PARTICULARS OF LOAN / ADVANCES DRAWN

NATURE	Amount Received	Instalments	Reference No.
G.P.F			
Festival			
Handloom			
Marriage			
Vehicle			
HBA			
Others			

T.A. BILL PARTICULARS FOR THE YEAR 2026

Month	Date of Submission	Amount Claimed	Amount Received	Date of Receipt
Jan				
Feb				
Mar				
Apr				
May				
Jun				
Jul				
Aug				
Sep				
Oct				
Nov				
Dec				

PARTICULARS OF LEAVE AVAILED IN 2026

KIND OF LEAVE CASUAL / EARNED / MEDICAL	No.of DAYS	FROM	TO

PAY DRAWN PARTICULARS - 2026

G.P.F / C.P.S A/C No : **Pay level :**

PARTICULARS	JANUARY Rs.	FEBRUARY Rs.	MARCH Rs.
Pay			
D.A			
H.R.A			
C.C.A			
Medical Allowance			
Other Allowance			
GROSS AMOUNT			
Festival Advance			
Spl. P.F. 2000			
F.S.F			
G.P.F / C.P.S Subscription			
G.P.F / C.P.S Subscription / Arrears / Advance			
P.L.I			
Professional Tax			
Quarters Rent			
HBA			
HBA-SFBF			
MCA / OCA			
Int.on MCA / OCA			
H.L.A			
Income Tax			
Income Tax Cess			
TOTAL RECOVERIES			
NET AMOUNT			
Pongal Gift			
DA Arrears			
Surrender Leave			
Leave Salary			
Name of Treasury			
Token No & date			
Date of Encashment			

PAY DRAWN PARTICULARS - 2026

G.P.F / C.P.S A/C No : **Pay level :**

PARTICULARS	APRIL Rs.	MAY Rs.	JUNE Rs.
Pay			
D.A			
H.R.A			
C.C.A			
Medical Allowance			
Other Allowance			
GROSS AMOUNT			
Festival Advance			
Spl. P.F. 2000			
F.S.F			
G.P.F / C.P.S Subscription			
G.P.F / C.P.S Subscription / Arrears / Advance			
P.L.I			
Professional Tax			
Quarters Rent			
HBA			
HBA-SFBF			
MCA / OCA			
Int.on MCA / OCA			
H.L.A			
Income Tax			
Income Tax Cess			
TOTAL RECOVERIES			
NET AMOUNT			
Pongal Gift			
DA Arrears			
Surrender Leave			
Leave Salary			
Name of Treasury			
Token No & date			
Date of Encashment			

PAY DRAWN PARTICULARS - 2026

G.P.F / C.P.S A/C No : **Pay level :**

PARTICULARS	JULY Rs.	AUGUST Rs.	SEPTEMBER Rs.
Pay			
D.A			
H.R.A			
C.C.A			
Medical Allowance			
Other Allowance			
GROSS AMOUNT			
Festival Advance			
Spl. P.F. 2000			
F.S.F			
G.P.F / C.P.S Subscription			
G.P.F / C.P.S Subscription / Arrears / Advance			
P.L.I			
Professional Tax			
Quarters Rent			
HBA			
HBA-SFBF			
MCA / OCA			
Int.on MCA / OCA			
H.L.A			
Income Tax			
Income Tax Cess			
TOTAL RECOVERIES			
NET AMOUNT			
Pongal Gift			
DA Arrears			
Surrender Leave			
Leave Salary			
Name of Treasury			
Token No & date			
Date of Encashment			

PAY DRAWN PARTICULARS - 2026

G.P.F / C.P.S A/C No : **Pay level :**

PARTICULARS	OCTOBER Rs.	NOVEMBER Rs.	DECEMBER Rs.
Pay			
D.A			
H.R.A			
C.C.A			
Medical Allowance			
Other Allowance			
GROSS AMOUNT			
Festival Advance			
Spl. P.F. 2000			
F.S.F			
G.P.F / C.P.S Subscription			
G.P.F / C.P.S Subscription / Arrears / Advance			
P.L.I			
Professional Tax			
Quarters Rent			
HBA			
HBA-SFBF			
MCA / OCA			
Int.on MCA / OCA			
H.L.A			
Income Tax			
Income Tax Cess			
TOTAL RECOVERIES			
NET AMOUNT			
Pongal Gift			
DA Arrears			
Surrender Leave			
Leave Salary			
Name of Treasury			
Token No & date			
Date of Encashment			

Technical

PCU FACTORS FOR VARIOUS TYPES OF VEHICLES ON RURAL ROADS (IRC : 64 - 1990) (Table 1)		
S. No.	**Vehicle Type**	**PCU Equivalency Factor**
Fast Vehicles		
1	Two Wheelers : Motor Cycle or Scooter	0.50
2	Passenger Car, Pick-up Van or Auto-Rickshaw	1.00
3	Agricultural Tractor, Light Commercial Vehicle	1.50
4	Truck or Bus	3.00
5	Truck-Trailer, Agricultural Tractor-Trailer	4.50
Slow Vehicles		
6	Cycle	0.50
7	Cycle Rickshaw	2.00
8	Hand Cart	3.00
9	Horse-drawn Vehicle	4.00
10	Bullock Cart*	8.00
** For smaller bullock carts, a value of 6 will be appropriate*		

PCU FACTORS FOR VARIOUS TYPES OF VEHICLES ON URBAN ROADS (IRC : 106 - 1990) (Table 1)			
S. No.	**Vehicle Type**	**Equivalent PCU factors / % composition of vehicle type in traffic stream**	
		5%	**10% and above**
Fast Vehicles			
1	Two wheelers : Motor Cycle or Scooter etc.,	0.5	0.75
2	Passenger Car, Pick-up Van	1.0	1.0
3	Auto Rickshaw	1.2	2.0
4	Light Commercial Vehicle	1.4	2.0
5	Truck or Bus	2.2	3.7
6	Agricultural Tractor-Trailer	4.0	5.0
Slow Vehicles			
7	Cycle	0.4	0.5
8	Cycle Rickshaw	1.5	2.0
9	Tonga (Horse-drawn Vehicle)	1.5	2.0
10	Hand Cart	2.0	3.0

DESIGN SPEED FOR NH/SH/MDR/ODR/VR: AS PER TABLE 3.2 OF IRC:73-2023										
Sl. No.	Nature of Terrain	Percent Cross Slope of the Country	Design Speed for 4/6/8 - Lane NH/SH (Kmph)		Design Speed for 2 Lane NH/SH (Kmph)		Design Speed for MDR (Kmph)		Design Speed for ODR/VR (Kmph)	
			Ruling	Min	Ruling	Min	Ruling	Min	Ruling	Min
1.	Plain	0 - 10	100	80	100	80	80	65	50	40
2.	Rolling	10 - 25	100	80	100	80	65	50	50	40
3.	Mountainous	25 - 60	60	40	50	40	40	30	30	20
4.	Steep	> 60	60	40	40	30	30	20	30	20

RECOMMENDED RIGHT-OF-WAY FOR HIGHWAYS AND EXPRESSWAYS: AS PER TABLE 4.1 OF IRC:73-2023		
Sl. No.	Road Classification	Minimum Right of Way
1.	2 - Lane Highways	30 m
2.	4 - Lane Highways	45 m
3.	6 - Lane Highways	60 m
4.	8 - Lane Highways	120 m
5.	Expressways	90 - 120 m
6.	2 - Lane Highways with Bypasses	45 - 60 m
7.	2 - Lane Highways in Open Areas (Mountainous and Steep Terrain)	24 m & 18 m (Exceptional)
8.	2 - Lane Highways in Built-up Areas (Mountainous and Steep Terrain)	20 m & 18 m (Exceptional)

RECOMMENDED RIGHT-OF-WAY FOR OTHER CLASSES OF ROADS: AS PER TABLE 4.2 OF IRC:73-2023									
Sl. No.	Road Classification	Plain & Rolling Terrain in m				Mountainous & Steep Terrain in m			
		Open Areas		Built-up Areas		Open Areas		Built-up Areas	
		Normal	Range	Normal	Range	Normal	Range	Normal	Range
1.	MDR	25	25-30	20	15-25	18	15	15	12
2.	ODR	15	15-25	15	15-20	15	12	12	9
3.	VR	12	12-18	10	10-15	9	9	9	9

WIDTH OF PAVED SHOULDER FOR 2/4/6/8 LANE HIGHWAYS:

i. For Plain and Rolling Terrain

Type of Section	Width of Shoulder (m)			Extra Earthen Width (m)
	Paved	Earthen	Total	
Open Country with Isolated Built-Up Area	1.5	1.0	2.5	1.0*
Built-up Area **	2.5	-	2.5	-
Approaches to Grade Separated Structures/Bridges/RoB with full Height RS wall/Retaining Wall**	2.5	-	2.5	-
Approaches to Bridges/Grade Separated Structures/RoB with free slope	1.5	1.0	2.5	1.0*

Note: 2.50m width of Paved Shoulder has been recommended for Open Country with Isolated Built-up Area **in IRC:SP:73-2018 (2-Lane Highways), IRC:SP:84-2019 (4-Lane Highways) & IRC:SP:87-2019 (6-Lane Highways). Now, the same has been revised as 1.50 m vide** MORT&H Circular No.RW/NH-33044/22/2020/S&R (P&B),Dated 4th June 2024.

ii. *For Mountainous and Steep Terrain (Hilly Areas)*

Type of Section	Side	Width of Shoulder (m)			Extra Earthen Width (m)
		Paved	Earthen	Total	
Open Country with Isolated Built-up Area	Hill Side	1.0	-	1.0	-
	Valley Side	1.0	0.5	1.5	1.0*
Built-up Area **	Hill Side	1.0	-	1.0	-
	Valley Side	1.0	-	1.0	-
Approaches to Grade Separated Structures/Bridges/RoB with full Height RS wall/Retaining Wall**	Hill Side	1.0	-	1.0	-
	Valley Side	1.0	-	1.0	-
Approaches to Bridges/Grade Separated Structures/RoB with free slope	Hill Side	1.0	-	1.0	-
	Valley Side	1.0	0.5	1.5	1.0*

**, ** Refer above Circular for more details*

RADII OF HORIZONTAL CURVE FOR EW/NH/SH: AS PER TABLE 6.1 OF IRC:73-2023		
Nature of Terrain	**Desirable Minimum Radius**	**Absolute Minimum Radius**
Palin & Rolling (Expressways)	1000 m	650 m
Palin & Rolling (NH/SH)	400 m	250 m
Mountainous & Steep (NH/SH)	150 m	75 m

MINIMUM RADII OF HORIZONTAL CURVE FOR MDR/ODR/VR: AS PER TABLE 6.2 OF IRC:73-2023

Classification of Road	Plain Terrain		Rolling Terrain		Mountainous Terrain				Steep Terrain			
					Area not affected by snow		Snow bound areas		Area not affected by snow		Snow bound areas	
	Ruling Minimum (m)	Absolute Minimum (m)	Ruling Minimum (m)	Absolute Minimum (m)	Ruling Minimum (m)	Absolute Minimum (m)	Ruling Minimum (m)	Absolute Minimum (m)	Ruling Minimum (m)	Absolute Minimum (m)	Ruling Minimum (m)	Absolute Minimum (m)
MDR	230	155	155	90	50	30	60	33	30	14	33	15
ODR/VR	90	60	90	60	30	13	33	15	30	13	33	15

EXTRA WIDTHOF PAVEMENTAT HORIZONTALCURVES:

i. For 2/4/6/8 Lane Highways: As per Table 6.6 of IRC:73 -2023.

