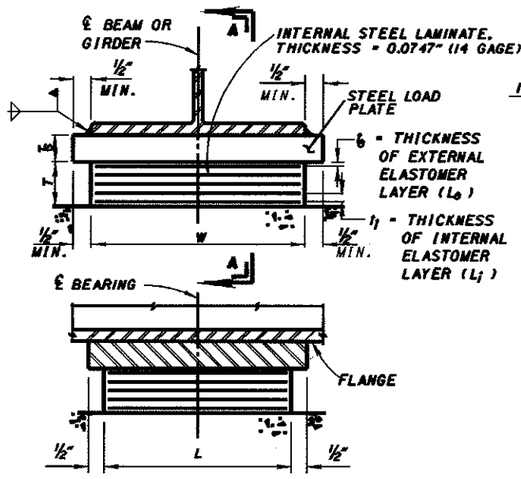
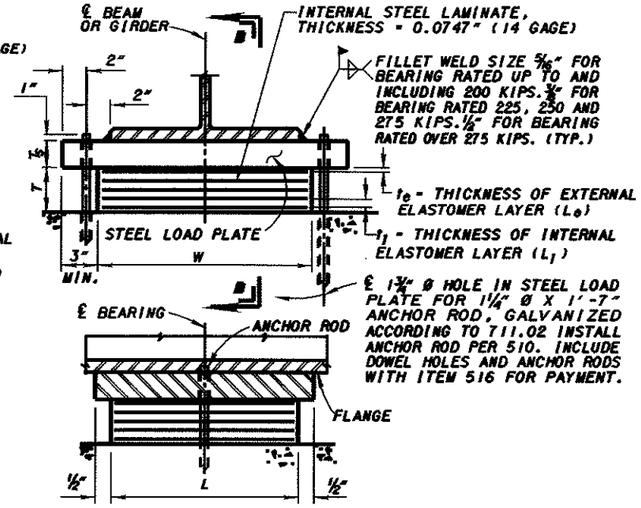


SECTION A-A

LAMINATED ELASTOMERIC EXPANSION BEARING



SECTION B-B

LAMINATED ELASTOMERIC FIXED BEARING

EXPANSION BEARINGS

TOTAL LOAD KIPS	SIZE (in.) L	W	50 DUROMETER t_i in.	50 DUROMETER t_e in.	50 DUROMETER MAX. kpi. OF L_i = min.	60 DUROMETER t_i in.	60 DUROMETER t_e in.	60 DUROMETER MAX. kpi. OF L_i = min.
75	7	11	0.20	0.15	7	0.28	0.20	5
100	8½	12	0.24	0.17	7	0.32	0.23	5
125	9	14	0.26	0.19	7	0.36	0.25	4
150	9½	16	0.28	0.20	7	0.39	0.28	4
175	10½	17	0.31	0.22	6	0.42	0.30	3
200	11½	18	0.33	0.24	5	0.46	0.33	3
225	12	19	0.35	0.25	5	0.48	0.34	3
250	13	20	0.37	0.27	5	0.51	0.37	2
275	13½	21	0.39	0.28	4	0.53	0.38	2
300	14	22	0.41	0.29	4	0.56	0.40	2
350	14½	25	0.44	0.31	4	0.60	0.43	2
MIN. NO. OF L_i, n min.			3			2		
MIN. STRESS DUE TO DEAD LOAD, lb./in.²			325			500		

