097-13 DPWH (CR)
2-10-97

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
MANILA

29 January 1997

DEPARTMENT ORDER)
NO. 25)
SERIES OF 1997)

SUBJECT: **Revised DPWH Standard Specification for Elastomeric Bearing Pads**

To be consistent and to keep abreast with the provisions of the latest edition of AASHTO and ASTM Standards, it is hereby directed that the attached Revised Standard Specification for Elastomeric Bearing Pads be strictly followed.

In no case shall materials be accepted for use without prior test for conformance to the requirements as prescribed herein.

This supersedes all existing specifications and related issuances issued contrary hereto.

This Order shall take effect immediately.

GREGORIO R. VIGILAR
Secretary

Attachment: As stated.

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Department Order No. 25
Series of 1997
Annex "A"

DPWH SPECIFICATION FOR ELASTOMERIC BEARING PADS

1. Scope

This Standard specifies the requirement for elastomeric bearing pads whose main function is to transfer loads or accomodate relative movement between a bridge superstructure and its supporting structure, or both while avoiding damaging strain and additional tension. Elastomeric bearings as herein defined shall include unreinforced pads (consisting of elastomer only) and reinforced bearings with steel laminates.

2. Definitions

2.1 Design Load - the mean compressive stress applied to the area of the steel laminate

2.2 Elastomeric Bridge Bearing - a block of vulcanized rubber, with or without internal reinforcement, that is placed between the bridge deck and bridge support for the purpose of accomodating potentially damaging movements of the bridge deck resulting from the thermal expansion or contraction, the action of traffic, wind and other effects.

2.3 External Load Plate - a steel plate bonded to the top or bottom elastomeric surface of a bearing or both.

2.4 Laminated Bearing - a bearing consisting of rubber with one or more reinforcing layers embedded in, and bonded to, the rubber.

2.5 Lot - shall be defined as those bearings presented for inspection at a specific time or date.

2.6 Reinforcing Layer - a rigid or inextensible layer sandwiched between rubber layers in a laminated bearing for the purpose of increasing the compressive stiffness of the bearing without increasing its shear stiffness. The layer is usually a steel plate .

2.7 Rubber Polymer - the polymer type upon which the vulcanized rubber is based.

2.8 Steel-laminated Elastomeric Bearing - a bearing molded of elastomeric material with one or more steel laminates embedded in and bonded to it, and to which one or two

external load plates maybe bonded.

2.9 Plain Elastomeric Bearing Pad - a bearing that consists only of elastomeric material

2.10 Plain Elastomeric Sandwich Bearing - a bearing that consists of a single layer of elastomeric material with one or more steel laminates embedded in and bonded to it, and to which one or two external load plates maybe bonded.

3. General Requirements

3.1 All bearings shall be designed in accordance with specifications contained in the latest edition of the AASHTO Standard Specification for Highway Bridges, 15th Edition,1992.

4. Classification and Use

4.1 The following are the types of elastomeric bearings (See Fig. 1):

a. Plain Elastomeric Bearing Pad

b. Plain Elastomeric Sandwich Bearing

c. Steel-Laminated Elastomeric Bearing without External Load Plates

d. Steel-Laminated Elastomeric Bearing with External Load Plate(s)

4.2 A laminated bearing pad is required when the thickness of the plain pad is more than 1 1/4 inches and the compressive strain is more than 15%.

5. Materials

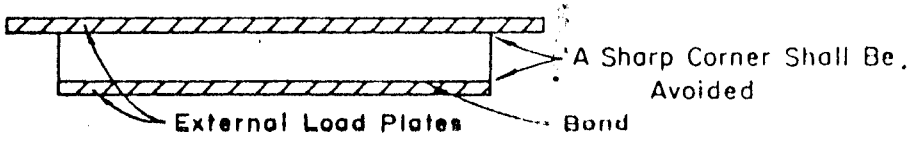
5.1 The elastomer for the manufacture of the bearing is furnished in two types as follows :

1. Type CR - Chloroprene Rubber
2. Type NR - Natural rubber

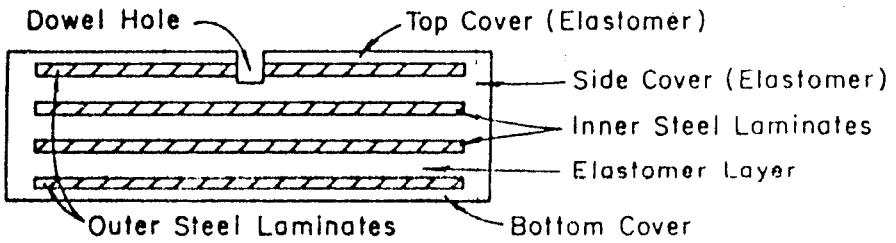
5.2 The elastomer compound used in the construction of a bearing shall contain only either natural rubber or chloroprene rubber as the raw polymer. No reclaimed rubber shall be used.

