per IRC-SP-63-2004.		
A)	60mm thick Plain precast interlock concrete block	Sqm	497.00
B)	80mm thick Plain precast interlock concrete block	Sqm	590.00
C)	80mm thick Polymer coated coloured precast interlock concrete blocks	Sqm	732.00
D)	60mm thick Polymer coated coloured precast interlock concrete blocks	Sqm	647.00
4.16	Footpaths and Separators (Construction of footpath/separator by providing a 150 mm compacted granular sub base as per clause 401 and 75 mm thick cement concrete base with PCC grade M-15, overlaid with precast cement concrete tiles 25mm thick fixed in 20mm thick cement mortar 1:3 including provision of all drainage arrangements but excluding kerb channel excluding cost of GSB.) as per clause 410.	Sqm	1667.00
4.17	Providing and fixing guard stones 200 x 200 x 900 mm made of precast RCC M-20 grade fixed at 300 mm into the ground in P.C.C. 1:3:6 blocks of size 400 x 400 x 400 mm and given two coats of paint with white and black bands including excavation.	Each	431.00
4.18	Providing and fixing kerb stones 100 mm thick and 600 mm wide chisel dressed cut stones fixed in CC 1:3:6 (block size 250 x 225 mm) including all excavation.	RM	298.00
4.19	Providing 50 mm thick flag stone flooring including bedding in CM 1:6 over 100 mm thick CC 1:3:6 including cement pointing 1:3 with pigment to match the colour of stone as per clause-410 including dressing of stones and all excavation complete.	Sqm	637.00

Item No.	Descriptions	Unit	Rate (Rs.)
4.20	Lime, Fly ash stabilized soil sub-base (Construction of Sub-base using lime-fly ash admixture with granular soil, free from organic matter/ deleterious material or clayey silts and low plasticity clays having PI between 5 and 20 and liquid limit less than 25 and 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, lime + fly ash content ranging between 10 to 30%, the minimum un-confined compressive strength and CBR value after 28 days curing and 4 days soaking to be 7.5kg/cm ² and 25% respectively, all as specified in IRC: 88:1984.)	Cum	503.00

CHAPTER- 5
BASES AND SURFACE COURSES (BITUMINOUS)

Item No.	Descriptions	Unit	Rate (Rs.)
5.1	Prime coat (Providing and applying primer coat with oil based bitumen emulsion (SS-1, grade confirming to IS:8887) on prepared surface of granular Base including clearing of road surface and spraying primer using mechanical means as per clause 502.		
	(i) on WBM/WMM surface @0.85 Kg/sqm.	Sqm	64.00
	(ii) on Stabilized soil @ 1.05 Kg/sqm.	Sqm	79.00
5.2	Tack coat Providing and applying tack coat with bitumen emulsion (RS-1, grade confirming to IS:8887) using emulsion pressure distributor on the prepared bituminous/granular surface cleaned with mechanical broom and as per clause 503.		
	(i) Bituminous surface @ 0.25 kg /Sqm	Sqm	15.00
	(ii) Granular surfaces treated with primes @ 0.30 kg /Sqm	Sqm	17.00
	(iii) Cement concrete Pavement @ 0.35 kg/Sqm	Sqm	20.00
5.3	Bituminous Macadam (Providing and laying bituminous macadam as per clause 504 with mixed prepared in minimum 40-60 TPH capacity hot mix plant using crushed aggregates of specified grading premixed with bituminous binder, transported to site, laid over a previously prepared surface with paver finisher to the required grade, level and alignment and rolled to achieve the desired compaction)		
A	With sensor paver finisher		
(i)	for Grading-I(40 mm nominal maximum size, bitumen content 3.30%)	Cum	6210.00
(ii)	for Grading-II(19 mm nominal maximum size, bitumen content 3.40%)	Cum	6448.00
B	With mechanical paver finisher		
(i)	for Grading-I(40 mm nominal maximum size, bitumen content 3.30%)	Cum	6018.00
(ii)	for Grading-II(19 mm nominal maximum size, bitumen content 3.40%)	Cum	6255.00
5.4	Dense Bituminous Macadam (Providing and laying dense bituminous macadam with minimum 40-60 TPH capacity HMP using crushed aggregates of specified grading, premixed with bituminous binder @ 4.0 to 4.5% by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No.505 complete in all respects.)		
A	With sensor paver finisher		
(i)	for Grading-I (37.5 mm nominal size, bitumen content 4.0%)	Cum	7488.00
(ii)	for Grading-II(26.5 mm nominal size bitumen content 4.50%)	Cum	8148.00
(iii)	Add extra to the Rate of Dense Bituminous Macadam with bitumen, if Bitumen Grade VG-40 is used instead of Bitumen Grade VG-30 in the items above.	Cum	@4%
B	With mechanical paver finisher		

Item No.	Descriptions	Unit	Rate (Rs.)
(i)	for Grading-I (37.5 mm nominal size, bitumen content 4.0%)	Cum	7269.00
(ii)	for Grading-II(26.5 mm nominal size bitumen content 4.50%)	Cum	7916.00
(iii)	Add extra to the Rate of Dense Bituminous Macadam with bitumen, if Bitumen Grade VG-40 is used instead of Bitumen Grade VG-30 in the items above.	Cum	@4%
5.5	Bituminous Concrete (Providing and laying bituminous concrete with minimum 40-60 TPH capacity hot mix plant using crushed aggregates of specified grading, premixed with bituminous binder @ 5.0 to 6.0% by weight of total mix of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORTH specification clause No. 507 complete in all respects)		
A	With sensor paver finisher		
(i)	for Grading-I(19 mm nominal size) with bitumen 5.5 %	Cum	9549.00
(ii)	for Grading I(19 mm nominal size) with CRMB 60- 5.5 %	Cum	9749.00
(iii)	for Grading II (13.2 mm nominal size) with bitumen 6.0 %	Cum	10092.00
(iv)	for Grading II (13.2 mm nominal size) with CRMB 60- 6.0 %	Cum	10311.00
(v)	Add extra to the Rate of Bituminous Concrete with bitumen, if Bitumen Grade VG-40 is used instead of Bitumen Grade VG-30 in the items above.	Cum	@4%
B	With mechanical paver finisher		
(i)	for Grading I (19 mm nominal size) with bitumen 5.5 %	Cum	9282.00
(ii)	for Grading I(19 mm nominal size) with CRMB 60- 5.5 %	Cum	9477.00
(iii)	for Grading II (13.2 mm nominal size) with bitumen 6.0 %	Cum	9812.00
(iv)	for Grading II (13.2 mm nominal size) with CRMB 60- 6.0 %	Cum	10026.00
(v)	Add extra to the Rate of Bituminous Concrete with bitumen, if Bitumen Grade VG-40 is used instead of Bitumen Grade VG-30 in the items above.	Cum	@4%
5.6*	Surface Dressing (Providing and laying surface dressing as wearing course in single coat using crushed stone aggregates of specified size on a layer of bituminous binder laid on prepared surface and rolling with pneumatic type roller to give proper surface finish as per clause 509.		
(i)	19 mm nominal size chipping with bitumen @ 1.2kg/m ²	Sqm	99.00
(ii)	13 mm nominal size chipping with bitumen @ 1.0kg/m ²	Sqm	80.00
5.7	Open-Graded Premix Surfacing (Providing, laying and rolling of open - graded premix surfacing of 20 mm thickness composed of 13.2 mm to 5.6 mm aggregates either using bitumen to required line, grade and level to serve as wearing course on a previously prepared base, including mixing in a suitable plant, laying and rolling with a smooth wheeled roller 8-10 tonne capacity, finished to required level and grades as per clause 510)		
(i)	Mechanical method using Bitumen and minimum 40-60 TPH capacity hot mix plant.-With mechanical paver finisher.	Sqm	122.00
(ii)	Mechanical method using cationic bitumen emulsion.	Sqm	159.00

Item No.	Descriptions	Unit	Rate (Rs.)
5.8	Close Graded Premix Surfacing/Mixed Seal Surfacing (Mechanical means using minimum 40-60 TPH capacity of HMP. Providing, laying and rolling of close-graded premix surfacing material of 20 mm thickness using 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, complete as per clause 508)		
I.	With sensor paver finisher		
A	With bitumen		
i)	Type A (11.2 mm to 0.09 mm size aggregates)	Sqm	168.00
ii)	Type B (13.2 mm to 0.09 mm size aggregates)	Sqm	151.00
B	With CRMB-60		
i)	Type A (11.2 mm to 0.09 mm size aggregates)	Sqm	172.00
ii)	Type B (13.2 mm to 0.09 mm size aggregates)	Sqm	154.00
II.	With mechanical paver finisher		
A	With bitumen		
i)	Type A (11.2 mm to 0.09 mm size aggregates)	Sqm	163.00
ii)	Type B (13.2 mm to 0.09 mm size aggregates)	Sqm	146.00
B	With CRMB-60		
i)	Type A (11.2 mm to 0.09 mm size aggregates)	Sqm	166.00
ii)	Type B (13.2 mm to 0.09 mm size aggregates)	Sqm	149.00
5.9	Seal Coat (Providing and laying seal coat for sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall including rolling and finishing using Type A and B seal coats as per clause 511)		
A	Type-‘A’ (Providing and laying liquid seal coat comprising of an application of a layer of binder followed by a cover of stone chips of 6.7mm size)	Sqm	62.00
B	Type-‘B’		
(i)	Providing and laying of premix sand seal coat with minimum 40-60 TPH HMP of appropriate capacity using crushed stone chipping (passing through 2.36mm size sieve) and with bitumen as binder.	Sqm	47.00
(ii)	Providing and laying of premix sand seal coat using crushed stone chipping (passing through 2.36mm size sieve) and with cationic emulsion as binder, by mechanical means.	Sqm	67.00
5.10	Mastic Asphalt (Providing and laying 25mm thick mastic asphalt wearing course with paving grade bitumen meeting the requirements given in table 500-39 prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with fine-grained hard stone chipping of 13.2 mm nominal size pre- coated with bitumen 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°C, protruding 1 mm to 4 mm over mastic surface, all complete as per clause-516.)	Sqm	511.00

Item No.	Descriptions	Unit	Rate (Rs.)
5.11	Mastic Asphalt (Providing and laying 12mm thick mastic asphalt wearing course with paving grade bitumen meeting the requirements given in table 500-39, prepared by using mastic cooker and laid to required level and slope after cleaning the surface, including providing antiskid surface with fine-grained hard stone chipping of 9.5 mm nominal size pre-coated with bitumen 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°C, protruding 1 mm to 4 mm over mastic surface, all complete as per clause-516.)	Sqm	297.00
5.12	Slurry Seal Providing and laying slurry seal consisting of a mixture of mineral 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 complete as per clause 512 for following types as given in table 500-25.		
(i)	Type-I (Thickness 2 - 3 mm)	Sqm	53.00
(ii)	Type-II (Thickness 4 - 6 mm)	Sqm	72.00
(iii)	Type-III (Thickness 6 -8 mm)	Sqm	83.00
5.13	Fog Spray (Providing and applying low viscosity bitumen emulsion SS-1 for sealing cracks less than 3 mm wide or incipient fretting or disintegration in an existing bituminous surfacing complete as per clause 513.	Sqm	44.00
	Add extra if blinded with grit of 3 mm size & under coated with 2% of the emulsion by weight.	Sqm	5.00
5.14	Crack Prevention Courses		
(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 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 complete as per clause 517)	Sqm	59.00
(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, 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 complete as per clause 517)	Sqm	75.00
(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 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 complete as per clause 517)	Sqm	100.00

Item No.	Descriptions	Unit	Rate (Rs.)
5.15	Open-Graded Premix Surfacing (By manual means) (Providing, laying and rolling of open-graded premix surfacing of 20 mm thickness composed of 13.2 mm to 5.6 mm aggregates using bitumen/cationic emulsion to required line, grade and level to serve as wearing course on a previously prepared base, including mixing, laying and rolling with a smooth wheeled roller 8-10 tonne capacity, finished to required level and grades. Work shall be executed as per clause 510 except laying by manual means instead of mechanical mixing and laying.)		
(i)*	Case – I:- Using Bitumen	Sqm	120.00
(ii)	Case –II :- Using Bitumen Emulsion MS grade	Sqm	161.00
5.16	Seal Coat Type-B (By manual means) (Providing and laying seal coat sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall using Type-B seal coat using crushed stone chipping passing through 2.36mm size sieve, using bitumen / cationic emulsion as binder. Work shall be executed as per clause 511 except laying by manual means instead of mechanical mixing and laying.)		
(i)*	Case – I:- Using Bitumen	Sqm	45.00
(ii)	Case –II :- Using cationic Bitumen Emulsion	Sqm	67.00
5.17	Microsurfacing Type-II: Providing and laying 4 to 6 mm thick microsurfacing layer as wearing course in single layer using crushed aggregates @ 9.0 Kg/Sqm manufactured Sand (Crushed stone dust with coarse aggregates as per required grading) with specific size as per table-3 of IRC:SP:81-2008 using Modified Cationic Bitumen @13.5% by weight of aggregates as per Table 8 of IRC:SP:81-2008, Break Control Additive @2% by weight of aggregate, purified water with pH 6-7 @ 12% by weight of aggregate & mineral filler @ 2.0% by weight of aggregate using specialized microsurfacing Paver finisher and other materials, machinery etc complete as per clause 514).	Sqm	181.00
5.18	Microsurfacing Type-III: Providing and laying 6 to 8 mm thick microsurfacing layer as wearing course in single layer using crushed aggregates @ 12.0 Kg/Sqm manufactured Sand (Crushed stone dust with coarse aggregates as per required grading) with specific size as per table-3 of IRC:SP:81-2008 using Modified Cationic Bitumen @13% by weight of aggregates as per Table 8 of IRC:SP:81-2008, Break Control Additive @2% by weight of aggregate, purified water with pH 6-7 @ 12% by weight of aggregate & mineral filler @ 2.0% by weight of aggregate using specialized microsurfacing Paver finisher and other materials, machinery etc complete as per clause 514).	Sqm	215.00
5.19 [#]	Providing and laying leveling course / profile corrective course with bituminous macadam		
	With minimum 40-60 TPH capacity hot mix plant using crushed aggregates of Grading-1 premixed with bituminous binder @ 3.1% transported to site and laid over a previously prepared surface with paver finisher to the required grade, level and alignment and rolled as per clause-501.6 and 501.7 to achieve the desired compaction complete in all respect and as per relevant clause section 500.		

