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Table 7.6 Calculation examples for unspecified car

1	2	3
α_i from Table 7.1	N_i from Table 7.2	$\frac{\alpha_i}{N_i}$
0.436560	3.02×10^{21}	0.144×10^{-21}
0.268660	2.88×10^{15}	93.2×10^{-18}
0.000910	866,889,178,000	1.05×10^{-15}
0.000900	2,749,089,000	0.3274×10^{-12}
0.000010	31,695,000	0.3155×10^{-12}
0.248080	2.21×10^{20}	1.12×10^{-21}
0.019790	7.25×10^{14}	27.3×10^{-18}
0.000220	349,862,089,000	0.629×10^{-15}
0.000070	1,352,654,000	51.8×10^{-15}
0.000020	18,378,000	1.088×10^{-12}
0.017730	2.19×10^{19}	0.808×10^{-21}
0.002350	2.11×10^{14}	11.2×10^{-18}
0.000040	148,244,137,000	0.270×10^{-15}
0.000020	10,667,000	1.875×10^{-12}
0.001830	2.71×10^{18}	0.676×10^{-21}
0.000150	6.27×10^{13}	2.39×10^{-18}
0.000020	645,000	31.01×10^{-12}
0.001460	1.28×10^{16}	0.114×10^{-18}
0.000020	2.30×10^{12}	8.70×10^{-18}
0.000020	5,637,292,000	3.55×10^{-15}
0.000190	3.85×10^{12}	49.3×120^{-18}
0.000010	12,214,742,000	0.819×10^{-15}
0.000010	140,826,000	71.0×10^{-15}
0.000010	3,673,000	2.723×10^{-12}
0.000010	580,000	17.24×10^{-12}
0.000010	580,000	17.24×10^{-12}
0.001010	13.4×10^{21}	75.2×10^{-27}
0.000350	12.8×10^{15}	27.3×10^{-21}
0.000130	13.4×10^{21}	9.68×10^{-27}
0.000040	3.85×10^{12}	10.4×10^{-18}
0.000020	12.8×10^{15}	1.56×10^{-21}
0.000020	13.4×10^{21}	1.49×10^{-27}
0.000010	3.85×10^{12}	2.60×10^{-18}
0.000020	12.8×10^{15}	1.56×10^{-21}
0.000010	12,214,742,000	0.819×10^{-15}
0.000010	13.4×10^{21}	0.745×10^{-27}
0.000010	12.8×10^{15}	0.781×10^{-21}
0.000010	13.4×10^{21}	0.745×10^{-27}
0.000010	3.85×10^{12}	2.60×10^{-18}
0.000020	13.4×10^{21}	1.49×10^{-27}

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Table 7.7 Road environment percent occurrence spectrum
Longitudinal coupler force for unspecified car

Force (lb)		Percent Occurrence
Maximum	Minimum	
20,000	0	43.6560
40,000	0	26.8660
60,000	0	0.0910
80,000	0	0.0900
100,000	0	0.0010
40,000	20,000	24.8080
60,000	20,000	1.9790
80,000	20,000	0.0220
100,000	20,000	0.0070
120,000	20,000	0.0020
60,000	40,000	1.7730
80,000	40,000	0.2350
100,000	40,000	0.0040
140,000	40,000	0.0020
80,000	60,000	0.1830
100,000	60,000	0.0150
180,000	60,000	0.0020
20,000	-20,000	0.1460
40,000	-20,000	0.0020
60,000	-20,000	0.0020

Positive force is DRAFT
Negative force is BUFF

Force (lb)		Percent Occurrence
Maximum	Minimum	
20,000	-40,000	0.0190
40,000	-40,000	0.0010
40,000	-60,000	0.0010
40,000	-80,000	0.0010
40,000	-100,000	0.0010
20,000	-120,000	0.0010
0	-20,000	0.1010
0	-40,000	0.0350
-20,000	-40,000	0.0130
0	-60,000	0.0040
-20,000	-60,000	0.0020
-40,000	-60,000	0.0020
-20,000	-80,000	0.0010
-40,000	-80,000	0.0020
-20,000	-100,000	0.0010
-80,000	-100,000	0.0010
-100,000	-140,000	0.0010
-120,000	-140,000	0.0010
-120,000	-180,000	0.0010
-160,000	-180,000	0.0020

Avg. cycles/mile: 105.03

7.3 Environmental Load Spectra

7.3.1 Ratio of Empty to Loaded Car Miles^{a/}

Table 7.8 Ratio of Empty to Loaded Car Miles

Type of Car	Ratio Empty/Loaded ^{a/}
Box	0.9
Gondola	0.9
Covered hopper	0.9
Open hopper	0.9
Refrigerator	0.9
Intermodal	0.0
Flat	0.9
Flat, multilevel	0.9
Tanks (private line cars only)	0.9
All other types	0.9

^{a/} If definitive Empty/Load data is available, it is permissible to use it in the analysis.

7.3.2 Test Car Characteristics

7.3.2.1 Box Car

Car Type	XM	50-ft box car with doors on two sides
Light weight	=	65,900 lb
Load capacity	=	153,000 lb
Load limit	=	154,100 lb
D-5 spring grouping	with	7 outer coils 4 inner coils 2 side coils with inner springs

Road Environment Percent Occurrence Spectra (REPOS) for Box Cars:

Table 7.9 Fully loaded 70-ton box car—total side-bearing load (kip)	C-II-120
Table 7.10 Fully loaded 70-ton box car—total vertical bolster load (kip)	C-II-123
Table 7.11 Fully loaded 70-ton box car—total center-plate load (kip)	C-II-125

^{a/} Analysis of Class I railroads (annual); AAR Economics and Finance Department; 1982 edition.