Radius of Curve	Extra Width
75 - 100 m	0.9 m
101 - 300 m	0.6 m

ii. For MDR/ODR/VR: AS per Table 6.7 of IRC:73 -2023.

Radius of Curve (m)	Upto 20	21 - 40	41 - 60	61 - 100	101 - 300
Two Lane	1.5 m	1.5 m	1.2 m	0.9 m	0.6 m
Single Lane	0.9 m	0.6 m	0.6 m	Nil	Nil

Cl.6.5.3 of IRC:73-2023 shall be referred for Method of Widening

Pavement Camber (as per IRC 73-2023; Cl.4.7)

- The cross falls on straight sections of road carriageway. Paved shoulders and paved portion of median shall be 2.5.percent for bituminous surface and 2.0 percent for cement concrete surface for all classes of roads.
- For 2/4/6/8 lane highways, the cross fall for earthen shoulders on straight portions shall be at least 0.5 percent and desirably 1.0 percent steeper than the slope of the pavement and paved shoulder.
- In case of expressways, the cross falls for earthen/granular shoulders on straight portions shall be at least 1.0 percent steeper than the slope of the pavement and paved shoulder.

SUPER ELEVATION: Refer IRC:38-1988

Super Elevation $e = V^2/225R$

Where, V = Design Speed in Kmph

R = Radius in meter

Maximum allowable Super Elevation:

i. For 2/4/6/8 Lane Highways

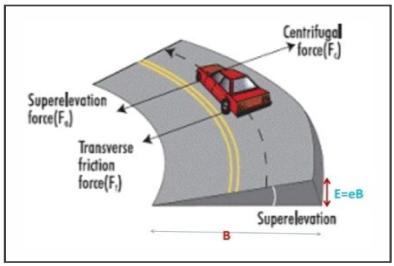
- *'e'* shall be limited to 7 % if the radius is less than the Ruling minimum
- *'e'* shall be limited to 5 % if the radius is more than or equal to the Ruling minimum as well as sections where project highway passes through urban section or falls on a major junction.

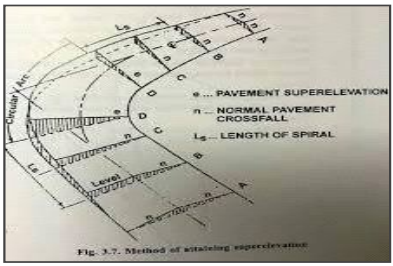
ii. For MDR/ODR/VR

- Maximum limit of Super Elevation is 7 %. For Hilly areas not bounded by snow, e is 10 %.

Attaining Super Elevation from straight section to circular curve portion:

- The normal cambered straight section of the road is changed into super elevated section on entering the circular curve portion in two stages.
- In first stage, the outer half of normal section (A) shall be brought to level in line with the centre (B).
- In second stage, it (B) shall be changed over to super elevated section (D) over full length of transition curve (Ls).
- In case transition curve is not there or adequate length can not be provided due to some reason, two-third super elevation shall be attained on straight reach and balance one-third on circular curve.
- This rate of change of super elevation should not be steeper than 0.66 percent (1 in 150) for roads in plain.
- The length of transition for different speed and curve radii shall be as per IRC:38-1988.





Relation between R and V:

$$R=0.0358\ V^2$$

Where R = Radius of the horizontal curve and V = Design Speed

Remedial measures to be proposed at acute curve locations:

- If proper radius of curve for a particular project road could not be provided as per standard due to site constraints or restricted RoW, the speed of the vehicles shall be reduced.
- Here, a speed limit board as per above formula shall be provided in addition to two sets of Transverse Bar Marking on both sides of curve as per IRC:35-2015 and IRC:99-2018.
- The curve shall be designed as transition cum circular curve and 7% of super elevation shall be attained as per procedure explained as above.
- Also, proper visibility shall be ensured clearing jungles and bushes if any at the inner curve portion.

GRADIENTS:

i. For 2/4/6/8 Laned Highways: As per Table 7.1 of IRC:73-2023

Sl. No.	Terrain	Ruling Gradient	Limiting Gradient
1.	Plain & Rolling	2.5 Percent (1 in 40)	3.3 Percent (1 in 30)
2.	Mountainous	5.0 Percent (1 in 20)	6.0 Percent (1 in 16.7)
3.	Steep	6.0 Percent (1 in 16.7)	7.0 Percent (1 in 14.3)

i. For MDR/ODR/VR: As per Table 7.2 of IRC:73-2023

Sl. No.	Terrain	Ruling Gradient	Limiting Gradient	Exceptional Gradient
1.	Plain & Rolling	3.3 Percent (1 in 30)	5 Percent (1 in 20)	6 Percent (1 in 16.7)
2.	Mountainous	5.0 Percent (1 in 20)	7 Percent (1 in 14.3)	10 Percent (1 in 10)
3.	Steep	6.0 Percent (1 in 16.7)	8 Percent (1 in 12.5)	10 Percent (1 in 10)

MINIMUM VERTICAL CLEARANCE OF UNDERPASS/OVERPASS: AS PER TABLE 9.2 OF IRC:73-2023

Sl. No.	Type of Underpass/Overpass	Min Vertical Clearance (m)	Remarks
1.	Vehicular Underpass	5.5	-
2.	Light Vehicular Underpass	4.0	-
3.	Smaller Vehicular Underpass	4.0	-
4.	Pedestrian Underpass	3.0	-
5.	Cattle Underpass	3.0	-
6.	Vehicular Overpass	5.5	Clear Height of 5.50m should be available to pass the vehicle. It is defined as maximum road level at crossing to soffit level at lowest level.

For ROB - The Horizontal and vertical clearance to be provided shall be as per requirement of Railway authorities (as per Cl - 7.18.2 of IRC SP13-2018)

MINIMUM DISTANCE FROM INTERSECTION TO FUEL STATIONS ON NON-URBAN STRETCHES: AS PER TABLE 10.1 OF IRC:73-2023

Sl. No.	Type of Terrain	Distance
1.	Plain & Rolling Terrain	
	Intersection with NHs/SHs/MDRs	300 m
	Intersection with Rural Roads/Approach Roads to public and private properties	300 m
2.	Hilly & Mountainous Terrain	
	Intersection with NHs/SHs/MDRs	100 m
	Intersection with all other roads and tracks	100 m

for more details, please refer Cl. 10. 6 of IRC: 73-2023, IRC: 12-2016 and recent MORT&H Circular

GRADE SEPARATOR - IRC : SP: 90-2023

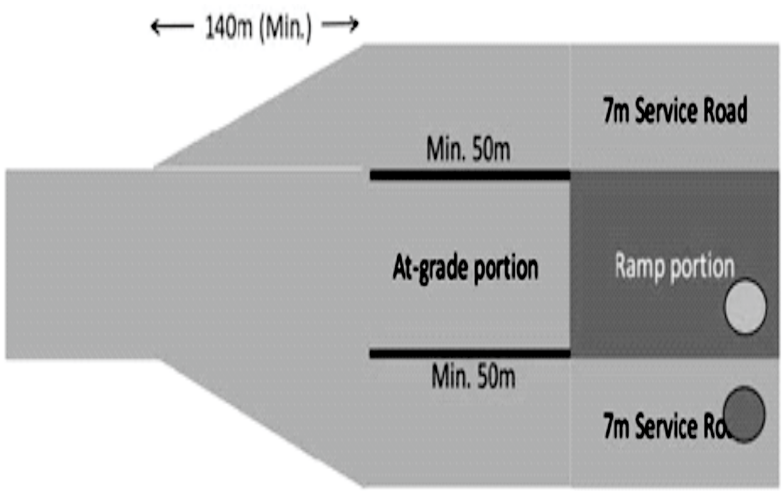
Cl. 3.11.4 (iii) : "An interchange at an at-grade intersection may be provided when the total traffic the total traffic of all the arms of the intersection is in excess of 10000 PCU's per hour."

Cl.3.8.1.1 (a) : "It may be desirable to have a grade separated facility at an intersection between two National Highways or between a NH and SH or, NH/SH crossing a village road even though, the level of congestion may not immediately indicate the need for such a facility."

APPROACHES: IRC: SP-90-2023

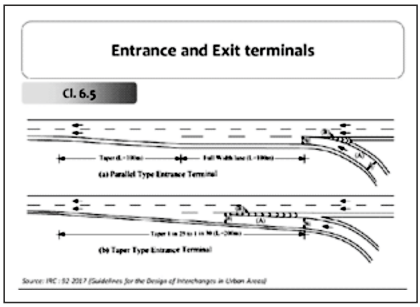
Cl.3.24 (Vi) : In order to avoid crisscrossing of pedestrians at start & end of approaches to the structures, New Jersey Type Concrete Crash Barrier (NJB) or Steel Railing with a height of 1.2m (to make it unclimbable) shall be provided for a min. length of 50m, so as to discourage such crisscrossing and avoid accidents.

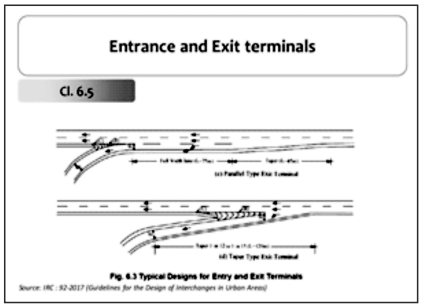
- If high pedestrian crossing, even FOBs shall be planned.



Source: IRC:SP:90-2023 (Guidelines for Grade Separators and Elevated Structures)

ENTRANCE AND EXIT TERMINALS: (IRC: 92-2017)





CARRIAGEWAY WIDTH:

Cl.4.2 (Note 3) : "Where the carriageway width changes, e.g. from SL to DL or DL to 4L or vice versa, the transition should be effected through a taper of 1 in 15 when it is from narrower to wider and it shall be 1 in 20 when it is from wider to narrow"

CL.4.2(Note 4) : "Where the carriageway width changes from 4L to 6L or 8L or vice-versa, the transition should be affected through a taper of 1 in 50"

CL.4.1.(II) : "The carriageway width on the connection one-way loops or curved structures shall be not less than equal to 2-lanes."