Item No.	Descriptions	Unit	Rate (Rs.)
A	With sensor paver finisher	Cum	5601.00
B	With mechanical paver finisher	Cum	5432.00
5.20 [#]	Semi-Dense Bituminous Concrete (Providing and laying semi-dense bituminous concrete with minimum 40-60 TPH capacity using crushed aggregates of specified grading, premixed with bituminous binder @ 4.50 to 5 % of mix and filler, transporting the hot mix to work site, laying with a hydrostatic paver finisher with sensor control to the required grade, level and alignment, rolling with smooth wheeled, vibratory and tandem rollers to achieve the desired compaction as per MORT&H specification clause No. 508 complete in all respects)		
A	With sensor paver finisher		
(i)	for Grading I (13 mm nominal size) with bitumen 4.5 %	Cum	8072.00
(ii)	for Grading I (13 mm nominal size) with CRMB 60- 4.5 %	Cum	8234.00
(iii)	for Grading II (10 mm nominal size) with bitumen 5.0 %	Cum	8715.00
(iv)	for Grading II (10 mm nominal size) with CRMB 60 - 5.0%	Cum	8895.00
B	With mechanical paver finisher		
(i)	for Grading I (13 mm nominal size) with bitumen 4.5 %	Cum	7840.00
(ii)	for Grading I (13 mm nominal size) with CRMB 60- 4.5 %	Cum	7998.00
(iii)	for Grading II (10 mm nominal size) with bitumen 5.0 %	Cum	8468.00
(iv)	for Grading II (10 mm nominal size) with CRMB 60 - 5.0%	Cum	8644.00
5.21 [*]	Recycling of Bituminous Pavement with Central Recycling Plant		
	Recycling pavement by cold milling of existing bituminous layers, planning the surface after cold milling, reclaiming excavated material to the extent of 30 percent of the required quantity, hauling and stock piling the reclaimed material near the central recycling plant after carrying out necessary checks and evaluation, adding fresh material @ 70 percent of required quantity including rejuvenators as required, mixing in a hot mix plant of minimum 100-120TPH capacity, transporting and laying at site and compacting to the required grade, level and thickness, all as specified in clause 504 and 519. Bitumen to be added as per requirement of the item in fresh material and @ 60 percent of the requirement of fresh mix for the quantity of recycled material.		
	Bituminous Macadam		
A	With sensor paver finisher		
(i)	for Grading-I(40 mm nominal maximum size, bitumen content 3.30%)	Cum	6057.00
(ii)	for Grading-II(19 mm nominal maximum size, bitumen content 3.40%)	Cum	6251.00
B	With mechanical paver finisher		
(i)	for Grading-I(40 mm nominal maximum size, bitumen content 3.30%)	Cum	5898.00
(ii)	for Grading-II(19 mm nominal maximum size, bitumen content 3.40%)	Cum	6068.00

Item No.	Descriptions	Unit	Rate (Rs.)
5.22 [*]	Recycling of Bituminous Pavement with Central Recycling Plant		
	Recycling pavement by cold milling of existing bituminous layers, planning the surface after cold milling, reclaiming excavated material to the extent of 30 percent of the required quantity, hauling and stock piling the reclaimed material near the central recycling plant after carrying out necessary checks and evaluation, adding fresh material @ 70 percent of required quantity including rejuvenators as required, mixing in a hot mix plant of minimum 100-120TPH capacity, transporting and laying at site and compacting to the required grade, level and thickness, all as specified in clause 505 and 519. Bitumen to be added as per requirement of the item in fresh material and @ 60 percent of the requirement of fresh mix for the quantity of recycled material.		
	Dense Bituminous Macadam		
A	With sensor paver finisher		
(i)	for Grading-I (37.5 mm nominal size, bitumen content 4.0%)	Cum	7182.00
(ii)	for Grading-II(26.5 mm nominal size bitumen content 4.50%)	Cum	7892.00
(iii)	Add extra to the Rate of Dense Bituminous Macadam with bitumen, if Bitumen Grade VG-40 is used instead of Bitumen Grade VG-30 in the items above.	Cum	@4%
B	With mechanical paver finisher		
(i)	for Grading-I (37.5 mm nominal size, bitumen content 4.0%)	Cum	6997.00
(ii)	for Grading-II(26.5 mm nominal size bitumen content 4.50%)	Cum	7519.00
(iii)	Add extra to the Rate of Dense Bituminous Macadam with bitumen, if Bitumen Grade VG-40 is used instead of Bitumen Grade VG-30 in the items above.	Cum	@4%

Note:-

- (*) This item to be executed with prior permission of Chief Engineer.
- (#) These items can be used for construction of roads other than National Highways. The works shall be executed as per the norms and methodology specified in MORT&H “Specifications for Road & Bridge works” (IVth Revision).

CHAPTER- 6 CEMENT CONCRETE PAVEMENTS

Item No.	Descriptions	Unit	Rate (Rs.)
6.1	Dry Lean Cement Concrete Sub-base as per IRC:SP-49 (Construction of dry lean cement concrete Sub-base over a prepared sub-grade with coarse and fine aggregate conforming to IS: 383, the size of coarse aggregate not exceeding 26.5 mm, aggregate cement ratio not to exceed 15:1, aggregate gradation after blending to be as per table 600-1, cement content not to be less than 150 kg/cum, optimum moisture content to be determined during trial length construction, concrete strength not to be less than 10 Mpa at 7 days, mixed in a batching plant, transported to site, laid with a paver with electronic sensor, compacting with 8-10 tonnes vibratory roller, finishing and curing as per clause 601.)	Cum	2332.00
6.2	Cement Concrete Pavement (Construction of un-reinforced, dowel jointed, plain cement concrete pavement as per IRC:58 over a prepared sub-base, coarse and fine aggregate conforming to IS:383 and graded as per table 600-3 mixed in a batching and mixing plant as per approved mix design, transported to site, laid with a fixed form or slip form paver, 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, dowel bar, tie rod, admixtures as approved, curing compound, finishing to lines and grades as per drawing as per clause 602.)		
(i)	With Cement concrete grade M-40 and minimum cement content @ 400 kg/cum.	Cum	4926.00
(ii)	With Cement concrete grade M-30 and minimum cement content @ 375 kg/cum.	Cum	4750.00
6.3*	Cement Concrete Pavement (Construction of un-reinforced, dowel jointed, plain cement concrete pavement over a prepared sub-base, coarse and fine aggregate conforming to IS:383, and graded as per table 600-3, mixed as per approved mix design at site, laid, spread, vibrated, compacted and finished in a continuous operation including provision of contraction, expansion, construction and longitudinal joints, joint filler, separation membrane, sealant primer, joint sealant, de-bonding strip, dowel bar, tie rod, admixtures as approved, curing compound, finishing to lines and grades as per drawing as per clause 602.)		
(i)	With Cement concrete grade M-40 and minimum cement content @ 400 kg/cum.	Cum	4708.00
(ii)	With Cement concrete grade M-30 and minimum cement content @ 375 kg/cum.	Cum	4539.00

Item No.	Descriptions	Unit	Rate (Rs.)
6.4	Construction of Base/Sub-base of pavement with lean concrete–flyash. (Construction of Base/sub-base using cement, sand, fly ash and as per clause 601 of MoRT&H specification, coarse aggregates proportioned as per table-4 of IRC:74:1979 with water cement ratio and slump as defined in the said table, minimum 28 days compressive strength of 158 Kg/cm ² , mix prepared in a batching and mixing plant and compacted with a vibratory roller 8-10 tonnes capacity within the time limit laid down vide clause 7.6.3 of IRC:74:1979, construction joints properly formed at the end of day's work, cured for 14 days, all as specified in IRC:74:1979 and as per approved plans.)	Cum	2235.00
6.5	Cement–Fly ash concrete pavement. (Grade M-40) (Construction of unreinforced, dowel jointed, plain cement concrete pavement over a prepared sub base with cement, coarse and fine aggregate conforming to IS:383, and gradation as per table 600-3 with minimum cement content @ 350 kg/cum and fly ash @ 15% by weight of cement as per IRC-68, mixed in a batching and mixing plant as per approved mix design, transported to site, laid with a fixed form or slip form paver, 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, dowel bar, tie rod, admixtures as approved, curing compound, finishing to lines and grades as per drawing as per clause 602.)	Cum	4799.00
6.6	Providing and laying cement concrete for plain concrete/ reinforced concrete i/c form work, shuttering complete in as per drawings and specifications.(For Village roads)		
(i)	P.C.C. M-10	Cum	2789.00
(ii)	P.C.C. M-15	Cum	3695.00
(iii)	P.C.C. M-25	Cum	4286.00
(iv)	P.C.C. M-30	Cum	4350.00

Note :- *This item to be executed on the Roads other than the National Highway.

CHAPTER- 7
GEOSYNTHETICS AND SUB-SURFACE DRAIN

Item No.	Descriptions	Unit	Rate (Rs.)
7.1	Sub-Surface Drain with Geotextiles		
	Construction of sub surface drain 200 mm dia using geotextiles treated with carbon black with physical properties as given in clause 702.2.3 formed in to a stable network and a planar geocomposite structure, joints wrapped with geotextile to prevent ingress of soil, all as per clause 702 and approved drawings including excavation and backfilling.	RM	738.00
7.2	Narrow Filter Sub-Surface Drain		
	Construction of a narrow filter sub-surface drain consisting of porous or perforated pipe laid in narrow trench surrounded by a geotextile filter fabric, with a minimum of 450 mm overlap of fabric and constructed as per clause 702.3 and 309.3.5 including excavation and backfilling.	RM	686.00
7.3	Laying Paving Fabric Beneath a Pavement Overlay (Providing and laying paving fabric as per clause 708 with physical requirements as per table: 700-16 over a tack coat of paving grade Bitumen of VG-10, laid at the rate of 1 kg/ 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 maximize paving fabric contact with pavement surface)	Sqm	190.00

CHAPTER- 8
TRAFFIC SIGNS, MARKINGS & OTHER ROAD APPURTENANCES

Item No.	Descriptions	Unit	Rate (Rs.)
8.1	Cast in Situ Cement Concrete M20 kerb (Construction of cement concrete kerb with top and bottom width 115 and 165 mm respectively, 250 mm high in PCC M20 grade on PCC M10 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 as per clause 409)	Meter	207.00
8.2	Cast in Situ Cement Concrete M20 Kerb with Channel (Construction of cement concrete kerb with channel with top and bottom width 115 and 165 mm respectively, 250 mm high in M20 grade PCC on M10 grade foundation 150 mm thick, kerb channel 300 mm wide, 50 mm thick in PCC M20 grade, sloped towards the kerb, kerb stone with channel laid with kerb laying machine, foundation concrete laid manually, all complete as per clause 409)	Meter	383.00
8.3	Printing new letters and figures of any shade. (Printing new letters and figures of any shade with synthetic enamel paint, Black or other approved colour to give an even shade as per clause 800.		
(i)	Hindi: (Matras, Comas and the like not to be measured and paid for half letter shall be counted as half letter.	per cm Height per letter	0.60
(ii)	English and Roman :(Hyphens and the like not to be measured)	per cm Height per letter	0.40
8.4	Retro- reflectorized Traffic signs (Providing and fixing of retro-reflectorized cautionary, mandatory and informatory sign as per IRC:67-2012 made of Micro prismatic grade type reflective sheeting vide clause 801.3, fixed over aluminum sheeting, 1.5 mm thick supported on a mild steel frame of size 40 x 40 x 5 mm and mild steel angle iron post 75 mm x75 mm x 6mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45cm x 60cm, 60 cm below ground level as per approved drawing)		
(i)	90 cm equilateral triangle	Each	5170.00
(ii)	60 cm equilateral triangle	Each	3128.00
(iii)	60 cm circular	Each	4460.00
(iv)	80 cm x 60 cm rectangular	Each	6533.00
(v)	60 cm x 45 cm rectangular	Each	4327.00
(vi)	60 cm x 60 cm square	Each	5272.00
(vii)	90 cm high octagon	Each	8552.00

Item No.	Descriptions	Unit	Rate (Rs.)
8.5	Direction and Place Identification signs upto 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorized sign as per IRC:67-2012 made of Micro prismatic grade type reflective sheeting vide clause 801.3, fixed over aluminum sheeting, 2 mm thick with area not exceeding 0.9 sqm supported on a mild steel single angle iron post 75 x 75 x 6 mm firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 x 45 x 60cm, 60cm below ground level as per approved drawing)	Sqm	12124.00
8.6	Direction and Place Identification signs with size more than 0.9 sqm size board. (Providing and erecting direction and place identification retro-reflectorized sign as per IRC:67-2012 made of Micro prismatic grade type reflective sheeting vide clause 801.3, fixed over aluminum sheeting, 2 mm thick with area exceeding 0.9 sqm supported on a mild steel angle iron post 75mm x 75mm x 6mm, 2 Nos. firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45cm x 45cm x 60cm, 60cm below ground level as per approved drawing)	Sqm	12426.00
8.7	Overhead Signs (Providing and erecting overhead signs with a corrosion resistant aluminum alloy sheet reflectorized with high intensity retro-reflective sheeting of Micro prismatic grade type with vertical and lateral clearance given in clause 802.2 and 802.3 and installed as per clause 802.6 over a designed support system of aluminum alloy or galvanized steel trestles and trusses of sections and type as per structural design requirements and approved plans)		
A	Truss and Vertical Support	Tonne	78148.00
B	Aluminum alloy plate for over head sign	Sqm	10557.00
8.8	Painting on Concrete Surfaces		
A	Two coats on new surfaces (Painting two coats after filling the surface with synthetic enamel paint in all shades on new plastered concrete surfaces)	Sqm	62.00
B	One coat on old surfaces (Painting one or two coats after cleaning all dirt & dust, filling the surface with synthetic enamel paint in all shades on old concrete surfaces)	Sqm	48.00
8.9	Painting on Steel Surfaces (Providing and applying two coats of ready mix paint of approved brand on steel surface after through cleaning of surface to give an even shade)	Sqm	50.00
8.10	Painting on Wood Surfaces		
	Providing and applying two coats of ready mix paint of approved brand on wood surface after thorough cleaning of surface to give an even shade.	Sqm	57.00
8.11	Painting Lines, Dashes, Arrows etc on Roads in Two Coats on New Work (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)		
(i)	Over 10 cm in width	Sqm	92.00
(ii)	Up to 10 cm in width	Sqm	82.00

Item No.	Descriptions	Unit	Rate (Rs.)
8.12	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)		
(i)	Over 10 cm in width	Sqm	63.00
(ii)	Up to 10 cm in width	Sqm	67.00
8.13	Road Marking with Hot Applied Thermoplastic Compound with Reflectorizing Glass Beads on Bituminous Surface (Providing and laying of hot applied thermoplastic compound 2.5 mm thick including reflectorizing glass beads @ 250 gms per sqm area, thickness of 2.5 mm is exclusive of surface applied glass beads as per IRC:35-1997. The finished surface to be level, uniform and free from streaks and holes.)	Sqm	707.00
8.14	Kilo Meter Stone (Reinforced cement concrete M15grade kilometer stone of standard design as per IRC:8-1980, fixing in position including painting and printing etc)		
(i)	5th kilometer stone (precast)	Each	2436.00
(ii)	Ordinary Kilometer stone (Precast)	Each	1460.00
(iii)	Hectometer stone (Precast)	Each	410.00
8.15	Painting, figuring and numbering as per IRC specification complete for		
(i)	5th kilometer stone	Each	264.00
(ii)	Ordinary Kilometer stone	Each	117.00
(iii)	Hectometer stone	Each	19.00
(iv)	Boundary stone	Each	22.00
8.16	Providing painting figuring and numbering to culverts upto 6 m span complete as per IRC specifications.	Each	217.00
8.17	Providing painting figuring and numbering to minor bridge up to 30 m linear waterway complete as per IRC specifications.	Each	181.00
8.18	Providing painting figuring and numbering to major bridge, linear waterway exceeding 30 m complete as per IRC specifications.	Each	201.00