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7.3.2.2 Gondola Car

Car Type	GB	100-ton high side gondola with fixed bottom, sides, and ends; without C-PEP.
Light weight	=	61,700 lb
Load capacity	=	200,000 lb
Load limit	=	201,300 lb
D-5 spring grouping	with	9 outer coils 5 inner coils

Road Environment Percent Occurrence Spectra (REPOS) for Gondola Cars:

Table 7.12	Fully loaded 100-ton high-side gondola in unit train service—total side bearing load	C-II-129
Table 7.13	Fully loaded 100-ton high-side gondola in unit train service—total vertical bolster load	C-II-131
Table 7.14	Fully loaded 100-ton high-side gondola in unit train service—total center plate load	C-II-133
Table 7.15	Fully loaded 100-ton high side gondola in unit train service—coupler load	C-II-137
Table 7.16	Empty 100-ton high side gondola in unit train service—total side bearing load	C-II-140
Table 7.17	Empty 100-ton high side gondola in unit train service—total vertical bolster load	C-II-141
Table 7.18	Empty 100-ton high side gondola in unit train service—total center plate load	C-II-142
Table 7.19	Empty 100-ton high side gondola in unit train service—coupler load	C-II-145

7.3.2.3 Gondola (Coal) Car—110 Ton

Car Type		286,000 lb (110 ton) coal car, with tubs
Light weight	=	52,000 lb
Load capacity	=	220,000 lb
Load limit	=	234,000 lb
D-5 spring grouping	with	9 outer coils 8 inner coils

Road Environment Percent Occurrence Spectra (REPOS) for Gondola Cars:

Table 7.20	Fully loaded 110-ton high-side gondola in unit train service—left individual side-bearing load (kip)	C-II-147
Table 7.21	Fully loaded 110-ton high-side gondola in unit train service—right individual side-bearing load (kip)	C-II-149
Table 7.22	Fully loaded 110-ton high-side gondola in unit train service—total vertical bolster load (kip)	C-II-151
Table 7.23	Fully loaded 110-ton high side gondola in unit train service—total center-plate load (kip)	C-II-157
Table 7.24	Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip)	C-II-163
Table 7.25	Fully loaded 110-ton high-side gondola in unit train service—car body twist moment (in.-kip)	C-II-181

7.3.2.4 Hopper Car

Car Type	HT	100-ton open top hopper car
Light weight	=	61,400 lb
Load capacity	=	200,000 lb
Load limit	=	201,600 lb
D-5 spring grouping	with	9 outer coils 5 inner coils

Road Environment Percent Occurrence Spectra (REPOS) for Gondola Cars:

Table 7.26	Loaded 100-ton hopper car—total side bearing load	C-II-183
Table 7.27	Loaded 100-ton hopper car—total vertical bolster load	C-II-185
Table 7.28	Loaded 100-ton hopper car—center plate load	C-II-187
Table 7.29	Loaded 100-ton hopper car—coupler load	C-II-191
Table 7.30	Loaded 100-ton hopper car—coupler load (severe environment)	C-II-195
Table 7.31	Loaded 100-ton hopper car—car body twist moment	C-II-199
Table 7.32	Empty 100-ton hopper car—total side bearing load	C-II-202
Table 7.33	Empty 100-ton hopper car—total vertical bolster load	C-II-203
Table 7.34	Empty 100-ton hopper car—center plate load	C-II-204
Table 7.35	Empty 100-ton hopper car—coupler load	C-II-207
Table 7.36	Empty 100-ton hopper car—car body twist moment	C-II-211

Note: The severe environment coupler load REPOS is shown in Table 7.30. This REPOS applies only to cars operating in heavy (greater than 10,000 trailing tons) trains over severe grades (up to 3%) and curves (up to 13° curves). The use of this REPOS is not mandatory and is suggested for cars in unit trains operating regularly in the severe environment.

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7.3.2.5 Tank Car

	Car 1	Car 2
Car Type	100-ton tank car with stub sills AAR 211A 100W1	AAR 211A 100W1
Capacity	= 25,580 gal	25,030 gal
Light weight	= 74,000 lb	60,700 lb
Load capacity	= 220,000 lb	220,000 lb
Load limit	= 212,000 lb	225,300 lb
D-5 spring grouping	with 7 outer coils 4 inner coils	7 outer coils 4 inner coils
Couplers	= AAR SE60EE	AAR SE60DE

Road Environment Percent Occurrence Spectra (REPOS) for Tank Cars:

Table 7.37 Fully loaded 110-ton tank car—individual side-bearing load (kip)	C-II-215
Table 7.38 Fully loaded 110-ton tank car—vertical bolster load (kip)	C-II-217
Table 7.39 Fully loaded 110-ton tank car—center-plate load (kip)	C-II-225
Table 7.40 Fully loaded 110-ton tank car—longitudinal coupler load (kip)	C-II-231
Table 7.41 Fully loaded 110-ton tank car—coupler vertical load (kip)	C-II-261
Table 7.42 Fully loaded 110-ton tank car— car body twist moment (in.-kip)	C-II-265
Table 7.43 Empty 110-ton tank car—individual side-bearing load (kip)	C-II-268
Table 7.44 Empty 110-ton tank car—vertical bolster load (kip)	C-II-271
Table 7.45 Empty 110-ton tank car—center-plate load (kip)	C-II-272
Table 7.46 Empty 110-ton tank car—longitudinal coupler load (kip)	C-II-275
Table 7.47 Empty 110-ton tank car—coupler vertical load (kip)	C-II-299
Table 7.48 Empty 110-ton tank car—car body twist moment (in.-kip)	C-II-300

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7.3.2.6 Intermodal Car (ARC 5)

Car Type	Flat; five platform articulated AAR Car Type Q256 Overall car length 256 ft 4 in.
Load capacity	= 65,000 lb/platform; total 325,000 lb
D-5 spring grouping	

Road Environment Percent Occurrence Spectra (REPOS) for ARC 5 Intermodal Cars:

Table 7.49	Fully loaded ARC-5 Car—intermodal standard bolster side-bearing load (kip)	C-II-301
Table 7.50	Fully loaded ARC-5 Car—intermodal standard bolster total vertical load (kip)	C-II-303
Table 7.51	Fully loaded ARC-5 Car—intermodal standard bolster center-plate load (kip)	C-II-307
Table 7.52	Fully loaded ARC-5 Car—articulated bolster side-bearing load (kip)	C-II-309
Table 7.53	Fully loaded ARC-5 Car—articulated bolster total vertical load (kip)	C-II-310
Table 7.54	Fully loaded ARC-5 Car—articulated bolster center-plate load (kip)	C-II-311
Table 7.55	Fully loaded ARC-5 Car—articulated connector vertical load (kip)	C-II-313
Table 7.56	Fully loaded ARC-5 Car—articulated connector lateral load (kip)	C-II-317
Table 7.57	Fully loaded ARC-5 Car—articulated connector longitudinal load (kip)	C-II-321
Table 7.58	Fully loaded ARC-5 Car—trailer-hitch vertical load (kip)	C-II-325
Table 7.59	Fully loaded ARC-5 Car—trailer-hitch lateral load (kip)	C-II-329
Table 7.60	Fully loaded ARC-5 Car—trailer-bogie vertical load (kip)	C-II-330
Table 7.61	Fully loaded ARC-5 Car—trailer-bogie lateral load (kip)	C-II-331
Table 7.62	Empty ARC-5 Car—intermodal standard bolster side-bearing load (kip)	C-II-332
Table 7.63	Empty ARC-5 Car—intermodal standard bolster center-plate load (kip)	C-II-333
Table 7.64	Empty ARC-5 Car—intermodal articulated connector vertical load (kip)	C-II-335
Table 7.65	Empty ARC-5 Car—intermodal articulated connector lateral load (kip)	C-II-339
Table 7.66	Empty ARC-5 Car—intermodal articulated connector longitudinal load (kip)	C-II-343
Table 7.67	Empty ARC-5 Car—intermodal trailer-hitch vertical load (kip)	C-II-346
Table 7.68	Empty ARC-5 Car—intermodal trailer-hitch lateral load (kip)	C-II-347
Table 7.69	Empty ARC-5 Car—intermodal trailer-bogie vertical load (kip)	C-II-348
Table 7.70	Empty ARC-5 Car—intermodal trailer-bogie lateral load (kip)	C-II-349

