

FHWA BRIDGE RAIL MEMORANDUM, MAY 30, 1997: PART 1, 2 & 3 COMBINED AND SORTED BY TYPE

FIGURE NUMBER	BRIDGE RAILING	RAILING HEIGHT (IN.)	TEST VEHICLE	IMPACT SPEED (MPH)	IMPACT ANGLE DEGREES	Meets NCHRP 230	PERFORMANCE LEVEL	NCHRP 350 EQUIVALENT TEST LEVEL FROM FHWA MEMO 3	REFERENCES	FHWA Bridge Rail Memo #1	FHWA Bridge Rail Memo #2	FHWA Bridge Rail Memo #3
<b>W-BEAM BRIDGE RAIL</b>												
1	Texas Type T6 (Tubular W-beam)	27	2,280 lb. Car 4,500 lb. Car 2,000 <sup>00</sup> Pickup 817 kg Car 2,452 kg Pickup	58 61.6 100 kph 80 kph 72 kph	15 27.5 16 20 20	Yes		TL-2	1,2 1,2 3 4	3		1-3
2	West Virginia W-beam Retrofit Railing for Concrete Baluster designs, curb mounted	28.5					Originally tested to PL-1	TL-2				3-11
<b>THREE-BEAM BRIDGE RAIL</b>												
3	NCHRP SL1 Thrie Beam, Wood Posts	32	2,250 lb. Car 2,250 lb. Car 4,500 lb. Car	63 60.1 61.9	18.7 15.9 14.5	Yes		TL-2	2.5	1		1-1
4	NCHRP SL1 Thrie Beam, Steel Posts	32	1,987 lb. Car 2,250 lb. Car 2,250 lb. Car 20,000 lb. Bus	61.4 58.6 60 44.7	14.1 16 16 7.7	Yes		TL-2	2.5	2		1-2
5	Nebraska Tubular Thrie Beam	32	1,970 lb. Car 4,700 lb. Car	61.4 59.8	20 24.3	Yes		TL-3	6.7	11		1-12
6	Oregon Side-Mounted Thrie Beam	27	1,970 lb Car 5,737 lb Pickup	52.2 46.1	19.7 20.8	Yes	PL-1	TL-2	8,9,10		1-1	2-1
7	Washington 10 gage Thrie Beam Retrofit for Balusters Curb/Sidewalk	30	1,840 lb Car 4,728 lb Car 5,400 lb Pickup	58.8 60.7 66.3	19.5 15.6 19.4	Yes	PL-1	TL-2	11		1-8	2-7
8	California Thrie Beam	32	1,935 lb Car 5,565 lb Pickup	48.7 44.9	18.3 21	Yes	PL-1	TL-2	12,13		1-9	2-8
9	Missouri Thrie Beam and Channel (top mounted)	30-5/8", 30.625"	1,984 lb Car 4,495 lb Car	59.6 60.9	15 24	Yes		TL-3	14,15		1-10	2-13
10	Michigan 10 gage retrofit on Curb/Sidewalk (Michigan R4 Retrofit Bridge Rail)	34	1,972 lb Car 5,724 lb Pickup 18,000 lb Truck	61.5 60.6 49	20 20 15	Yes	PL-2	TL-4	16		1-15	2-15
11	Delaware Thrie-beam Retrofit Railing (curb-mounted)	32	8,000 kg Single-Unit Truck	80 kph	15		Tested to NCHRP 350	TL-4	4			3-24
<b>METAL TUBE BRIDGE RAIL</b>												
<b>Aluminum Tube Bridge Rail</b>												
12	Aluminum Tri-Beam (Modified AASHTO BR5)	32	2,150 lb. Car 4,500 lb. Car	61.3 58.9	21.5 27.2	Yes		TL-2	17,18	4		1-4
13	Foothills Parkway Aluminum Bridge Rail	33	2,069 lb Car 5,486 lb Pickup 5,565 lb Pickup	52 46.6 45.7	22 20.7 22.7		passed PL-1, NCHRP 230 failed, anchorage not long enough passed, corrected anchorage, PL-1	TL-2	19,20		2-22	3-12
<b>Steel Tube Bridge Rail, Attached to Bottom of Deck</b>												
14	Texas Energy Absorbing Bridge Rail	27	1,972 lb. Car 4,500 lb. Car	62.6 61	16 25	Yes		NCHRP 230	21,22,23	6		
<b>Steel Tube Bridge Rail, Attached to Side of Deck</b>												
15	California Type 18 (See-Through, Collapsing Ring)	36	1,850 lb. Car 4,530 lb. Car	59.7 60.7	12 23	Yes		NCHRP 230	24,13	17		