Item No.	Descriptions	Unit	Rate (Rs.)
8.19	Providing & Fixing Delineator made of M.S. Hollow Rectangular Pipe (Conforming to IS: 4923) of cross section 96mmx 48mm of 1.20 meter length. The top of the hollow pipe, welded and closed with 16 gauge M.S. Sheet. The height of the Delineator above ground level should be between 0.8 meter and 1.0 meter. The bottom of the delineator should be provided with holdfast of length 15cm on each side. Delineator should be painted with coat of Zinc Chromate stoving Prime and two coats of Black Stove Enamel (Oven Baked) paint with 3nos. 15 cm bands of white Retro-reflective Sheeting of Engineering Grade pasted around the pipe and 2 Nos. High intensity Grade Retro-reflective Sheeting of size 8 cm x 10cm pasted on the top of each side of Delineator and treated With HLVA & fixing the same in M-15 grade concrete block of size 30x30x30cms including transportation etc. complete. The construction and placement of the delineator must be as per IRC: 79.	Each.	1913.00
8.20	Providing & Fixing Hazard Marker Type-2 Partial Retro Reflective Size 0.30 x 0.90M made of 16 gauge (1.6 mm) thick mild steel sheet Confirming to IS:2062 Painted with one cast of Zinc Chromate Stoving Primer and two coats of Black Stove Enamel (Oven Baked) paint with 10 cm bands of yellow Retro- Reflective Sheeting of Engineering Grade pasted a per IRC:79 including one MS angle Iron post of size 50x50x5 mm of 1.65 meter long duly painted with synthetic enameled paint block including bolts and fixing the same in M-15 concrete black of size 30x30x30cm, including transportation etc. Complete.	Each.	1491.00
8.21	Providing & Fixing; Object Marker of size 30 cm equilateral Triangle made of 1.5 mm thick Aluminum sheet pasted with High intensity Grade Retro Reflective Sheeting duly treated with HLVA complete with post of angle size 50x50x5 mm of 0.75 m and fixing the same in M 15 concrete block of size 30x30x30cm including transportation etc. complete.	Each.	924.00
8.22	Providing and Fixing Linear Delineator System as per MOST clause 806 of specification for Roads and Bridges, of size 33''x 4'' made with corrugate Aluminum (Confirming to IS:736 -Material Designation, 24345; or 1900) and reflective sheeting of Micro prismatic Lens sheeting as stipulated in MOST circular (RW/NH-33023/31/88-DO.iii) confirming to ASTM D4956-01 Type IX and fixing the same with bracket made of galvanized steel fixed with 6 Nos. high precision Screws confirming to IS:1364.	Each.	2520.00
8.23	Providing & Fixing tree studs in Square/ Round shape of 4'' side/diameter made of 2 mm aluminum substrate (Confirming to IS:736 -Material Designation, 24345 or 1900) end reflective surface of High Intensity grade as specified in section 801.3 of MORT&H duly treated with HLVA and fixing the same with four Nos. high strength nails confirming to IS:1367 on trees at site each.	Each.	67.00

Item No.	Descriptions	Unit	Rate (Rs.)
8.24	Boundary pillar (Reinforced cement concrete M15 grade boundary pillars of standard design as per IRC:25, fixed in position including finishing and lettering but excluding painting as per clause 807)	Each.	384.00
8.25	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 struted 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 clause 808)	Meter.	245.00
8.26	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 struted 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 808)	Meter	397.00
8.27	Tubular Steel Railing on Medium Weight steel channel (ISMC series) 100mm x 50mm (Providing, fixing and erecting 50 mm dia steel pipe 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)	Meter	1655.00
8.28	Tubular Steel Railing on Precast RCC posts, 1.2 m high above ground level (Providing, fencing and erecting 50 mm dia painted steel pipe railing in 3 rows on precast M-20 grade RCC vertical posts 1.8 meters high (1.2 m above GL) with 3 holes 50 mm dia for pipe, fixed 2 meters centre to centre, complete as per approved drawing)	Meter	1264.00
8.29	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-25 grade concrete with HYSD reinforcement conforming to IRC:21-2000 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)	Meter	3150.00

Item No.	Descriptions	Unit	Rate (Rs.)
8.30	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 galvanized 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 811.3)	Meter	2602.00
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 galvanized 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 811.3)	Meter	4055.00
8.31	Flexible Crash Barrier, Wire Rope Safety Barrier (Providing and erecting a wire rope safety barrier with vertical posts of medium weight RS Joist (ISMB series) 100 mm x 75 mm (11.50 kg/m), 1.50 m long 0.85 m above ground and 0.65 m below ground level, split at the bottom for better grip, embedded in M15 grade cement concrete 450 x 450 x 450 mm, 1.50 m center to center and with 4 horizontal steel wire rope 40 mm dia and anchored at terminal posts 15 m apart. Terminal post to be embedded in M15 grade cement concrete foundation 2400 x 450 x 900 mm (depth), strengthened by a strut of RS joist 100 x 75 mm, 2 m long at 450 inclination and a tie 100 x 8 mm, 1.50 m long at the bottom, all embedded in foundation concrete as per approved design and drawing, rate excluding excavation and cement concrete.)	Meter	5409.00
8.32	Road Markers/Road Stud with Lens Reflector (Providing and fixing of road stud 100x 100 mm, die cast in aluminum, resistant to corrosive effect of salt and grit, fitted with lens 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 BIS:873, part-IV:1973)	Each	267.00
8.33	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, all as per BIS: 873)	Each	645.00

Item No.	Descriptions	Unit	Rate (Rs.)
8.34	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 ⁰ , 'A' frame painted with 2 coats of yellow paint, complete as per IRC:SP:55-2001)	Each	2363.00
8.35	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 45 ⁰ , complete as per IRC:SP:55-2001)	Each	3783.00
B	With Wooden Components (Construction of a permanent type barricade made of wooden components, 1.5 m high from road level, fitted with 3 horizontal planks 200 mm wide and 3.66 m long on 100 x 100mm wooden vertical post, painted with yellow and white stirrups, 150 mm in width at an angle of 45 ⁰ , complete as per IRC:SP:55-2001)	Each	1822.00
C	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	10585.00
8.36	Drum Delineator in Construction Zone (Provision of metal drum, 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	388.00
8.37	Providing and fixing Raised Pavement Markers made of polycarbonate ABS moulded body and reflective panels with micro prismatic lens capable of providing total internal reflection of the light entering the lens face and shall support a load of 16000 Kg tested in accordance to ASTM D 4280 type H and complying to specifications of category A of MORT&H(RW/NH-33023/10/97 -DO III Dtd. 11.06.1997). The pavement markers will be auto moulded by dual polymer shanks and must comply with all the MoRT&H specifications. The height, width and length shall not exceed 50 mm, 100 mm and 100 mm respectively and with minimum reflective area of 13 Sq.cm. on each side and slope to the base shall be 35 +/-5 degree. The strength of detachment of the integrated cylindrical shanks (of diameter not less than 19 +/- 2 mm and height not less than 30 +/- 2 mm) from the body is to be a minimum value of 500 kgf. Fixing will be by drilling holes on road for the shanks to go inside, without nails and using epoxy resin based adhesive and complete as directed by the Engineer-in-charge.	Each	440.00

Item No.	Descriptions	Unit	Rate (Rs.)
8.38	Providing and fixing of Route Marker Sign Board with High Intensity Grade Retro-reflective Sheeting (as per section 801.3) made of 1.5 mm thick aluminum sheet. The single vertical post made from M.S. angle post (75 mm x 75 mm x 6 mm) firmly fixed to the ground by means of properly designed foundation with M15 grade cement concrete 45 cm x 45 cm x 60 cm, 60 cm below ground level as per approved drawing. Size of board 600 mm x 440 mm for the upper board and 300 mm x 250 mm for the lower plate as per IRC Specifications.	Each	2879.00
8.39	Providing and fixing overhead concrete sign board of size 1200 x 1000 mm on road side made of RCC M20 grade of 50 mm thick with 10 mm. dia. bar reinforcement @ 150 mm c/c in both directions fixed on two vertical post 150x150 mm size made of RCC M20 grade making grooves at top for fixing of boards with 4 nos. vertical bars of 10 mm dia and stirrups with 8 mm dia bars @ 150 mm c/c . The post to be embedded and fixed to a depth of 600 mm below ground level in PCC of M15 grade, block of size 500 x 500 x 700 mm and the height of post at the bottom of the sign board from crown of the road is not less than 1.5 m. All components of sign and support shall be primed and painted with two coats of synthetic enamel paint with all relevant specifications. The rates shall include cost of excavation , supply of all materials, labour, T & P, painting and figuring, carriage to site and fixing complete as directed by the Engineer-in-charge.	Each	5336.00
8.40	Providing and fixing concrete sign boards resting on ground pre-cast/ cast-in-situ in PCC M20 grade with surface reinforcement of 8 mm dia bars @ 155 mm c/c over 300 mm thick PCC M15 grade foundation concrete with 50mm offset all round as per drawing i/c cost of excavation, plastering with CM 1:3 & finishing with neat slurry cement, painting two or more coats to give an even shade and figuring as directed by Engineer-in-charge.		
(i)	Type A : Village boards (600 mm long, 300 mm wide at bottom & 100 mm wide at top, and height 600 mm above 500 mm thick block of size 700 x 400 x 500 mm with both faces inclined)	Each	3208.00
(ii)	Type B : Destination boards (700 mm long, 300 mm wide at bottom & 100 mm wide at top, and height 800 mm above 500 mm thick block of size 800 x 400 x 500 mm with one face vertical)	Each	3972.00
(iii)	Type C : Cautionary boards (500 x 500 x 500 mm at bottom & 500 x (500 + 100)/2 x 500 mm at top over 300 mm thick block of size 500 x 500 x 300 mm with one face vertical)	Each	4297.00
8.41	Providing and fixing of empty maxphalt drums on road sides, filling it with earth/moorum/boulders etc. including making holes with pick axes available within 50 m lead, white washing two coats etc complete.	Each	309.00

Item No.	Descriptions	Unit	Rate (Rs.)
8.42	Construction of boulder/stone masonry wall 60 cm thick and 80 cm height, including white washing 3 coats on one side of the wall for temporary diversion/guard walls including all materials complete.		
	(i) In mud mortar	Rm.	692.00
	(ii) In cement mortar C.M. 1:6	Rm.	965.00
8.43	Construction of R.R. masonry walls 0.45 m thick and 0.60 m height in CM 1: 3 including excavation , white washing two coats on one side of wall for guard wall/protection wall over 100 mm thick base concrete of PCC 1:3:6 etc complete.	Rm.	1016.00
8.44	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 slopes to toe of slopes in fills, constructing head walls at both ends, providing a minimum fill of granular material over top and sides of RCC pipes as per IRC: 98-2011, bedded on a 0.3 m thick layer of granular material free of rock pieces , outer to outer distance of pipes 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:98-2011 and approved drawings.		
(i)	Single row for one utility service	Meter	553.00
(ii)	Double row for two utility service	Meter	1023.00
(iii)	Triple row for three utility service	Meter	1484.00
8.45	Providing and fixing Solar Blinker Light 300 mm dia, LED Aspect made of FRP/Poly carbonate with battery backup fitted on 150 mm dia MS pipe - 3.0 metre long from the ground level, firmly fixed to the ground by mean of properly designed foundation with M-15 grade cement concrete 60cm x 60cm x 60cm, below ground level.	Each	22500.00
8.46	Providing and fixing of Solar Raised Pavement Markers made of polycarbonate molded body with circular shape, solar powered, LED self illumination in active mode, 360 degree illumination and reflective panels with micro-prismatic lens capable of providing total internal reflection of the light entering the lens face in passive mode. The marker shall support a load of 20000 kg tested in accordance to ASTM D 4280. The marker should be resistant to dust and water ingress according to IP 65 standards and should withstand temperatures in the range of 0°C to 70°C. Color of lighting could be provided in red or yellow (amber) as per requirement and typical frequency of blinking is 1Hz. There should be current losses of less than 20 micro-amperes at 2.4 V in sleep-charging mode to enhance the life of the marker and a full charge should provide for a minimum autonomy of 50 hours. The height, width and length of the marker shall not be less than 10 mm x 100 mm x 100 mm. Also, the surface diameter of the marker shall not be less than 100 mm respectively.	Each	3500.00

Item No.	Descriptions	Unit	Rate (Rs.)
	The weight of the marker shall not exceed 0.5 Kilograms. Fixing will be by drilling holes on the road for the shanks to go inside, without nails and using epoxy resin based adhesive as per manufacturer's recommendation and complete as directed by the engineer.		
8.47	The Median Marker shall be made of tough, high impact resistant, injection-molded, thermoplastic body with an isosceles trapezoidal structure of length, width and height not less than 15cm, 10cm and 10cm respectively and thickness not less than 1.8mm. The logo of the manufacturer shall be embossed on either side of the body. The Median Marker shall have fluorescent yellow color retro-reflective sheeting, with fully reflective micro prismatic cube corners as its retro-reflective elements and meets IRC 67-2010 type XI specifications, of size not less than 3.5"x 3.5" on both sides of the body. The edges of this retro-reflective sheeting shall be protected in such a way that they are not exposed. Median Marker shall be fixed by a combination of epoxy adhesive and grouting.	Each	750.00

CHAPTER- 9 PIPE CULVERTS

Item No.	Descriptions	Unit	Rate (Rs.)
9.1	Excavation for Structures (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.)		
	Ordinary soil		
	Up to 3 m depth	Cum.	146.00
9.2	Providing and laying Reinforced Cement Concrete pipe NP 4 / prestressed concrete pipe on first class bedding (Laying Reinforced cement concrete pipe NP4/prestressed concrete pipe for culverts on first class bedding of granular material including fixing collar with cement mortar 1:2 and bedding as per clause 2904 but excluding excavation, protection works, backfilling, concrete and masonry works in head walls and parapets .)		
A	600 mm dia	Meter	2863.00
B	900 mm dia	Meter	6147.00
C	1000 mm dia	Meter	6767.00
D	1200 mm dia	Meter	9015.00
9.3	Providing and laying Reinforced Cement Concrete pipe NP 4 / prestressed concrete pipe (Laying Reinforced cement concrete pipe NP4 /prestressed concrete pipe for culverts including fixing collar with cement mortar 1:2 but excluding bedding below pipe , excavation, protection works, backfilling, concrete and masonry works in head walls and parapets .)		
A	600 mm dia	Meter	2706.00
B	900 mm dia	Meter	5990.00
C	1000 mm dia	Meter	6609.00
D	1200 mm dia	Meter	8843.00
9.4	Providing and laying Reinforced Cement Concrete pipe NP 3 / prestressed concrete pipe on first class bedding. (Laying Reinforced cement concrete pipe NP3 /prestressed concrete pipe for culverts on first class bedding of granular material including fixing collar with cement mortar 1:2 but excluding excavation, protection works, backfilling, concrete and masonry works in head walls and parapets).		
A	450 mm dia	Meter	1893.00
B	600 mm dia	Meter	2617.00
C	900 mm dia	Meter	5032.00
D	1000 mm dia	Meter	5528.00

Item No.	Descriptions	Unit	Rate (Rs.)
E	1200 mm dia	Meter	7157.00
9.5	Providing and laying Reinforced Cement Concrete pipe NP 3 / prestressed concrete pipe. (Laying Reinforced cement concrete pipe NP3 /prestressed concrete pipe for culverts including fixing collar with cement mortar 1:2 but excluding bedding below pipes, excavation, protection works, backfilling, concrete and masonry works in head walls and parapets .)		
A	450 mm dia	Meter	1769.00
B	600 mm dia	Meter	2459.00
C	900 mm dia	Meter	4874.00
D	1000 mm dia	Meter	5370.00
E	1200 mm dia	Meter	6984.00
9.6	Providing 1st class bedding below pipes with graded sand or other granular materials passing through 5.6 mm sieve as per clause 2904.	Cum.	759.00
9.7	Stone masonry work in cement mortar 1:3 for head wall complete as per drawing and Technical Specifications section 1400 and 2200		
(i)	Random Rubble Masonry (coursed or uncoursed)	Cum.	3428.00
(ii)	Coursed rubble masonry (first sort)	Cum.	3562.00
(iii)	Ashlar masonry (first sort)	Cum.	4220.00
9.8	Pointing with cement mortar (1:3) on stone masonry head walls as per Technical specifications section 1300 and 2200	Sqm.	32.00
9.9	Plain cement concrete complete as per drawing and Technical Specifications		
	PCC Grade M 15	Cum.	3768.00
	PCC Grade M 20	Cum.	4174.00
9.10	Providing and laying boulders apron on river bed for protection against scour with stone boulders weighing not less than 40 kg each complete as per drawing and Technical specification as per clause 2503.	Cum.	2413.00
9.11	Providing and laying Pitching Stone/Boulder 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 as per clause 2504.	Cum.	2413.00
9.12	Providing and laying Filter material underneath pitching in slopes complete as per drawing and Technical specification including trimming of slopes to proper profile and preparation of bed and as per clause 2504.	Cum.	2079.00