7.3.2.7 Intermodal Car (5-Unit Well Car)

Car Type	5 Unit Stack Car, AAR Code S162
Light weight	= 179,400 lb total, 35,880 lb per unit
Load capacity	= 622,000 lb total, 124,400 lb per unit
Load limit	= 622,000 lb total, 124,400 lb per unit
D-5 spring grouping	with 7 outer coils D-5 7 inner coils D-6
Couplers	= Standard couplers

Road Environment Percent Occurrence Spectra (REPOS) for 5-unit Well Cars:

Table 7.71	Loaded 5-unit well car—individual side-bearing load (kip)	C-II-351
Table 7.72	Loaded 5-unit well car—center-plate load (kip)	C-II-353
Table 7.73	Loaded 5-unit well car—vertical bolster load (kip)	C-II-365
Table 7.74	Loaded 5-unit well car—longitudinal coupler force (kip)	C-II-377

Note: For longitudinal coupler force analysis on loaded 5-unit well cars, it is recommended that Table 7.24, “Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip),” be used.

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7.3.2.8 Total Side-Bearing Load—Fully Loaded 70-ton Box Car

Test Date	1981–1982
Test Mode	General Freight Service in Various Parts of the Country
Max MPH	Not Measured
Average MPH	Not Measured
Recorded Mileage	11,748
Total Number of Cycles	21,342
Average Cycles/Mile	1.82
Track Class	Various

Table 7.9 Fully loaded 70-ton box car—total side-bearing load (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
80	-50	0.004686	20	-50	0.004686
60	-90	0.004686	20	-40	0.042170
60	-60	0.014057	20	-30	0.618499
60	-50	0.018742	20	-20	2.914441
60	-40	0.009371	20	-10	5.097929
60	-10	0.009371	20	0	8.368475
60	0	0.009371	20	10	2.417768
60	50	0.004686	10	-40	0.018742
50	-70	0.004686	10	-30	0.276450
50	-60	0.004686	10	-20	2.010121
50	-50	0.065598	10	-10	9.230625
50	-40	0.046856	10	0	43.337082
50	-30	0.070284	0	-60	0.004686
50	-20	0.023428	0	-50	0.009371
50	0	0.014057	0	-40	0.028114
50	10	0.004686	0	-30	0.445132
50	30	0.009371	0	-20	2.951926
50	40	0.023428	0	-10	14.309812
40	-60	0.004686	-10	-60	0.004686
40	-50	0.004686	-10	-40	0.032799
40	-40	0.196795	-10	-30	0.187424
40	-30	0.379533	-10	-20	1.227626
40	-20	0.173367	-20	-40	0.009371
40	-10	0.051542	-20	-30	0.112454
40	0	0.089026	-30	-80	0.004686
40	10	0.014057	-30	-50	0.004686
40	20	0.004686	-30	-40	0.042170
40	30	0.079655	-40	-80	0.009371
30	-50	0.028114	-40	-70	0.004686
30	-40	0.206166	-40	-60	0.004686
30	-30	0.988661	-40	-50	0.018742
30	-20	1.438478	-50	-70	0.004686
30	-10	0.698154	-60	-90	0.009371
30	0	1.021460	-60	-80	0.004686
30	10	0.262393	-60	-70	0.009371
30	20	0.229594	-70	-80	0.009371

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7.3.2.9 Total Vertical Bolster Load—Fully Loaded 70-ton Box Car

Test Date	1981–1982
Test Mode	General Freight Service in Various Parts of the Country
Max MPH	Not Measured
Average MPH	Not Measured
Recorded Mileage	11,748
Total Number of Cycles	3,325,874
Average Cycles/Mile	283.10

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Table 7.10 Fully loaded 70-ton box car—total vertical bolster load (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
300	10	0.000030	180	20	0.000030	140	70	0.043237
290	10	0.000090	180	30	0.000421	140	80	0.034517
290	20	0.000120	180	40	0.001353	140	90	0.004450
290	30	0.000030	180	50	0.000902	140	100	0.000180
280	20	0.000120	180	60	0.000301	140	110	0.000120
270	20	0.000210	180	140	0.000030	140	120	0.001022
270	30	0.000060	180	160	0.000030	140	130	0.016296
260	10	0.000060	180	170	0.001112	130	50	0.000030
260	20	0.000030	170	30	0.000180	130	60	0.006374
260	30	0.000120	170	40	0.000992	130	70	0.076281
250	10	0.000030	170	50	0.003728	130	80	0.203405
250	20	0.000060	170	60	0.001563	130	90	0.111790
250	30	0.000180	170	70	0.000331	130	100	0.006765
240	20	0.000060	170	80	0.000090	130	110	0.002886
240	30	0.000180	170	110	0.000060	130	120	0.030067
230	20	0.000090	170	130	0.000030	120	50	0.000030
230	30	0.000150	170	140	0.000060	120	60	0.001323
220	20	0.000090	170	150	0.000180	120	70	0.066719
220	30	0.000421	170	160	0.002435	120	80	0.789898
220	40	0.000150	160	30	0.000090	120	90	1.722014
220	200	0.000090	160	40	0.000661	120	100	0.774413
220	210	0.000090	160	50	0.003969	120	110	0.157492
210	30	0.000331	160	60	0.005623	110	60	0.000060
210	40	0.000180	160	70	0.001894	110	70	0.024535
210	50	0.000120	160	80	0.000301	110	80	2.661015
210	200	0.000271	160	90	0.000060	110	90	19.130009
200	30	0.000511	160	120	0.000030	110	100	17.229998
200	40	0.000060	160	130	0.000060	100	60	0.000030
200	50	0.000210	160	140	0.000180	100	70	0.002285
200	60	0.000030	160	150	0.004179	100	80	3.842990
200	70	0.000060	150	40	0.000271	100	90	52.372822
200	80	0.000030	150	50	0.003157	90	70	0.000451
200	90	0.005953	150	60	0.012508	90	80	0.570707
200	100	0.009050	150	70	0.013861	80	60	0.000030
200	110	0.000752	150	80	0.003398	80	70	0.004480
200	190	0.000180	150	90	0.000150	70	60	0.001293
190	30	0.000150	150	120	0.000180	60	40	0.000932
190	40	0.000722	150	130	0.000451	50	40	0.000361
190	50	0.000210	150	140	0.007697	40	30	0.000150
190	60	0.000060	140	50	0.001233			
190	180	0.000361	140	60	0.013049			