CL.13.2.1 : The overall widths adopted for culverts and small bridges for 2-lane carriageway are as follows:-NH and SH: 12m Minimum -MDR: 8.4m

CL.4.6.3 : At bridges and causeways, the clear width of roadway between kerbs should be more than or equal to the width of the approaching roadway in any case.

BYPASSES:

- The width of Carriageway for Bypass shall be at least Two Lane with Paved Shoulders irrespective of the traffic as per MoRT&H Circular No.NH-14019/6/2012-P&M, Date 5th October 2012.
- The Bypass alignment shall be decided based on Desire Line Diagram (DLD) using O-D Survey as per IRC : 102-2022: Planning for Bypasses Around Towns (first Revision).
- The Bypasses shall not start from the existing Highway forming T Intersection. It is desirable to give priority to the bypass traffic. Hence, the Take off point of the Bypasses shall be at an acute angle on a large radius from the existing Highway leading to the town/city. The existing road shall be realigned to join with the bypass in a T or Y Intersection.
- Drawings enclosed in IRC:102-2022 shall be referred in this regard.

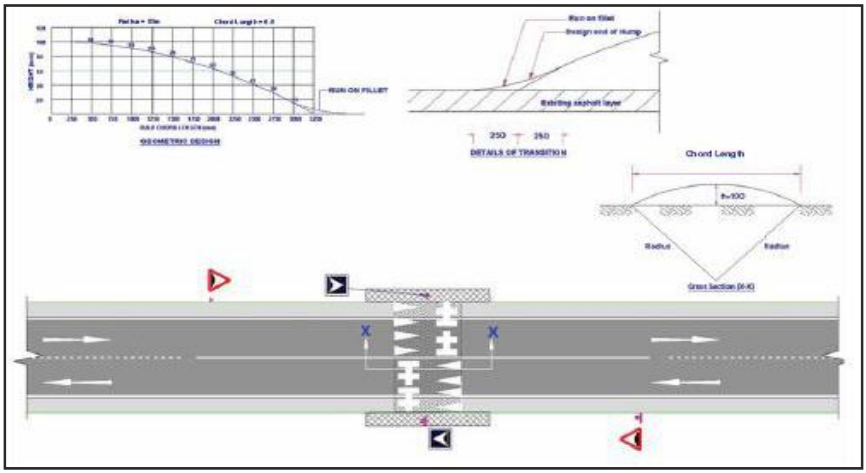
GEOMETRICALIMPROVEMENTS TO INTERSECTION :

- The design elements of Intersection such as Turning Radius, Width at Intersection, Central and Directional Island, Storage Lane, Acceleration and Deceleration Lanes shall be decided based on IRC:SP:41 -1994. The TYPE DESIGNS FOR INTERSECTIONS published by MoRT&H, Section 3 of IRC:SP:73-2018 and IRC:SP:84-2019 shall also be referred in this regard.
- Proper visibility shall be ensured at all Intersections to prevent accidents.
- Relevant portion of IRC:35 -2015 shall be referred for Lane Marking and Studs.
- Crowding of Sign Boards shall be avoided at the Intersection. Only important and necessary Signs shall be provided based on Sign Plans in Annexure V of IRC:67-2022.
- Speed Calming Measures shall be done based on IRC:99-2018.

CALMING SPEED MEASURES: AS PER IRC:99-2018: GUIDELINES FOR TRAFFIC CALMING MEASURES IN URBAN AND RURAL AREAS

i. **Circular Speed Breaker (Circular Hump): As per Cl.3.1.1.1 of IRC:99-2018**

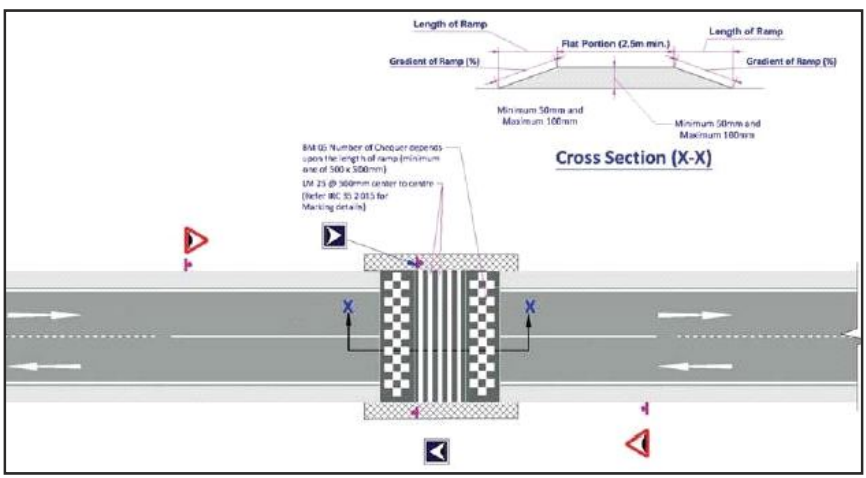
- The profile of circular shaped hump in based on the shape of circular arc with a radius varying from 11m to 113m and a chord Length varying from 3.0 m to 9.5 m to achieve a desired speed of 20 km/hr to 50 km/hr
- The height of the hump shall be exactly 10 cm.
- The road marking over the Hump shall be as per below and IRC:35-2015.



Geometric details of Circular Hump as per Fig.3.1 of IRC:99-2018

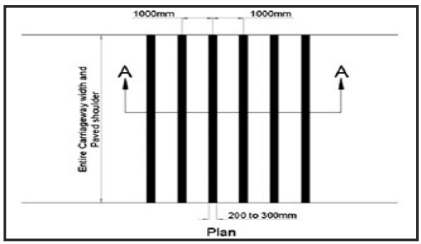
ii. Trapezoidal Hump: As per Cl.3.1.1.2 of IRC:99-2018

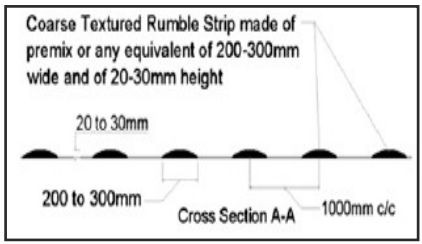
- The Flat portion shall be 2.5 m minimum and the Ramp Portion shall be 0.70 m to 2.5m for a desired speed of 20km/h to 50km/h as per Table 3.2 of IRC:99-2018.
- The height of the hump shall be minimum 50 mm to maximum 100 mm
- The road marking over the Hump shall be as per below and IRC:35-2015.



Geometric details of Trapezoidal Hump as per Fig.3.2 of IRC:99-2018

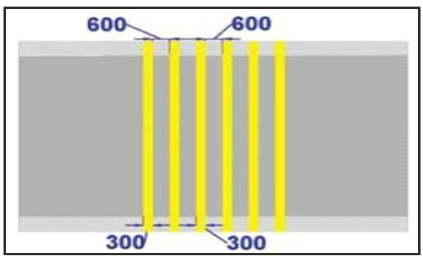
iii. Rumble Strip: As per Cl.2.3.3.3 of IRC:99-2018



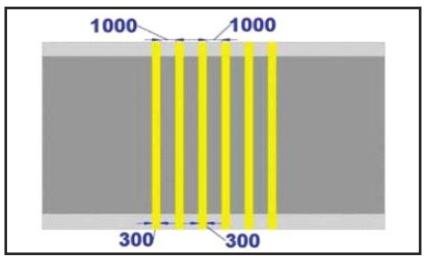


- Properly designed Rumble Strips can be provided at NHs and SHs where speed restrictions are required.
- The rumble strip can be cast in situ with cement concrete or premix bituminous materials.
- The raised section should be 20 mm to 30 mm high, 200-300 mm wide spaced at 1.0 m centre to centre of roughly 6 numbers at one location as per Fig.2.6 of IRC:99-2018.

iv. Transverse Bar Markings: As per Cl.2.3.3.4 of IRC:99-2018



TBM with 5mm Height & 600mm Gap



TBM with 15mm Height & 1000mm Gap

- Two types of Thermoplastic bar Marking has been mentioned in IRC:99-2018
- 1.Thermoplastic Marking of 5mm height of 300mm wide at 600 mm apart.
- 2. Thermoplastic Marking of 15mm height of 300mm wide at 1000 mm apart.
- One set is of six strips.
- **5mm height is achieved through two applications of Thermoplastic and 15mm height is achieved through six applications of Thermoplastic, applied at an interval not less than 1 hour, after each layer gets solidified.**
- **The Number of Sets shall be decided based on approach speed of the Vehicles as per Table 11.1 of IRC:35-2015.**

Approach Speed	Bar Marking (TM 08)	Distance (d1, d2, d3 & d4) from Hazard
Upto 50 Kmph	1 Set	d1 = 50m
51 - 65 Kmph	2 Sets	d1 = 50m, d2 = 80m
66 - 80 Kmph	3 Sets	d1 = 50m, d2 = 80m, d3 = 120m
81 - 100 Kmph	4 Sets	d1 = 50m, d2 = 80m, d3 = 120m, d4 = 180m

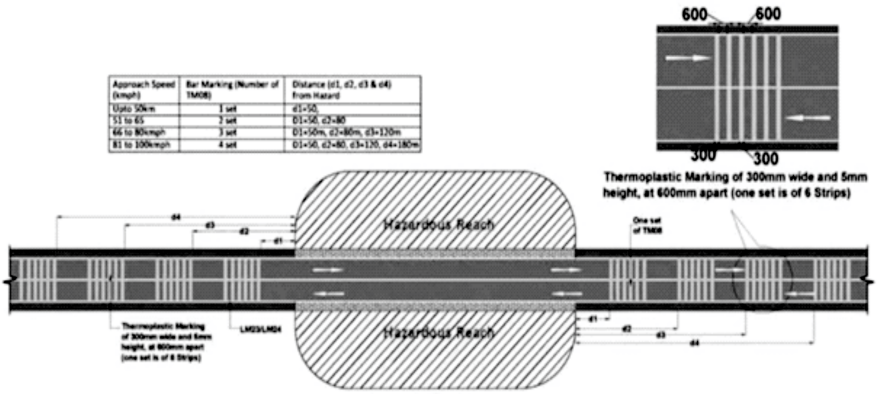


Fig. 11.2 Bar Marking

Fig 11.2 of IRC : 35-2015

v. Other Speed Calming Measures: As per Cl.2.3.3.4 of IRC:99-2018

i. Speed tables, ii. Raised Crossings, iii. Raised Intersections, iv. Textured Pavements & v. Roundabouts.

vi. Work Zone Safety: Shall be done as per IRC:SP:55 -2015 during execution.