16	Collapsing Ring Bridge Railing	59	2,090 lb. Car 4,400 lb. Car 40,000 lb. Bus 40,000 lb. Tractor-Trailer 70,000 lb. Tractor-Trailer	58.7 62 53.9 57 44.4	23.5 22.7 15.1 15.6 10	Yes		NCHRP 230	25,26,27,28	21		
17	Ohio Box Beam Rail (W-beam backed up with box beam)	27	1,980 lb. Car 4,790 lb. Car	60.6 60	19.6 25	Yes		TL-2	6	8		1-6
18	California Type 115	30	1,965 lb Car 5,635 lb Pickup	59 64.2	19 21	Yes	PL-1	TL-2	29,13		1-7	2-6
19	Illinois Side Mounted Bridge Rail	32	1,970 lb Car 5,565 lb Pickup 18,000 lb Truck	59.9 60.4 51.4	20.1 20.4 14.7		tested to PL-2	TL-4	8,30		2-6	3-22
<b>Steel Tube Bridge Rail, Attached to Top of Deck</b>												
20	Texas T101 Bridge Rail	27	2,780 lb. Car 4,660 lb. Car 4,630 lb. Car 6,900 lb. Bus 19,940 lb. Bus 20,010 lb. Bus 31,880 lb. Bus	57.3 60.2 59.8 53.4 55.3 52 58.4	15 15 25.8 15 15.2 13.2 16	Yes		TL-3	18,31,32,33,2	7		1-11
21	Texas 421 Aesthetic Steel Pipe Bridge Rail	32	1,800 lb Car 4,500 lb Car	59.7 62.4	21.4 26.6	Yes		TL-2	34,35		1-12	2-11
22	Washington, D.C. Historic Bridgerail [curb-mounted retrofit]	27	1,965 lb Car 5,565 lb Pickup	49.7 47.7	21.5 20.6		PL-1	TL-2	36		2-23	3-15
<b>Steel Tube Bridge Rail, Attached to Parapet</b>												
23	AASHTO BR2 (California Type 9)	27	1,929 lb. Car 4,540 lb. Car	60.9 57	13.1 26	Yes		TL-2	2, unknown 37	5		1-5
24	North Carolina - Standard 1 Bar Metal Rail	32	1,990 lb. Car 4,660 lb. Car 19,920 lb. Bus	59.7 60 57.3	18.8 25 14.8	Yes		TL-2	6,8 6,8 18,31,32,33	13		1-10
25	Modified Texas C202 Bridge Rail	54	1,918 lb Car 4,400 lb Car 79,770 lb Van Type Tractor Trailer	61.3 59.4 49.1	21 25.9 15	Yes	Special PL-4 (originally PL-3)	TL-5	38 38 39		1-25	2-23
26	BR27D-two steel Rails on 18" concrete parapet w/ 8-in curb and 5-ft sidewalk	42	1,967 lb Car 5,565 lb Pickup	51.7 45.3	20.8 20.2		PL-1	TL-2	8,40,41		2-2	3-16
27	BR27D-flush-mounted	42	1,970 lb Car 5,565 lb Pickup	51.2 45.6	20.5 18.8		PL-1	TL-2	8,40,41		2-3	3-17
28	BR27C-single steel rail on 24" concrete parapet w/ 8-in. curb and 5-ft sidewalk	42	1,965 lb Car 5,568 lb Pickup 18,000 lb Truck	61.7 62.6 51	18.7 19.4 13.7		PL-2	TL-4	8,40,42		2-4	3-18
29	BR27C-flush-mounted	42	1,970 lb Car 5,570 lb Pickup 18,000 lb Truck	60.3 55.3 52.5	19.8 19.6 12.8		PL-2	TL-4	8,40,42		2-5	3-19
30	Minnesota Combination Bridge Rail, Design #3	36"	1,800 lb Car 4,442 lb Pickup 1,960 lb Car	59.8 60.6 62.5 61	16.2 25.5 25.9 20.6		Tested to NCHRP 350	TL-4	43			3-26
<b>Steel Tube Bridge Rail, Attached to Curb</b>												
31	Oregon - 2 Tube Mounted Rail (Curb Mounted)	32	1,994 lb. Car 4,640 lb. Car	58.6 60	18.8 25	Yes		TL-2	6,7	12		1-9
32	Wyoming 2-Tube, Curb Mounted (6")	29 in., 740 mm	1,988 lb Car 4,510 lb Car 2,000 kg Pickup	61.1 63.3 101.7 kph	20 25 25.2	Yes		TL-3	44,45 44,46 46		1-4	2-14
