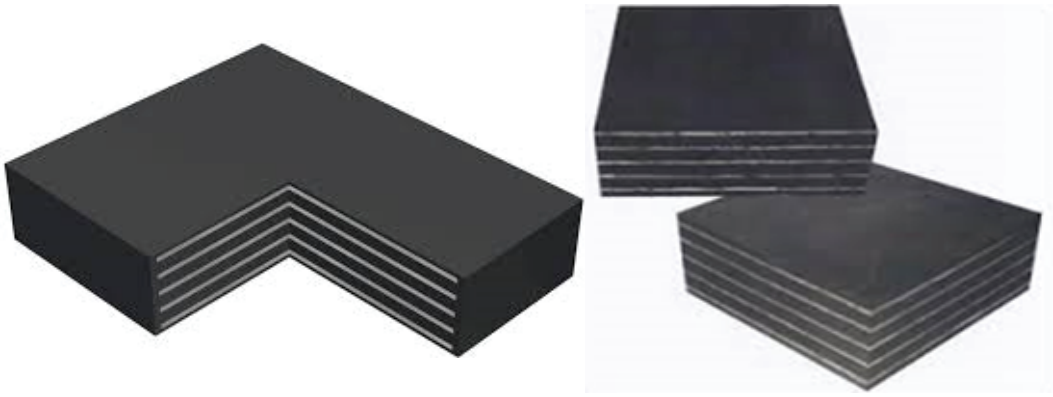
KANTA FLEX
TECHNOLOGY DECADE AHEAD

ELASTOMERIC BRIDGE BEARING TO LATEST IRC: 83 - 2015 (PART - II)

Kanta System of Elastomeric bridge bearing is made out of Poly chloroprene rubber having low crystallization rates and adequate shelf life, with steel laminates, moulded as single unit and vulcanized under heat & pressure, in accordance with IRC 83 (Part – II) of 2015 and relevant National & International standards for road and rail bridges.



MATERIAL:

- Raw Material: Low crystalized Poly chloroprene rubber such as Neoprene WRT, Neoprene W, Bayprene 110, Bayprene 210, Skyprene B-5, Skyprene B-30, Denka S-40V, and Denka M-40

- Steel laminates: Laminates of mild steel shall conforms to IS 2062 / IS 1079 or equivalent international standard.

SALIENT FEATURES:

- Kanta System of Elastomeric bearings are designed for ultimate limit state (ULS) and to withstand for ultimate design loads and movements of the structure.
- Varity of bearings are available like Plain pad / Strip bearing, Laminated bearing, Laminated bearing with thicker end laminates with or without exposed, Bearings with separate steel plate directly vulcanized with the bearing, Bearings with positive anchorage, Bearings with PTFE bonded to the elastomer, Bearing with sliding interface and Bearing with restraint against translation to simulate support condition
- All are indigenous design, meant for Indian road & environment conditions.
- Quality can be checked thoroughly in all aspects as per the design and requirements.
- Qualified and trained engineers available for study the actual requirements and to design the bearing considering the various aspects like Load, horizontal forces, movements and rotations.
- Maintenance free and designed for the function of 20years.
- Available in Indian National Rupee currency and Indian economy is saved.

1.ELASTOMER

1.1 The definition of Elastomer as per BS: 5400: Section 9.1: 1983 is a compound containing natural or chloroprene rubber with properties similar to those of rubber. The UIC 772 R states that natural or synthetic rubber may be used but it must satisfy any local regulation and standards in force in each country.

1.2 Whereas in IRC 83 (Part II) of 1987 the recommended elastomer is that it shall have the property of low rate of crystallization and adequate shelf life. Only one elastomer has got such properties named as 'CHLOROPRENE', and the grade of Neoprene WRT, Bayprene 110, Skyprene B5, and Denka S40V.

1.3 It is therefore advisable that, the raw elastomer shall be used as recommended by IRC 83 (Part II) of 1987 with its latest amendments.

2.ELASTOMERIC PAD & ELASTOMERIC BEARING

2.1 An un-reinforced plain pad is called as elastomeric pad. It is used due to the flexibility and to distribute the load of moderate intensity, emanating from concrete slab bridges or joist – in – concrete bridges less than 20 meter long between expansion joints.

2.2 The reinforced elastomeric bearing is generally called as laminated bearing which will have the reinforcement steel plates to withstand heavy concentrated loads produced by the heavily loaded beams.

2.3 The elastomeric bearing is consisting of one or more internal layers of elastomer bonded to internal steel laminates by the process of vulcanization. The bearing caters for translation and / or rotation of the super structure by elastic deformation.