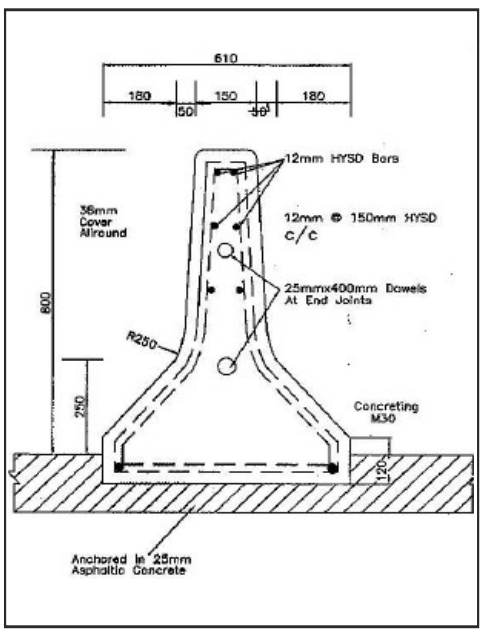
GEOMETRICAL IMPROVEMENTS OF HORIZONTAL CURVE:

- Horizontal Curve shall be geometrically improved as per IRC:38 -1988 when sufficient RoW is available with proper radius.

IRC:119-2015: GUIDELINES FOR TRAFFIC SAFETY BARRIERS

- W Beam steel Barrier shall be provided based on IRC:119 -2015.

- Concrete Barrier at Four Lane reaches for a width of 0.61m may be proposed as per Fig.26 of IRC:119 -2015 to ensure uniformity through out the State.



EXTRACT OF SPECIFICATIONS FOR IMPORTANT ROAD AND BRIDGE WORKS (MORT&H REVISION - V)

GRANULAR SUBBASE: As PER Cl. 401 of MoRT&H Vth Revision and Cl.7.2 of IRC:37-2018

- Obtain mix design
- Necessary gradation of component materials shall be ensured during collection stage
- Ensure that the materials are brought from the quarry for which the design mix is obtained
- If the thickness of the sub-base layer provided in the design permits, the sub-base layer shall have two layers; drainage layer and the filter layer.
- The upper layer of the sub-base functions as a drainage layer to drain away the water that enters through surface cracks.
- The lower layer of the sub-base should function as the filter/separation layer to prevent intrusion of subgrade soil into the pavement.
- The minimum thickness of drainage as well as filter layer shall be 100 mm (i.e.,minimum thickness of each of these two layers is 100 mm).
- If the design thickness of the granular sub-base is less than or equal to 200 mm, both drainage and filter layers cannot be provided separately. For such cases, a single drainage-cum-filter layer with GSB gradation V or VI of MoRTH Specifications may be provided.
- The minimum thickness of the single filter-cum-drainage layer shall be 150 mm from functional requirement.
- The filter and drainage layers should be designed as per IRC:SP:42[24] and IRC:SP:50[25].
- It is necessary to extend both drainage and filter layers to full width up to the slope of the embankment to have efficient drainage.
- When GSB layer is also provided below the median in continuation with that of the pavement, a non-woven geo-synthetic may be provided over the GSB in the median part so that the fines percolating through the median do not enter into the GSB and choke it.
- The Optimum moisture content shall be maintained during mixing and compaction of Granular subbase
- Moisture content of the mix shall be checked and suitably adjusted so that, at the time of compaction, it is from 1 to 2 percent below the optimum moisture content.
- Rolling shall be continued till the density achieved is at least 98 percent of the maximum dry density for the material determined as per IS:2720 (Part 8).
- Excess of moisture shall be avoided as this leads to segregation of materials
- CBR Test shall be conducted for the GSB sample for comparison with the design mix

Table 400-1 : Grading for Granular Sub-Base Materials						
IS Sieve Designation	Percent by Weight Passing the IS Sieve					
	Grading I	Grading II	Grading III	Grading IV	Grading V	Grading VI
75.0 mm	100	-	-	-	100	-
53.0 mm	80-100	100	100	100	80-100	100
26.5 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

IRC:67-2022:

- Fourth Revision of Code of Practice for Road Signs has been published in 2022. The modifications recommended in existing Signs and New Signs included shall be referred from IRC:67-2022.

- For Example, the Cautionary Signs for School Ahead and Men at Work shall be as below.

- The Route Marker Sign for SH road has been modified in line with Route Marker Sign for NH. The Route Marker Sign for State Highway Roads may be placed as below for easy identification of SH roads. The BR in the Figure shall be replaced by TN to denote Tamilnadu.

Fig. 15.34 School Ahead

Fig. 15.42 People at Work

Fig. 22.01 State Highway Route Marker Sign

Fig. 22.02 National Highway Route Marker Sign

CLASSIFICATION OF CEMENT CONCRETE PIPES ACCORDING TO IS : 458 -2003		
Class	**Description**	**Conditions under which normally used**
NP1	Unreinforced Concrete non-pressure pipes	For drainage and irrigation use, above ground or in shallow trenches
NP2	Reinforced Concrete, light duty, non-pressure pipes	For drainage and irrigation use, for cross drains / culverts carrying light traffic
NP3	Reinforced and also unreinforced (in case of pipes manufactured by vibrated casting process) concrete, medium-duty, non-pressure pipes	For drainage and irrigation use, for cross drains / culverts carrying medium traffic
NP4	Reinforced and also unreinforced (in case of pipes manufactured by vibrated casting process) concrete, heavy-duty, non-pressure pipes	For drainage and irrigation use, for cross drains / culverts carrying heavy traffic
P1	Reinforced Concrete pressure pipes tested to a hydrostatic pressure of 0.2 MPa (20m head)	For use on gravity mains, the site test pressure not exceeding two - thirds of the hydrostatic test pressure
P2	Reinforced Concrete pressure pipes tested to a hydrostatic pressure of 0.4 MPa (40m head)	For use on pumping mains, the site test pressure not exceeding half of the hydrostatic test pressure
P3	Reinforced Concrete pressure pipes tested to a hydrostatic pressure of 0.6 MPa (60m head)	For use on pumping mains, the site test pressure not exceeding half of the hydrostatic test pressure
Note - The uses are only by way of recommendations as a general guidance and the exact usage shall be decided by the engineer-in-charge		

WET MIX MACADAM

- The WMM work Shall consist of laying and compacting clean, crushed, graded aggregate and granular material, premixed with water, to a dense mass on a prepared sub-grade/sub-base/base or existing pavement.
- The thickness of a single compacted Wet Mix Macadam layer shall not be less than 75mm. When vibrating or other approved types of compacting equipment are used, the compacted depth of a single layer of the sub-base course may be up to 200mm with the approval of the Engineer.
- If the thickness of single compacted layer does not exceed 100mm, a smooth wheel roller of 80 to 100KN weight may be used. For a compacted single layer up to 200 mm, the compaction shall be done with the help of vibratory roller of minimum static weight of 80 to 100 KN with an arrangement for adjusting the frequency and amplitude. The speed of the roller shall not exceed 5 Km/h.
- While constructing wet mix macadam, arrangement shall be made for the lateral confinement of wet mix. This shall be done by laying materials in adjoining shoulders along with that of wet mix macadam layer.
- Wet Mix Macadam shall be prepared in an approved mixing plant of suitable capacity having provision for controlled addition of water and forced/positive mixing arrangement like pug mill or pan type mixer of concrete batching plant.
- The wet mix should not vary from the optimum value by more than agreed limits. The mixed material should be uniformly wet and no segregation should be permitted.
- The Mix may be spread by a paver finisher. The paver finisher shall be self-propelled of adequate capacity. In exceptional cases where it is not possible for the paver to be utilized, mechanical means like motor grader may be used with the prior approval of the Engineer.
- The Engineer may permit manual mixing and /or laying of wet mix macadam where small quantity of wet mix macadam is to be executed. Manual mixing /laying in inaccessible /remote locations and in situations where use of machinery is not feasible can also be permitted.
- Rolling should not be done when the sub-grade is soft or yielding or when it causes a wave-like motion in the sub-base / base course or sub-grade. If irregularities develop during rolling which exceed 12 mm when tested with a 3m straight edge, the surface should be loosened and premixed material added or removed as required before rolling again so as to achieve a uniform surface conforming to the desired grade and cross fall.
- Rolling shall be continued till the density achieved is at least 100 Percent of the maximum dry density for the material, as per IRC: 109-2015.
- The surface of any finished layer shall be well-closed, free from movement under compaction equipment or any compaction planes, ridges, cracks and loose material.

Table 2 Grading Requirements of Aggregates for Wet-Mix Macadam

IS Sieve Designation	53.00 mm	45.00 mm	22.40 mm	11.20 mm	4.75 mm	2.36 mm	600* micron	75* micron
Percent by Weight Passing Sieve	100	95-100	60-80	40-60	25-40	15-30	6-18	4-8

* The fraction passing the 75 micron sieve shall not be greater than two-thirds of the fraction passing the 600 micron sieve.

The grading of the WMM shall be within and approximately parallel to the grading envelope.

Table 900 - 3 : Quality Control Tests and their Minimum Frequency for Sub - Bases and Bases (Excluding Bitumen Bound Bases)			
Sl. No.	**Type of Construction**	**Test**	**Frequency (minimum)**
1	Granular	(i) Gradation	One test per 400 cu.m
		(ii) Atterberg limits	One test per 400 cu.m
		(iii) Moisture content prior to compaction	One test per 400 cu.m
		(iv) Density of compacted layer	One test per 1000 sq.m
		(v) Deleterious constituents	As required
		(vi) C.B.R	As required
2	Wet Mix Macadam (As per Table3 of IRC:109- 2015)	Gradation Plasticity Index	One test per 500 m3 subjected to minimum 2 tests per day
		Moisture content prior to comparism	One test per 250 m3
		Density of compacted layer	One test per 2000 m2 subjected to minimum 4 test per day
		Aggregate Impact Value/Los Angeles Abrasion Value	One test per 1000 m3 subjected to minimum 1 test per day
		(VI.) Flakiness and Elongation Index	One test per 500 m3 subjected to minimum 1 test per day

Physical Requirements for GSB / WMM / CRM (as per Clause 401, 406 & 407)				
Sl. No.	Tests	Limits		
		GSB	WMM	CRM
1	Gradation	As Per design Mix	As per grading requirement	As per grading requiremen
2	Los Angeles Abrasion Value or Aggregate Impact Value	Maximum 40% (If the water absorption is greater than 2 %, the aggregates shall be tested for wet AIV)	Maximum 40% or Maximum 30%	Maximum 40% or Maximum 30%
3	Combined Flakiness and Elongation Indices (Total)	-	Maximum 35%	Maximum 35%
4	Water Absorption Value	Maximum 2%*	Maximum 2%**	Maximum 2%**
5	Liquid Limit of material passing 425 micron	Maximum 25	-	Maximum 25
6	Plasticity Index of material passing 425 micron	Maximum 6	-	Maximum 6
7	CBR at 98% dry density	Minimum 30%	-	-
8	Field Density	Maximum 98%	Maximum 100%	Maximum 98%

*If the water absorption is more than 2%. wet aggregate Impact Value (AIV) test. Shall be carried out as per IS 5640.