CHAPTER- 10
MAINTENANCE OF ROADS

Item No.	Descriptions	Unit	Rate (Rs.)
10.1	Restoration of Rain Cuts (Restoration of rain cuts with soil, moorum, gravel or a mixture of these, clearing the loose soil, benching for 300 mm width, laying fresh material in layers not exceeding 250 mm and compacting with plate compactor or power rammers to restore the original alignment, levels and slopes)	Cum.	163.00
10.2	Filling Pot-holes and Patch Repairs with 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 510, compacting, trimming and finishing the surface to form a smooth continuous surface, all as per clause 3004.2 i/c tack coat.)	Sqm.	146.00
10.3	Filling Pot-holes and Patch Repairs with Close Graded Premix Surfacing / Mixed Seal 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 512, compacting, trimming and finishing the surface to form a smooth continuous surface, all as per clause 3004.2 i/c tack coat.)	Sqm.	170.00
10.4	Crack Filling (Filling of crack using slow - curing bitumen emulsion and applying crusher dust in case crack are wider than 3mm.)	Meter	4.30
10.5	Dusting (Applying crusher dust to areas of road where bleeding of excess bitumen has occurred.)	Sqm.	0.90
10.6	Repair of joint Grooves with Epoxy Mortar Repair of spalled joint grooves of contraction joints, longitudinal joints and expansion joints in concrete pavements using epoxy mortar or epoxy concrete)	Meter	232.00
10.7	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)	Meter	25.00
10.8	Hill Side Drain Clearance (Removal of earth from the choked hill side drain and disposing it on the valley side manually)	Meter	26.00
10.9	Land Slide Clearance in soil (Clearance of land slides in soil and ordinary rock by all machines and labours required and disposal of the same on the valley side)	Cum.	57.00

Item No.	Descriptions	Unit	Rate (Rs.)
10.10	Land slide Clearance in Hard Rock Requiring Blasting (Clearing of land slide in hard rock requiring blasting for 50% of the boulders and disposal of the same on the valley side.)	Cum.	119.00
10.11	Detailed survey of existing road including chaining, leveling, with cross section at 25.0 m intervals and closing survey each day's work, fixing bench marks, painting, taking trial pits and submission of road cross sections, L-sections, quantity statements and details of all cross drainage works in computerized prints in five copies in proper files and all type of compliance required by the Engineer-in-charge.	Km.	14175.00

CHAPTER- 11 HORTICULTURE

Item No.	Descriptions	Unit	Rate (Rs.)
11.1	Maintenance of Lawns or Turfing of Slopes (Maintenance of lawns or Turfing of slopes (rough grassing) for a period of one year including watering etc.)	Sqm	131.00
11.2 (a)	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	168.00
(b)	Maintenance of Hedge for one year	Meter	138.00
11.3	Planting and Maintaining of Flowering Plants and Shrubs		
(a)	Planting flowering plants and shrubs in central verge i/c digging trenches, filling earth & farm manure.	Km	50947.00
(b)	Maintenance of flowering plants and shrubs in central verge for one year	Km	122100.00
11.4	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 manure, planting the saplings, backfilling the trench, watering, fixing the tree guard and maintaining the plants for one year)	Each	750.00
11.5	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 (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	1296.00
11.6	Edging with 2nd class Bricks, laid dry lengthwise (Edging with 2 nd 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	28.00
11.7	Making Tree Guard 53 cm dia. and 1.3 m high as per design from empty bitumen drum (Making tree guard 53 cm dia. and 1.3 m high as per design from empty bitumen drum, slit suitably to permit sun and air, (supplied by the department at stock issue rate) including providing and fixing 2 nos. MS sheet rings 50 x 0.5 mm with rivets, complete in all respect)	Each	360.00

Item No.	Descriptions	Unit	Rate (Rs.)
11.8	Making Tree Guard 53 cm dia. and 2 meters high as per design from empty bitumen drums (Making tree guard 53 cm dia and 2 meters high as per design from empty bitumen drums, slit suitably to permit sun and air, (supplied by the department at stock issue rate) including providing and fixing four legs 40 cm long of 30 x 3 mm MS riveted to tree guard and providing and fixing 2 nos. MS sheet rings 50 x 0.5 mm with rivets complete in all respects.)	Each	702.00
11.9	Tree Guard with MS Angle Iron and Steel Wire (Providing and fixing tree guard 0.60 meter square, 2.00 meter high fabricated with MS angle iron 30 x 30 x 3 mm, MS iron 25 x 3 mm at 100mm centre to centre and steel wire 3 mm dia. welded and fabricated as per design in two halves bolted together, fixed in ground with P.C.C M-10 of dimensions 150x150x200mm.)	each tree guard	2430.00

CHAPTER- 12
ARBORICULTURE AND ROAD BEAUTIFICATION

Item No.	Descriptions	Unit	Rate (Rs.)
12.1	Manufacturing, supply & fixing of precast RCC collar of size 50 cm. inner dia. and 50 cm. height, 7.50 cm. thickness with & gauge 4 mm thick MS wire casted with M-20 concrete of approved design, i/c transportation, labour & all material complete.	Each	1305.00
12.2	Manufacturing, supply & fixing of precast RCC jaali for tree guard of size 75 cm. width and 120 cm. height, 5.0 cm. thickness with & gauge 4 mm thick MS wire casted with M-20 concrete of approved design, i/c cost of all material complete.	One RCC jaali tree guard	2979.00
12.3	Fabricating, supply & fixing of MS circular tree guard of 75 cm. dia. and 120 cm. height (above GL), MS tree guard made with 3 no. 25 x 25 x 5 mm MS angle iron 150 cm. long fixed vertically and 3 nos. 20 x 5 mm MS flat fixed circumferentially around MS angle, with support of MS angle and flat 13 gauge MS wire mesh welded in square grid pattern with an opening of 2" x 2". This item includes finished by filling putty and applying primer coat of zinc chromate including cost of all materials & labour complete including fixing in ground with P.C.C M-10 of dimensions 150x150x200mm).	Each	2460.00
12.4	Providing and fixing of 600 mm dia. clear opening Granite finish U.V. stabilized abrasion resistance top layer composite rein manhole cover with frame reinforcement with high performance glass fibre load designation EHD-40 (40 Ton load capacity) confirming to testing procedure as per IS:1726. Deflection at full load should not be more than 12mm.	Each	20095.00
12.5	Manufacturing, supply & fixing of precast kerb stone of size 400mmx259mmx200mm thick made of M-20 concrete rectangular in shape with one corner chamfered by 100 mm x 100 mm as approved design i/c cost of all material, labour and curing etc. complete.	Each	140.00
12.6	Providing and planting of 3'0" to 4'0" heighted wasingtonia, filipheria/bismarkia novelist plam plants with 1'6" x 1'6" depth pit formation and soil preparation, (Mixing organic manure and plant's protection insecticide). Up to 4 month maintenance.	Each	935.00
12.7	Providing and planting of 4'0" to 5'0" heighted Ficus prestige/Blackiana plants with 1'6" x 1'6" depth pit formation and soil preparation, (Mixing organic manure and plant's protection insecticide). Up to 4 month maintenance.	Each	660.00

Item No.	Descriptions	Unit	Rate (Rs.)
12.8	Providing and planting of Bogenbelia dwarf, chandni dwarf, kaner dwarf vr flower bearing plants with 0'9" x 0'9" depth pit formation and soil preparation work's, (Mixing organic manure and plant's protection insecticide). Up to 4 month maintenance.	Each	88.00
12.9	Providing and planting of dwarf red Ekalyha plants showing mass effect view with 0'9" x 0'9"x1'0" depth pit formation and soil preparation work's, (Mixing organic manure and plant's protection insecticide). Up to 4 month maintenance.	Each	72.00
12.10	Providing and planting of plumeria (Champa) 2'0" to 3'0" heightened plants with 1'0" x 1'0"x1'6" depth pit formation and soil preparation work's, (Mixing organic manure and plant's protection insecticide). Up to 4 month maintenance.	Each	380.00
12.11	Providing and planting of Golden durenta multi branches plants for showing mass effect in 0'6" x 0'6" distance with soil preparation work's, (Mixing organic manure and plant's protection insecticide). Up to 4 month maintenance.	Each	182.00
12.12	Providing and planting maxican carpet grass in mount with soil preparation (with organic manure and plants protection insecticide) and escaping works. Up to 4 month maintenance.	Sqm.	44.00
12.13	Human and other sculptures		
	(a) 5 to 7 feet	Each	75000.00
	(b) 2 to 5 feet	Each	30000.00
12.14	Cement art Mural work	Sqm.	3500.00

**PUBLIC WORKS DEPARTMENT,
CHHATTISGARH**

SOR (Road Works) 01-01-2015

**STANDARD
TABLES &
USEFUL DATA**

FIELD LABORATORY EQUIPMENT

121.3 Laboratory equipment

The following items of laboratory equipment shall be provided in the field laboratory

121.3.1 General

(i)	Oven - Electrically operated, thermoplastic ally controlled range upto 200°C sensitivity 1°C	1 No.
(ii)	Platform balance 300 kg capacity	1 No.
(iii)	Electronic 20 kg capacity-self indicating type	1 No.
(iv)	Electronic Balance 5 kg capacity accuracy 0.5 gm	2 Nos.
(v)	Water bath-electrically operated and thermoplastically controlled with adjustable shelves, sensitivity 1°C	1 No.
(vi)	Thermometers : Mercury-in-glass thermometer range 0° to 250°C Mercury-in-steel thermometer with 30 cm stem, range upto 300°C	
(vii)	Kerosene or gas stove or electric hot plate	1 No.
(viii)	Glassware, spatulas, wire gauzes, steel scales, measuring tape, casseroles, karahis, enameled trays of assorted sizes, pestle-mortar, porcelain, dishes, gunny bags, plastic bags, chemical, digging tools like pickaxes, shovels etc.	
(ix)	Set of IS sieves with lid and pan: 450 mm diameter 63 mm, 53 mm, 37.5 mm, 26.5 mm, 13.2 mm, 9.5 mm, 6.7 mm and 4.75 mm size	1 set
	200 mm diameter: 2.36 mm, 2.0 mm, 1.18 mm, 600 micron, 425 micron, 300 micron, 150 micron and 75 micron	2 sets
(x)	Water testing kit	1 set
(xi)	First aid box	1 set

121.3.2 For soils and aggregates

(i)	Riffle Box	1 No.
(ii)	Atterberg Limits (liquid and plastic limits) determination apparatus	1 set
(iii)	Compaction Test Equipment both 2.5 kg and 4.5 kg rammers (Light and Heavy compactive efforts)	1 set
(iv)	dry Bulk Density Test apparatus (sand pouring cylinder, tray, can etc.) complete	1 set
(v)	Speedy Moisture Meter complete with chemicals	1 set
(vi)	Post hole Auger with extensions	1 set
(vii)	Core cutter apparatus 10 cm dia, 10/15 cm height, complete with dolly, rammer etc.	1 set
(viii)	Aggregate Impact Value Test apparatus/LosAngeles Abrasion Test apparatus	1 set
(ix)	Flakiness and Elongation Test Gauges	1 set
(x)	Standard measures of 30, 15 and 3 litres capacity along with standard tamping rod	1 set
(xi)	California Bearing ratio test apparatus	1 set
(xii)	Unconfined compression test apparatus	1 set

121.3.3 For bitumen and bituminous mixes

(i)	Penetrometer with standard needles	1 set
(ii)	Riffle box - small size	1 No.
(iii)	Centrifuge type bitumen extractor, hand operated, complete with petrol/commercial benzene	1 set
(iv)	Marshall stability test apparatus, complete with all accessories	1 set
(v)	Filed density bottle along with cutting tray, chisel, hammer and standard sand	2 Nos.
(vi)	3 m straight edge	1 No.
(vii)	Camber board	1 No.
(viii)	core cutting machine with 10 cm dia diamond cutting edge	1 set
(ix)	Vacuum pump and 3 specific gravity bottles	1 set

121.3.4 For cement and cement concrete

(i)	Vicat apparatus for testing setting times	1 set
(ii)	slump testing apparatus	4 sets
(iii)	Compression and Flexural strength testing machine of 200 tonne capacity with additional dial for flexural testing	1 No.
(iv)	Needle Vibrator	2 Nos.
(v)	Air Meter	1 No.
(vi)	Vibrating hammer for vibrating dry mix as for Dry Lean Cement concrete sub-base	1 No.

STANDARD TABLES
EARTH WORK, EROSION CONTROL AND DRAINAGE

Table 300-1
Density Requirements of Embankment and Sub-Grade Materials.

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

- Note :**
1. This table is not applicable for lightweight fill materials, e.g. cinder, fly ash etc.
 2. The material to be used in subgrade shall be non-expansive and shall satisfy design CBR at the specified dry density and moisture content. In case the available materials fail to meet the requirement of CBR, use of stabilization methods in accordance with Clause 403 and 404 or by any stabilization method approved by the Engineer shall be followed.

Table 300-2
Compaction Requirements for Embankment and Sub-grade.

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 then 95%
3.	Expansion clays.	
	(a) Sub-grade and 500mm portion just below the sub-grade.	Not allowed
	(b) Remaining portion of embankment	Not less than 90 - 95%

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

EARTH WORK, EROSION CONTROL AND DRAINAGE**Table 300-03****Grading Requirement for Filter Material Percentage Passing by Weight**

Sieve Designation	Percentage passing by weight		
	Class I	Class II	Class III
53 mm	-	-	100
45 mm	-	-	97-100
26.5 mm	-	100	-
22.4 mm	-	95-100	58-100
11.2 mm	100	48-100	20-60
5.6 mm	92-100	28-54	4-32
2.8 mm	83-100	20-35	0-10
1.4 mm	59-96	-	0-5
710 micron	35-80	6-18	-
355 micron	14-40	2-9	-
180 micron	3-15	-	-
90 micron	0-5	0-4	0-3

TABLE 300-4**GRADING REQUIREMENTS FOR AGGREGATE DRAINS**

Sieve Size	Percent passing by weight	
	Type A	Type B
63 mm	-	100
37.5 mm	100	85-100
19 mm	-	0-20
9.5 mm	45-100	0-5
3.35 mm	25-80	-
600 micron	8-45	-
150 micron	0-10	-
75 micron	0-5	-

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

TABLE 400-1
Grading for Granular Sub-base Materials

IS Sieve Designation	Percentage by weight passing the IS sieve					
	Grading I	Grading II	Grading III	Grading IV	Grading V	Grading VI
75 mm	100	-	-	-	100	-
53 mm	80-100	100	100	100	80-100	100
26.50 mm	55-90	70-100	55-75	50-80	55-90	75-100
9.50 mm	35-65	50-80	-	-	35-65	55-75
4.75 mm	25-55	40-65	10-30	15-35	25-50	30-55
2.36 mm	20-40	30-50	-	-	10-20	10-25
0.85 mm	-	-	-	-	2-10	-
0.425 mm	10-15	10-15	-	-	0-5	0-8
0.075 mm	< 5	< 5	< 5	< 5	-	0-3

TABLE 400-2
Physical Requirements for Materials for Granular Sub-base

Aggregate Impact Value (AIV)	IS: 2386 (Part 4) or IS : 5640	40 maximum
Liquid Limit	IS : 2720 (Part 5)	Maximum 25
Plasticity Index	IS : 2720 (Part 5)	Maximum 6
CBR at 98% dry density (at IS : 2720 - Part 8)	IS 2720 (Part 5)	Minimum 30 unless otherwise specified in the Contract

TABLE 400-8
PHYSICAL REQUIREMENTS OF COARSE AGGREGATES FOR WATER BOUND MACADAM FOR SUB-BASE/BASE COURSED

Test	Test method	Requirements
1. *** Los Angeles Abrasion value Or Aggregate Impact Value	IS : 2386 (Part-4) IS:2386 (Part-4) or IS:5640*	40 per cent (Max) 30 per cent (Max)
2. Combined Flakiness and Elongation Indices (Total) **	IS:2386 (Part-I)	35 per cent (Max)

* Aggregates which get softened in presence of water shall be tested for impact value under wet condition in accordance with IS:5640.