2.4 The steel laminates, internal elastomer layers and top & bottom of the elastomeric cover are to be arranged as sand witch type and shall be cast as single unit in a mould and vulcanized under uniform heat & pressure.

2.5 The rules for designing the elastomeric bearing are dealt in detail in clause No 3.1 to 3.5

2.6 The elastomer shall conform to the clause No. 1.2 and the properties of elastomer shall meet to the clause No. 2.7. The steel laminates shall meet to the IS: 2062 of 1999 to grade Fe 410W B.

2.7 PROPERTIES OF THE ELASTOMER

S.NO.	PROPERTIES	UNITS	REQUIRED VALUE
1.	Polymer Content	%	> 60
2.	Ash Content	%	< 5
3.	Hardness	Shore A	55 – 65
4.	Tensile Strength	Kg/Cm2	> 170
5.	Elongation	%	> 400
6.	Compression set	%	< 35
7.	ACCELERATED AGEING		
7a.	Change in hardness	Shore A	+ 15 Maximum
7b.	Change in tensile	%	- 15 Maximum
7c.	Change in elongation	%	- 15 Maximum
8.	Adhesion strength	KN /m	> 7

3.DESIGN RULES

3.1 The design requires the determination of plan dimension of breadth (along span) and length (perpendicular to span) of the elastomeric bearing, besides detailing the thickness of internal layers of the elastomer and steel laminates. The elastomer cover on the sides and at top & bottom are also to be specified.

3.2 The dimension of the bearing and number of internal layers of the elastomers shall satisfy the following criteria:

a) The overall length divided by the overall breadth shall be less than or equivalent to 2.
b) The total elastomer thickness shall be less than or equivalent to the overall breadth divided by 5
c) The total elastomer thickness shall be greater than or equivalent to the overall breadth divided by 10
d) If the steel laminate thickness is 3mm, then the internal elastomer thickness shall be 8mm or 10mm only.
e) If the steel laminate thickness is 4mm, then the internal elastomer thickness shall be 12mm.
f) If the steel laminate thickness is 6mm, then the internal elastomer thickness shall be 16mm. This design is to be used for special case only.
g) The thickness of the outer elastomer layers (Top & Bottom Layers) shall be half of the thickness of internal elastomer layer, subject to maximum of 6mm.
h) The side cover elastomer shall be 6mm for all bearings.

3.3 The basic criteria for design are that the elastomeric bearing accommodates the horizontal movement by shearing and the rotation by non-uniform linearly varying compressive deformation. The vertical stiffness of bearing should be adequate to avoid significant changes in height by bulging at the sides under vertical compression.

3.4 This is ensured by restricting the value of shape factor ‘S’ which is defined as: ‘ratio of one loaded surface area to the surface area free to bulge, for an internal layer of elastomer, excluding the side cover’ and it shall be greater than 6 & less than or equivalent to 12.

3.5 The shape factor is directly related to elastic modulus and its behavior of elastic functioning.

4.FUNCTION OF THE ELASTOMERIC BEARING

4.1 The function of the elastomeric bearing is to provide a connection to control the interaction of loadings and movements between parts of the structure, usually between super structure and sub structure.

4.2 The elastomeric bearings (un-reinforced and laminated) are generally suitable for: -
- Translation movements towards longitudinal and transverse directions.
- Rotation about transverse axis in longitudinal direction & rotation about longitudinal axis in transverse direction.
- Rotation in plan area.
- Loading resisted to vertical, longitudinal and transverse direction.

4.3 The elastomeric bearings can accommodate translation movement in any direction and rotational movement about any axis by elastic deformation, but they should not be used in tension.

5.TEST ON ELASTOMERIC BEARING

5.1 The UIC 772 R has recommended the following test on the elastomeric bearing.

a) Determination of vertical stress – strain curve
b) Determination of modulus G
c) Determination of ultimate strength in compression.
d) Verification of bond between the rubber and metal plates.

5.2 The IRC 83 (Part II) has recommended the following test on the elastomeric bearing.

a) Determination of shear modulus.
b) Determination of elastic modulus (Short term loading)
c) Determination of adhesion strength
d) Determination of ultimate compressive strength

5.3 The test specimens may be selected from the lot of the bearings or can be cut from the bearing selected at random or can be made especially for the testing purpose but it should be identical compound and construction under identical vulcanization condition as used in the manufactures of bearings, but the size shall be not less than 150 x 200.

5.4 There are two levels of inspection depending upon the quantity of the lot.

5.5 As per UIC 772 R if the lot consist the quantity of 20 is called as a small lot and subject to level 2 testing. In case of IRC 83 (Part II) the quantity of the small lot is considered as 24.