**If the water absorption is more than 2% soundness test shall be carried out as per IS:2386 (Part-5)

Table 500-3 : Quantity of Bitumen Emulsion (SS-I) as Primer for various Granular Surfaces	
Type of Surface	Rate of Spray* (kg/m^2)
WMM / WBM	0.7-1.0
Stabilized soil bases / Crusher Run Macadam	0.9-1.2

*The correct quantity of primer shall be as per cl 502.2.4 Morth V Revision

Table 500-5 : Rate of Application of Tack coat		
S.No.	Type of Surface	Rate of Spray of binder in kg per sq.m (Cationic Bitumen Emulsion RS - 1)
1	Bituminous Surfaces	0.20 to 0.30
2	Granular Surfaces treated with primer	0.25 to 0.30
3	Cement Concrete Pavement	0.30 to 0.35

Mixing, Laying and Rolling Temperatures for Bituminuos Mixes (Degree celsius)					
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.
Modified Bitumen	165-185	165-185	150-170	130-160	115-155

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

** The difference in Temperature between the binder and aggregate shall at no time exceed 14°C

Table 500-13 & Table 500-18 : Permissible Variations in the Actual Mix from the Job Mix Formula		
Description	Permissible Variation	
	Base/ Binder Course (±)	Wearing Course (±)
Aggregate passing 19 mm sieve or larger	8 %	7 %
Aggregate passing 13.2 mm & 9.5 mm	7 %	6 %
Aggregate passing 4.75 mm	6 %	5 %
Aggregate passing 2.36 mm, 1.18 mm & 0.6 mm	5 %	4 %
Aggregate passing 0.3 mm and 0.15 mm	4 %	3 %
Aggregate passing 0.075 mm	2 %	1.5 %
Binder Content	0.3 %	0.3 %
Mixing temperature	10 °C	10 °C

Physical Properties of Coarse Aggregate (BM/DBM/BC)			
Property	**Test**	**Requirement**	**Test method**
Cleanliness	Grain size analysis	BM/DBM/BC - Max 5% passing 0.075mm	IS:2386 Part I
Particle Shape	Flakiness & Elongation Index (Combined)	BM/DBM/BC - Max 35%	IS:2386 Part I
Strength*	Los Angeles Abrasion Value	BC- Max 30% DBM - Max 35% BM - Max 40%	IS:2386 Part IV
	(or) Aggregate Impact Value	BC - Max 24% DBM - Max 27% BM - Max 30%	IS:2386 Part IV
Polishing**	Polished Stone Value	BC - Min 55	BS 812 - 114
Durability	Soundness (Either Sodium or Magnesium Sulphate) - 5 cycles		
	Sodium Sulphate	BM/DBM/BC - Max 12 %	IS:2386 Part V
	Magnesium Sulphate	BM/DBM/BC - Max 18%	IS:2386 Part V
Water Absorption	Water Absorption	BM/DBM/BC - Max 2%	IS:2386 Part III
Stripping	Coating and Stripping of Bitumen Aggregate	BM/DBM/BC - Min Retained Coating 95%	IS:6241
Water Sensitivity	Retained Tensile Strength***	BM/DBM/BC - Min 80%	AASHTO T 283

*Note: * The aggregate may satisfy either of the two tests*

** * Only for wearing courses*

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

Table 500-11 : Requirements for DBM / BC Mix					
Properties	**Viscosity Grade Paving Bitumen**	**Modified Bitumen**			**Test Method**
		Hot Climate		**Cold Climate**	
Compaction level (Number of blows)	75 blows on each face of the specimen				
Minimum stability (kN at 60° C)	9.0	12		10	AASHTO T 245
Marshall Flow (mm)	2-4	2.5-4		3.5-5	AASHTO T 245
Marshall Quotient (Stability /flow)	2-5	2.5-5			MS-2 & ASTM D2041
% Air voids	3-5				
% Voids Filled with Bitumen (VFB)	65-75				
Coating of Aggregate Particles with Bitumen	95% (Minimum)				IS:6241
Tensile Strength Ratio	80% (Minimum)				AASHTO T 283
% Voids in Mineral Aggregate VMA					
Nominal Maximum Particle size (mm)	9.5	13.2	19.0	26.5	37.5
Min % VMA related to designed 4% air voids *	15	14	13	12	11
* *For intermediate value of designed percentage air voids interpolate the VMA*					

IS 73 -2013 - Requirements of Paving Bitumen (Viscosity Grade) (Table 1)						
Sl. No.	Characteristics	Paving Grades				Method of Test, Ref. to
		VG 10	VG 20	VG 30	VG 40	
1	Penetration at 25°C, 100g, 5 Sec., 0.1mm, Min	80	60	45	35	IS : 1203
2	Absolute Viscosity at 60°C, Poises	800 - 1200	1600 - 2400	2400 - 3600	3600 - 4800	IS : 1206 (Part 2)
3	Kinematic Viscosity at 135°C, cSt, Minimum	250	300	350	400	IS : 1206 (Part 3)
4	Flash point, (Cleveland open cup), °C, Minimum	220	220	220	220	IS : 1448 (P 69)
5	Solubility in trichloroethylene, percent, Minimum	99.0	99.0	99.0	99.0	IS : 1216
6	Softening Point (R&B), °C, Minimum	40	45	47	50	IS : 1205
7	Tests on residue from Rolling Thin Film Oven Test (RTFOT)					
	a) Viscosity ratio at 60 °C, Max	4.0	4.0	4.0	4.0	IS : 1206 (Part 2)
	b) Ductility at 25 °C, cm, Min	75	50	40	25	IS : 1208

Aggregate Grading for DBM / BC / BM (Table 500-10, 500-17 & 500-7)						
Specification	**DBM**		**BC**		**BM**	
Grading	**1**	**2**	**1**	**2**	**1**	**2**
Nominal Maximum aggregate size *	37.5 mm	26.5 mm	19 mm	13.2 mm	40 mm	19 mm
Layer thickness	75 -100 mm	50 -75 mm	50 mm	30 -40 mm	80 -100 mm	50 -75 mm
IS Sieve Size (mm)	Cumulative Percent by Weight of total aggregate passing					
45	100	-	-	-	100	-
37.5	95-100	100	-	-	90-100	-
26.5	63-93	90-100	100	-	75-100	100
19	-	71-95	90-100	100	-	90-100
13.2	55-75	56-80	59-79	90-100	35-61	56-88
9.5	-	-	52-72	70-88	-	-
4.75	38-54	38-54	35-55	53-71	13-22	16-36
2.36	28-42	28-42	28-44	42-58	4-19	4-19
1.18	-	-	20-34	34-48	-	-
0.6	-	-	15-27	26-38	-	-
0.3	7-21	7-21	10-20	18-28	2-10	2-10
0.15	-	-	5-13	12-20	-	-
0.075	2-8	2-8	2-8	4-10	0-8	0-8
Bitumen Content % by mass of total mix (Min)* *	4%	4.5%	5.2%	5.4%	3.3%	3.4%
Modified Between (VG)	4.3%	4.7%	5.4%	5.6%	-	-

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

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

TABLE 900-4 : QUALITY CONTROL TESTS FOR BITUMINOUS WORKS AND THEIR MINIMUM FREQUENCY			
Sl. No.	**Type of Construction**	**Test**	**Frequency (min.)**
1	Prime Coat/ Tack Coat/ Fog Spray	Quality of Binder	Number of samples per lot and tests as per IS: 73, IS: 217 and IS: 8887 as applicable
		Binder temperature for application	At regular close intervals
		Rate of spread of Binder	Three tests per day
2	Seal Coat/ Surface Dressing	Quality of Binder	Same as mentioned under Serial No.1
		Aggregate Impact Value or Los Angeles Abrasion Value	One test per 200 cum of each source and whenever there is change in the quality of aggregate
		Combined Flakiness and Elongation Indices	One test per 100 cum of Aggregate for each source and whenever there is change in the quality of Aggregate
		Stripping value of Aggregates (Immersion Tray Test)	One test of each source and whenever there is change in the quality of Aggregate
		Water absorption of Aggregate	-do-
		Water Sensitivity of mix	-do-
		Grading of Aggregate	Two tests per day
		Soundness (Magnesium Sulphate / Sodium Sulphate)	One test for each source and whenever there is change in the quality of Aggregate
		Polished Stone Value (not applicable for SAM / SAMI)	-do-
		Temperature of binder in boiler, Aggregate in dryer and mix at the time of laying and compaction	At regular Intervals
		Rate of spread of materials	Same as mentioned under Serial No. 1
		Percentage of fractured faces (When gravel is used)	One test per 100 cu.m of Aggregate

S. No.	Type of Construction	Test	Frequency (min.)
3	Open-graded Premix Surfacing / Close-graded Premix Surfacing	Quality of Binder	Same as mentioned under Serial No. 1
		Aggregate Impact Value or Los Angeles Abrasion Value	Same as mentioned under Serial No. 2
		Combined Flakiness and Elongation Indices	Same as mentioned under Serial No. 2
		Stripping Value	Same as mentioned under Serial No. 2
		Water Absorption of Aggregate	Same as mentioned under Serial No. 2
		Water sensitivity of mix	Same as mentioned under Serial No. 2
		Grading of Aggregate	Same as mentioned under Serial No. 2
		Soundness (Magnesium Sulphate /Sodium Sulphate)	Same as mentioned under Serial No. 2
		Polished Stone value	Same as mentioned under Serial No. 2
		Temperature of Binder at application	At regular Intervals
		Binder Content	Two tests per day per plant
		Percentage of fractured faces	Same as mentioned under Serial No.2
4	Bituminous Macadam	Quality of Binder	Same as mentioned under Serial No. 1
		Aggregate Impact Value or Los Angeles Abrasion Value	Same as mentioned under Serial No. 2
		Combined Flakiness and Elongation Indices	One test per 350 cu.m for each source
		Stripping Value	Same as mentioned under Serial No. 2
		Water Absorption of Aggregate	Same as mentioned under Serial No.2
		Water sensitivity of mix	Same as mentioned under Serial No. 2
		Grading of Aggregate	Same as mentioned under Serial No. 2

S. No.	Type of Construction	Test	Frequency (min.)
		Soundness (Magnesium Sulphate / Sodium Sulphate)	Same as mentioned under Serial No. 2
		Percentage of fractured faces	Same as mentioned under Serial No. 2
		Binder Content	Same as mentioned under Serial No. 3
		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
		Density of Compacted layer	One test per 700 sq.m area
		Rate of spread of Mixed Material	At regular intervals
5	Dense Bituminous Macadam / Bituminous Concrete	Quality of Binder	Number of samples per lot and tests as per IS:73 or IRC:SP:53, IS:15462
		Aggregate Impact Value or Los Angeles Abrasion Value	One test per 350 cu.m of aggregate for each source and whenever there is change in the quality of aggregate
		Combined Flakiness and Elongation Indices	One test per 350 cu.m of aggregate for each source and whenever there is change in the quality of aggregate
		Soundness test (Magnesium Sulphate / Sodium Sulphate)	One test for each source and whenever there is change in the quality of aggregate
		Water Absorption of Aggregate	One test for each source and whenever there is change in the quality of aggregate
		Sand equivalent test	One test for each source and whenever there is change in the quality of aggregate
		Plasticity Index	One test for each source and whenever there is change in the quality of aggregate