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

*** In case water bound macadam is used for sub-base, the requirements in respect of Los Angeles value and Aggregate Impact value shall be relaxed to 50 % and 40% maximum respectively.

TABLE 400-9
Grading Requirements of Coarse Aggregates

Grading No.	Size Range	IS Sieve Designation	Percent by weight Passing
1)	63 mm to 45 mm	75 mm	100
		63 mm	90 - 100
		53 mm	25 - 75
		45 mm	0 - 15
		22.4 mm	0 - 5
2)	53 mm to 22.4 mm	63 mm	100
		53 mm	95 - 100
		45 mm	65 - 90
		22.4 mm	0 - 10
		11.2 mm	0 - 5

TABLE 400-10
Grading for Screenings

Grading Classification	Size of Screenings	IS Sieve Designation	Percent by weight Passing the Sieve
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
		9.5 mm	80 - 100
		5.6 mm	50 - 70
		180 micron	5 - 25

TABLE 400-11
Approximate Quantities of Coarse Aggregates and Screenings Required for 75 mm Compacted Thickness of Water Bound Macadam (WBM) Sub-Base / Base Course for 10 m² Area

Classification	Size Range	Compacted Thickness	Loose Qty.	Screenings			
				Stone Screening		Crushable Type Such as Moorum or Gravel	
				Grading Classification & Size	For WBM Sub-base / Base Course (Loose Quantity)	Grading Classification & Size	Loose Qty.
Grading 1	63 mm to 45 mm	75 mm	0.91 to 1.07 m ³	Type A 13.2 mm	0.12 to 0.15 m ³	Not uniform	0.22 to 0.24 m ³
-do-	-do-	-do-	-do-	Type B 11.2 mm	0.20 to 0.22 m ³	-do-	-do-
Grading 2	53 mm to 22.4 mm	75 mm	-do-	-do-	0.18 to 0.21 m ³	-do-	-do-

TABLE 400-12
Physical Requirements of Coarse Aggregates for
Wet Mix Macadam for Sub-base / Base Courses

S. No.	Test	Test Method	Requirements
1)	Los Angeles Abrasion value or Aggregate Impact value	IS : 2386 (P Art-4) IS : 2386 (P Art-4) or IS : 5640	40 percent (Max.) 30 percent (Max.)
2)	Combined Flakiness and Elongation indices (Total)	IS : 2386 (Part-1)	35 percent (Max.)*

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

TABLE 400-13
Grading Requirements of Aggregates for Wet Mix Macadam

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
600.00 micron	8 - 22
75.00 micron	0 - 5

BASE AND SURFACE COURSES (BITUMINOUS)

**TABLE 500-1
SELECTION CRITERIA FOR VISCOSITY - GRADED (VG) PAVING BITUMENS
BASED ON CLIMATIC CONDITIONS**

Lowest Daily Mean Air Temperature, °C	Highest Daily Mean Air Temperature, °C		
	Less than 20 °C	20 to 30 °C	More than 30 °C
More than - 10 °C	VG-10	VG-20	VG-30
-10°C or lower	VG-10	VG-10	VG-20

**TABLE 500-2
MIXING, LAYING AND ROLLING TEMPERATURES FOR BITUMINOUS MIXES
(DEGREE CELCIUS)**

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

*** Rolling must be completed before the mat cools to these minimum temperatures.**

**TABLE 500-6
PHYSICAL PROPERTIES OF COARSE AGGREGATE**

Property	Test	Requirement	Test Method
Cleanliness	Grain size analysis	Max 5 % passing 75 micron	IS:2386 Part I
Particle Shape	Flakiness and Elongation Indices	Max. 35%	IS:2386 Part I
Strength	Los Angeles Abrasion Value or	Max. 40%	IS:2386 Part IV
	Aggregate Impact Value	Max. 30%	IS:2386 Part IV
Durability	Soundness (Sodium or Magnesium)	5 cycles	IS:2386 Part V IS:2386 Part V
	Sodium Sulphate	Max. 12%	
	Magnesium Sulphate	Max. 18%	
Water Absorption	Water Absorption	Max. 2%	IS:2386 Part III
Stripping	Coating and Stripping of Bitumen Aggregate	Min. Retained Coating 95%	IS:6241
Water Sensitivity	Retained tensile Strength*	Min. 80%	AASHTO 283

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

TABLE 500-7
Aggregate Grading and Bitumen Content

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

* Nominal maximum aggregate size is the largest specified sieve size upon which any of the aggregate material is retained.

** Corresponds to specific gravity of the Aggregate being 2.7. In case aggregates have specific gravity more than 2.7, bitumen content can be reduced proportionately. Further, for regions where highest daily mean air temperature is 30⁰C or lower and lowest daily mean air temperature is -10⁰C or lower, the bitumen content may be increased by 0.5 percent.

TABLE 500-8
PHYSICAL REQUIREMENTS FOR COARSE AGGREGATE
FOR DENSE BITUMINOUS MACADAM

Property	Test	Requirement	Method of Test
Cleanliness (dust)	Grain size analysis	Max 5 % passing 75 micron	IS:2386 Part I
Particle Shape	Combined Flakiness and Elongation Indices*	Max. 35%	IS:2386 Part I
Strength	Los Angeles Abrasion Value or Aggregate Impact Value	Max. 35% Max. 27%	IS:2386 Part IV
Durability	Soundness either : Sodium Sulphate or Magnesium Sulphate	Max. 12% Max. 18%	IS:2386 Part V
Water Absorption	Water Absorption	Max. 2%	IS:2386 Part III
Stripping	Coating and Stripping of Bitumen Aggregate Mix	Min. Retained Coating 95%	IS:6241
Water Sensitivity	Retained tensile Strength**	Min. 80%	AASHTO 283

* 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 values of flakiness index and elongation index so found are added up.

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

TABLE 500-9
Grading Requirements for Mineral Filler.

IS Sieve (mm)	Cumulative percent passing by weight of total aggregate
0.6	100
0.3	95-100
0.075	85-100

TABLE 500-10
Composition of Dense Graded Bituminous Macadam

Grading	1	2
Nominal Aggregate size*	37.5 mm	26.5 mm
Layer Thickness	75 - 100 mm	50-75 mm
IS Sieve (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	Min 4.0**	Min 4.5**

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

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

TABLE 500-11
Requirements for Dense Graded Bituminous Macadam

Properties	Viscosity Grade Paving Bitumen	Modified bitumen		Test Method
		Hot climate	Cold cimате	
Compaction level	75 blows on each face of the specimen			
Minimum stability (kN at 600C)	9.0	12.0	10.0	AASHTO T245
Marshall flow (mm)	2-4	2.5-4	3.5-5	AASHTO T245
Marshall Quotient Stability Flow	2-5	2.5-5		MS-2 and ASTM D2041
% air voids	3-5			
% Void Filled with Bitumen (VFB)	65-75			
Coating of aggregate particle	95% minimum			IS:6241
Tensile Strength ratio	80% minimum			AASHTO T283
% Voids in Mineral Aggregate (VMA)	Minimum percent voids in mineral aggregate (VMA) are set out in Table 500-13			

TABLE 500-12
Minimum percent Voids in Mineral Aggregate (VMA).

Nominal Maximum Particle size ¹ (mm)	Minimum VMA, percent related to Design Percentage Air Voids		
	3.0	4.0	5.0
26.5	11.0	12.0	13.0
37.5	10.0	11.0	12.0

Note:1. Interpolate minimum voids in the mineral aggregate (VMA) for design percentage air voids values between those listed.

TABLE 500-13
Permissible Variations in the Actual Mix from the Job Mix Formula.

Description	Base/Binder course
Aggregate passing 19mm sieve or larger	± 8%
Aggregate passing 13.2mm, 9.5 mm	± 7%
Aggregate passing 4.75 mm	± 6%
Aggregate passing 2.36mm, 1.18mm, 0.6mm	± 5%
Aggregate passing 0.3mm, 0.15 mm	± 4%
Aggregate passing 0.075 mm	± 2%
Binder content	± 0.3%
Mixing temperature	± 10 °C

TABLE 500-15
(Specifications for Road & Bridge Works IVth Revision)
Composition of Semi-Dense Bituminous Concrete Pavement Layers.

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	VG-30	VG-30

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.

TABLE 500-16
(Specifications for Road & Bridge Works IVth Revision)
Requirements for Semi-Dense Bituminous Pavement Layers.

Minimum stability kN at 60°C	8.2
Minimum flow (mm)	2
Maximum flow (mm)	4
Compaction level (Number of blows)	75 blows on each of the two faces of the specimen
Percent air voids	3-5
Percent voids in mineral aggregate (VMA)	See Table 500-12
Percent voids filled with bitumen (VFB)	65-78

TABLE 500-16
Physical Requirements for Coarse Aggregate for Bituminous Concrete

Property	Test	Specification	Method of Test
Cleanliness	Grain size analysis	Max 5% passing 0.075 mm sieve	IS:2386 Part I
Particle shape	Combined Flakiness and Elongation Indices	Max 35%	IS:2386 Part I
Strength	Los Angeles Abrasion Value or Aggregate Impact Value	Max 30% Max 24%	IS:2386 Part IV
Durability	Soundness either : Sodium Sulphate or Magnesium Sulphate	Max 12% Max 18%	IS:2386 Part V
Polishing	Polished Stone Value	Min 55	BS : 812 - 114
Water Absorption	Water Absorption	Max 2%	IS:2386 Part III
Stripping	Coating and Stripping of Bitumen Aggregate Mix	Minimum retained coating 95%	IS:6241
Water Sensitivity	Retained Tensile Strength*	Min 80%	AASHTO 283

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

TABLE 500-17
Composition of Bituminous Concrete Pavement Layers.

Grading	1	2
Nominal Aggregate size*	19 mm	13.2 mm
Layer Thickness	50 mm	30 - 40 mm
IS Sieve (mm)	Cumulative % by weight of total aggregate passing	
45	-	-
37.5	-	-
26.5	100	-
19	90-100	100
13.2	59-79	90-100
9.5	52-72	70-88
4.75	35-55	53-71
2.36	28-44	42-58
1.18	20-34	34-48
0.6	15-27	26-38
0.3	10-20	18-28
0.15	5-13	12-20
0.075	2-8	4-10
Bitumen content % by mass of total mix	Min 5.2**	Min 5.4**

Notes :-

- * The nominal maximum particle size is the largest specified sieve size up on which any of the aggregate is retained.
- ** Corresponds to specific gravity of aggregate being 2.7. In case aggregate have specific gravity more than 2.7, the minimum bitumen content can be reduced proportionately. Further the region where highest daily mean air temperature is 30°C or lower and lowest daily air temperature is - 10°C or lower, the bitumen content may be increased by 0.5 percent.

TABLE 500-18
Permissible Variations in the Plant Mix from the Job Mix Formula.

Description	Base/Binder course
Aggregate passing 19mm sieve or larger	± 7%
Aggregate passing 13.2mm, 9.5 mm	± 6%
Aggregate passing 4.75 mm	± 5%
Aggregate passing 2.36mm, 1.18mm, 0.6mm	± 4%
Aggregate passing 0.3mm, 0.15 mm	± 3%
Aggregate passing 0.075 mm	± 1.5%
Binder content	± 0.3%
Mixing temperature	± 10 °C

TABLE 500-19
Aggregate Gradation

IS Sieve Designation (mm)	Cumulative Percent by Weight of Total Aggregate Passing	
	Type A	Type B
13.2 mm	-	100
11.2 mm	100	88-100
5.6 mm	52-88	31-52
2.8 mm	14-38	5-25
0.090 mm	0-5	0-5

TABLE 500-20
Recommended Nominal Size of Aggregate (mm)

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

TABLE 500-21
Grading requirements for Aggregates for Surface Dressing.

IS Sieve Designation (mm)	Cumulative percent by weight of total aggregates passing for the following nominal sizes (mm)			
	19	13	10	6
26.5	100	-	-	-
19.0	85-100	100	-	-
13.0	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 13.2mm retained 9.5mm	Passing 9.5mm retained 6.3mm	Passing 6.3mm retained 3.35mm

TABLE 500-23
Quantities of Materials Required for 10 Sqm. of Road surface for 20mm Thick Open Graded Premix Surfacing Using Bitumen

Materials		Quantity
Aggregates	(a) Nominal Stone size 13.2mm (passing 22.4mm sieve and retained on 11.2mm sieve)	0.18 m ³
	(b) Nominal Stone size 11.2mm (passing 13.2mm sieve and retained on 5.6mm sieve)	0.09 m ³
Total		0.27 m³
Binder	(a) For 0.18m ³ of 13.2mm nominal size stone of 52 kg bitumen per m ³	9.5 kg
	(b) For 0.09 m ³ of 11.2mm nominal size stone of 56 kg bitumen per m ³	5.1 kg
Total		14.6 kg.

TABLE 500-24
Quantities of Materials Required for 10 Sqm. of Road surface for 20mm Thick Open Graded Premix Surfacing Using Cationic Bitumen Emulsion

	Aggregates	
(a)	Coarse aggregate nominal 13.2mm size, passing IS 22.4mm sieve and retained on IS 11.2mm sieve.	0.18 m ³
(b)	Coarse aggregate nominal 11.2mm size (passing IS 13.2mm sieve and retained on IS 5.6mm sieve)	0.09 m ³
	Binder	20 to 23 kg

TABLE 500-25
Different Types of Slurry Seals

Items	Type I (2-3 mm)	Types II (4-6 mm)	Type III (6-8 mm)**
Application	Filling of hair cracks	Filling of surface cracks 1-3 mm and preventive / renewal treatment (upto 450 CVPD)***	Filling of surface cracks 3-6 mm and preventive / renewal treatment (upto 1500 CVPD)***
Quantity* of slurry (kg/m ²)	4.3 to 6.5	8.4 to 9.8	10.1 to 12
Residual binder (% by weight of dry aggregate)	10 to 16	7.5 to 13.5	6.5 to 12

* In terms by weight of dry aggregate.

** Indicative only.

*** CVPD : Commercial Vehicles per day

TABLE 500-26
Properties of Aggregates for Slurry Seal

Properties	Test Method	Specification
Sand Equivalent Value	IS:2720 (Part 37)	Min 50 percent
Water absorption*	IS:2386 (Part 3)	Max 2 percent
Soundness with - Sodium sulphate Magnesium sulphate	IS:2386 (Part 5)	Max 12 percent Max 18 percent

* In case water absorption exceeds 2% but is less than 4%, same may be permitted subject to conformity of soundness test and wet stripping test.