5.3 Steel laminates used for reinforcement shall be made from rolled mild steel conforming to ASTM A 36, A 570 or equivalent, unless otherwise specified by the Engineer. The laminates shall have a minimum nominal thickness of 20 gage.

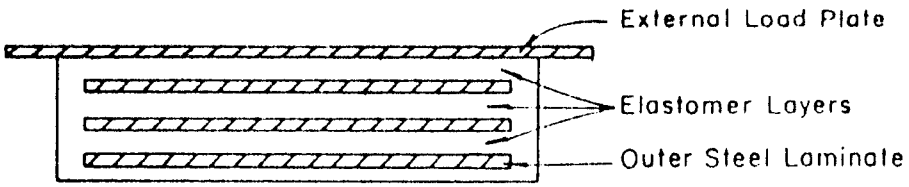
PLAIN ELASTOMERIC BEARING PAD



PLAIN ELASTOMERIC SANDWICH BEARING



STEEL-LAMINATED ELASTOMERIC BEARING
(No External Load Plates)



STEEL-LAMINATED ELASTOMERIC BEARING
(With One External Load Plate)

Fig. 1 - Types of Elastomeric Bearings

6. Manufacture

6.1 Plain bearing pads shall be molded individually, or cut from previously molded strips or slabs, or extruded and cut to length. Cutting shall not heat the materials and shall produce a smooth finish. Fabricators will not be allowed to make pads of finished thickness by plying pads of lesser thickness together.

6.2 Bearings with steel laminates shall be cast as a unit in a mold and shall be bonded and vulcanized under heat and pressure. The elastomer at the outer edges of the bonds to external load plates shall be shaped to avoid serious stress concentrations.

6.3 Internal steel laminates shall be free of sharp edges, burrs and shall have a minimum edge cover of 1/8 in (3mm).

6.4 External load plates shall be protected from rusting by the manufacturer, and preferably shall be hot bonded to the bearing by vulcanization during the primary molding process.

6.5 Bearing assemblies shall be pre-assembled in the shop by the supplier and checked for proper completeness and geometry before shipping to the site.

7. Physical Requirements

7.1 The elastomer compound shall meet the minimum requirement of Table 1.

7.2 Dimensions and Permissible Variations

7.2.1 All elastomeric layers, for example, plain-bearing pads, laminates, and covers, shall be of uniform thickness unless otherwise specified in the contract or purchase order.

7.2.2 All internal steel laminates shall be of uniform thickness. When specified in the contract or purchase order, the thickness of the outer steel laminates may differ if not adjacent to an external load plate.

7.2.3 The minimum thickness of internal steel laminates shall be 1.5 mm or 0.060 in (16 gage) when the greater of the length or width of a rectangular bearing or diameter of a circular bearing is less than 450 mm or 18 in. In all other cases, the minimum thickness shall be 2 mm or 0.075 inch (14 gage)

7.2.4 Bearing dimensions and elastomer layer thicknesses shall satisfy the tolerances in Table 2, in which D is the length, width or diameter as appropriate, and T is

the total elastomer thickness

7.2.5 Variation from a plane parallel to a design surface shall not exceed an average slope of 0.005 for the upper surface and 0.006 for a side surface

Table 1 - Quality Control Properties of Elastomer

	Natural Rubber (NR)		Chloroprene (CR)	
Grade (Durometer)	60	70	60	70
Physical Properties:				
A. Before Aging				
Tensile Strength, MPa (D412)	15.5 (min.)	15.5 (min)	15.5 (min)	15.5 (min)
Elongation, % (D412)	400 (min)	300 (min)	350 (min)	300 (min)
Durometer Hardness, Shore Pts. (D2240)	60 ± 5	70 ± 5	60 ± 5	70 ± 5
Tear Resistance, N/mm (D624)	31.5 (min)	31.5 (min)	31.5 (min)	31.5 (min)
Compression Set, % (D395)	25 (max)	25 (max)	35 (max)	35 (max)
Method B, Temperature, ^{0}C	70	70	100	100
B. After Aging				
Temperature of the Test, ^{0}C	70	70	100	100
Aging Time, Hours	168	168	70	70
Tensile Strength, % (D573)	-25 (max)	-25 (max)	-15 (max)	-15 (max)
Elongation, %	-25 (max)	-25 (max)	-40 (max)	-40 (max)
Durometer Hardness, Shore Points	+10 (max)	+10 (max)	+15 (max)	+15 (max)
Other Properties:				
Ozone Resistance (D1149)				
Partial Pressure, MPa	25	25	100	100
Duration, Hours	48	48	100	100
Tested at 20% strain 37.7^{0}C ±1^{0} C mounting procedure D518 Procedure A	-	-	No Cracks	No Cracks
Brittleness D2137, low temp brittleness at -40^{0}C	Pass	Pass	Pass	Pass
Shear Modulus Nominal Hardness Shear Modulus at 23^{0}C, MPa	0.85 - 1.1	1.13-1.84	0.85-1.1	1.13-1.84

Plain pads and laminated bearings shall be manufactured to the design dimensions and these specifications with the tolerances listed in Table 2, unless other tolerances are shown on the design drawings.