S. No.	Type of Construction	Test	Frequency (min.)
		Polished stone value	One test for each source and whenever there is change in the quality of aggregate
		Percentage of fractured faces	One test per 350 cu.m of aggregate when crushed gravel is used
		Mix Grading	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
		Stability and voids analysis of mix including theoretical maximum specific gravity of loose mix	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
		Moisture Susceptibility of mix (AASHTO T 283)	One test for each mix type whenever there is change in the quality or source of coarse or fine aggregate
		Temperature of binder in boiler, aggregate in dryer and mix at the time of laying and compaction	At regular intervals
		Binder Content	One set for each 400 tonnes of mix subject to minimum of two tests per day per plant
		Rate of spread of Mix Material	After every 5th truck load
		Density of Compacted layer	One test per 700 sq.m area
6	Cold Mixes		All tests as per Sl. No.5
7	Quality of Modified Binder		Number of samples per lot and tests as per IS : 15462

Table 1 Requirements of Polymer Modified Bitumen (PMB)

AS PER IS 15462 - 2019

(Clause 6.5 and 9.5.3)

Sl No.	Characteristics	Grades and Requirements					Method of Test Ref to	
		PMB 64-10	PMB 70-10	PMB 76-10	PMB 82-10	PMB 76-22	Annex	IS/ASTM
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(A) Tests to be Carried out on Original Binder								
i)	Softening point (R&B), °C, Min	60	65	70	80	75	—	IS 1205
ii)	Elastic recovery of half thread in ductilometer at 15°C, percent, Min	70	70	70	85	80	Annex A	—
iii)	Flash point, COC, °C, Min	230	230	230	230	230	—	IS 1209
iv)	Viscosity at 150°C, P.a.s, Max	1.2	1.2	1.2	1.6	1.5	—	ASTM D 4402
v)	Complex modulus (G*) divided by Sin delta (G*/sin δ) as Min 10 kPa, 25 mm Plate, 1 mm Gap, at 10 rad/s, at a temperature, °C	64	70	76	82	76	Annex B	—
vi)	Phase Angle (δ), degree, Max	75	75	75	75	75	Annex B	¤
vii)	Separation, difference in softening point (R&B), °C, Max	3	3	3	3	3	Annex C	¤
viii)	FRAASS breaking point, °C, Max	-10	-10	-10	-10	-22	¤	IS 9381
(B) Tests to be Carried out on Rolling Thin Film Oven (RTFO) Residue								
i)	Loss in mass, percent, Max	1.0	1.0	1.0	1.0	1.0	—	IS 9382
ii)	Complex modulus (G*) divided by Sin delta (G*/sin δ) as Min 2.2 kPa, 25 mm Plate, 1 mm Gap, at 10 rad/s, at a temperature, °C	64	70	76	82	76	Annex B	—
iii)	MSCR TEST							
	a) Standard Traffic (S)	64	70	76	82	76	Annex	-
							D	

	b) Heavy Traffic (H)	64	70	76	82	76	Annex D	-
	c) Very Heavy Traffic (V)	64	70	76	82	76	Annex D	-
	d) Extremely Heavy Traffic (E)	64	70	76	82	76	Annex D	-
(C) Tests to be Carried out on Pressure Aging Vessel (PAV) Residue								
i)	Complex modulus (G*) multiplied by Sin delta (G*/sin δ) as Min 6 000 kPa, 8 mm Plate, 2 mm Gap, at 10 rad/s at a temperature, °C	31	34	37	40	31	Annex C	—

1. FRAASS Breaking Point only to be evaluated in case the project site has subzero temp conditions.
2. Method for Preparation of Rolling Thin Film Oven (RTFO) Residue is given in Annex E.
3. Method for Preparation of Pressure Aging Vessel (PAV) Residue is given in Annex F.

Table 1 Requirements of Type A Rubber Modified Bitumen (NRMB)
AS PER IS 17079 - 2019
(Clause 6.5)

Sl. No	Characteristics	Requirements		Method of Test, Ref to	
		NRMB 70	NRMB 40	IS No.	Annex
(1)	(2)	(3)	(4)	(5)	(6)
i)	Penetration at 25°C, 0.1 mm, 100 g, 5 s, Min	50	30	1203	-
ii)	Softening point (R and B), °C, Min	55	60	1205	-
iii)	Flash point, COC, °C, Min	220	220	1209	-
iv)	Elastic recovery of half thread in ductilometer at 15°C, percent, Min	40	30	-	A
v)	Separation, difference in softening point, R and B, °C, Max	4	4	-	B
vi)	Viscosity at 150°C, Poise	2-6	3-9	1206 (part 2)	-
vii)	Thin film oven test and tests on residue				
a)	Loss in mass, percent, Max	1.0	1.0	9382	-
b)	Change in Softening Point, °C, Max	6	5	1205	-
c)	Reduction in penetration of residue at 25°C, percent, Max	40	40	1203	-
d)	Elastic recovery of half thread in ductilometer at 25°C, percent, Min	25	20	-	A

Table 2 Requirements of Type B Rubber Modified Bitumen (CRMB)

AS PER IS 17079 - 2019

(Clause 6.5)

Sl. No	Characteristics	Requirements		Method of Test, Ref to	
		CRMB 55	CRMB 60	IS No.	Annex
(1)	(2)	(3)	(4)	(5)	(6)
i)	Penetration at 25°C, 0.1 mm, 100 g, 5 s	60-30	50-20	1203	-
ii)	Softening point (R and B), °C, Min	55	60	1205	-
iii)	Flash point, COC, °C, Min	220	220	1209	-
iv)	Elastic recovery of half thread in ductilometer at 15°C, percent, Min	60	60	-	A
v)	Complex modulus as (G*/sin) as Min 1.0 kPa at 10 rad/s at a temperature, °C	64	70	15462	-
vi)	Separation, difference in softening point, R&B, °C, Max	4	4		B
vii)	Viscosity at 150°C, Poise	4-8	6-12	1206 (Part 2)	-
viii)	Thin film oven test and tests on residue				
a)	Loss in mass, percent, Max	1.0	1.0	9382	-
b)	Change in Softening Point, °C, Max	5	5	1205	-
c)	Reduction in penetration of residue at 25°C, percent, Max	35	35	-	-
d)	Elastic recovery of half thread in ductilometer at 25°C, percent, Min	35	35	-	-
e)	Complex modulus as (G*/sin) as Min 2.2 kPa at 10 rad/s at a temperature, °C	64	70	15462	-

Guidance regarding storage temperature and time				
Modified Binder	Binder Temperature ^{o}C at point of mixing	Holding time at Mixing Temperature (max)	Temperature for Medium - Time Storage period (^{o}C)	Medium-Time Storage period
Blended from Specified modifiers	170-185	4 days	130-140	14 days

Requirements of Mix Prepared with Modified Bitumen - IRC : SP : 53-2010					
S. No.	Properties	Requirement			Method of Test
		Hot Climate	Cold Climate	High Rainfall	
1	Marshall Stability (75 blows) at 60 °C, Minimum	12kN	10kN	12kN	MS-2
2	Marshall Flow at 60 °C, mm	2.5-4.0	3.5-5.0	3.0-4.5	MS-2
3	Marshall Quotient, [Stability/flow] Kg/mm		250-500		
4	Voids in Compacted mix %		3.0-5.0		
5	Modified Binder content by weight of Mix minimum**	BC SDBC DBM	Grading 1* -5.4% Grading 2* -5.6% Grading 1 - 4.7% Grading 2 - 5.2% Grading 1 - 4.3% Grading 2 - 4.7%		
6	Requirement of Retained stability after 24 hours in water at 60 °C % Minimum	90	95	100	MS-2
7	Coating with aggregate, %	95	95	100	AASHTO T 182

* Grading 1 & 2 corresponds to IRC 111

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

501.8.3.4 : PROFILE CORRECTIVE COURSE (PCC) AND ITS APPLICATION

- The PCC materials shall be of the same specifications as that of the overlay / strengthening course

- A milling machine shall remove the high spots in the existing surface and all loose materials shall be removed

- Where the maximum thickness of PCC is less than 40 mm, the PCC shall be constructed as an integral part of the overlay course

Mix Seal Surfacing / Close Graded Premix Surfacing (CGPS)

Table 500-19 : Aggregate Grading for Mix Seal Surfacing

IS Sieve size (mm)	Cumulative % by weight of total aggregate passing	
	Type A (Rainfall > 150cm/year)	Type B (Rainfall < 150cm/year)
13.2	-	100
11.2	100	88-100
5.6	52-88	31-52
2.8	14-38	5-25
0.090	0-5	0-5

Proportioning of Materials :

The total quantity of aggregates used for type A or B, shall be 0.27 cum per 10 square metre area for a carpet thickness of 20 mm. The quantity of binder for premixing shall be 22.0 kg and 19.0 kg per 10 square metre for Type A and Type B surfacing respectively

PHYSICAL CHARACTERISTICS OF CEMENT (AS PER BIS)					
S. No.	Characteristics		IS : 269-2015		IS : 1489-2015
		Ordinary Portland Cement - 33 Grade	Ordinary Portland Cement - 43 Grade	Ordinary Portland Cement - 53 Grade	Portland Pozzolana Cement (Fly ash based)
1	Fineness - Minimum, (m^2/Kg)	225	225	225	300
2	Soundness by Le Chatelier Method - Maximum, (mm)	10	10	10	10
3	Initial Setting Time - Minimum, (minutes)	30	30	30	30
4	Final Setting Time - Maximum, (minutes)	600	600	600	600
5	Compressive Strength at 3 days - Minimum (MPa)	16	23	27	16
6	Compressive Strength at 7 days - Minimum (MPa)	22	33	37	22
7	Compressive Strength at 28 days - Minimum (MPa)	33	43	53	33

REMOVAL OF FORMS (AS PER IS : 456)		
Sl. No.	**Type of Formwork**	**Minimum Period before Striking Formwork**
1	Vertical formwork to columns, walls, beams	16-24 hrs
2	Soffit formwork to slabs (props to be refixed immediately after removal of formwork)	3 days
3	Soffit formwork to beams (props to refixed immediately after removal of formwork)	7 days
4	Props to slabs:	
	1. Spanning upto 4.5 m	7 days
	2. Spanning over 4.5 m	14 days
5	Props to beams and arches:	
	1. Spanning upto 6 m	14 days
	2. Spanning over 6 m	21 days