FIXED BEARINGS

TOTAL LOAD KIPS	50 DUROMETER SIZE (in.) L	W	T in.	t_i in.	t_e in.	60 DUROMETER SIZE (in.) L	W	T in.	t_i in.	t_e in.
100	7½	13	1½	0.21	0.15	9	11	1 9/16	0.29	0.21
125	8½	14	1 11/16	0.23	0.16	9½	12	1 11/16	0.31	0.22
150	9½	15	1¾	0.25	0.18	10½	13	1 13/16	0.34	0.25
175	10	16	1 13/16	0.27	0.19	11½	14	2	0.37	0.27
200	10½	18	1 15/16	0.29	0.21	12½	15	2 1/16	0.40	0.29
225	11	19	2	0.30	0.22	13½	16	2 3/16	0.43	0.31
250	11½	20	2 1/16	0.32	0.23	14	17	2 5/16	0.45	0.32
275	12	21	2 3/16	0.33	0.24	14½	18	2 7/16	0.48	0.34
300	12½	22	2¼	0.34	0.25	15	19	2½	0.50	0.35
350	14	23	2 7/16	0.38	0.27	15½	21	2 5/8	0.53	0.38
NUMBER OF L_i				4				3		
NUMBER OF STEEL LAMINATES				5				4		

GENERAL NOTES

DESIGN SPECIFICATIONS: THIS DESIGN DATA CONFORMS TO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, 1992 INCLUDING THE 1993 AND 1994 INTERIM SPECIFICATIONS AND THE ODOT BRIDGE DESIGN MANUAL.

DESIGN LOADING: MAXIMUM REACTION = TOTAL DEAD LOAD PLUS LIVE LOAD WITHOUT IMPACT, (SERVICE LOAD REACTIONS).

BASIS OF DESIGN: (SEE DESIGN TABLE)

1. AVERAGE COMPRESSIVE STRESS $< \frac{G_c S}{\beta} < \sigma_c$ IN P.S.I.
2. COMPRESSIVE DEFLECTION
   $\Delta_c = (0.0425 \times n \times t_i + 0.0375 \times 2 \times t_e)$ INCHES
3. COMPRESSIVE DEFLECTION INCLUDING CREEP = Δ_c (1+CREEP)
4. ROTATION $\theta = \frac{2\Delta_c}{L}$ RADIANS
5. SHEAR FORCE $F_s = G_H \times \frac{WL}{T_e} \times \Delta_s$ POUNDS

   Δ_s = SHEAR DEFORMATION OF THE BEARING IN ONE DIRECTION, INCHES.
   T_e = TOTAL THICKNESS OF ELASTOMER LAYERS, INCHES
6. SLIPPAGE
   MINIMUM DEAD LOAD STRESS = 2.50 X G_H P.S.I.
   BASED ON COEFFICIENT OF FRICTION = 0.20
7. STABILITY $\frac{L}{3} > T$

ROTATION: EXPANSION AND FIXED BEARINGS ARE DESIGNED FOR A MAXIMUM ROTATION OF 0.01 RADIANS (1% SLOPE). PROVIDE A BEVELED LOAD PLATE IF BEAM ROTATION DUE TO AN UPPER NON-LEVEL LOADING SURFACE PLUS BEAM (GIRDER) ROTATION DUE TO DEFLECTION UNDER LIVE LOAD EXCEEDS 0.01 RADIANS. IN GENERAL, FOR MAXIMUM PERFORMANCE OF THE BEARINGS, PROVIDE BEVELED LOAD PLATES TO MAKE PROVISION FOR LEVEL LOADING SURFACES IF THE GRADE AT THE BEARING EXCEEDS ½ %.

LOAD PLATE

THE STEEL LOAD PLATE SHALL BE BONDED BY VULCANIZATION TO THE ELASTOMER DURING THE MOLDING PROCESS. THICKNESS OF LOAD PLATE, $T_s = C\sqrt{\frac{R \times W}{L + T}}$ - BEAM FLANGE THICKNESS.

WITH BEARING STIFFNERS USE 80% OF T_s.

MINIMUM T_s = 1½" FOR BEARING RATED UP TO AND INCLUDING 200 KIPS. AND MINIMUM T_s = 2" FOR BEARING RATED OVER 200 KIPS.

