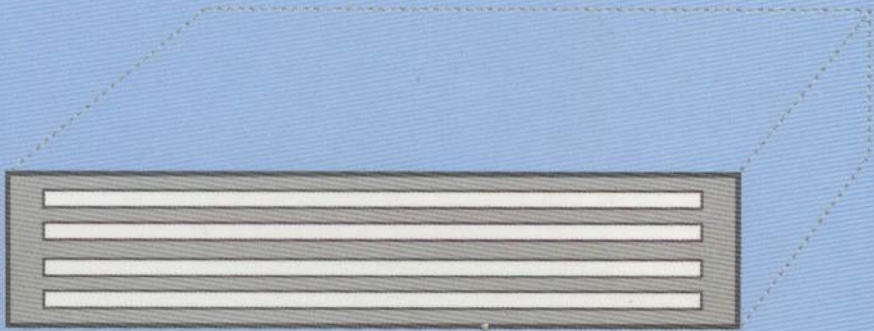
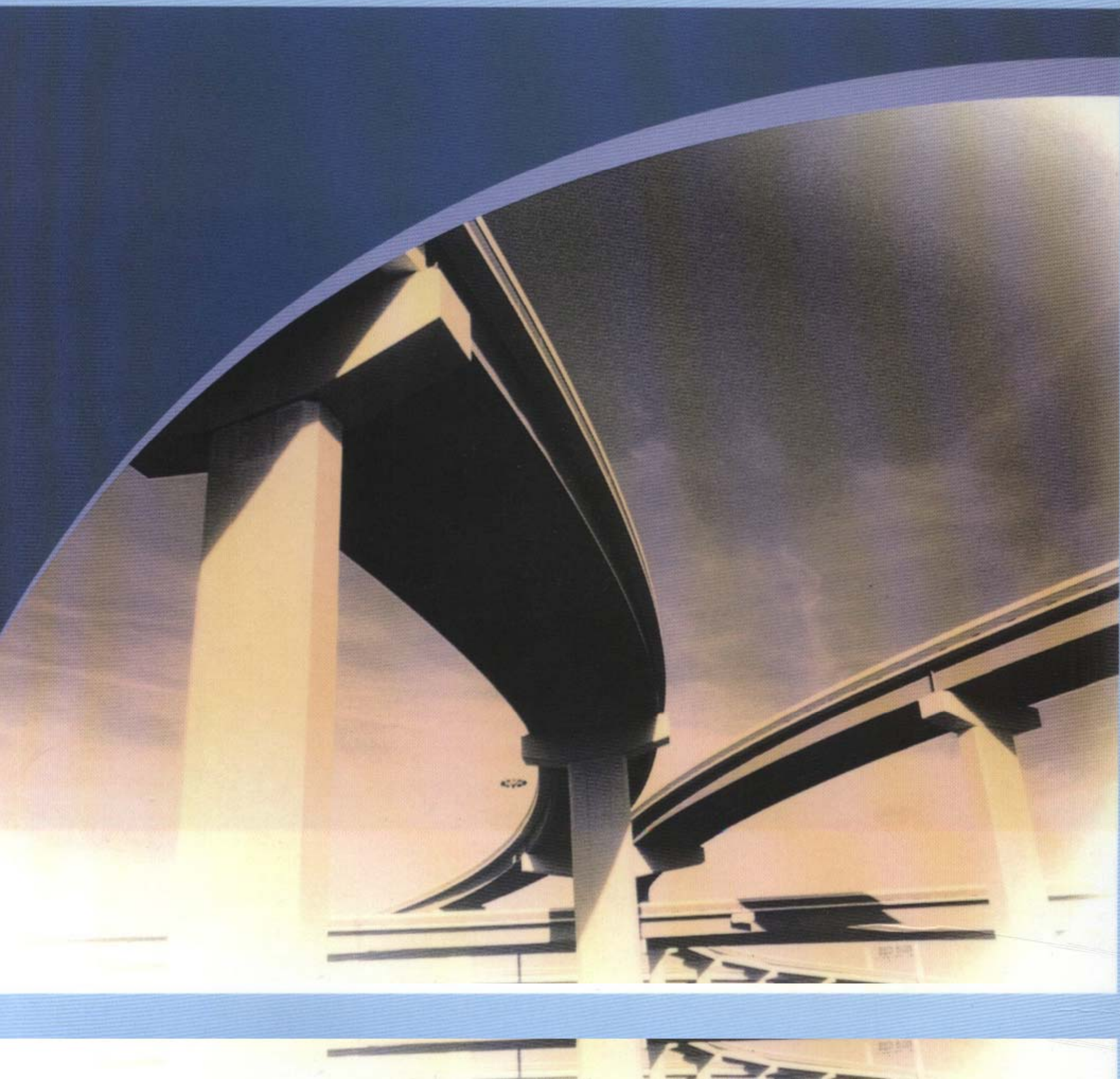
Laminated Elastomeric Bearings /
Plain Bearing Strips & Bearing Pads
To BS. 5400
or &
AASHTO M251
DIN 4141