5.6 If the lot quantity is > 20 numbers (UIC 772 R) and > 24 numbers (IRC 83 – Part II) it is considered as a large lot and subject to level 1 testing.

6.NATURE OF TESTING

6.1 Under the level 2 testing, the bearings under small lot are subjected to the following verifications: -

a) Visual inspection for all bearings (100%) in terms of dimension and surface defects.
b) Properties of the elastomer confirming to the clause no: 2.7
c) Determination of shear modulus and elastic modulus.
d) Destructive tests are not involved for the small lots

6.2 Under the level 1 testing, the bearings under large lot are subjected to the following verifications: -

a) Visual inspection for all bearings (100%) in terms of dimension and surface defects.
b) All bearing subject to an axial load testing corresponding to the value of 5 MPa & 15 MPa applied in steps and held constant while examining misalignment of reinforcing plates, poor bond at laminate / steel interface, variation in the thickness of internal elastomer layer and external elastomer covers and any surface defects.
c) Properties of the elastomer confirming to the clause no: 2.7
d) Load test on finished bearing or cut bearing or specially moulded bearing confirming to the clause no: 5.1 or 5.2 as applicable.

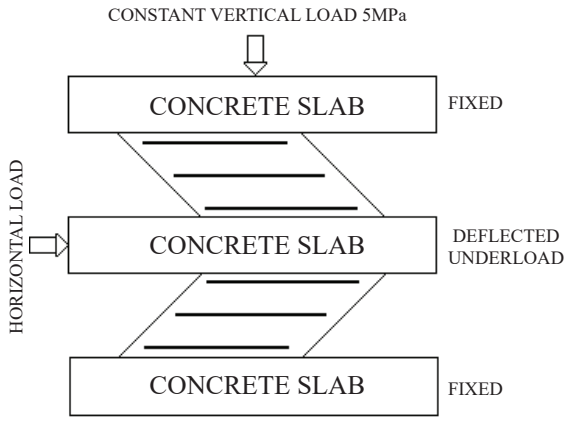
6.3 Ozone resistant test can be waived since the bearings are manufactured with a raw material of chloroprene elastomer, which has got the resistance capacity of ozone. It is therefore recommended that, test on accelerated ageing can be considered as adequate test, when the bearings are not used / located under adverse climatic condition.

7.TESTING PROCEDURE
DETERMINATION OF SHEAR MODULUS

7.1 This test is meant for determining the value of shear modulus G under specified short term loading. This testing method is recommended by the standards of IRC 83 (Part II) & UIC 772 R.

7.2 The upper and lower concrete slabs are securely fixed at the sides of the frame of the testing press, while horizontal force is applied to center plate.

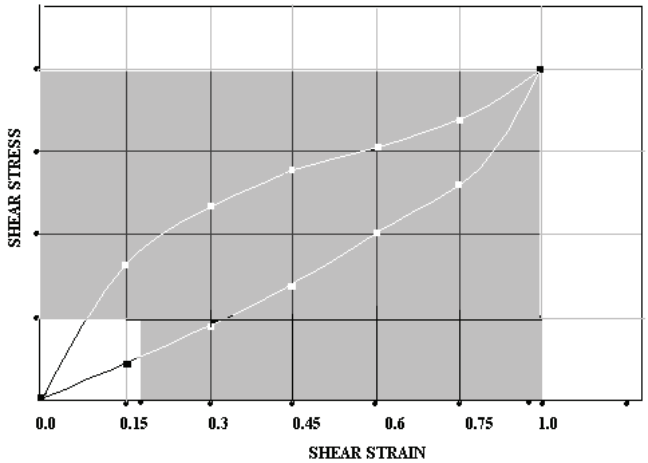
7.3 In order to prevent slipping of the bearings, a constant vertical load 5 MPa or 50 Kg/Cm2 is applied.



7.4 Before conducting the test the bearing shall be preloaded with maximum horizontal load and to be unloaded. During the testing the rate of loading shall be 0.05 to 0.1 MPa per minute.

7.5 The horizontal load is applied in stages and horizontal defection for each stage is noted. The test is continued and horizontal load is gradually increased to the maximum, when the horizontal defection becomes equal to the total thickness of the elastomer.

