Extract of Miscellaneous tables useful in execution of the work

Embankment upto 3 meter – Soil density & Compaction

S. No.	Type of Work	Maximum laboratory dry unit weight when tested as per IS:2720 (Part-7)
1	Embankment upto 3 meters height	Not less than 14.4 kN/M^3
2	Embankment exceeding 3 meters height	Not less than 15.2 kN/M^3
3	Sub-grade and earthen shoulders/verges/backfill	Not less than 16.5 kN/M^3

Notes:

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

S. No.	Type of Work	Relative compaction as percentage of Max laboratory dry density as per IS:2720 (Part-7)
1	Sub-grade and earthen shoulders.	Not less than 100%
2	Embankment	Not less than 97%

Grading for granular sub-base materials (Locally available material).

Table ***400-1 (as per MORTH specification)for Item No 4.9***

IS sieve	Percent by Weight passing the sieve		
Designation	Grading I	Grading II	Grading III
75.0 mm	100	-	-
53.0 mm	-	100	-
26.5 mm	55.75	50-80	100
4.75 mm	10.30	15-35	25-45
0.075 mm (75 micron)	< 10	< 10	< 10

Grading for granular sub-base materials.

Table ***400.1 (as per MORD specification)for Item No 4.1& 7.3***

IS Sieve Designation	Percentage by Weight Passing the IS sieve		
	Grading I	Grading II	Grading III
75 mm	100	-	-
53 mm	-	100	-
26.50 mm	55-75	50-80	100
9.5 mm	-	-	-
4.75 mm	10-30	15-35	25-45
2.36 mm	-	-	-
0.425 mm	-	-	-
0.075 mm	< 10	< 10	< 10

Note :

1- The Materials passing 425 micron (0.425mm) sieve for all the three grading when tested according to IS:2720 (Part 5) shall have liquid limit and plasticity index not more than 25% and 6% respectively.

2- The minimum CBR value for GSB material shall not be less than 20.

Gravel / Soil-Aggregate Base & Surface course

Table 402.2 : **Grading Requirement for Base Course (GSB Roads)**

Sieve Size	Per cent by Mass Passing IS Sieve Grading Designation		
	A	B	C
53 mm	100		
37.5 mm	97-100	100	
26.5 mm		97-100	100
19 mm	67-81		97-100
9.5 mm		56-70	67-79
4.75 mm	33-47	39-53	47-59
0.425 mm	10-19	12-21	12-21
0.075 mm	4.0-8.0	4.0-8.0	4.0-8.0

Table 402.3 : **Grading Requirement for Surface Course (GSB Roads)**

IS Sieve	Per cent by Mass Passing Designated Sieve
26.5 mm	100
19 mm	97-100
4.75 mm	41-71
0.425 mm	12-28
0.075 mm	9-16
Platicity Index	4-10

Approximate Quantities of Coarse Aggregate and Screening Required for 100/75mm compacted thickness of Water Bound Macadam (WBM) sub-base/base/Surface course for 10sqm area.

Classification	Size Range	Compacted Thickness	Loose Quantity	Screenings			
				Stone Screenings		Crushable type such as Moorum of Gravel	
				Grading Classification size	For WBM sub-base/base course (Loose Qty.)	Properties	Loose Qty.
	Sqm	mm	cum		cum		cum
Grading-I	90 mm to 45 mm	100	1.21 to 1.43	Type A 13.2 mm	0.27 to 0.30	LL<20;PI<6 Percent passing0.075mm<10	0.30 to 0.32 m^3
Grading-II	63 mm to 45 mm	75	0.91 to 1.07	Type A 13.2 mm	0.12 to 0.15	-----do----	0.22 to 0.24 m^3
Grading-II	63 mm to 45 mm	75	0.91 to 1.07	Type B11.2 mm	0.20 to 0.22	-----do----	0.22 to 0.24 m^3
Grading-III	53 mm to 22.4 mm	75	0.91 to 1.07	Type B11.2 mm	0.18 to 0.21	-----do----	0.22 to 0.24 m^3

Grading requirement for coarse agregates.

Grading No.	Size Range	IS Sieve Designation	Percent by weignt Passing
I.	90 mm to 45 mm	125 mm	100
		90 mm	90-100
		63 mm	25-60
		45 mm	0-15
		22.4 mm	0-5
II	63 mm to 45 mm	90 mm	100
		63 mm	90-100
		53 mm	25-75
		45 mm	0-15
		22.4 mm	0-5
III	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

Note – The compacted thickness for a layer with Grading I shall be 100 mm while for layer with other gradings i.e. II and III, it shall be 75 mm

Grading for Screenings for WBM.

Grading Classification	Size Range	IS Sieve Designation	Percent by weignt Passing
A.	13.2 mm	13.2 mm	100
		11.2 mm	95-100
		5.6 mm	15-35
		180 micron	0-10
B.	11.2 mm	11.2 mm	100
		5.6 mm	90-100
		180 micron	15-35

TABLE 500-10. OF MORTH SPECIFICATION, CLAUSE 507

COMPOSITION OF DENSE GRADED BITUMINOUS MACADAM PAVEMENT LAYERS

For Item No 5.13

Grading	**1**	**2**
Nominal aggregate size	**40mm**	**25mm**
Layer Thickness	**80-100mm**	**50-75mm**
IS Sieve[1] (mm)	**Cumulative % by weight of total aggregate passing**	
45	100	
37.5	95-100	100
26.5	63-93	90-100
19	-	71-95
13.2	55-75	56-80
9.5	-	-
4.75	38-54	38-54
2-36	28-42	28-42
1.18	-	-
0.6	-	-
0.3	7-21	7-21
0.15	-	-
0.075	2-8	2-8
Bitumen content % by mass of total mix[0]	Min 4.0	Min 4.5
Bitumen grade (pen)	VG-30 or VG-10	VG-30 or VG-10

Note:

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

2- Determined by the Marshall method.