Elastomeric Bearings

Why Laminated Neoprene Elastomeric Bridge bearings?

Neoprene bridge bearings - plain or laminated - elastomeric bearings are much easier to install in a bridge than compared to other types of bearing used and require nil maintenance. Unlike most other elastomer, Neoprene rubber under-goes no marked stiffening at low temperature when the thermal contraction of the bridge deck is at maximum. Such stiffening could be deleterious to bearing and / or structure. Correctly-designed and suitably compounded laminated Neoprene Rubber bridge bearings can be confidently expected to function efficiently for at least a decade.

Advantages of Neoprene Elastomeric bearings

As efficient bearing plates for pre-cast, pre-stressed concrete or steel beams in bridges and buildings, Neoprene Pads - plain and laminated - manufactured by us permits a smooth and uniform transfer or load from the beam to the substructure and allow beam rotation at the bearing due to deflection of the beam under load. They further allow lateral and longitudinal movement of the beam caused by thermal forces. Neoprene Pads have no moveable parts and thermal expansion and contraction are absorbed by the pad's ability to give and take in shear. There is no sliding motion between pad and beam or between pad and abutment.

Neoprene bridge bearing specifications

The material specifications for the elastomeric bearing shall meet all the current requirements of AASHTO M251. Bearing pads and elastomeric bearings will comply with Articles 18.2.3. through 18.2.6 of Secion 18, Bearing Devices, Division II, Construction, of the AASHTO Standard Specifications of Highway Bridges.

Bearing pads, strips and laminated bearings shall be of the compound known as neoprene and shall be cast in molds under pressure and heat. A plain elastomeric bearing pad and steel load distribution plate combination shall be classified as a laminated elastomeric bearing. Test specimens shall be in accordance with ASTM D 3182 or D 3183. Where test specimens are cut from the finished product, a 20 percent variation from the original physical properties is allowed.

Physical properties of Neoprene Rubber Compound*

Physical properties of Neoprene Rubber Compound offered in comparison with AASHTO M251 specification (results reproduced from last in-house test)

SL. NO.	PROPERTIES			AASHTO M251 SPECIFIED	IN HOUSE LAB MEASUREMENTS
1	Hardness	(Number)°	[ASTM D 2240]	60 ± 5°	62°
2	Tensile Strength	(kg/cm^2)	[ASTM D 412]	≥ 156.0	160
3	Ultimate Elongation	(%)		≥ 350.0	360
4	Change in durometer Hardness (max)	(Points)		≤ +15°	4°
5	Change in tensile strength (max)°	(kg/cm^2)	[ASTM D 573]	≥ -15	-5
6	Change in				

Manufacturing procedure - Compression moulding:

Elastomeric bearings shall be composed of multiple laminates of elastomeric material separated by steel reinforcing. The overall size of the bearing, the number of laminates and thickness of laminates are designed in accordance to the requirement of Load to be Transferred. Bearings having steel plates as reinforcement shall be cast / compression moulded/vulcanized as a single unit in a mould under pressure and heat.