Table 2 Tolerances

	mm
1. Overall vertical dimensions	
Design thickness 32 mm (1 1/4 in) or less	- 0, +3
Design thickness over 32 mm (1 1/4 in)	- 0, +6
2. Overall horizontal dimensions	
914 mm (36 in) and less	- 0, +6
Over 914 mm (36 in)	- 0, +12
3. Thickness of individual layers of elastomer(laminated bearing only) at any point within the bearing	±20 percent of design value but no more than ±3 mm (1/8 in)
4. Variation from a plane parallel to the theoretical surface: (as determined by measurements at the edge of the bearings)	
Top	Slope relative to the bottom of no more than 0.005 radians.
Sides	6
5. Position of exposed connection members	3
6. Edge cover of embedded laminates of connection members	-0, +3
7. Size of holes, slots or inserts	±3
8. Position of holes,slots, or inserts	±3

8. Sampling

8.1 Sampling, testing and acceptance consideration will be made on a lot basis. A lot shall be further defined as the smallest number of bearings as determined by the following criteria:

8.1.1 A lot shall not exceed a single contract or project quantity

8.1.2 A lot shall not exceed 50 bearings.

8.1.3 A lot shall consist of those bearings of the same type regardless of load capacity.

8.2 For acceptance purposes, bearing from within the lot shall be selected at random as samples for inspection and testing.

8.3 A minimum of three bearings shall be taken from the lot for testing. If the number of bearings in the lot exceeds 50 then for each additional 50 or part thereof, one additional bearing shall be taken for testing.

9. Testing

9.1 The materials shall be tested in accordance with AASHTO M-251 or with the appropriate method in ASTM.

9.2 Prior to installation, the contractor shall furnish the Engineer , test results from any accredited testing laboratories confirming that all components of the bearing pad furnished conforms to the applicable requirements herein specified.

10. Acceptance and Rejection

10.1 If lack of elastomer to steel bond is indicated, the bearing shall be rejected.

10.2 If laminate placement faults are observed which result in elastomer layer thickness that exceed the tolerances in Table 2, the bearing shall be rejected.

10.3 If there are at least three separate surface cracks which are each at least 2 mm wide and 2 mm deep, the bearing shall be rejected.

10.4 Record the median compressive stiffness (K) of the bearing of median stiffness. The compressive stiffness of each bearing tested shall not differ from (K) by more than 10%.

10.5 For each bearing that fails to meet the requirements in 10.1, two additional bearings maybe sampled and shall meet the requirements in 10.1 or the lot shall be rejected.

10.6 If the lot is not rejected, the bearing of median stiffness (K) shall be subjected to the elastomeric material tests in 10.2.

11. Handling. Transport, Storage and Installation

11.1 During handling, transport, storage and installation, bearings shall be kept clean and protected from mechanical damage, heat, contaminants and other deleterious effects.

11.2 Bearings shall be placed on surfaces that are plane to within 1/16 in. and, unless the bearings are placed in opposing pairs, horizontal to within 0.01 radians.

11.3 Any lack of parallelism between the top of bearing and the underside of the girder that exceeds 0.01 radians shall be corrected either grinding of the surface , grout pack bearing seats or modification of the bearing such that intended bearing placement is as originally designed with the least amount of bearing modification, or as otherwise directed by the Engineer.

11.4 Exterior plates of the bearing shall not be welded unless at least 1 1/2 in. of steel exists between the weld and the elastomer.

11.5 Each completed bearing shall have its components clearly identified, be securely bolted , straffed or otherwise fastened to prevent any relative movement and marked on its top as to location and orientation in each structure in the projects conformity with the plans

11.6 Dismantling at the site shall not be done unless absolutely necessary for inspection or installation.

12. References

12.1 AASHTO M 251-90 - Standard Specification for Plain and Laminated Elastomeric Bridge Bearings

12.2 ASTM D 4014-89 - Standard Specification for Plain and Steel-laminated Elastomeric bearings for Bridges

12.3 AASHTO Standard Specifications for Highway Bridges 15th Edition,1992