TABLE 500-27
Size requirements for Coarse Stone Aggregates Slurry Seal

Sieve Size (mm)	Percentage by Mass Passing (Minimum Layer Thickness)		
	Type I (2-3 mm)	Type II (4-6 mm)	Type III (6-8 mm)
9.5	-	-	100
6.3	-	100	90-100
4.75	100	90-100	70-90
2.36	90-100	65-90	45-70
1.18	65-90	45-70	28-50
0.600	40-65	30-50	19-34
0.300	25-42	18-30	12-25
0.150	15-30	10-21	7-18
0.075	10-20	5-15	5-15

BASE AND SURFACE COURSES (BITUMINOUS)

TABLE 500-28
Tolerances for Slurry Seal

Description	Tolerance
Aggregate passing 4.75 mm	± 5%
Aggregate passing 2.36mm, 1.18mm, 0.6mm	± 5%
Aggregate passing 0.3mm	± 4%
Aggregate passing 0.15 mm	± 3%
Aggregate passing 0.075 mm	± 2%

TABLE 500-29
Mix Design Criteria for Slurry Seal Mix

Requirement	Specifications	Test Method
Mix Time, minimum	180 seconds	Appendix 1 IRC:SP:81
Consistency, maximum	3 cm	Appendix 3 IRC:SP:81
Wet cohesion, pass % minimum	20 kg. cm	Appendix 4 IRC:SP:81
Wet stripping, Pass %, minimum	90	Appendix 5 IRC:SP:81
Wet Track abrasion loss, (one hour soak) maximum	800 g/m ²	Appendix 6 IRC:SP:81

TABLE 500-30
Indicative Quantity of Ingredients Slurry Seal

Ingredients	Limits (Percent by Weight of Dry Aggregates)
Cationic Bitumen Emulsion	10 to 16 for type I 7.5 to 13.5 for Type II 6.5 to 12 for Type III
Water	6 to 12
Filler	1.0 to 2.0
Additive	0.5 to 2.0

TABLE 500-31
Types of Micro-Surfacing and Rate of Application

Items	Type II (4 to 6mm)**	Type III (6 to 8 mm)**
Application	Preventive and Renewal Treatment for Roads Carrying <1500 CVPD	Preventive and Renewal Treatment for Roads Carrying 1500 to 4500 CVPD
Quantity of mix* (kg/m ²)	8.4 to 10.8	11.1 to 16.3
Residual binder (percentage by weight of dry aggregate)	6.5 to 10.5	5.5 to 10.5

* By weight of dry aggregate ** Indicative only.

TABLE 500-32
Requirement of Modified Bitumen Emulsion for Micro-Surfacing

Requirements	Specifications	Method of test
Residue on 600 micron IS sieve (percent by mass), maximum	0.05	IS:8887
Viscosity by Say bolt Furol Viscometer, at 25°C, in second	20-100	IS:8887
Coagulation of emulsion at low temperature	Nil	IS:8887
Storage stability after 24 h (168 h), % maximum	2(4)	IS:8887
Particle charge, + ve/ -ve	+ ve	IS:8887
Test on residue:		
a) Residue by evaporation, % minimum	60	IS:8887
b) Penetration at 25°C/100 g/5 s	40-100	IS:1203
c) Ductility at 27°C, cm, minimum	50	IS:1208
d) Softening point, in °C, minimum	57	IS:1205
e) Elastic recovery*, %, minimum	50	IS:15462
f) Solubility in tri-chlorethylene, % minimum	97	IS:1216

* In case, elastic recovery is tested for Torsional Elasticity Recovery as per Appendix-8 of IRC:81, the minimum value shall be 20 percent.

TABLE 500-33**Mix Design Criteria for Micro-Surfacing Mix**

Requirements	Specifications	Method of test as given in IRC:SP:81
Mix time, minimum	120 s	Appendix-1
Consistency, maximum	3 cm	Appendix-3
Wet Cohesion, within 30 min, minimum	12 kg cm	Appendix-4
Wet Cohesion, within 60 min, minimum	20 kg cm	Appendix-4
Wet stripping, pass %, minimum	90	Appendix-5
Wet track abrasion loss (one hour soak), maximum	538 g/m ²	Appendix-6

TABLE 500-39**Requirements for Physical Properties of Binder for Mastic Asphalt**

Property	Test Method	Requirements
Penetration at 25°C	IS:1203	15 $\pm$ 5*
Softening point, °C	IS:1205	65 $\pm$ 10
Loss on heating for 5h at 163°C, % by 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

* In cold climate regions (temperature < 10°C) VG-40 Grade Bitumen may be used.

TABLE 500-40**Grade and Thickness of Mastic Asphalt Paving and Grading of Coarse Aggregate.**

Application	Thickness Range (mm)	Nominal size of coarse aggregate (mm)	Coarse aggregate content, % by mass of total mix
Roads and bridge decks	25-50	13	40 $\pm$ 10
Heavily stressed areas i.e. junctions and toll plazas	40-50	13	45 $\pm$ 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		

TABLE 500-41**Grading of Fine Aggregate (Inclusive of Filler) for Mastic Asphalt**

IS Sieve	Percentage by weight of aggregate
Passing 2.36 mm but retained on 0.600 mm	0-25
Passing 0.600 mm but retained on 0.212 mm	10-30
Passing 0.212 mm but retained on 0.075 mm	10-30
Passing 0.075 mm	30-55

TABLE 500-42
Composition of Mastic Asphalt Blocks without Coarse Aggregate

IS Sieve	Percentage by Weight of Mastic Asphalt	
	Minimum	Maximum
Passing 2.36 mm but retained on 0.600 mm	0	22
Passing 0.600 mm but retained on 0.212 mm	4	30
Passing 0.212 mm but retained on 0.075 mm	8	18
Passing 0.075 mm	25	45
Bitumen Content % by mass	14	17

TABLE 500-43
Quantity of Materials Required for 10 sq.m of Road Surface for Stress Absorbing Membrane

S. No.	Type and Width of Crack	Specification of SAM to be Applied	Quantity of Binder Kg/10m ²	Quantity of Chipping
1)	Hair cracks and map cracks upto 3 mm width	Single coat SAM or 2 nd coat of two coat SAM	8-10	0.10 m ³ of 5.6 mm chips
2)	Map cracks or alligator cracks 3 mm to 6 mm width	single coat SAM	10-12	0.11 m ³ of 5.6 mm chips
3)	Map cracks or alligator cracks 6 mm to 9 mm width	Two coat SAM 1 st coat 2 nd coat	12-14 8-10	0.12m ³ of 5.6 mm and 11.2 mm chips in 1:1 ratio 0.10 m ³ of 5.6mm chips
4)	Cracks above 9 mm width and cracked area above 50 percent	Two coat SAM 1 st coat 2 nd coat	14-16 8-10	0.12m ³ of 11.2 mm 0.10 m ³ of 5.6mm chips
5)	All types of cracks with crack width below 6 mm	single coat SAM I	8-10	0.10 m ³ of 5.6mm chips
6)	All types of cracks with crack width above 6 mm	Single Coat SAM I	10-12	0.10 m ³ of 11.2mm chips

TABLE 500-49
Size Requirement for Coarse Stone Aggregates as per Nominal Size

S. No.	Nominal Size of Aggregate	Designation of Sieve Through which the Aggregates shall Wholly Pass	Designation of Sieve on which the Aggregates shall Wholly Retained
1)	75 mm	106 mm	63 mm
2)	63 mm	90 mm	53 mm
3)	45 mm	53 mm	26.5 mm
4)	26.5 mm	45 mm	22.4 mm
5)	22.4 mm	26.5 mm	13.2 mm
6)	13.2 mm	22.4 mm	11.2 mm
7)	11.2 mm	13.2 mm	6.7 mm
8)	6.7 mm	11.2 mm	2.8 mm

TABLE 500-50
Percent Reduction in Volume of Aggregates (As per Clause-520)

S. No.	Standard 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	12.5
2)	45 mm and 26.5 mm	10.0
3)	22.4mm, 13.2 mm, 11.2 mm and 6.7mm	5.0
4)	Fine aggregate	5.0

QUALITY CONTROL FOR ROAD WORKS
TABLE 900-1
Tolerances in Surface Levels.

1.	Sub-Grade	$\pm 20\text{mm}$
2.	Sub-base a) Flexible pavement b) Concrete Pavement	$\pm 10\text{mm}$ $\pm 6\text{mm}$
3.	Base Course for flexible pavement. a) Bituminous Base/ Binder Course b) Granular i) Machine laid ii) Manually laid.	$\pm 6\text{mm}$ $\pm 10\text{mm}$ $\pm 15\text{mm}$
4.	Wearing course for flexible pavement. i) Machine laid ii) Manually laid.	$\pm 6\text{mm}$ $\pm 10\text{mm}$
5.	Cement Concrete pavement	$\pm 5\text{mm}$

TABLE 900-2
Maximum Permitted number of Surface Irregularities.

	Surface of carriageways and paved shoulders				Surface of Laybys, Service Areas and all Bituminous Base Course			
Irregularity	4mm		7 mm		4 mm		7mm	
Length (m)	300	75	300	75	300	75	300	75
Number of Surface Irregularities on National Highways/ Expressway*	15	9	2	1	40	18	4	2
Number of Surface Irregularities on Road of Lower category*	40	18	4	2	60	27	6	3

* *Category of each section of road as described in the contract.*

The maximum allowable difference between the road surface and underside of a 3m straight edge when placed parallel with, or at right angles to the center line of the road at points decided by the Engineer shall be :

(i)	For Pavement surface (bituminous and cement concrete)	3mm
(ii)	For Bituminous base courses.	6mm
(iii)	For Granular sub-base/base courses.	8mm
(iv)	For Sub-base under concrete pavements	10mm
(v)	For subgrade	15mm

TABLE 900-3
Control Tests and their Minimum Frequency for Sub-Bases and Bases
(Excluding Bitumen Bound Bases)

S. No.	Type of Construction	Test	Frequency (Min.)
1.	Granular	(i) Gradation (ii) Atterberg Limits (iii) Moisture content prior to compaction. (iv) Density of compacted layer (v) Deleterious constituents (vi) CBR	One test per 400 m ³ One test per 400 m ³ One test per 400 m ³ One test per 1000 m ³ As required As required
2.	Lime/Cement Stabilised Soil Sub- base	(i) Quality of Lime/Cement (ii) Lime/Cement Content (iii) Degree of pulverization (iv) CBR or unconfined compressive strength test on a set of three specimens. (v) Moisture content prior to compaction (vi) Density of compacted layer (vii) Deleterious constituents	One test for each consignment subject to a minimum of one test per 5 tonnes. Regularly through procedural checks. Periodically as considered necessary As required One set of two tests per 500 m ² One set of two tests per 500 m ² As required
3.	Water Bound Macadam	(i) Aggregate impact value (ii) Grading of aggregate (iii) Combined Flakiness and Elongation indices. (iv) Atterberg limits of binding material (v) Atterberg limits of screenings	One test Per 1000 m ³ of aggregate One test per 250 m ³ One test per 500 m ³ of aggregate One test per 50m ³ of binding material. One test per 100 m ³ of aggregate

4.	Wet Mix Macadam	(i) Aggregate impact value	One test per 1000 m ³ of aggregate
		(ii) Grading of aggregate	One test per 200 m ³ of aggregate
		(iii) Combined Flakiness and Elongation indices	One test per 500 m ³ of aggregate
		(iv) Atterberg limits of portion of aggregate passing 425 micron sieve.	One test per 200 m ³ of aggregate
		(v) Density of compacted layer	One set of three test per 1000 m ²

TABLE 900-4
Control Tests for Bituminous Works and their Minimum Frequency

S. No.	Type of Construction	Test	Frequency (Min.)
1.	Primer Coat/ Tack Coat/Fog spray	(i) Quality of binder	No. of samples per lot and tests as per IS:73, IS:217 and IS:8887 as applicable
		(ii) Binder temperature for application	At regular close intervals
		(iii) Rate of spread of binder	Three tests per day
2.	Seal coat/ Surface dressing	(i) Quality of binder	Same as mentioned under Serial No.1
		(ii) Aggregate Impact value/ Los Angles Abrasion Value	One test per 200 m ³ of each source and whenever there is change in the quality of aggregate
		(iii) Combined Flakiness and Elongation indices	One test per 100 m ³ of aggregate for each source and whenever there is change in the quality of aggregate
		(iv) Stripping value of aggregates (Immersion Tray Test)	One test of each source and whenever there is change in the quality of aggregate
		(v) Water absorption of aggregate	-do-
		(vi) Water sensitivity of mix	-do-
		(vii) Grading of aggregates	Two tests per day
		(viii) Soundness (Magnesium and Sodium Sulphate)	One test for each source and whenever there is change in the quality of aggregate
		(ix) Polished stone value (not applicable for SAM/ SAMI)	-do-
		(x) Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	At regular intervals
		(xi) Rate of spread of materials	Same as mentioned under Serial No.1
		(xii) Percentage of fractured faces	One test per 100 cu.m of aggregate.

TABLE 900-4
Control Tests for Bituminous Works and their Minimum Frequency.

S. No.	Type of Construction	Test	Frequency (Min.)
3.	Open-graded Premix Surfacing/ Close-graded Premix Surfacing	(i) Quality of binder (ii) Aggregate Impact Value/ Los Angeles Abrasion Value (iii) Combined Flakiness and Elongation indices (iv) Stripping Value (v) Water absorption of aggregates (vi) Water sensitivity of mix (vii) Grading of aggregates (viii) Soundness (Magnesium and Sodium Sulphate) (ix) Polished stone value (x) Temperature of binder at application (xi) Binder content (xii) Percentage of fractured faces	Same as mentioned under Serial No.1 Same as mentioned under Serial No.2 Same as mentioned under Serial No.2 Same as mentioned under Serial No.2 Same as mentioned under Serial No.2 Same as mentioned under Serial No.2 Same as mentioned under Serial No.2 Same as mentioned under Serial No.2 Same as mentioned under Serial No.2 At regular intervals Two tests per day per plant Same as mentioned under Serial No.2

4.	Bituminous Macadam	(i)	Quality of binder	Same as mentioned under Serial No.1
		(ii)	Aggregate Impact Value/ Los Angeles Abrasion Value	Same as mentioned under Serial No.2
		(iii)	Combined Flakiness and Elongation indices	One test per 350 cu.m for each source
		(iv)	Stripping Value	Same as mentioned under Serial No.2
		(v)	Water sensitivity of mix	Same as mentioned under Serial No.2
		(vi)	Grading of aggregates	Same as mentioned under Serial No.2
		(vii)	Water absorption of aggregates	Same as mentioned under Serial No.2
		(viii)	Soundness (Magnesium and Sodium Sulphate)	Same as mentioned under Serial No.2
		(ix)	Percentage of fractured faces	Same as mentioned under Serial No.2
		(x)	Binder content	Same as mentioned under Serial No.3
		(xi)	Control of temperature of binder and aggregate for mix and of the mix at the time of laying and rolling.	Same as mentioned under Serial No.2
		(xii)	Density of Comp layer	One test per 700 sq. m area
		(xiii)	Rate of spread of mixed material	At regular intervals

TABLE 900-4
Control Tests for Bituminous Works, and their Minimum Frequency.

S. No.	Type of Construction	Test	Frequency (Min.)
5.	Dense Bituminous Macadam Bituminous Concrete	(i) Quality of binder	Number of samples per lot and tests as per IS:73 or IRC:SP:53, IS:15362
		(ii) Aggregate Impact Value/ Los Angeles Abrasion Value	One test per 350 m ³ of aggregate for each source and whenever there is change in the quality of aggregate
		(iii) Flakiness and Elongation Indices	One test per 350 m ³ of aggregate for each source and whenever there is change in the quality of aggregate
		(iv) Soundness (Magnesium and Sodium Sulphate test)	One test for each source and whenever there is change in the quality of aggregate
		(v) Water absorption of aggregates	One test for each source and

		(vi) Sand equivalent test (vii) Plasticity Index (viii) Polished stone value (ix) Percentage of fractured faces (x) Mix grading (xi) Stability and voids analysis of mix including theoretical maximum specific of loose mix (xii) Moisture Susceptibility of mix (AASHTO T283) (xiii) Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction (xiv) Binder Content (xv) Rate of spread of mixed material (xvi) Density of compacted layer	whenever there is change in the quality of aggregate One test for each source and whenever there is change in the quality of aggregate One test for each source and whenever there is change in the quality of aggregate One test for each source and whenever there is change in the quality of aggregate One test per 350 cu.m of aggregate when crushed gravel is used One set for individual constituent and mixed aggregate from dryer for each 400 tonnes of mix subject to minimum of two tests per day per plant. Three tests for stability, flow value, density and void contents for each 400 tonnes of mix subject to minimum of two tests per day per plant One test for each mix type whenever there is change in the quality or source of coarse or fine aggregate At regular intervals One set for each 400 tonnes of mix subject to minimum of two sets per day per plant After every 5th truck load One test per 700 sq.m area
Note:- For Semi Dense Bituminous Concrete Tests & Frequencies mentioned in Specifications for Road & Bridge Works IVth Revision shall be followed.			