R = REACTION IN KIPS INCLUDING IMPACT
C = 0.194 FOR f_s = 20 KSI
C = 0.167 FOR f_s = 27 KSI

WELDING OF THE LOAD PLATE TO THE SUPERSTRUCTURE SHALL BE CONTROLLED SO THAT THE PLATE TEMPERATURE AT THE ELASTOMER BONDED SURFACE SHALL NOT EXCEED 300 °F AS DETERMINED BY THE USE OF PYROMETRIC STICKS OR OTHER TEMPERATURE MONITORING DEVICES.

BEARING ANCHOR RODS: AT THE OPTION OF THE CONTRACTOR, THE BEARING ANCHOR RODS (OR FORMED HOLES), LOCATED AND SUPPORTED BY TEMPLATES, MAY BE CAST-IN-PLACE.

BRIDGE SEAT REINFORCING: PROJECT PLANS SHALL INCLUDE PLAN VIEWS OF THE SEAT AREAS FOR FIXED BEARINGS SHOWING THE ANCHOR RODS AND THE MAIN REINFORCING BARS IN THE TOP OF THE BRIDGE SEAT. ADEQUATE DIMENSIONS SHALL BE SHOWN TO ENSURE THAT THERE WILL BE NO INTERFERENCE BETWEEN THE ANCHOR RODS AND THE REINFORCING STEEL, AND THAT THE SEAT AREA WILL ACCOMODATE THE BEARING. BEARING SEAT SHALL BE LEVEL.

BEARING REPOSITIONING: IF DECK CONCRETE IS PLACED AT AN AMBIENT TEMPERATURE HIGHER THAN 80 °F OR LOWER THAN 40 °F AND THE BEARING SHEAR DEFLECTION EXCEEDS ONE-SIXTH OF THE BEARING HEIGHT AT 60 °F ± 10 °F, THE BEAMS OR GIRDERS SHALL BE RAISED TO ALLOW THE BEARINGS TO RETURN TO THEIR UNDEFORMED SHAPE AT 60 °F ± 10 °F.

ELASTOMERIC BEARINGS SHALL COMPLY WITH ITEM 516 AND SECTIONS 18.2.5 THRU 18.2.8 OF AASHTO, DIVISION II, CONSTRUCTION. BEARING MATERIAL SHALL BE GRADE 3, THE DESIGN DUROMETER AND THE BEARING SHALL BE MEET THE LOAD TEST REQUIREMENTS FOR DESIGN METHOD A.

BRIDGE PLANS: DETAIL BRIDGE PLANS SHALL INCLUDE THE FOLLOWING INFORMATION WHEN SPECIFYING BEARINGS:

1. DUROMETER OF THE ELASTOMER.
2. PLAN AND ELEVATION VIEWS OF ELASTOMERIC BEARING AND STEEL LOAD PLATE.
3. THICKNESS OF INTERNAL AND EXTERNAL ELASTOMER LAYERS.
4. NUMBER OF INTERNAL ELASTOMER LAYERS REQUIRED.
5. OVERALL THICKNESS OF BEARING (DIMENSION T).
6. SIZE OF FILLET WELD CONNECTING LOAD PLATE TO BEAM OR GIRDER FLANGE.
7. DEAD LOAD AND LIVE LOAD WITHOUT IMPACT REACTIONS AT BEARING LOCATION (SERVICE LOAD REACTIONS).
8. DETAILS OF STEEL LOAD PLATE ORIENTATION FOR SKEWED STRUCTURES. SEE DETAILS SHOWN ON THIS SHEET.
9. DESIGN NOTES PERTAINING TO THE STEEL LOAD PLATE WELDING, ANCHOR RODS, BRIDGE SEAT REINFORCING IF APPLICABLE, AND BEARING REPOSITIONING. CORROSION PROTECTION FOR THE STEEL LOAD PLATE SHALL BE THE SAME AS THE SUPERSTRUCTURE STEEL AND THE ELASTOMER NOTE.
10. BASIS OF PAYMENT NOTE

LIMITATIONS: THIS DESIGN DATA CAN BE USED ONLY WHEN THE TOTAL REACTION, ROTATION AND NUMBER OF INTERNAL ELASTOMER LAYERS ARE WITHIN THE LIMITS SHOWN, NO VERTICAL OR HORIZONTAL RESTRAINT IS REQUIRED AND AN OVERLAPPING STEEL END DAM IS NOT USED. OTHERWISE, THE LAMINATED ELASTOMERIC BEARING SHALL BE INDEPENDENTLY DESIGNED OR ANOTHER TYPE OF BEARING SHALL BE USED. THESE DRAWINGS SHOULD NOT BE MADE A PART OF THE PROJECT PLANS.