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7.3.2.10 Total Center-Plate Load—Fully Loaded 70 ton Box Car

Test Date	1981–1982
Test Mode	General Freight Service in Various Parts of the Country
Max MPH	Not Measured
Average MPH	Not Measured
Recorded Mileage	10,454
Total Number of Cycles	3,121,080
Average Cycles/Mile	298.6
Track Class	Various

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Table 7.11 Fully loaded 70-ton box car—total center-plate load (kip) (page 1 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
300	0	0.000032	180	60	0.000064
300	10	0.000032	180	130	0.000032
270	0	0.000064	180	140	0.000032
260	0	0.000032	180	150	0.000032
260	10	0.000032	180	160	0.000128
260	20	0.000064	180	170	0.000897
250	10	0.000032	170	0	0.000096
250	20	0.000032	170	10	0.000032
250	30	0.000032	170	20	0.000096
240	20	0.000032	170	30	0.000449
240	30	0.000064	170	40	0.001442
230	10	0.000064	170	50	0.002243
230	20	0.000032	170	60	0.001218
230	30	0.000032	170	70	0.000096
230	190	0.000032	170	80	0.000032
220	20	0.000032	170	90	0.000032
220	30	0.000032	170	120	0.000032
220	40	0.000032	170	130	0.000032
220	210	0.000032	170	140	0.000032
210	0	0.000032	170	150	0.000032
210	20	0.000032	170	160	0.002051
210	30	0.000064	160	0	0.000064
210	200	0.000032	160	10	0.000032
200	20	0.000160	160	20	0.000224
200	30	0.000160	160	30	0.000641
200	40	0.000064	160	40	0.001250
200	190	0.000128	160	50	0.003589
190	10	0.000032	160	60	0.004422
190	20	0.000032	160	70	0.002787
190	30	0.000481	160	80	0.000256
190	40	0.000288	160	130	0.000128
190	50	0.000096	160	140	0.000352
190	60	0.000032	160	150	0.004518
190	140	0.000032	150	0	0.000032
190	160	0.000032	150	10	0.000064
190	170	0.000064	150	20	0.000096
190	180	0.000384	150	30	0.000417
180	10	0.000128	150	40	0.001025
180	20	0.000128	150	50	0.004197
180	30	0.000545	150	60	0.009772
180	40	0.000641	150	70	0.012143
180	50	0.000833	150	80	0.007433

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Table 7.11 Fully loaded 70-ton box car—total center-plate load (kip) (page 2 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
150	90	0.000673	110	70	0.136011
150	120	0.000128	110	80	2.201994
150	130	0.000769	110	90	17.249990
150	140	0.008298	110	100	21.660002
140	0	0.000032	100	10	0.000128
140	10	0.000128	100	20	0.000192
140	20	0.000192	100	30	0.000737
140	30	0.000513	100	40	0.002916
140	40	0.001570	100	50	0.016148
140	50	0.003268	100	60	0.048220
140	60	0.015123	100	70	0.225403
140	70	0.035212	100	80	4.971004
140	80	0.046074	100	90	40.567913
140	90	0.019833	90	0	0.000064
140	100	0.000224	90	10	0.000096
140	110	0.000160	90	20	0.000224
140	120	0.001442	90	30	0.000288
140	130	0.016308	90	40	0.001378
130	0	0.000096	90	50	0.032681
130	10	0.000288	90	60	0.206691
130	20	0.000545	90	70	0.641701
130	30	0.001314	90	80	3.219014
130	40	0.002723	80	10	0.000032
130	50	0.005255	80	20	0.000064
130	60	0.016276	80	30	0.000384
130	70	0.069687	80	40	0.001346
130	80	0.199707	80	50	0.059627
130	90	0.234502	80	60	0.590308
130	100	0.050399	80	70	0.910710
130	110	0.004422	70	30	0.000128
130	120	0.036686	70	40	0.000352
120	0	0.000096	70	50	0.019384
120	10	0.000192	70	60	0.486787
120	20	0.000673	60	30	0.000032
120	30	0.001890	60	40	0.000192
120	40	0.004838	60	50	0.003781
120	50	0.009932	50	0	0.000064
120	60	0.023389	50	20	0.000064
120	70	0.098524	50	30	0.000160
120	80	0.699598	50	40	0.000865
120	90	2.218014	40	0	0.000064
120	100	2.428006	40	10	0.000064
120	110	0.360997	40	20	0.000064
110	0	0.000064	40	30	0.000769
110	10	0.000032	30	10	0.000032
110	20	0.000384	30	20	0.000096
110	30	0.001121	20	0	0.000096
110	40	0.004774	20	10	0.000128
110	50	0.013617	10	0	0.000064
110	60	0.035853			

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7.3.2.11 Total Side Bearing Load—Fully Loaded 100-Ton High-Side Gondola, Unit Train Service

Test Date	1982–1983
Test Mode	Unit Train Service in Various Parts of the Country
Max MPH	65
Average MPH	24.7
Recorded Mileage	8,262
Total Number of Cycles	54,439
Average Cycles/Mile	6.6
Track Class	Various

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Table 7.12 Fully loaded 100-ton high-side gondola in unit train service—total side bearing load