Internal Laminates

Internal plates shall be ASTM A 36/4 36M or A 570/A 570M, Grade 36 or Grade 40. All plates shall be deburred. The Internal plates shall not be less than 1.88mm (0.074inch) thick. The steel plates separating the elastomeric layers will be completely bonded by vulcanization to the elastomeric material on all surfaces using special metal to rubber bonding adhesive. All external load bearing steel plate(s) if present, shall be factory vulcanized to the elastomeric bearings during the primary molding process.

Mechanical Bridge Bearings.

Mechanical bearings are also manufactured and supplied by us and further investments for plant up-gradation is under way. Please send us your requirement for Pot Bearings.

Testing of Neoprene Bridge Bearings

In house Quick Production Test of all bearings shall be done at Clients/Representative presence. Tests confirming to AASHTO specification in accordance with Acceptance Testing on either Level I or Level II or Short/Long-Duration Compression. Test up to 4200 kN with horizontal shear up to 400kN can be carried out in our facility.

Rubber Compound for BS 5400.

Natural Rubber Compounds are used where Laminated Elastomeric bearings are designed, manufactured and tested in accordance to requirements with BS 5400 Part 9 and Neoprene Compound for AASHTO specification.

Bearing Load Calculations

Let us verify load calculations for your bearings. Send us sizes, construction and load details of your bearings and we will send results on design parameters compared to AASHTO LRFD similar to this table.

Elastomeric Bridge Bearing Design

Design spreadsheet based on AASHTO 16th Edition 1197 Interim (Method A) AASHTO LRHD

Bearing type (P - Plain R - reinforced)		R		
Bearing type (F - Fixed, E - expansion)		E		
Dead Load rotation.	Φ	0.005	Radian [Slope of girder at the bearing]	
Dead Load (unfactored)	DL	112.4	kips.	kN 500
Live Load W/O impact (unfactored)	LL	56.2	kips.	kN 250
Bearing design load	P	168.6	kips. [LL + DL]	kN 750
Horizontal movement - long	Δs	1.1	in. [sum of range of movements from all sources]	
Shear moduls	G	0.130	ksi [AASHTO table 14.6.5.2-1]	
Load application parallel to bearing plain	F_{sy}	11.423	kips.	kN 50.81
Inner layer thickness	hri	0.3740157	in. [Arbitrary design value >= 0.40 in]	
Cover layer thickness	hrc	0.2165354	in. [Arbitrary design value >= 0.7*hri]	OK
DESIGN CHECK		57.89	%	hrc<= 70% of hri
Number of inner layers	n	5	Nos. [Arbitrary desgin value]	
Total elastomer thickness	hrt	2.3031496	in. (2hrc + n*hri)>= 2 Delta s	OK
DESIGN CHECK	2Δs	2.283		hrt>= 2*Delta s
DESIGN CHECK	ra	1.75		ra max 4
Bearing length	L	16.141732	in. [Arbitrary design value]	
Bearing width	W	9.8425197	in. [Arbitrary design value]	
Bearing area	A	158.87532	in2. [L*W]	
Shape factor (Inner layers)	Si	3.270	[Si = LW/(2hri(L+W))]	
Shape factor (Cover layers)	Sc	14.118	[Sc = LW/(2hrc(L+W))]	
Average compressive stress	σs	1.06125	ksi. [σs = P/A]	OK
Allowable compressive stress	σall	0.42504	ksi. [1.0*GS]	
DESIGN CHECK	Amin	118.068		Amin<A
Modifier constant	k	0.6	[AASHTO table 14.3.1]	
Compression modulus (Inner layer)	Eci	5.3928617	ksi. [Eci = 3G (1+(2kSi²))]	
Compression modulus (Cover layer)	Ecc	93.676832	ksi. [3G (1+(2kSc²))]	
Compressive strain (Inner layer)	εci	0.1967882	[P/(A*Eci)]	OK
Compressive strain (Cover layer)	εcc	0.0113289	[P/(A*Ecc)]	
Instantaneous deflection	Δc	0.3729157	in. [Δc=Σεchri][BOPP max=0.2in. in deck joint location]	
Allowable rotation	ΦAll	0.0999326	Radians [ΦAll = σs/(0.5GS(L/hrt)²]	
DESIGN CHECK	Φreq	0.01		Theta All>=Theta req.
Average compressive stress (LL only)	σ L	0.3537505	kips. [LL/A]	
Allowable fetigue stress	Fμ	24	kips. [AASHTO tab. 10.3. 1A categry A over 200000 cycles]	
Shim steel grade		33	kips [1997 interim AASHTO Divi II, C18.4.1.1.2]	
Shim thickness	ts	0.15748	in. [Arbitrary design value] BOPP min = 11gage = 1/8"	
DESIGN CHECK (Shim thickness)	ts min	0.03608	In. Meets AASHTO equations 14.6.5.3.7-1&2, & BOPP	
PROJECT	Project:		bearing quantity:	