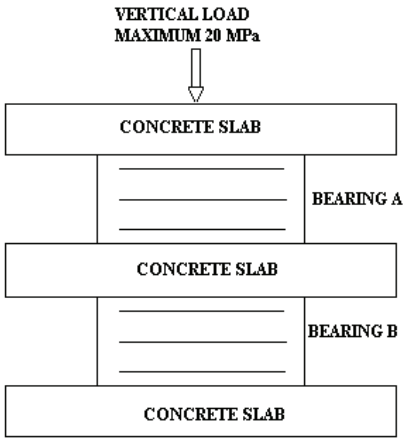
7.6 A shear stress – shear strain curve shall be plotted as shown below and the value of the shear modulus can be determined as: -



8.TESTING PROCEDURE
DETERMINATION OF ELASTIC MODULUS

8.1 This test is meant for determining the value of apparent elastic modulus under specified short-term axial loading, through the vertical stress Vs strain curve.

8.2 This test is carried out simultaneously on two bearings placed between three concrete slabs as per the figure shown below:



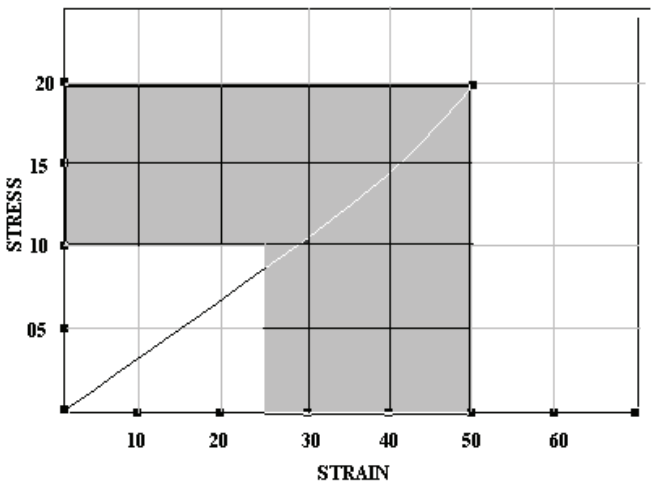
8.3 Bearing shall be preloaded up to 20 MPa and shall be allowed to retain for 10 minutes and then to be unloaded to initial position.

8.4 Test to be carried out by increasing the axial load gradually @ 0.5 MPa to 1 MPa per minute up to 20 MPa (double the time of design load) as per IRC 83 – Part II.

In case of UIC 772 R the maximum limitation to carry out the test is given to the choice of railway administration.

8.5 During the test, the applied load and corresponding strain deflections are to be recorded at equal intervals. Deflection shall be measured at four edges and mean value shall be taken in to account for calculation.

8.6 The compressive stress Vs strain curve shall be plotted and the value of apparent elastic modulus shall be determined at the stress between 10 & 20 MPa as per figure shown below:-



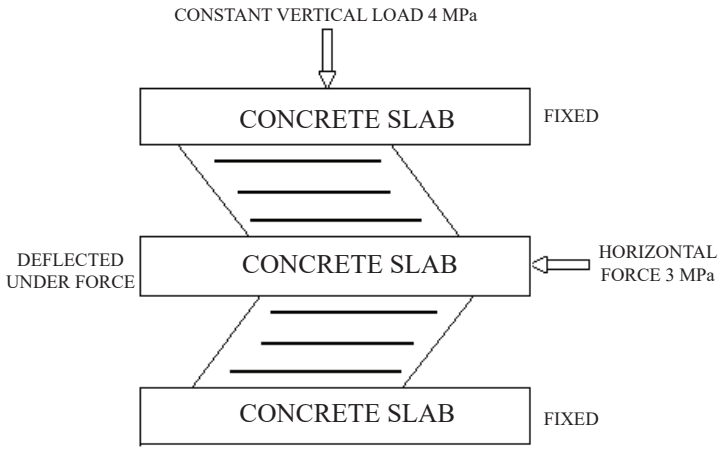
8.7 In case of UIC 772 R the value of the required elastic modulus is not specified and left to the choice of railway administration.
8.8 Whereas the IRC 83 - Part II as given the formula i.e. E = 1/{ (0.2/S2)+0.0005} where S is Shape factor. The determined E value from the plotted graph shall meet with a value of the above formula with a tolerance of +/- 20%.

8.9 During the test there shall be no evidence of any defects or damage.

9.DETERMINATION OF STRIPPING STRENGTH
(VERFICATION OF BOND BETWEEN THE ELASTOMER & STEEL LAMINATES)

9.1 The UIC 772 R & IRC 83 – Part II have given two different test procedures to verify the bond between the elastomer and the steel laminates.

9.2 In case of UIC 772 R, the procedures of shear modulus is continued and horizontal load is gradually increased to the maximum, when the horizontal defection becomes equal to the double the time of total thickness of the elastomer.