BASIS OF PAYMENT: THE UNIT BID PRICE SHALL INCLUDE ALL MATERIALS, LABOR, TESTING, ANCHOR RODS AND INCIDENTALS NECESSARY TO FURNISH AND INSTALL LAMINATED ELASTOMERIC BEARINGS, EITHER FIXED OR EXPANSION. PAYMENT WILL BE MADE AT THE CONTRACT PRICE FOR ITEM 516, EACH, ELASTOMERIC BEARINGS WITH INTERNAL LAMINATES AND LOAD PLATE (NEOPRENE): — " x — " x — " WITH — " x — " x — " LOAD PLATE.

EXPANSION BEARING:

NOTES :

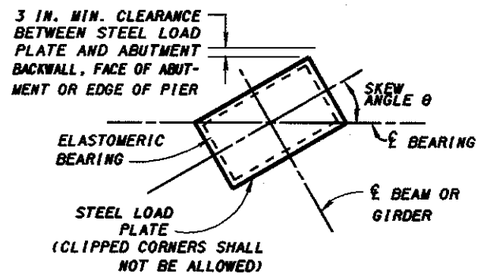
1. MAXIMUM NUMBER OF INTERNAL ELASTOMER LAYERS, L_i, SHOWN IN THE TABLE LIMITS THE INSTANTANEOUS DEFLECTION DUE TO TOTAL LOAD PLUS THE EFFECTS OF CREEP TO ⅛ INCH AND ENSURES THE BEARING STABILITY.
2. MINIMUM NUMBER OF L_i SHOWN ALLOWS FOR MAXIMUM ROTATION AROUND AN AXIS PERPENDICULAR TO THE ℄ BEAM (GIRDER) = 0.01 RADIANS.
3. NUMBER OF L_i REQUIRED PER BEARING IS PROPORTIONAL TO "D", THE ACTUAL DISTANCE FROM THE BEARING TO THE NEUTRAL POINT OF SUPERSTRUCTURE ALONG CENTERLINE OF ROADWAY.

   MAXIMUM SHEAR DEFORMATION, Δ_s =
   $6.5 \times 10^{-6} \times 90° \times 12$ in./ft. $\times$ D (ft.) = $7.02 \times 10^{-3} \times$ D (ft.)
   TOTAL THICKNESS OF ELASTOMER LAYERS MUST SATISFY THE RELATION :
   $T_e = 2 \times t_e + n \times t_i$ INCHES $\geq 2 \times$ SHEAR DEFORMATION. WHERE n = NUMBER OF INTERNAL ELASTOMER LAYERS.
4. TOTAL THICKNESS OF LAMINATED PAD, T(in.) = $2 \times t_e + n \times t_i + (n+1) \times 0.0747$
5. DESIGN EXAMPLE :
   DL = 80K; LL = 70K; DL + LL = 150K; D = 140'
   USE 9½" X 16" : t_i = 0.28" : t_e = 0.20" ; (50 DUROMETER)
   $T_e = 2 \times t_e + n \times t_i \geq 2 \times 7.02 \times 10^{-3} \times D$
   $T_e = 2 \times 0.20 + n \times 0.28 \geq 2 \times 7.02 \times 10^{-3} \times 140 = 1.97$ INCHES
   n = 5.53; USE n = 6
   AND NUMBER OF INTERNAL STEEL LAMINATES = 7
   TOTAL THICKNESS, T =
   $2 \times 0.20 + 6 \times 0.28 + 7 \times 0.0747 = 2.60$ INCHES
   CHECK DL STRESS : $\frac{80{,}000}{9.5 \times 16} = 526$ P.S.I. > 325 P.S.I. MIN.
   THEREFORE, NO BEARING SLIDING WILL OCCUR.