TABLE 500-15 OF MORTH SPECIFICATION, CLAUSE 508

COMPOSITION OF SEMI DENSE BITUMINOUS CONCRETE PAVEMENT LAYERS

For Item No 5.14

Grading	**1**	**2**
Nominal aggregate size	**13mm**	**10mm**
Layer Thickness	**35-40mm**	**25-30mm**
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[0]	Min 4.5	Min 5.0
Bitumen grade (pen)	VG-30 or VG-10*	VG-30 or VG-10*

Note:

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

2- Determined by the Marshall method.

* Only in exceptional circumstances, VG-10 grade may be used, as approved by the Engineer

Modified Penetration Macadam

Rate of application of aggregates and bitumen for 10 sq.m area.

Description	Thickness of the modified penetration macadam layer			
	75 mm		50 mm	
	On bitumenous surface (cum)	On WBM surface (cum)	On bitumenous surface (cum)	On WBM surface (cum)
a) 40 mm size hand broken metal	0.9	0.9	0.6	0.6
b) 12 mm size stone chips	0.18	0.18	0.18	0.18
c) Bitumen for grouting (kg)	20	20	17.5	17.5

Note : Tack coat shall be applied as per clause 503.

Quantities of materials Required for 10 Sqm. Of Road surface for 20mm Thick premix surfacing using penetration bitumen or cutback.

Aggregates		
(a)	Nominal Stone size 13.2 mm (passing 22.4 mm sieve and retained on 11.2 mm sieve)	0.18 m^3
(b)	Nominal Stone size 11.2 mm (passing 13.2 mm sieve and retained on 5.6 mm sieve)	0.09 m^3
	Total	**0.27 M^3**
Binder (Quantities in Terms of Straight run bitumen)		
(a)	For 0.18 m^3 of 13.2 mm nominal size stone at 52 kg bitumen per m^3	9.5 kg.
(b)	For 0.09 m^3 of 11.2 mm nominal size stone at 56 kg bitumen per m^3	5.1 kg.
	Total	**14.6 Kg.**

Quantity requirement of binder for seal coat for 10 Sq.m area

Type of seal coat	***Bitumen (Kg)***	***Bituminous emulsion(Kg)***
Type A : Liquid seal coat	***9.8***	***12 to 14***
Type B : Premix seal coat	***6.8***	***10 to 12***
Type C : Premix seal coat using stone chips of 6.7 mm size	***4.5% by weight of total mixture***	***9 to 11***

Quality Control for Road Work

Tolerances in Surface Levels.

1	Sub-Grade	+ 20 mm - 25 mm
2	Sub=base (a)Flexible Pavement (b)Concrete Pavement (Dry Lean Concrete or rolled concrete)	 + 10 mm - 20 mm + 6 mm - 10 mm
3	Base Course for flexible pavement, a) Bituminous Course b) Other than bituminous. i) Machine laid ii) Manually laid	 + 6 mm - 6 mm + 10 mm - 10 mm + 15 mm - 15 mm
4	Wearing Course for Flexible Pavement. i) Machine laid ii) Manually laid	 + 6 mm - 6 mm + 10 mm - 10 mm
5	Cement Concrete Pavement.	+5 mm - 6 mm*

* This may not exceed – 8mm at 0-30 cm from the edges.

Other 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	12.577

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	2.325	1.848
5	4.620	3.624
8	6.036	4.740

d) Structural Steel (Sections which are normally required in bridge work)

Type of Section	Size in MM	Weight Kg / M
Angle	40 × 40 × 6	3.500
	50 × 50 × 6	4.500
	75 × 75 × 6	6.800
	75 × 75 × 10	11.00
	100 × 100 × 6	9.200
	100 × 100 × 10	14.900
	130 × 130 × 10	19.700
	130 × 130 × 12	23.400
Tee	100 × 100 × 10	15.00
Channel	75 × 40 × 6	5.700

e) <u>Structural Flats</u> (Sections which are normally required in bridge work)

Thickness of Plate	Weight 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.

S. No.	Material	Unit Metric	Weights in KG
1	Cement	Cum	1440
2	Steel		
	a) Mild Steel	Cu. Cm.	0.00784
	b) Cast Steel	Cu. Cm.	0.00784
	c) H.T. Steel	Cu. Cm.	0.00784
3	Stainless Steel	Cu. Cm.	0.00784
4	Lead	Cu. Cm.	0.0113
5	Plain Cement Concrete or R.C.C.	Cu. M.	2306 to 2400
6	Stones		
	a) Lime	Cum	2650
	b) Sand	Cum	2800
7	Stone Masonry Rubble	Cum	2100
8	Bricks	Cum	1600
9	Bricks Masonry	Cum	1920
10	Timber	Cum	650 to 720

3. Conversion Factors

Top Convert.	Into	Multiply	
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	Hactare	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	35.147
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
Lbs. Per Sq. Inch	Tonne Per Sq. M.	10.937	0.0914