Shim steel grade		33	kips [1997 interim AASHTO Divi II, C18.4.1.1.2]	
Shim thickness	ts	0.15748	in. [Arbitrary design value] BOPP min = 11gage = 1/8"	
DESIGN CHECK (Shim thickness)	ts min	0.03608	In. Meets AASHTO equations 14.6.5.3.7-1&2, & BOPP	

Design

ARP Elastomeric laminated bearings are designed, manufactured and tested in accordance with B.S. 5400: Part 9 or and AASHTO M251.

Maximum capacity of a rubber bearing is controlled by a combination of rotation, load and shear movement. Where shear movement is required, the maximum direct load which a bearing can carry is reduced from that when no shear movement is required, and similarly with roation. (The bearing should normally be placed so that rotation occurs about the longer axis.) The ratio of live to dead load also has an influence.

For a detailed proposal, please send an enquiry, following the format of the schedule in Table 9 of B.S. 5400: Section 9.1 or and AASHTO M251. Elastomeric bearings are designed for serviceability limit state effects only.

Natural Rubber is used for BS54009 and Neoprene-Chloroprene for AASHTO M251, DIN 4141.

Design Parameters

(E6) - 2000 N/mm2 Bulk modulus G-0.82 N/mm2 Shear Modulus

Manufacturing General Notes

Elastomeric bridge bearings can be conveniently divided into two types - "Fixed", where horizontal movements of the deck are restrained and "Free", where the deck can move horizontally.

Fixed ends

Fixed end is usually provided by dowels passing from the deck to the abutment and one end of those dowels should be fitted with dowel caps, which permit the deck to expand and contract laterally and to rotate.

Free ends

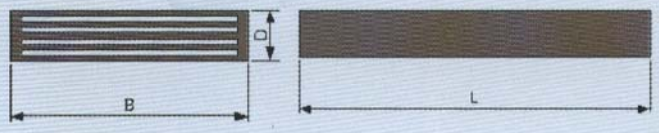
The bearings at the "Free" end will usually located satisfactorily by friction alone, if the contact stress does not fall below 2 N/sq mm.

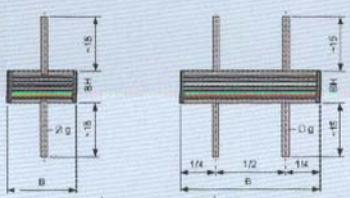
Inclined Soffits

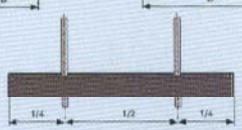
Some additional consideration is required where the superstructure is inclined or has a cross-fall. Where the inclination is small, it may be possible to mount the bearings parallel with the slope, provided that the inclined component of vertical loading can be taken on the fixed end dowels, or resisted by the bearings in shear without excessive movement. Otherwise, the solution is to step the soffit and abutment to provide horizontal seatings for the bearings.