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
110	-120	0.001837	50	-20	0.005511	10	-90	0.001837
100	90	0.001837	50	-10	0.005511	10	-80	0.007348
90	-110	0.003674	50	0	0.012858	10	-70	0.012858
90	-100	0.007348	50	10	0.011022	10	-60	0.031228
90	-80	0.001837	50	40	0.007348	10	-50	0.121237
80	-140	0.001837	40	-90	0.005511	10	-40	0.466577
80	-120	0.001837	40	-80	0.012858	10	-30	1.021327
80	-110	0.005511	40	-70	0.014695	10	-20	1.430959
80	-90	0.005511	40	-60	0.053271	10	-10	0.938665
80	-80	0.003674	40	-50	0.062455	10	0	1.754257
80	-70	0.001837	40	-40	0.033065	0	-100	0.003674
80	-20	0.001837	40	-30	0.022043	0	-90	0.003674
80	70	0.001837	40	-20	0.005511	0	-80	0.014695
70	-110	0.001837	40	-10	0.001837	0	-70	0.034901
70	-100	0.001837	40	0	0.031228	0	-60	0.077151
70	-90	0.011022	40	10	0.020206	0	-50	0.203898
70	-80	0.009185	40	20	0.005511	0	-40	0.900090
70	-70	0.005511	40	30	0.020206	0	-30	3.826301
70	-60	0.005511	30	-90	0.003674	0	-20	15.946290
70	-50	0.001837	30	-80	0.009185	0	-10	58.781391
70	-10	0.001837	30	-70	0.016532	-10	-80	0.001837
70	0	0.001837	30	-60	0.056944	-10	-70	0.003674
70	10	0.001837	30	-50	0.113889	-10	-60	0.007348
60	-100	0.001837	30	-40	0.152464	-10	-50	0.042249
60	-80	0.020206	30	-30	0.099194	-10	-40	0.264516
60	-70	0.020206	30	-20	0.042249	-10	-30	1.476882
60	-60	0.009185	30	-10	0.034901	-10	-20	8.132038
60	-50	0.001837	30	0	0.091846	-20	-50	0.001837
60	-20	0.003674	30	10	0.051434	-20	-40	0.029391
60	-10	0.005511	30	20	0.060618	-20	-30	0.639248
60	10	0.005511	20	-100	0.003674	-30	-50	0.003674
60	40	0.001837	20	-80	0.001837	-30	-40	0.148790
60	50	0.001837	20	-70	0.020206	-40	-60	0.005511
50	-100	0.001837	20	-60	0.047760	-40	-50	0.051434
50	-90	0.007348	20	-50	0.163486	-50	-80	0.001837
50	-80	0.011022	20	-40	0.365547	-50	-70	0.001837
50	-70	0.012858	20	-30	0.424328	-50	-60	0.020206
50	-60	0.025717	20	-20	0.288396	-60	-80	0.003674
50	-50	0.040412	20	-10	0.174507	-60	-70	0.005511
50	-40	0.005511	20	0	0.418817	-70	-80	0.005511
50	-30	0.007348	20	10	0.334319	-110	-120	0.001837

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7.3.2.12 Total Vertical Bolster Load—Fully Loaded 100-Ton High-Side Gondola, Unit Train Service

Test Date	1982- 1983
Test Mode	Unit Train Service in Various Parts of the Country
Max MPH	65
Average MPH	24.7
Recorded Mileage	8,262
Total Number of Cycles	1,280,487
Average Cycles/Mile	155
Track Class	Various

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Table 7.13 Fully loaded 100-ton high-side gondola in unit train service—total vertical bolster load

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
300	40	0.000078	210	80	0.000469	170	110	0.045842
300	50	0.000390	210	90	0.001093	170	120	0.057791
300	60	0.000078	210	100	0.000703	170	130	0.029598
290	60	0.000078	210	110	0.000078	170	140	0.002577
290	70	0.000078	210	190	0.000078	170	150	0.001093
280	30	0.000078	210	200	0.000390	170	160	0.009918
280	60	0.000234	200	60	0.000156	160	70	0.000156
270	50	0.000078	200	70	0.000469	160	80	0.003124
270	70	0.000234	200	80	0.001328	160	90	0.015697
260	60	0.000312	200	90	0.000937	160	100	0.060211
260	70	0.000078	200	100	0.002109	160	110	0.153692
260	80	0.000156	200	110	0.001015	160	120	0.256777
250	40	0.000078	200	120	0.000234	160	130	0.301135
250	50	0.000078	200	180	0.000078	160	140	0.159549
250	60	0.000078	200	190	0.000469	160	150	0.049981
250	70	0.000078	190	60	0.000469	150	70	0.000156
250	80	0.000078	190	70	0.000703	150	80	0.001640
250	90	0.000234	190	80	0.001562	150	90	0.018587
240	60	0.000156	190	90	0.001874	150	100	0.105975
240	70	0.000390	190	100	0.004920	150	110	0.462090
240	80	0.000078	190	110	0.005076	150	120	1.311688
240	90	0.000078	190	120	0.001093	150	130	2.966371
240	100	0.000078	190	130	0.000078	150	140	6.345554
240	230	0.000078	190	170	0.000234	140	80	0.000234
230	40	0.000078	190	180	0.000625	140	90	0.007888
230	50	0.000078	180	60	0.000078	140	100	0.128701
230	60	0.000156	180	70	0.001250	140	110	0.126915
230	70	0.000390	180	80	0.003592	140	120	7.563138
230	80	0.000078	180	90	0.004920	140	130	33.734039
230	90	0.000156	180	100	0.007888	130	90	0.000937
230	100	0.000234	180	110	0.016634	130	100	0.084343
230	220	0.000156	180	120	0.008512	130	110	2.682261
220	60	0.000078	180	130	0.002265	130	120	35.688061
220	70	0.000547	180	150	0.000078	120	90	0.000703
220	80	0.000469	180	160	0.000469	120	100	0.042796
220	90	0.000547	180	170	0.001874	120	110	6.399987
220	100	0.000469	170	70	0.000703	110	90	0.001093
210	50	0.000156	170	80	0.005232	110	100	0.053105
210	60	0.000234	170	90	0.012730	100	90	0.001328
210	70	0.000390	170	100	0.025147	90	80	0.000078

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7.3.2.13 Center Plate Load—Fully Loaded 100-Ton High-Side Gondola, Unit Train Service

Test Date	1982–1983
Test Mode	Unit Train Service in Various Parts of the Country
Max MPH	65
Average MPH	24.7
Recorded Mileage	8,262
Total Number of Cycles	1,650,850
Average Cycles/Mile	199.8
Track Class	Various