TABLE 1700-4 : REQUIREMENTS OF CONSISTENCY		
Sl.No.	**Type**	**Slump (mm) at the Time of Placing of Concrete**
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 structure 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, eg. Deck slab girders, box girders, walls with thickness less than 300 mm	75 - 125
5	Under water concreting through tremie, e.g. bottom plug, cast in - situ piling	150 - 200
6	Pumpable concrete transported through transit mixer justify	75 - 150

WEIGHT PER METRE OF STEEL BARS AS PER IS - 1786 (Table 1)											
Diameter (mm)	6	8	10	12	16	20	25	28	32	36	40
Weight/m (kg)	0.222	0.395	0.617	0.888	1.58	2.47	3.85	4.83	6.31	7.99	9.86

PROPERTIES OF STEEL BARS AS PER IS1786-2008 (Table 3)								
Sl. No.	Properties	Grade of Steel						
		Fe 415	Fe 415 D	Fe 500	Fe 500 D	Fe 550	Fe 550 D	Fe 600
1	0.2 percent proof stress - Minimum (MPa)	415	415	500	500	550	550	600
2	Tensile Strength - Minimum (MPa)	485	500	545	565	585	600	660
3	Elongation Percentage - Minimum (%)	14.5	18	12	16	10	14.5	10

DRY LEAN CEMENT CONCRETE (SUB BASE)

TABLE 600 - 1 : AGGREGATE GRADATION FOR DRY LEAN CONCRETE	
Sieve Designation	% by weight Passing the sieve
26.50 mm	100
19.00 mm	75-95
9.50 mm	50-70
4.75 mm	30-55
2.36 mm	17-42
600 micron	8-22
300 micron	7-17
150 micron	2-12
75 micron	0-10

Combined Aggregate Gradation for Pavement Quality Concrete as per IRC : 44-2017			
Sieve Designation	Percentage by Weight Passing		
	31.5 mm Nominal Size	26.5 mm Nominal Size	19 mm Nominal Size
37.5 mm	100	100	100
31.50 mm	90 - 100	100	100
26.50 mm	85 - 95	90 - 100	100
19.0 mm	68 - 88	75 - 95	90 - 100
9.50 mm	45 - 65	50 - 70	48 - 78
4.75 mm	30 - 55	30 - 55	30 - 58
600 micron	8 - 30	8 - 30	8 - 35
150 micron	0 - 10	0 - 10	0 - 12
75 micron	0 - 5*	0 - 5*	0 - 5*
(Wet Sieving)	0 - 2**	0 - 2**	0 - 2**

** Crushed Sand*
** * Natural Sand*

TABLE 1700 – 9 : MINIMUM FREQUENCY OF SAMPLING	
Quantity of Concrete in work (cum)	**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 cum or part thereof
Note: Three test specimens shall be made for each sample	

CLAUSE 1717.7 ACCEPTANCE CRITERIA - COMPRESSIVE STRENGTH

- The mean strength determined from any group of four consecutive non-overlapping samples exceed the specified characteristic compressive strength by 3 Mpa.
- Strength of any sample shall not be lesser than the specified characteristic compressive strength minus 3 MPa.

SECTION 1000 : MATERIALS FOR STRUCTURES

Coarse Aggregate

- For plain and RCC or pre stressed concrete, coarse aggregate shall consist of clean, hard, strong, dense, non-porous and durable pieces of crushed stone
- Shall not consist of disintegrated stones, soft, flaky, elongated particles, salt, alkali, vegetable matter or other deleterious materials
- The combined flakiness and elongation index shall not exceed 40%

Table 1000-1 : Grading Requirements of Coarse Aggregate			
IS Sieve Size	**% 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	90 – 100	100
12.5 mm	...	...	90 – 100
10 mm	10 – 35	25 – 55	40 – 85
4.75 mm	0 – 5	0 – 10	0 – 10

PROPERTIES OF COARSE AGGREGATES (IS 383 -2016)				
Sl. No	Type of Structures	Impact Value Maximum (%)	Crushing Value Maximum (%)	Abrasion Value Maximum (%)
1	Concrete roads and pavements	30	30	30
2	Other Concrete Structures	45	30	50

Sand / Fine Aggregate

TABLE 1000 – 2 : Grading Requirements of Fine Aggregates			
IS Sieve	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

902. Control of Alignment, Level and Surface Regularity

- Horizontal alignment shall be reckoned with respect to C/L of the carriageway as per drawing
- The edges of the carriageway shall be correct within the tolerance of (+/-) 10 mm
- The edges of the roadway and lower layers of pavement shall be corrected within the tolerance of (+/-) 25 mm

TABLE 900 – 1 : TOLERANCES IN SURFACE LEVELS		
Sl. No.	**Pavement Course**	**Tolerance**
1	Sub Grade	± 20 mm
2	Sub Base	
	a. Flexible pavement	± 10 mm
	b. Concrete pavement	± 6 mm
3	Base – course for flexible pavement	
	a. Bituminous Base / Binder course	± 6 mm
	b. Granular i) Machine laid ii) Manually laid	 ± 10 mm ± 15 mm
4	Wearing course for flexible pavement	
	a. Machine laid	± 6 mm
	b. Manually laid	± 10 mm
5	Cement concrete pavement	± 5 mm

Provided, however, that the negative tolerance for wearing course shall not be permitted in conjuction with the positive tolerance for base course, if the thickness of the former is thereby reduced by more than the following limits:

- 4 mm for bituminous wearing course of thickness 40 mm or more
- 3 mm for bituminous wearing course of thickness less than 40 mm
- 5 mm for concrete pavement slab

UNIT WEIGHT OF MATERIALS		
Sl. No.	Materials	Weight (kg/cum)
(A)	**BUILDING MATERIALS:**	
1	Brick	1600 – 1920
2	Cement	1440
3	Chalk	2200
4	Glass	2560
5	Lime - Slaked	580 - 640
6	Lime - Unslaked	880 - 1040
7	Laterite	2080 - 2400
8	Surki	1010
9	Lime Stone	2650
10	Sand Stone	2800
11	Granite Stone	2400
12	Steel	7850
13	Cast Iron	7030 - 7130
14	Timber	720 - 750
15	Broken Stone	1600 - 1870
16	Broken Bricks	1010 - 1450
17	Lime Concrete	1920
18	Cement Concrete	1800 - 2300
19	Reinforced Cement Concrete	2300 - 2700
20	Aggregates	1500 - 1800
21	Gravel	1600 - 1920
22	Sand / Grit	1700 - 1850
23	Aggregate Blend	
	i) 13.2mm to 90 microns	1575
	ii) 11.2mm to 90 microns	1600
(B)	**BITUMINOUS SUBSTANCES:**	
1	Bitumen	1153
2	Bituminous Mix	1555
3	Crude Oil	880
4	Pitch	1100
5	Coal Tar	1200
(C)	**LIQUIDS:**	
1	Alcohol	780
2	Gasoline	670
3	Ice	910
4	Nitric Acid	1500
5	Sulphuric Acid	1800
6	Vegetable Oil	930
7	Water (Fresh & Pure)	1000
8	Water (Sea)	1025

DATA FOR RETAINING WALL			
Sl. No.	**Description of backing material filled in the back of retaining wall**	**Weight (Kg/cum)**	**Angle of Repose (in Degrees)**
1	Dry sand (Clean)	1550 - 1600	30 - 35
2	Moist sand	1600 - 1750	35
3	Wet sand	1750 - 2000	25 - 26
4	Consolidated dry sand	1920	35
5	Dry earth (Vegetable)	1600	20 - 30
6	Moist earth (Vegetable)	1600 - 1750	45 - 50
7	Wet earth (Vegetable)	1750 - 1920	15 - 17
8	Dry consolidated earth (Vegetable)	1600	30
9	Gravel (Clean)	1440	40
10	Sand gravel mixer	1600 - 1750	26 - 30
11	Rubble stone	1600 - 1750	45
12	Dry clay	1920 - 2240	35
13	Damp clay	2000 - 2550	45
14	Wet clay	2000 - 2550	15
15	Mud	1600 - 1920	0
16	Coal ashes	640	40 - 45

LIST OF IRC CODES FREQUENTLY USED BY THE HIGHWAYS ENGINEERS

Sl. NO.	CODE	CODE NAME
I.	**TYPE DESIGNS FOR KM, HM AND BOUNDARY STONES**	
1.	IRC:8-1980	Type Design for Highway Kilometre Stone
2.	IRC:25-1967	Type Designs for Boundary Stones
3.	IRC:26-1967	Type Designs for 200-Metre Stone
II.	**TRAFFIC CENSUS, PCU, PLANNING, SURVEY & INVESTIGATION**	
1.	IRC:9-2022	Traffic Census for Non-Urban Roads
2.	IRC:52-2019	Guidelines for the Alignment Survey and Geometric Design of Hill Roads
3.	IRC:64-1990	Guidelines for Capacity of Roads in Rural Areas
4.	IRC:70-2017	Guidelines on Regulation and Control of Mixed Traffic in Urban Areas
5.	IRC:102-2022	Planning for Bypasses Around Towns
6.	IRC:106-1990	Guidelines for Capacity of Urban Roads in Plain Areas
7.	IRC:108-2015	Guidelines for Traffic Forecast on Highways
8.	IRC:SP:19-2020	Manual for Survey, Investigation and Preparation of Road Projects
9.	IRC:SP:54-2018	Project Preparation Manual for Bridges
III.	**SPECIFICATION / GEOMETRIC DESIGN STANDARDS FOR ROADS**	
1.	IRC:73-2023	Geometric Design Standards for Non-Urban Roads
2.	IRC:86-2018	Geometric Design Standards for Urban Roads and Streets
3.	IRC:SP:20-2002	Rural Roads Manual
4.	IRC:SP:23-1983	Vertical Curves for Highways
5.	IRC:SP:73-2018	Manual of Specification & Standards for Two Laning of Highways with Paved Shoulder
6.	IRC:SP:84-2019	Manual of Specification & Standards for Four Laning of Highways
7.	IRC:SP:87-2019	Manual of Specification & Standards for Four Laning of Highways
8.	IRC:SP:99-2023	Manual of Specification & Standards for Expressways
9.	MORT&H	Specification for Road and Bridge Works, 2013 (Fifth Revision)
10.	MORT&H	Pocket Book for Highway Engineers, 2019 (Third Revision)
11.	MoRD	Specification for Rural Roads (Fifth Revision)
IV.	**ROAD EMBANKMENT CONSTRUCTION**	
1.	IRC:34-2011	Recommendations for Road Construction in Areas Affected by Water Logging, Flooding and/or Salts Infestation
2.	IRC:36-2010	Recommended Practice for Construction of Earth Embankments and Sub-Grade for Road Works
3.	IRC:56-2011	Recommended Practices for Treatment of Embankment and Roadside Slopes for Erosion Control
4.	IRC:75-2015	Guidelines for the Designs of High Embankments
5.	IRC:113-2013	Guidelines for the Design and Construction of Geosynthetic Reinforced Embankments on Soft Subsoils.
6.	IRC:SP:58-2001	Guidelines for Use of Fly Ash in Road Embankments
7.	IRC:SP:102-2014	Guidelines for the Design and Construction of Reinforced Soil Walls
8.	IRC:SP:121-2018	Guidelines for Use of Iron, Steel and Copper Slag in Construction of Rural Roads
9.	IRC:SP:132-2022	Guidelines on Use of Industrial Wastes for Road Embankment and Subgrade Construction
V.	**DESIGN OF FLEXIBLE PAVEMENTS / MAINTENANCE OF BITUMINOUS ROAD**	
1.	IRC:37-2018	Guidelines for the Design of Flexible Pavements
2.	IRC:81-1997	Guidelines for Strengthening of Flexible Road Pavements Using Benkelman Beam Deflection Technique
3.	IRC:82-2023	Code of Practice for Maintenance of Bituminous Road
4.	IRC:116-2014	Specifications for Readymade Bituminous Pothole Patching Mix using Cut-Back Bitumen
5.	IRC:120-2015	Recommended Practice for Recycling of Bituminous Pavements
6.	IRC:SP:72-2015	Guidelines for the Design of Flexible Pavements for Low Volume Rural Roads