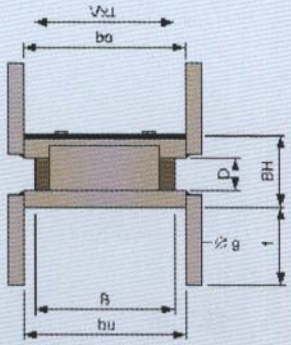
Plinths

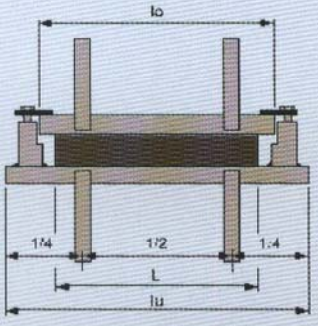
The contact stresses under elastomeric bearings are low and seldom require special attention. However, where a bearing is seated on a raised concrete plinth of approximately thesame size as the bearing, then the plinth will need to be reinforced. To ensure that the bearing is adequately restrained, and to guard against spalling of the concrete edge, it is important that any plinth should extend at least 50mm beyond the edge of the bearing, and that the reinforcement should contain the concrete assuming 45°dispersion of stress from the bearing.











Installation

Seating

Where the support is concrete, the cast surface is usually irregular, so the bearings should be placed accurately to line and level on a 5-15mm thick bedding of stiff mortar. This can be ordinary sand/cement with a low water/cement ratio, or a mortar of fine dry sharp sand and chemical resin. In either case, the cube crusing strength of the mortar should be at least 20N/mm2. Where the support is steel, a rolled surface may be suitable for use directly, provided that it is reasonably smooth and true to level, but otherwise some surface preparation will be needed. Trowelling often seems to produce a beadding that is slightly rounded on the top surface, and it is preferable to screed off or cast against a flat plate.

In-situ superstructure

When the superstructure is to be concrete cast in-situ, the spaces around and between the bearings can be filled with expanded polystyrene, or well rammed damp sand covered with an impervious membrane such as polythene sheet. Extreme care must be taken not to distrub the bearings during casting, and a temporary bond to the substructure with an impact adhesive will help. After curing of the superstructure, the sand infill can be washed away from around the bearings, or the polystyrene can be broken up and blown out with compressed air. (It should not be dissolved, because the solvent may attack the elastometer in the bearings).

Precast concrete and steel superstructures

Where precast concrete beams are being used they should be lowered on to a mortar skim (2-3mm), on the top of the bearings, to eliminate soffit irregularities and twist in the beams. The bearings should be selected to accommodate the rotation due to precamber of the beams at this very low level of vertical loading, or the beams should be propped until the mortar skim has hardened into a wedge, so that the bearings are not rotated at this stage.

Steel beams will have to be jig drilled to accommodate any fixing devices, or have them ready attached to drop into pockets in the substructure for grouting. It is sometimes possible to land the beams directly on the bearings without using any mortar, because the camber tends to be fairly consistent, and tapered plates can be attached to the beams during fabrication, to provide horizontal seatings for the bearings, although care must be taken to avoid difficulties due to lateral inaccuracies in level.

With both steel and precast concrete beams, it may prove easier to attach the dowels and bearings to the beams, and lower the whole assembly onto a mortar skim on the bedding on the supports. The bearings can be temporarily attached to the beams with an impact control, and the beams should be propped until it has set.

assembly onto a mortar skim on the bedding on the supports. The bearings can be temporarily attached to the beams with an impact

General arrangement drawings

We suggest that before detailing General arrangement drawings are obtained with the latest information on dimensions and material specifications as the information in this publication is subject to change and updating.

General Note:

BS5400 Part 9a: Elastomer Natural Rubber NR
AASHTO M251: Elastomer Neoprene CR
DN 4141: Elastomeric Neoprene

Sizes of Plain & Laminated Elastomeric Bearings / Strips and Bearing Pads

Please Contact us for details on
Standard sizes of plain & laminated
bearings manufactured by us.
or visit our website www.pretread.com

Disclaimer

For a copy of our standard disclaim please contact us.

E & O.E.

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