TABLE 900-4
Control Tests for Bituminous Works, and their Minimum Frequency.

S. No.	Type of Construction	Test	Frequency (Min.)
6.	Slurry seal and Micro surfacing	(i) Quality of Aggregate Sand Equivalent Value ,Water Absorption, Soundness Test (Sodium/ Magnesium Sulphate Test) (ii) Quality of Emulsion (iii) Aggregate Moisture (iv) Aggregate Gradation (v) Binder Content (vi) Calibration of Machine (vii) Quantity of Slurry (By weight of aggregate)	One per source / site One per lot of 20 t as per IS:8887 Two per day Two per day at site Two per lane per Km Once per Project Daily (Travel time of Machine)
7.	Mastic asphalt	(i) Quality of binder (ii) Aggregate Impact Value and Los Angeles Abrasion Value (iii) Combined Flakiness and Elongation Indices (iv) Stripping value (v) Water sensitivity of mix (vi) Grading of aggregates (vii) Water absorption of aggregates (viii) Soundness (Magnesium and Sodium Sulphate) (ix) Percentage of fractured faces (x) Binder content and aggregates grading (xi) Control of temperature of binder in boiler, aggregate in the dryer and mix at the time of laying and rolling (xii) Rate of spread of mixed material (xiii) Hardness number	Same as mentioned under Serial No.5 Same as mentioned under Serial No.5 Same as mentioned under Serial No.5 Same as mentioned under Serial No.2 Same as mentioned under Serial No.5 Two tests per day per plant on the individual constituent and mixed aggregates from the dryer Same as mentioned under Serial No.5 Same as mentioned under Serial No.5 Same as mentioned under Serial No.5 Same as mentioned under Serial No.3 At regular close intervals Regular control through check of layer thickness. Minimum two tests per day
8.	Constrol Tests for Geotextiles		The requirements of Section 700 shall apply

MATERIALS FOR STRUCTURE

**TABLE 1000-1
GRADING REQUIREMENTS OF COARSE AGGREGATE**

IS Sieve Size	Percentage Passing for Graded Aggregate of Nominal Size		
	40 mm	20 mm	12.5 mm
63 mm	-	-	-
40 mm	95-100	100	-
20 mm	30 -70	95-100	100
12.5 mm	-	-	90-100
10 mm	10-35	25-55	40-85
4.75 mm	0-5	0-10	0-10

**TABLE 1000-2
GRADING REQUIREMENTS OF FINE AGGREGATE**

IS Sieve Size	Percent Passing for		
	Grading Zone I	Grading Zone II	Grading Zone III
10 mm	100	100	100
4.75 mm	90 - 100	90 - 100	90 - 100
2.36 mm	60 - 95	75 - 100	85 - 100
1.18 mm	30 - 70	55 - 90	75 - 100
600 micron	15 - 34	35 - 59	60 - 79
300 micron	5 - 20	8 - 30	12 - 40
150 micron	0 - 10	0 -10	0 - 10

**TABLE 1000-3
Grades of Reinforcing Bars**

Grade Designation	Bar Type Conforming to Governing IS Specifications	IS Characteristic Strength f_y MPa	Elastic Modulus GP
Fe240	IS:432 Part I Mild Steel	240	200
Fe 415	IS:1786 High Strength Deformed Steel Bars (HSD)	415	200
Fe 500 or Fe 500D	IS:1786 High Strength Deformed Steel Bars (HSD)	500	200
Fe 550 or Fe 550D	IS:1786 High Strength Deformed Steel Bars (HSD)	550	200
Fe 600	IS:1786 High Strength Deformed Steel Bars (HSD)	600	200

Note :- If any grade of steel given in the above table is not available steel of next higher grade may be used.

1010 WATER

Water used for mixing and curing shall be clean and free from oils, acids, alkalis, salts, sugar, organic materials or other substances that may be deleterious to concrete or steel.

pH value of water shall not be less than 6. Potable water is generally considered satisfactory for mixing concrete.

As a guide, the following concentrations represent the maximum permissible values:

- (a) To neutralize 200 ml sample of water, using phenolphthalein as an indicator, it should not require more than 2 ml of 0.1 normal NaOH. For details of test refer IS:3025 (Part 22)
- (b) To neutralize 100 ml sample of water, using mixed indicator, it should not require more than 25 ml of 0.02 normal H_2SO_4 . For details of test refer IS : 3025 (Part 23)
- (c) The permissible limits for solids shall be as follows

	Tested as per	Permissible Limit max
Organic	IS:3025 (Pt. 18)	200 mg/lit
Inorganic	IS:3025 (Pt. 18)	3000 mg/lit
Sulphates (SO_3)	IS:3025 (Pt. 28)	400 mg/lit
Chlorides (Cl)	IS:3025 (Pt. 32)	2000 mg/lit for concrete work not containing embedded steel and 500 mg/lit for prestressed/reinforced concrete work
Suspended matter	IS:3025 (Pt. 17)	2000 mg/lit

All samples of water (including potable water) shall be tested and suitable measures taken, where necessary, to ensure conformity of the water to the requirements stated herein.

1012. CONCRETE ADMIXTURES

1012.3.1. Information Required from the Manufacturer

- a) Normal dosage and detrimental effects, if any, on under dosage and over dosage.
- b) The chemical names of the main ingredients.
- c) The chloride content, if any, expressed as a percentage by the weight of the admixture.
- d) Values of dry material content, ash content and relative density which can be used for Uniformity Tests.
- e) Whether it leads to the entrainment of air when used as per the manufacturer's recommended dosage, and if so to what extent.
- f) Confirmation regarding its compatibility with type of cement.
- g) Whether it increases the risk of corrosion of reinforcement or other embedments.
- h) Whether it affects the durability of concrete adversely.

1012.3.2. Physical and Chemical Requirements

- (a) " Plasticizers " and "Super-Plasticizers" shall meet the requirements indicated for " Water reducing Admixture"
- (b) Except where resistance to freezing and thawing and to disruptive action of deicing salts is required, the air content of freshly mixed concrete in accordance with the pressure method given in IS:1199 shall not be more than 2 per cent higher than that of the corresponding control mix and in any case not more than 3 per cent of the test mix.
- (c) The chloride content of the admixture shall not exceed 0.2 per cent when tested in accordance with IS:6925. In addition, the maximum permissible limit of chloride content of all the constituents as indicated in Section 1700 of these Specifications shall also not be exceeded.
- (d) Uniformity tests on the admixtures are essential to compare qualitatively the composition of different samples taken from batch to batch or from the same batch at different times.

The tests that shall be performed along with: permissible variations are as follows:

- i) Dry Material Content : within 3 percent and 5 percent of liquid and solid
 - ii) Ash content : within 1 percent of the value stated by the manufacturer.
 - iii) Relative Density (for liquid admixtures) : within 2 percent of the value stated by the manufacturer .
- (e) All tests relating to the concretes admixtures shall be conducted periodically at and independent laboratory and compared with the data given by the manufacturer.

1508. REMOVAL OF FORMWORK

The scheme for removal of form work (i.e. de-shuttering and decentering) shall be planned in advance and furnished to the Engineer for scrutiny and approval. No formwork or any part thereof shall be removed without prior approval of the Engineer.

The Formwork shall be so removed as not to cause any damage to concrete. Centering shall be gradually and uniformly lowered in such a manner as to permit the concrete to take stresses due to its own weight uniformly and gradually to avoid any shock or vibration.

Form work shall not be released unless the concrete has achieved strength of at least twice the stress the concrete may be subjected at the time of the removal of formwork. When no test is conducted for determination of strength of concrete and where the time of removal of formwork is not specified, the same shall be as under :

a)	Walls, piers, abutments, columns and vertical faces of structural members	12 to 48 hours as may be decided by the Engineer
b)	Soffits of Slabs (with props left under)	3 days
c)	Props (left under slabs)	14 days
d)	Soffit of Girders (with props left under)	7 days
e)	Props (left under girders)	21 days

The above time schedule is applicable when ordinary Portland Cement is used without any admixtures at an ambient temperature exceeding 10°C.

Where there are re-entrant angles in the concrete sections, the formwork should be removed at these sections as soon as possible after the concrete has set, in order to avoid cracking due to shrinkage of concrete.

STRUCTURAL CONCRETE

TABLE 1700 - 1
Grades of Concrete

Type of Concrete / Grade Designation			Characteristic Strength in MPa
Nominal Mix Concrete	Standard Concrete	High Performance Concrete	
M15	M15		15
M20	M20		20
	M25		25
	M30	M30	30
	M40	M35	35
	M45	M40	40
	M50	M45	45
		M50	50
		M55	55
		M60	60
		M65	65
		M70	70
		M75	75
		M80	80
		M85	85
		M90	90

TABLE 1700-2 :
Requirement of Concrete for Different Exposure Condition using 20 mm Aggregate

Exposure Condition	Maximum Water Cement Ratio	Minimum Cement Content , kg/m ³	Minimum Grade of Concrete
Moderate	0.45	340	M25
Severe	0.45	360	M30
Very Severe	0.40	380	M40

Note :-

- i) All three provisions given in the above table for a particular exposure condition, shall be satisfied.
- ii) The term cement for maximum w/c ratio and minimum cement content shown in Table includes all cementitious materials mentioned in Clause 1715.2. The maximum limit of flyash and ground granulated blast furnace slag in the blended cement shall be as specified in IS:1489 (Part 1) and IS:455 respectively.
- iii) For plain cement concrete, with or without surface reinforcement, the minimum grade of concrete can be lowered by 5 MPa and maximum water/cement ratio exceeded by 0.05.

Cement content shown in the above table shall be increased by 40 kg/m³ for use of 12.50 mm nominal size aggregates and decreased by 30 kg/m³ for use of 40 mm nominal size aggregates.

TABLE 1700-4.
Requirements of Consistency

type	Slump(mm)
1 (a) Structures with exposed inclined surface requiring low slump concrete to allow proper compaction	25
(b) Plain cement concrete	25
2. RCC structures with widely spaced reinforcements; e.g. solid columns, piers, abutments, footings, well steining	40 - 50
3. RCC structures with fair degree of congestion of reinforcement; e.g. pier and abutment caps, box culverts, well curb, well cap, walls with thickness greater than 300 mm	50 - 75
4. RCC and PSC structures with highly congested reinforcements e.g. deck slab girders, box girders, walls with thickness less than 300 mm	75 - 125
5. Underwater concreting through tremie e.g. bottom plug, cast-in-situ piling	150 - 200

TABLE 1700-2
Requirements of Concrete for Different Exposure Condition using 20 mm Aggregate

Exposure Condition	Maximum Water Cement Ratio	Minimum Cement Content, kg/m³	Minimum Grade of Concrete
Moderate	0.45	340	M25
Sever	0.45	360	M30
Very Severe	0.40	380	M40

TABLE 1700-5
Current Margin for Initial Design Mix

Concrete Grade	Current Margin (MPa)	Target Mean Strength (Mpa)
M 15	10	25
M 20	10	30
M 25	11	36
M 30	12	42
M 35	12	47
M 40	12	52
M 45	13	58
M 50	13	63
M 55	14	69
M 60	14	74
M 65	15	80
M 70	15	85
M 75	15	90
M 80	15	95
M 85	16	101
M 90	16	106

TABLE 1700-6
Requirements for Nominal Mix Concrete

Concrete Grade	Total Quantity of Dry Aggregate by Mass per 50 kg of Cement to be taken as the Sum of Individual Masses of Fine and Coarse Aggregate (kg)	Proportion of Fine to Coarse Aggregate (by Mass)	Maximum Quantity of Water for 50 kg of Cement (Litres)	
			PCC	RCC
M 15	350	Generally 1:3, subject to upper limit 1:1.5 and lower limit of 1:2.5	25	
M 20	250		25	22

TABLE 1700 - 9
MINIMUM FREQUENCY OF SAMPLING

Quantity of Concrete in work, m ³	No. 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 50 m ³ or part thereof

Note :- At least one sample shall be taken from each shift of work.

USEFUL DATA

1. Areas & Weights of Steel

a) Mild Steel Round Bars

Dia in mm	Area Sq. cm.	Weight Kg/M	Perimeter Cms.
6	0.283	0.222	1.887
8	0.503	0.395	2.514
10	0.785	0.617	3.143
12	1.131	0.888	3.771
16	2.011	1.578	5.028
18	2.545	2.000	5.657
20	3.142	2.466	6.286
22	3.801	2.984	6.914
25	4.909	3.853	7.857
28	6.157	4.830	8.800
32	8.042	6.313	10.057
40	12.566	9.684	12.571

b) High Tensile Steel

Dia in mm	Area Sq. cm.	Weight Kg/M	Perimeter Cms.
3	0.070	0.056	0.943
5	0.196	0.154	1.571
7	0.385	0.302	2.200
8	0.503	0.395	2.514

c) H.T. Cables each containing 12 wires

Dia of wire in mm	Total area of H.T. Sq. Cm.	Weight Kg/M
3	2.352	1.848
5	4.620	3.624
8	6.036	4.740

d) Structural steel (Sections which are normally required in bridge works)

Types Section	Size in M.M.	Weight Kg./M.
Angle	40 x 40 x 6	3.500
	50 x 50 x 6	4.500
	75 x 75 x 6	6.800
	75 x 75 x 10	11.000
	100 x 100 x 6	11.000
	100 x 100 x 10	14.900
	130 x 130 x 10	19.700
Tee	130 x 130 x 12	23.400
	100 x 100 x 10	15.00
	75 x 40 x 6	5.700

- e) Structural Flats (Sections which are normally required in bridge works)

Thickness of Plate	Weights Kg./M.
1 M.M.	0.00078
2 M.M.	0.00156
3 M.M.	0.00235
6 M.M.	0.00470
10 M.M.	0.00783
12 M.M.	0.00940
20 M.M.	0.01566
25 M.M.	0.01957

2. Weight of Materials for construction (as per IS:875 (Part I) 1987)

S.No.	Material	Unit Metric	Weights in Kg.
1.	Cement	Cum.	1440
2.	Steel		
	a) Mild Steel	Cu.Cm.	0.0078
	b) Cast Steel	Cu.Cm.	0.0078
	c) H.T. Steel	Cu.Cm.	0.0078
3.	Stainless Steel	Cu.Cm.	0.0078
4.	Lead	Cu.Cm.	0.0113
5.	Copper	Cu.Cm.	8.79 to 8.94
6.	Plain Cement Concrete	Cum.	1600 to 2400
7.	PSC	Cum.	2400
8.	RCC	Cum.	2310 to 2700
9.	Stones		
	a) Lime	Cum.	2400 to 2640
	b) Sand	Cum.	2240 to 2400
10.	Stone Masonry Rubble	Cum.	2100
11.	Bricks	Cum.	1600 to 1920
12.	Brick Masonry	Cum.	1920 to 2240
13.	Timber	Cum.	650 to 720

3. Conversion Factors.

Top Convert	Into	Multiply by	
Inch	Millimeter	25.40	0.039
Inch	Centimeter	2.540	0.3937
Foot	Meter	0.3048	3.2808
Mile	Kilometer	1.609	0.621
Square Inch	Sq. Centimeter	6.4516	0.155
Square Foot	Square Meter	0.0929	10.764
Acre	Hectare	0.4047	2.471
Sq.Mile	Sq. Kilometer	2.590	0.386
Cubic Inch	Cu. Centimeter	16.387	0.0161
Cubic Foot	Cubic Meter	0.0283	35.3147
Gallon (Imp.)	Litre	4.546	0.220
Pound	Kilogram	0.4536	2.2046
Ton	Tonne	1.0160	0.9842
Lbs. Per Sq. Inch	Kg. Per Sq. Cm.	0.0703	14.223
Ton Per Sq. Foot	Tonne Per Sq. M.	10.937	0.0914
To obtain	From		Multiply by

MAINTENANCE OF BITUMINOUS SURFACING

The type of defects in bituminous surfacing are grouped under four categories.