33	Wyoming 2-tube steel railing on 150 mm Curb (32.7" railing, on 5.9' curb)	830 mm (32.7")	896 kg Car 2,000 kg Pickup 8,000 kg Truck	97.8 kph 101.0 kph 79.7 kph	20.8 24.9 15.9		Tested to NCHRP 350	TL-4	47		2-25	3-25
34	Illinois 2399, 2-Rail on Curb	32	1,961 lb Car 5,797 lb Pickup 18,000 lb Truck	58.7 63.6 59.8	20 19.2 15.1	Yes	PL-2	TL-4	8,48,15 8,48,15,49 8,48,15,49		1-21	2-19
35	GW (George Washington) Memorial Parkway Steel Tri-Rail on curb	42	1,936 lb Car 5,490 lb Pickup	54.4 52.6 46.8	21 22.6 22.7	Yes	failed PL-1 passed PL-1, NCHRP 230 passed PL-1, NCHRP 230	TL-2	50,51		2-21	3-13
36	New England Transportation Consortium (NETC) 2-rail curb-mounted railing, steel	864 mm (34 in)	884 kg (1970 lb) Car 2,258 kg (5,068 lb) Pickup 8,000 kg (17,621 lb) Pickup	100.9 kph (62.7 mph) 92.2 kph (57.3 mph) 81.7 kph (50.8 mph)	20.6 20.6 15.5		tested to PL-2 and TL-4	TL-4	36		2-18&19	3-23

FIGURE NUMBER	BRIDGE RAILING	RAILING HEIGHT (IN)	TEST VEHICLE	IMPACT SPEED (MPH)	IMPACT ANGLE DEGREES	Meets NCHRP 230	PERFORMANCE LEVEL	NCHRP 350 EQUIVALENT TEST LEVEL FROM FHWA MEMO 3	REFERENCES	FHWA Bridge Rail Memo #1	FHWA Bridge Rail Memo #2	FHWA Bridge Rail Memo #3
<b>VERTICAL CONCRETE PARAPET (Open or Closed) / General</b>												
37	Modified Kansas Corral (Open Concrete Beam & Post)	27	1850 lb Car	59	18.9	Yes		TL-2	6,751,52	9		1-7
38	Oklahoma Modified TR-1 Bridge Rail (Open Concrete Beam & Post)	29	1,980 lb. Car	58.7	19.3	Yes		TL-2	6.7	10		1-8
39	Texas T202 Concrete Beam and Post	27	1,800 lb Car	59.4	15	Yes		TL-2	53.2		1-2	2-2
40	Federal Lands Modified Kansas Corral	27	1,990 lb Car	51	20.5	Yes	PL-1	TL-2	51,52,6		1-3	2-3
41	Nebraska Concrete Beam and Post	29	1,971 lb Car	59.8	21	Yes		TL-2	54,55,56		1-5	2-4
42	Iowa Concrete Beam and Post	29	1,922 lb Car	60.1	20.5	Yes	PL-1	TL-2	54		1-6	2-5
43	Texas T411 Aesthetic Concrete Baluster	32	1,780 lb Car	60.2	21.2	Yes		TL-2	57,58,61,59		1-11	2-10
44	Aesthetic Stone Masonry - Faced Concrete Bridge Rail (BW (Baltimore-Washington) Parkway, Smooth Stone)	32	4,694 lb Car	60.4	25	Yes		TL-2 TL-3	60		1-13	2-12 / 3-10
45	Iowa Concrete Block Retrofit	32	2,014 lb Car	56.8	20	Yes	PL-2	TL-4	61,15		1-16	2-16
46	32-in Vertical Concrete Parapet	32	1,965 lb Car	60.5	20	Yes	PL-2	TL-4	8,62,48,15,8,63,48,15,8,48,15		1-17	2-17
47	42-in Vertical Concrete Parapet	42	50,050 lb Tractor/Trailer	51.4	16.2	Yes	Roller Over	TL-5	8,64,15,8,65,15		1-22	2-20
48	Texas C411 42" Concrete Aesthetic Baluster on 8-in high curb and 6-ft wide sidewalk	42	1,970 lb Car	60.1	20.5	Yes	PL-3	TL-2	58,66		2-16	3-9
49	Natchez Trace Concrete Bridgerail (post and beam)	32.5	2,015 lb Car	51.5	19.5			TL-2	50,51		2-20	3-14
50	Nebraska Open Concrete Bridgerail (modified from earlier TL-2 design with expansion gap)	29	5,300 lb Pickup	47.7	20		PL-2	TL-4	55,56,58		2-15	3-20