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Table 7.14 Fully loaded 100-ton high-side gondola in unit train service—total center plate load (page 1 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
300	40	0.000061	210	90	0.000727
300	50	0.000061	210	100	0.000242
300	60	0.000303	210	190	0.000121
290	20	0.000061	210	200	0.000363
290	50	0.000061	200	40	0.000242
280	50	0.000121	200	50	0.000485
280	70	0.000061	200	60	0.001393
270	40	0.000061	200	70	0.001454
270	50	0.000121	200	80	0.001090
270	60	0.000061	200	90	0.001211
260	20	0.000061	200	100	0.000909
260	30	0.000061	200	110	0.000303
260	40	0.000061	200	190	0.000606
260	50	0.000061	190	0	0.000121
260	60	0.000061	190	20	0.000182
250	50	0.000061	190	30	0.000182
250	60	0.000182	190	40	0.000242
250	80	0.000061	190	50	0.000363
240	20	0.000061	190	60	0.001636
240	50	0.000121	190	70	0.003332
240	60	0.000182	190	80	0.003574
240	80	0.000061	190	90	0.002908
240	100	0.000061	190	100	0.002302
240	230	0.000061	190	110	0.000606
230	30	0.000061	190	150	0.000061
230	40	0.000061	190	170	0.000363
230	50	0.000303	190	180	0.001151
230	60	0.000363	180	0	0.000061
230	70	0.000242	180	10	0.000182
230	80	0.000182	180	20	0.000303
230	90	0.000121	180	30	0.000242
230	190	0.000061	180	40	0.000485
220	50	0.000303	180	50	0.000545
220	60	0.000182	180	60	0.001333
220	70	0.000485	180	70	0.005270
220	80	0.000182	180	80	0.008299
220	90	0.000061	180	90	0.010298
220	200	0.000121	180	100	0.009147
220	210	0.000363	180	110	0.003937
210	10	0.000061	180	120	0.000363
210	20	0.000061	180	150	0.000061
210	30	0.000061	180	160	0.000727
210	50	0.000303	180	170	0.002786
210	60	0.000727	170	10	0.000061
210	70	0.000182	170	20	0.000182
210	80	0.000363	170	30	0.000061

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Table 7.14 Fully loaded 100-ton high-side gondola in unit train service—total center plate load (page 2 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
170	40	0.000182	140	80	0.034164
170	50	0.000666	140	90	0.120725
170	60	0.001999	140	100	0.486292
170	70	0.006542	140	110	2.247132
170	80	0.016052	140	120	10.369570
170	90	0.029621	140	130	29.501230
170	100	0.040343	130	0	0.000061
170	110	0.029984	130	10	0.000182
170	120	0.011267	130	20	0.000363
170	130	0.001151	130	30	0.000242
170	140	0.000303	130	40	0.000909
170	150	0.001999	130	50	0.001696
170	160	0.006542	130	60	0.003089
160	20	0.000121	130	70	0.009268
160	30	0.000666	130	80	0.029136
160	40	0.000606	130	90	0.108004
160	50	0.001030	130	100	0.569279
160	60	0.002241	130	110	5.167852
160	70	0.005815	130	120	32.548672
160	80	0.020353	120	10	0.000061
160	90	0.062392	120	30	0.000061
160	100	0.137504	120	40	0.000061
160	110	0.193778	120	50	0.000485
160	120	0.126661	120	60	0.001696
160	130	0.044341	120	70	0.003150
160	140	0.011388	120	80	0.014296
160	150	0.030832	120	90	0.068510
150	0	0.000121	120	100	0.647238
150	10	0.000061	120	110	9.868311
150	20	0.000121	110	40	0.000061
150	30	0.000969	110	50	0.000121
150	40	0.000969	110	60	0.000303
150	50	0.001514	110	70	0.000666
150	60	0.004301	110	80	0.004180
150	70	0.010479	110	90	0.042947
150	80	0.029015	110	100	1.336637
150	90	0.100069	100	60	0.000061
150	100	0.295543	100	70	0.000424
150	110	0.766510	100	80	0.003271
150	120	1.330034	100	90	0.042644
150	130	1.632422	90	60	0.000121
150	140	1.698630	90	70	0.000666
140	0	0.000182	90	80	0.009450
140	10	0.000182	80	60	0.000061
140	20	0.000242	80	70	0.001878
140	30	0.001090	70	50	0.000061
140	40	0.000545	70	60	0.000909
140	50	0.002060	60	50	0.000363
140	60	0.005149	50	40	0.000182
140	70	0.011146	40	30	0.000061

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7.3.2.14 Coupler Load—Fully Loaded 100-Ton High-Side Gondola, Unit Train Service

Test Date	1982–1983
Test Mode	Unit Train Service in Various Parts of the Country
Max MPH	65
Average MPH	24.7
Recorded Mileage	8,262
Total Number of Cycles	9,718
Average Cycles/Mile	1.2
Track Class	Various

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Table 7.15 Fully loaded 100-ton high side gondola in unit train service—coupler load (page 1 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
220	-120	0.010290	160	100	0.020580
220	-80	0.010290	160	120	0.092612
220	-60	0.010290	160	140	0.195513
220	-20	0.010290	140	-200	0.010290
220	180	0.010290	140	-180	0.020580
220	200	0.010290	140	-160	0.020580
200	-180	0.010290	140	-120	0.010290
200	-160	0.030871	140	-60	0.010290
200	-100	0.010290	140	-40	0.041161
200	-60	0.010290	140	-20	0.051451
200	-40	0.020580	140	0	0.020580
200	-20	0.010290	140	20	0.113192
200	0	0.020580	140	40	0.123482
200	20	0.010290	140	60	0.185223
200	40	0.010290	140	80	0.288125
200	80	0.010290	140	100	0.349866
200	100	0.020580	140	120	1.203951
200	180	0.133772	120	-200	0.010290
180	-180	0.010290	120	-180	0.010290
180	-120	0.010290	120	-160	0.041161
180	-100	0.010290	120	-140	0.041161
180	-80	0.010290	120	-120	0.041161
180	-60	0.010290	120	-100	0.082321
180	-40	0.020580	120	-80	0.041161
180	-20	0.020580	120	-60	0.051451
180	0	0.030871	120	-40	0.041161
180	20	0.082321	120	-20	0.072031
180	40	0.010290	120	0	0.010290
180	60	0.041161	120	20	0.154353
180	80	0.030871	120	40	0.113192
180	100	0.051451	120	60	0.421898
180	140	0.051451	120	80	0.895246
180	160	0.164643	120	100	2.315291
160	-160	0.010290	100	-200	0.030871
160	-120	0.020580	100	-180	0.020580
160	-100	0.010290	100	-160	0.041161
160	-80	0.010290	100	-140	0.082321
160	-60	0.010290	100	-120	0.133772
160	-40	0.051451	100	-100	0.226384
160	-20	0.020580	100	-80	0.226384
160	0	0.010290	100	-60	0.236674
160	20	0.092612	100	-40	0.144063
160	40	0.030871	100	-20	0.164643
160	60	0.061741	100	0	0.185223
160	80	0.051451	100	20	0.370447
160	100	0.020580	100	40	0.267545