- a) Surface defects which include fatty surfaces smooth surfaces, streaking and hungry/dry surfaces.
- b) Cracks which cover hairline cracks, alligator cracks, longitudinal cracks, edge cracks, shrinkage cracks and reflection cracks.
- c) Deformation defects, which comprise of slippage rutting, corrugation, shoving, shallow depressions and settlements.
- d) A disintegration defect, which consists of stripping, loss of aggregates, releveling, pot-holes and edge breaking.

The general cause and remedies for these defects are given as below :

a) Surface Defects

Natural Defect	Cause	Remedy
<i>Fatty surfaces</i>	<i>Excess bitumen, soft grad of bitumen, non-uniform spraying and loss of cover aggregates as in surface dressing, heavy axle loads.</i>	<i>Apply hot dry cover aggregates or sand and roll gently for removal of excess binder; burn it, if necessary or relay area affected.</i>
<i>Smooth surfaces</i>	<i>Polishing of aggregates by traffic, excess binder.</i>	<i>Resurface with premix carpet using hard aggregates or with slurry seal.</i>
<i>Streaking (alternate lean and rich lines of bitumen in surface dressing) in longitudinal/ transverse direction. Hungry / Dry surfaces.</i>	<i>Non-uniform application of binder, low temperature of binder, manual spraying, mechanical faults during spraying. Use of insufficient binder, use of absorptive aggregates, loss of aggregates from surface.</i>	<i>Apply new surface dressing with proper care in spraying of bitumen. Apply slurry seal, or for emergency repair apply for seal.</i>

b) Cracks

<i>Hair-line cracks (fine cracks at close intervals)</i>	<i>Insufficient bitumen, excess filler, compacting when too hot, over compaction</i>	<i>Apply fog-seal with bitumen, cutback bitumen or bitumen emulsion</i>
<i>Alligator cracks (intercorrected cracks forming a series of blocks)</i>	<i>Excessive movement of base or sub-base layer, base saturation, excessive loads over weathered surfacing, inadequate pavement thickness.</i>	<i>Fill crack with bitumen emulsion or cutback bitumen and apply slurry seal or sand-bitumen mix, install drainage.</i>
<i>Longitudinal cracks (at the joint between pavement and shoulder or at the joint between two paving lanes)</i>	<i>Contraction or movement of sub-grade beneath shoulder, lane joint crack due to weak joint or differential frost heave along centre-line.</i>	<i>Fill and seal cracks with cutback bitumen or bitumen emulsion, apply sand-bitumen mix, if cracks are wider than 3mm.</i>

<i>Edge cracks (parallel to outer edge of pavement 0.3 to 0.5m. inside)</i>	<i>Lack of lateral support from shoulder, poor surface drainage, base saturation shrinkage, frost heave inadequate pavement width.</i>	<i>Rectify drainage system, provide hard and paved shoulders, fill cracks and lay premix carpe with seal-coat, if edge of the pavement has settled, bring it upto the desired grade with plant mix patching material</i>
<i>Shrinkage cracks (transverse direction or inter-connected cracks in large blocks)</i>	<i>Shrinkage of bituminous layer caused by volume change of bituminous mix with high content of hard bitumen, lack of traffic.</i>	<i>Apply slurry seal or sand-bitumen mix for filling such cracks.</i>
<i>Reflection cracks (usually in over lays over cement concrete or badly cracked bituminous base)</i>	<i>Due to joints and cracks in the pavement layer underneath.</i>	<i>Fill cracks and seal suitably depending on size of crack. Apply a crack relief layer for prevention of such cracks.</i>

c) Deformation defects

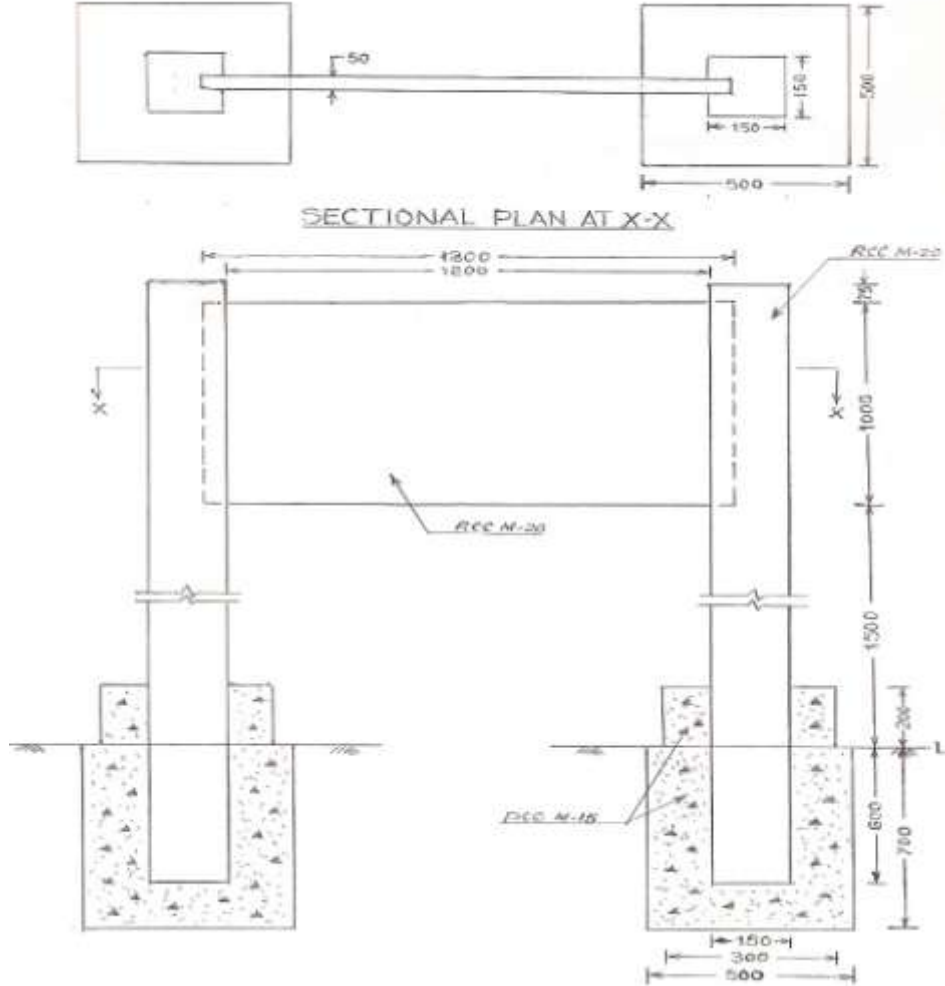
<i>Slippage (between top layer and layer below accompanied by crescent-shaped. Cracks in direction of the thrust of wheels).</i>	<i>Lack of bond between layers due to omission or inadequacy of tack coat or prime coat, dust or moisture in between layers, heavy thrust by traffic.</i>	<i>Remove affected area, apply tack coat and punch with premix.</i>
<i>Rutting (Longitudinal depressions or grooves in wheel tracks)</i>	<i>Heavy Channelized traffic, low stability of mix due to inadequate compaction, weak pavement, high intensity of load stress as from bullock carts, plastic deformation.</i>	<i>Full ruts with premix carpet and compact. Relay affected portion with bituminous mix of good stability if necessary.</i>
<i>Corrugations (Regular undulations causing shallow wavy surface).</i>	<i>Lack of stability in mix, excess binder/fines, soft bitumen, poor aggregate interlock, oscillations set up by vehicles, frequent braking of vehicles, faulty laying of mix.</i>	<i>Scarify and relay the surface, cut high spots and fill low spots. Use heater-planner to rectify defects.</i>
<i>Shoving (plastic movement within surface resulting in localized bulging of surface, occurring commonly at bus stops, intersections, sharp curves, steep gradients).</i>	<i>Lack of stability of mix, excess binder/fines, softer grade of bitumen, lack of bond between layers, heavy traffic with frequency braking, sharp negotiation of curves and gradients</i>	<i>Remove affected portion and relay with-premix carpet and compact.</i>

<i>Shallow depressions (localized and limited in size) dipping about 25mm or more below desired profile.</i>	<i>Heavier traffic, settlement of lower pavement layers, poor construction method.</i>	<i>Fill with premix carpet and compact to desired grade and profile.</i>
<i>Settlement (large localized deformation which may or may not be generally followed by extensive cracks)</i>	<i>Poor compaction of fill, poor drainage ion lower layer, inadequate pavement thickness, frost heave or swelling effect of moisture on expansive soil.</i>	<i>Excavate defective fill, reconstruct under controlled conditions to required thickness, provide adequate drainage, strengthen the pavement if required.</i>

d) Disintegration defects

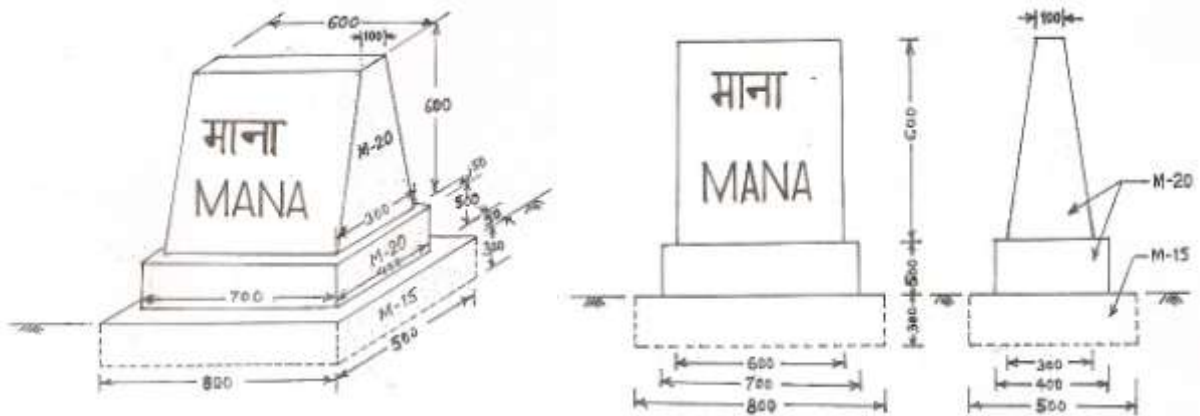
<i>Stripping (loss of adhesion between binder and aggregates in presence of water)</i>	<i>Softer grade bitumen, siliceous type of aggregates, rain, soon after laying of surface.</i>	<i>Use anti- stripping agent in suitable doses in case of siliceous aggregates, use of proper grade of bitumen for coating, and provide adequate surface drainage.</i>
<i>Loss aggregates (as in surface-dressing)</i>	<i>Non uniform spraying of binder, delayed spreading of aggregates, traffic soon after laying, insufficient binder, ageing of binder.</i>	<i>Apply liquid seal, fog-seal or slurry-seal. Relay, if necessary with liquid seal with proper quality control.</i>
<i>Raveling (progressive disintegration of premix carpet by loss of aggregates)</i>	<i>Insufficient binder, ageing of binder, overheated bituminous mix, improper coating, inferior aggregates, lack of compaction while laying, construction during cold weather.</i>	<i>If raveling if not extensive provide surface dressing, sand bitumen mix or slurry seal. For extensive raveling, apply renewal coat of premix carpet.</i>
<i>Pot-holPes (bowl shaped holes of varying sizes on surface and extending to base course resulting from localized disintegration)</i>	<i>Poor surface drainage, localized defects in bituminous mix, insufficient binder, insufficient layer thickness.</i>	<i>Fill pot holes with premix carpet, after cutting these to regular size and applying tack coat. Fill deep pot holes with bituminous penetration macadam or storable mix.</i>
<i>Edge breaking (frayed edges)</i>	<i>Infiltration of water, softening of foundation, worn-out shoulders with insufficient side support, inadequate thickness at edge.</i>	<i>Relay shoulders with good materials and compact provide adequate drainage.</i>

TYPE DESIGN FOR CONCRETE BOARDS :



ELEVATION

TYPE DESIGN FOR CONCRETE BOARDS (TYPE – A) VILLAGE BOARDS :

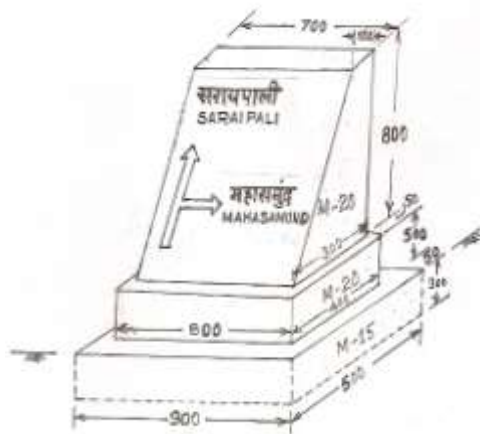


PERSPECTIVE VIEW

ELEVATION

SIDE VIEW

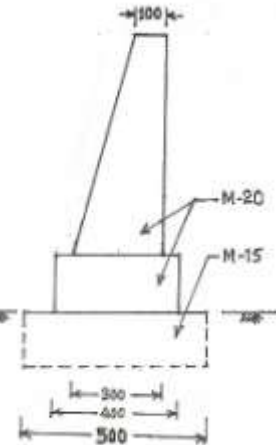
TYPE DESIGN FOR CONCRETE BOARDS (TYPE – B) DESTINATION BOARDS :



PERSPECTIVE VIEW

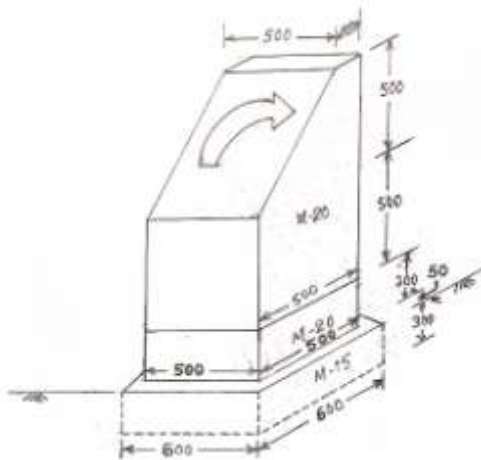


ELEVATION

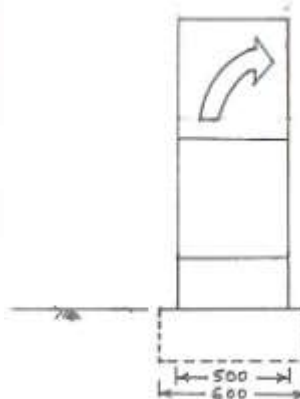


SIDE VIEW

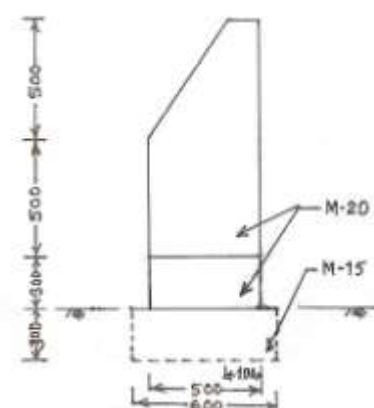
TYPE DESIGN FOR CONCRETE BOARDS (TYPE – C) CAUTIONARY BOARDS :



PERSPECTIVE VIEW



ELEVATION



SIDE VIEW

ROAD MAP OF CHHATTISGARH