VI.	BRIDGES / CULVERTS	
1.	IRC:5-2024	Standard Specifications and Code of Practice for Road Bridges, Section I – General Features of Design
2.	IRC:6-2017	Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Loads Combinations
3.	IRC:22-2015	Standard Specifications and Code of Practice for Road Bridges, Section VI – Composite Construction (Limit State Design)
4.	IRC:24-2010	Standard Specifications and Code of Practice for Road Bridges, Steel Road Bridges (Limit State Design)
5.	IRC:40-2024	Standard Specifications and Code of Practice for Road Bridges, Section IV – Brick, Stone and Cement Concrete Block Masonry
6.	IRC:78-2024 (Part-I)	Standard Specifications and Code of Practice for Road Bridges, Foundations and Superstructure Part-I: General Features and Working Stress Design
7.	IRC:78-2020 (Part-II)	Code of Practice for Limit State Design of Foundations
8.	IRC:83-2015 (Part I to IV)	Standard Specifications and Code of Practice for Road Bridges, Section-IX-Bearings
9.	IRC:87-2018	Guidelines for Formwork, Falsework and Temporary Structures for Road Bridges
10.	IRC:92-2017	Guidelines for the Design of Interchanges in Urban Areas
11.	IRC:112-2020	Code of Practice for Concrete Road Bridges
12.	IRC:122-2017	Guidelines for Construction of Precast Concrete Segmental Box Culverts
13.	IRC:SP:65-2022	Guidelines for Design and Construction of Segmental Bridges
14.	IRC:SP:66-2022	Guidelines for Design of Continuous Bridges
15.	IRC:SP:13-2022	Guidelines for the Design of Small Bridges and Culverts
16.	IRC:SP:82-2008	Guidelines for the Design of Causeways and Submersible Bridges
17.	IRC:SP:90-2023	Manual for Grade Separators and Elevated Structures
18.	IRC:SP:105-2015	Explanatory Hand book to IRC:112-2011: Code of Practice to Concrete Road Bridges
19.	IRC:SP:109-2015	Guidelines for Design and Construction of Small Diameter Piles for Road Bridges
20.	IRC:SP:112-2017	Manual for Quality Control in Road and Bridge Works
21.	IRC:SP:114-2018	Guidelines for Seismic Design of Road Bridges
22.	MoRT&H	Pocketbook for Bridge Engineers, 2000 (First Revision)
VII.	**BRIDGE INSPECTION / MAINTENANCE / REHABILITATION / RIVER TRAINING**	
1.	IRC:123-2017	Guidelines on Geophysical Investigation for Bridges
2.	IRC:SP:18-1978	Manual for Highway Bridge Maintenance Inspection
3.	IRC:SP:35-2024	Manual for Bridge Management, Inventory, Inspection and Maintenance
4.	IRC:SP:37-2010	Guidelines for Evaluation of Load Carrying Capacity of Bridges
5.	IRC:SP:37-2010	Guidelines on Repair, Strengthening and Rehabilitation of Concrete Bridges
6.	IRC:SP:40-2019	Guidelines on Repair, Strengthening and Rehabilitation of Concrete Bridges
7.	IRC:SP:51-2015	Guidelines for Load Testing of Bridges
8.	IRC:SP:54-2018	Project Preparation Manual for Bridges
9.	IRC:SP:74-2007	Guidelines for Repair and Rehabilitation of Steel Bridges
10.	IRC:SP:80-2008	Guidelines for Corrosion Prevention, Monitoring and Remedial Measures for Concrete Bridge Structures
11.	IRC:SP:134-2008	Guidelines for Assessment of Wave Effects on Bridges
VIII.	**JUNCTION, & CURVE IMPROVEMENT, SPEED CALMING MEASURES, ROAD MARKING, SIGNS & ROAD SAFETY**	
1.	IRC:35-2015	Code of Practice for Road Markings
2.	IRC:38-1988	Guidelines for Design of Horizontal Curves for Highways and Design Tables
3.	IRC:53-2012	Road Accident Recording Forms A-I and 4
4.	IRC:65-2017	Guidelines for Planning and Design of Roundabouts
5.	IRC:67-2022	Code of Practice for Road Signs
6.	IRC:79-2019	Recommended Practice for Road Delineators
7.	IRC:93-1985	Guidelines on Design and Installation of Road Traffic Signals
8.	IRC:99-2018	Guidelines for Traffic Calming Measures in Urban and Rural Areas
9.	IRC:103-2022	Guidelines for Pedestrian Facilities
10.	IRC:119-2015	Guidelines for Traffic Safety Barriers
11.	IRC:131-2022	Guidelines for Identifying and Treating Black Spots

12.	IRC:SP:41-1994	Guidelines for the Design of AT-Grade Intersections in Rural & Urban Areas
13.	IRC:SP:43-2022	Guidelines on Traffic Management Technique for Urban Areas
14.	IRC:SP:55-2014	Guidelines on Traffic Management in Work Zones
15.	IRC:SP:85-2023	Guidelines for Variable Message Signs
16.	IRC:SP:88 -2019	Manual for Road Safety Audit
17.	MORT&H	Type Designs for Intersection on National Highways, 1992
IX	**OTHER IMORTANT CODES**	
1.	IRC:12-2016	Unified Guidelines for Access Permission to Fuel Stations, Private Properties, Rest Area Complexes and such Other Facilities along National Highways. (Note: MoRT&H Circular issued recently shall be referred in this regard)
2.	IRC:80-2022	Type Designs for Pick-up Bus Stops on Rural Highways
3.	IRC:98-2011	Guidelines on Accommodation of Utility Services on Roads in Urban Areas
4.	IRC:104-1988	Guidelines on Environmental Impact Assessment of Highway Projects
5.	IRC:109-2015	Guidelines for Wet Mix Macadam
6.	IRC:135-2023	Guidelines for Development of Bus Ports in India
7.	IRC:SP:21-2009	Guidelines on Landscaping and Tree Plantation
8.	IRC:SP:42-2014	Guidelines on Road Drainage
9.	IRC:SP:49-2014	Guidelines for the Use of Dry Lean Concrete as Sub-base for Rigid Pavements
10.	IRC:SP:68-2022	Guidelines for Construction of Roller Compacted Concrete Pavements
11.	IRC:SP:70-2016	Guidelines for the Use of High Performance Concrete (Including Self Compacting Concrete in Bridges)
12.	IRC:SP:86-2010	Guidelines for Selection, Operation and Maintenance of Paver Finisher
13.	IRC:SP:98-2020	Guidelines for the Use of Waste Plastic in Hot Bituminous Mixes (Dry Process) in Wearing Courses
14.	IRC:SP:103-2014	Guidelines on Tree Plantation along Rural Roads
15.	IRC:SP:106-2015	Engineering Guidelines on Landslide Mitigation Measures for Indian Roads
16.	IRC:SP:110-2017	Application of Intelligent Transport System for Urban Roads
17.	IRC:SP:116-2018	Guidelines for Design and Installation of Gabion Structures
X	**IMORTANT IS CODES**	
1.	IS : 456-2000	Plain & Reinforced concrete code of practice
2.	IS : 800-2007	Code of Practice for General Construction in Steel
3.	IS : 2386 Part I– VI	Methods of test for aggregates for concrete
4.	IS:1892-1979	Code Of Practice For Subsurface Investigation For Foundations
XI	**USEFUL STANDARD DRAWINGS USED BY HIGHWAYS ENGINEERS**	
1.	MORT&H	STANDARD DRAWINGS FOR ROAD BRIDGES [R.C.C. SOLID SLAB SUPERSTRUCTURE (15° & 30° SKEW) SPAN 4.0M to 10.0M (WITH AND WITHOUT FOOTPATHS)] - Ministry of Surface Transport (Roads Wings), New Delhi.
2.	MORT&H	STANDARD DRAWINGS FOR ROAD BRIDGES [R.C.C. SOLID SLAB SUPERSTRUCTURE (22° SKEW) SPAN 4M to 10M (WITH AND WITHOUT FOOTPATHS)] - Ministry of Surface Transport (Roads Wings), New Delhi.
3.	MORT&H	STANDARD DRAWINGS FOR ROAD BRIDGES [PRESTRESSED CONCRETE BEAMS & R.C.C. SLAB TYPE SUPERSTRUCTURE] - Ministry of Surface Transport (Roads Wings), New Delhi.
4.	MORT&H	STANDARD PLANS FOR 3.0M TO 10.0M SPAN REINFORCED CEMENT CONCRETE SOLID SLAB SUPERSTRUCTURE WITH & WITHOUT FOOTPATHS FOR HIGHWAYS - Ministry of Surface Transport (Roads Wings), New Delhi.
5.	MORT&H	STANDARD PLANS FOR SINGLES, DOUBLE AND TRIPLE CELL BOX CULVERTS WITH AND WITHOUT EARTH CUSHION - Ministry Of Surface Transport Dept. Of Road Transport & Highways, New Delhi.
6.	MORT&H	STANDARD PLANS FOR HIGHWAY BRIDGES PSC GIRDER AND RC SLAB COMPOSITE SUPERSTRUCTURE WITH AND WITHOUT FOOTPATHS - Ministry of Surface Transport (Roads Wings), New Delhi.
7.	MORT&H	STANDARD PLANS FOR HIGHWAY BRIDGES R.C.CT - BEAM AND SLAB SUPERSTRUCTURE - Ministry of Surface Transport (Roads Wings), New Delhi.
8.	MORT&H	TYPE DESIGNS FOR INTERSECTIONS ON NATIONAL HIGHWAYS - Ministry of Surface Transport (Roads Wings), New Delhi .

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