9.3 In case of IRC 83 – Part II the testing procedure for determination of stripping strength is as follows: -

Two identical test piece shall be cut from the test bearing to the plan dimension not less than 100 x 200mm, and two opposing ends of each test piece shall be beveled to an angle of 45 °

9.4 The test assembly is as per the figure given below and two test specimens shall be kept in between three concrete slabs.

9.5 A vertical load of 4 MPa shall be applied is to be constant in order to avoid the slippage during the test and horizontal load shall be applied on the middle of the concrete slab gradually upto 3 MPa.

9.6 At this horizontal load generally the 45° angled test specimen becomes to the rectangular shape and there shall be no cracks or peelings or separations between the elastomer and steel laminates.

10.TEST FOR THE DETERMINATION OF ULTIMATE COMPRESSIVE STRENGTH

10.1 The test specimen not less than 100 x 200mm cut from the bearings or specially molded shall be kept directly between the plates of the testing equipment.

10.2 The rate of loading shall not exceed 10 MPa per minute and the load to be increased till the failure of the steel laminates or till the irreversible squeezing out of elastomer whichever is earlier.

10.3 The ultimate compressive strength shall be not less than 60 MPa (6 times of the design load).

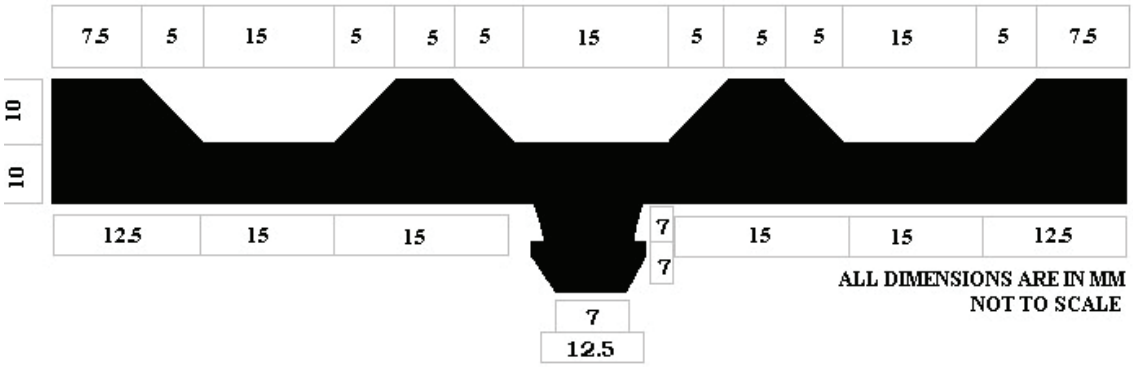
STANDARD PLAN DIMENSION

STANDARD PLAN DIMENSION OF THE ELASTOMERIC BEARING

	A	B	C	D	E	F	G	H	I	J
	MM	MM	MT	kN	kN	MM	Nos.	Nos.	MM	MM
01.	160	250	035	350	070	08	3	1	32	16
02.	160	320	046	460	090	08	3	1	32	16
03.	200	320	058	580	120	08	4	2	40	24
04.	200	400	073	730	150	08	4	2	40	24
05.	250	400	092	920	180	10	4	2	50	30
						12	3	1	48	24
06.	250	500	116	1160	230	10	4	2	50	30
						12	3	1	48	24
07.	320	500	150	1500	300	10	5	2	60	30
						12	4	2	60	36
08.	320	630	195	1900	380	10	5	2	60	30
						12	4	2	60	36
09.	400	630	239	2400	480	12	6	3	84	48
10.	400	800	306	3100	600	12	6	3	84	48

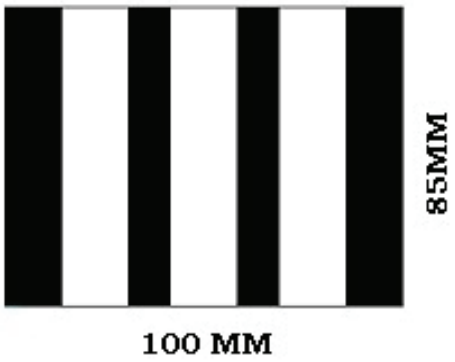
(A) Overall breadth in mm
(B) Overall length in mm
(C) Maximum design load in metric ton
(D) Maximum design load in kN
(E) Minimum design load in kilo Newton
(F) Thickness of the internal elastomer in mm
(G) Maximum number of internal elastomer
(H) Minimum number of internal elastomer
(I) Total elastomer thickness maximum in mm
(J) Total elastomer thickness minimum in mm

GROOVED BEARING PAD



DIMENSION: LENGTH: 100MM X WIDTH: 85MM X THICKNESS: 20MM

TOP VIEW



DIMENSION DETAIL