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Table 7.15 Fully loaded 100-ton high side gondola in unit train service—coupler load (page 2 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
100	60	0.751183	20	-60	0.689442
100	80	6.956164	20	-40	1.101050
80	-180	0.010290	20	-20	1.780202
80	-160	0.051451	20	0	4.733484
80	-140	0.092612	0	-160	0.010290
80	-120	0.195513	0	-140	0.051451
80	-100	0.174933	0	-120	0.082321
80	-80	0.411607	0	-100	0.174933
80	-60	0.432188	0	-80	0.411607
80	-40	0.349866	0	-60	1.142210
80	-20	0.411607	0	-40	3.097345
80	0	0.607121	0	-20	13.408110
80	20	1.389175	-20	-200	0.010290
80	40	0.884956	-20	-180	0.010290
80	60	4.980449	-20	-160	0.020580
60	-180	0.020580	-20	-140	0.030871
60	-160	0.020580	-20	-120	0.082321
60	-140	0.061741	-20	-100	0.113192
60	-120	0.144063	-20	-80	0.267545
60	-100	0.236674	-20	-60	1.059889
60	-80	0.504219	-20	-40	8.335048
60	-60	0.555670	-40	-160	0.041161
60	-40	0.699732	-40	-140	0.020580
60	-20	0.864375	-40	-120	0.030871
60	0	0.864375	-40	-100	0.082321
60	20	1.996296	-40	-80	0.195513
60	40	7.254579	-40	-60	2.891541
40	-180	0.010290	-60	-140	0.020580
40	-160	0.020580	-60	-120	0.061741
40	-140	0.041161	-60	-100	0.205804
40	-120	0.072031	-60	-80	1.193661
40	-100	0.246964	-80	-160	0.030871
40	-80	0.329286	-80	-140	0.030871
40	-60	0.679152	-80	-120	0.030871
40	-40	0.823215	-80	-100	0.648282
40	-20	1.378885	-100	-180	0.010290
40	0	1.389175	-100	-160	0.010290
40	20	10.074090	-100	-140	0.061741
20	-160	0.010290	-100	-120	0.267545
20	-140	0.041161	-120	-140	0.123482
20	-120	0.154353	-140	-160	0.030871
20	-100	0.298415	-160	-180	0.010290
20	-80	0.370447			

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7.3.2.15 Total Side Bearing Load—Empty 100-Ton High-Side Gondola, Unit Train Service

Test Date	1982–1983
Test Mode	Unit Train Service in Various Parts of the Country
Max MPH	65
Average MPH	27
Recorded Mileage	7,338
Total Number of Cycles	142,895
Average Cycles/Mile	19.5
Track Class	Various

Table 7.16 Empty 100-ton high side gondola in unit train service—total side bearing load

Maximum Load	Minimum Load	Percent Occurrence
30	-50	0.000700
30	-40	0.009797
30	-30	0.061584
30	-20	0.038490
30	-10	0.002099
30	10	0.001400
30	20	0.010497
20	-40	0.022394
20	-30	0.373001
20	-20	2.291193
20	-10	1.391931
20	0	0.119668
20	10	0.087477
10	-40	0.010497
10	-30	0.368102
10	-20	5.980615
10	-10	19.338680
10	0	4.893103
0	-40	0.002099
0	-30	0.093775
0	-20	4.643270
0	-10	57.905460
-10	-30	0.007698
-10	-20	2.293992
-20	-30	0.052486

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7.3.2.16 Total Vertical Bolster Load, Empty 100-Ton High-Side Gondola, Unit Train Service

Test Date	1982–1983
Test Mode	Unit Train Service in Various Parts of the Country
Max MPH	65
Average MPH	27
Recorded Mileage	7,338
Total Number of Cycles	227,360
Average Cycles/Mile	37.8
Track Class	Various

Table 7.17 Empty 100-ton high side gondola in unit train service—total vertical bolster load

Maximum Load	Minimum Load	Percent Occurrence
60	0	0.001082
60	10	0.000361
50	0	0.000361
50	10	0.003605
50	20	0.009374
50	30	0.009014
50	40	0.016224
40	0	0.001803
40	10	0.033891
40	20	0.513773
40	30	3.655898
30	0	0.011898
30	10	1.062157
30	20	42.830261
20	0	0.059489
20	10	51.763409
10	0	0.027401

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7.3.2.17 Center Plate Load—Empty 100-Ton High-Side Gondola, Unit Train Service

Test Date	1982–1983
Test Mode	Unit Train Service in Various Parts of the Country
Max MPH	65
Average MPH	27
Recorded Mileage	7,338
Total Number of Cycles	730,935
Average Cycles/Mile	99.8
Track Class	Various

Table 7.18 Empty 100-ton high side gondola in unit train service—total center plate load

Maximum Load	Minimum Load	Percent Occurrence
70	0	0.000274
60	0	0.001231
50	0	0.012313
50	10	0.006841
50	20	0.001094
50	40	0.000410
40	0	0.186200
40	10	0.704851
40	20	0.856027
40	30	0.943996
30	0	2.482300
30	10	9.511790
30	20	43.195499
20	0	6.608932
20	10	33.284359
10	0	2.203890

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7.3.2.18 Coupler Load—Empty 100-Ton High-Side Gondola, Unit Train Service

Test Date	1982–1983
Test Mode	Unit Train Service in Various Parts of the Country
Max MPH	65
Average MPH	27
Recorded Mileage	7,338
Total Number of Cycles	2,202
Average Cycles/Mile	0.3
Track Class	Various

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Table 7.19 Empty 100-ton high side gondola in unit train service—coupler load