51	32-in High Kansas Corral	32	18,040 lb Truck	51.5	15			TL-4	52		2-14	new
<b>New Jersey Barrier</b>												
52	California Type 25 (N.J. Concrete Safety Shape)	32	4,540 lb. Car	38	7	Yes		NCHRP 230	67,68,69,67,68,69,13,67,68,69,70	14		
53	N.J. Concrete Safety Shape	32	1,970 lb. Car	60.4	15	Yes		TL-4	71,71,72,67,73,unknown,71,unknown,71,71,67,74,73,67,74,73,71,71,71,71,40,030 lb. Tractor-Trailer	15		1-15
54	32-in NJ-Shape	32	5,724 lb Pickup	57.7	20.6		PL-2	TL-4	8,75,48,15,8,76,48,15		1-18	
55	L.B. Foster Precast NJ-Shape, bolted down with Keiken-Gold Polyester Resin Bolts	34	18,000 lb Truck	51.7	15	Yes	Roller Over	TL-4	77		1-20	2-18
56	Missouri 30" NJ Concrete Barrier (to test effect of 2" asphalt overlay on standard barrier height)	30	18,011 lb Truck	52.5	16.1			TL-4	78,72		2-17	3-21
57	California Type 20 (N.J. Safety Shape with Rail)	39	4,980 lb. Car	45	7	Yes		TL-3	79,80,81	18		1-13
58	Nevada Safety Shape Parapet	39	4,980 lb. Car	64	15			TL-3	6	19		1-14
59	New Jersey Turnpike Heavy Vehicle Barrier (Extended N.J. Safety Shape)	42	4,880 lb. Car	58.6	16.5	Yes		TL-5	82,83,84,5	20		1-17
60	Texas T5 Modified (Extended N.J. Safety Shape)	approx 90" above deck	80,120 lb Tank Type Tractor-Trailer	51.4	15	Yes		TL-6	85	22		1-18
61	Texas Type HT (Modified T5)	50	80,080 lb Truck	48.4	14.5	Yes	Roller Over	TL-5	86		1-24	2-22
<b>F-SHAPE CONCRETE BARRIER / SINGLE SLOPE</b>												
62	F Profile Concrete Safety Shape	32	2,250 lb. Car	56.4	14.3	Yes		TL-4	67,73	16		1-16
63	32-in F-Shape	32	1,966 lb Car	60.1	21.4	Yes	PL-2	TL-4	8,67,48,15,8,68,49,15,8,69,15,8,90,15,8,91,15		1-19	
64	42-in F-Shape	42	40,560 lb Bus	55.7	15.7	Yes	PL-3	TL-5	8,92,64,8,93,64		1-23	2-21
65	Single Slope Concrete Bridge Rail	32	2076 kg (4,573 lb) Pickup	87.2 kph (54.0 mph)	25.5			TL-4	94,36,96,96,94,36,95			3-27
<b>TIMBER BRIDGE RAIL</b>												
66	Glu-Lam Wood on Wood Deck	35	1,983 lb Car	59.2	20	Yes	PL-1	TL-2	20,97		1-14	2-9
67	Timber Rail #1 on Transversely Laminated Timber Deck	27	1,965 lb Car	50.1	18.6		PL-1	TL-2	98,99		2-9	3-1
68	Timber Rail #2 on Transversely Laminated Timber Deck	27	1,967 lb Car	49.7	21		PL-1	TL-2	100,99		2-10	3-2
69	Timber Rail #3 on Longitudinally Laminated Timber Deck	27	1,968 lb Car	51	20.4		PL-1	TL-2	101,99		2-12	3-3
70	Steel System - Thrie Beam on steel posts	81.28 cm	2,452 kg Pickup	71.2 kph	19.1		MWRSF PL-1	TL-2	102,103		2-11	3-4
71	Curb System - Glu-Lam timber rail w/curb	81.28 cm	2,452 kg Pickup	71 kph	23.4		MWRSF PL-1	TL-2	102,103		2-7	3-5
72	Shoe Box System-Glu-Lam rail w/out curb	81.28 cm	839 kg Car	80.7 kph	21.5		MWRSF PL-1	TL-2	102,103		2-8	3-6
73	TRC-8000 - Thrie - beam w/diffused steel posts	84.5 cm	2,452 kg Truck	72.4 kph	21.8			TL-4	104,105		2-24	3-7
74	GC-8000 Glu-Lam timber rail w/curb	83.8 cm	2,087 kg Pickup	98.0 kph	24.9		MWRSF PL-2	TL-4	104,105		2-13	3-8