FIXED BEARINGS:

NOTES :

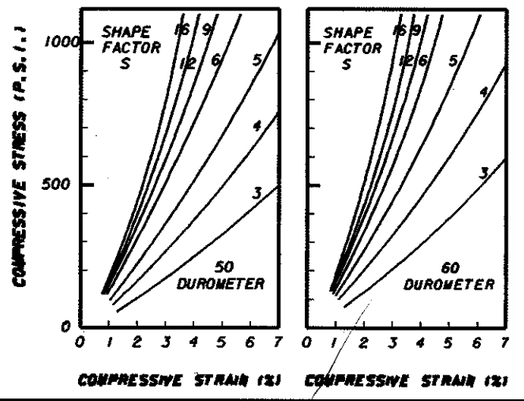
1. THIS DESIGN FOR FIXED BEARINGS ALLOWS FOR A MAXIMUM ROTATION AROUND AN AXIS PERPENDICULAR TO THE ℄ OF BEAM (GIRDER) = 0.01 RADIANS.
2. THE INSTANTANEOUS DEFLECTION DUE TO THE TOTAL LOAD PLUS THE LONG TERM DEFLECTION DUE TO CREEP IS LESS THAN ⅛ INCH.
3. DESIGN EXAMPLE :
   DL = 70K; LL = 55K; DL + LL = 125K
   USE 9½" X 12" : t_i = 0.31" : t_e = 0.22" ; (60 DUROMETER)
   TOTAL THICKNESS, T = 1 13/16"
   NUMBER OF INTERAL ELASTOMER LAYERS = 3
   NUMBER OF STEEL LAMINATES = 4



LAMINATED ELASTOMERIC BEARING ORIENTATION AT ABUTMENTS/PIERS

DESIGN DATA	DUROMETER (HARDNESS) 50	60
ALLOWABLE COMPRESSIVE STRESS FOR EXPANSION BEARINGS, σ_c IN P.S.I.	1000	1000
ALLOWABLE COMPRESSIVE STRESS FOR FIXED BEARINGS, σ_c P.S.I.	1100	1100
SHEAR MODULUS AT 73°F MAXIMUM COMPRESSIVE STRENGTH, G_c P.S.I.	95	130
SHEAR MODULUS AT 73°F FOR HORIZONTAL FORCES, G_H P.S.I.	130	200
COMPRESSIVE STRAIN % FOR THE EXTERIOR ELASTOMER	3.75	3.75
COMPRESSIVE STRAIN % FOR THE INTERIOR ELASTOMER	4.25	4.25
DEFLECTION DUE TO CREEP AT 25 YEARS DIVIDED BY INSTANTANEOUS DEFLECTION, %	25	35
*β FOR EXTERIOR ELASTOMERIC LAYERS	1.4	1.4
*β FOR INTERIOR ELASTOMERIC LAYERS	1.0	1.0
SHAPE FACTOR $S = \frac{WL}{2t_i(W+L)}$, FOR EXPANSION BEARINGS	10.53	7.69
SHAPE FACTOR $S = \frac{WL}{2ti(W+L)}$, FOR FIXED BEARINGS	11.58	8.46

* MODIFYING FACTOR



STATE OF OHIO DEPARTMENT OF TRANSPORTATION
BUREAU OF BRIDGES AND STRUCTURAL DESIGN

DESIGN AGENCY

ENGINEER OF BRIDGES — DATE

REVISIONS	DESIGNED	DETAILED	CHECKED	REVIEWED
2-20-95	JFF	JFF/REF	JAM/WRG	LAW

DESIGN DATA

LAMINATED ELASTOMERIC BEARINGS FOR STEEL BEAM AND GIRDER BRIDGES

1 | 1