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
160	40	0.136240	60	-20	0.908265
160	60	0.045413	60	0	0.817439
160	80	0.045413	60	20	4.722979
160	100	0.090827	60	40	6.675749
140	-200	0.045413	40	-100	0.090827
140	40	0.090827	40	-80	0.181653
140	60	0.317893	40	-60	0.408719
140	80	0.544959	40	-40	0.681199
140	100	0.499546	40	-20	2.089010
120	-100	0.090827	40	0	3.088102
120	-60	0.045413	40	20	16.167120
120	20	0.045413	20	-100	0.045413
120	40	0.045413	20	-80	0.090827
120	60	0.136240	20	-60	0.544959
120	80	0.908265	20	-40	1.362398
120	100	3.224342	20	-20	3.496821
100	-260	0.045413	20	0	10.535880
100	-100	0.090827	0	-100	0.045413
100	-80	0.045413	0	-80	0.090827
100	-60	0.272480	0	-60	1.952770
100	-40	0.090827	0	-40	3.360581
100	-20	0.045413	0	-20	12.579470
100	20	0.090827	-20	-80	1.407811
100	40	0.136240	-20	-60	1.316985
100	60	0.090827	-20	-40	11.852860
100	80	1.135332	-40	-60	0.045413
80	-120	0.045413	-40	-140	0.045413
80	-100	0.045413	-40	-120	0.045413
80	-80	0.136240	-40	-100	0.045413
80	-60	0.272480	-40	-80	0.090827
80	-40	0.272480	-40	-60	0.862852
80	-20	0.227066	-60	-140	0.181653
80	0	0.227066	-60	-120	0.136240
80	20	1.044505	-60	-100	0.090827
80	40	0.590372	-60	-80	0.181653
80	60	0.953678	-80	-100	0.136240
60	-100	0.136240	-100	-120	0.045413
60	-80	0.181653	-120	-200	0.045413
60	-60	0.635786	-200	-240	0.045413
60	-40	0.363306			

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7.3.2.19 Left Individual Side-Bearing Load—Fully Loaded 110-ton High-Side Gondola, Unit Train Service

Test Date	March 2006– December 2007
Test Mode	Unit Train Coal Service—286,000 lb GRL
Max MPH	51
Average MPH	25.0
Recorded Mileage	8,480
Total Number of Cycles	2,337,365
Average Cycles/Mile	275.6
Track Class	

Travel Speed Distribution		
Range (mph)		Percent at Level
0	5	5.4
5	10	9.3
10	15	11.0
15	20	11.7
20	25	16.1
25	30	10.3
30	35	14.3
35	40	11.0
40	45	5.0
45	50	4.5
50	55	1.5

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Table 7.20 Fully loaded 110-ton high-side gondola in unit train service—left individual side-bearing load (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
80	75	0.00004	55	45	0.00060	40	15	0.02422
80	70	0.00004	55	40	0.00030	40	10	0.03166
80	60	0.00004	55	35	0.00026	40	5	0.03816
80	50	0.00004	55	30	0.00017	40	0	0.04223
80	5	0.00004	55	25	0.00026	35	30	0.44319
80	0	0.00017	55	20	0.00030	35	25	0.29084
75	65	0.00004	55	15	0.00060	35	20	0.17772
75	55	0.00004	55	10	0.00068	35	15	0.08980
75	5	0.00013	55	5	0.00133	35	10	0.09151
75	0	0.00013	55	0	0.00488	35	5	0.10597
70	35	0.00004	50	45	0.00402	35	0	0.09853
70	20	0.00004	50	40	0.00663	30	25	3.18226
70	10	0.00004	50	35	0.00218	30	20	0.80595
70	5	0.00013	50	30	0.00133	30	15	0.30907
70	0	0.00047	50	25	0.00137	30	10	0.29953
65	60	0.00009	50	20	0.00103	30	5	0.26975
65	55	0.00017	50	15	0.00210	30	0	0.19877
65	50	0.00004	50	10	0.00214	25	20	5.22486
65	45	0.00004	50	5	0.00454	25	15	1.17188
65	40	0.00004	50	0	0.00907	25	10	0.99206
65	15	0.00004	45	40	0.01502	25	5	0.77600
65	5	0.00047	45	35	0.01266	25	0	0.37410
65	0	0.00081	45	30	0.00791	20	15	10.36975
60	55	0.00017	45	25	0.00646	20	10	4.50002
60	50	0.00004	45	20	0.00552	20	5	2.58607
60	45	0.00009	45	15	0.00590	20	0	0.72406
60	25	0.00004	45	10	0.00864	15	10	49.07732
60	20	0.00004	45	5	0.01258	15	5	5.66805
60	15	0.00026	45	0	0.02002	15	0	1.47611
60	10	0.00030	40	35	0.07277	10	5	5.65628
60	5	0.00090	40	30	0.06439	10	0	2.90986
60	0	0.00214	40	25	0.03803	5	0	1.64942
55	50	0.00056	40	20	0.02362			

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7.3.2.20 Right Individual Side-Bearing Load—Fully Loaded 110-ton High-Side Gondola, Unit Train Service

Test Date	March 2006–December 2007
Test Mode	Unit Train Coal Service—286,000 lb GRL
Max MPH	51
Average MPH	25.0
Recorded Mileage	8,480
Total Number of Cycles	2,162,551
Average Cycles/Mile	255
Track Class	

Travel Speed Distribution		
Range (mph)		Percent at Level
0	5	5.4
5	10	9.3
10	15	11.0
15	20	11.7
20	25	16.1
25	30	10.3
30	35	14.3
35	40	11.0
40	45	5.0
45	50	4.5
50	55	1.5

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Table 7.21 Fully loaded 110-ton high-side gondola in unit train service—right individual side-bearing load (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
85	10	0.00005%	55	25	0.00060%	40	5	0.02465%
85	0	0.00005%	55	20	0.00037%	40	0	0.02386%
75	5	0.00005%	55	15	0.00018%	35	30	1.00645%
75	0	0.00009%	55	10	0.00042%	35	25	0.20670%
70	30	0.00005%	55	5	0.00120%	35	20	0.06136%
70	5	0.00028%	55	0	0.00314%	35	15	0.03658%
70	0	0.00023%	50	45	0.02613%	35	10	0.03995%
65	45	0.00005%	50	40	0.00467%	35	5	0.06312%
65	40	0.00005%	50	35	0.00231%	35	0	0.10760%
65	35	0.00009%	50	30	0.00319%	30	25	4.37086%
65	25	0.00005%	50	25	0.00116%	30	20	0.54154%
65	20	0.00014%	50	20	0.00088%	30	15	0.14053%
65	10	0.00009%	50	15	0.00162%	30	10	0.12499%
65	5	0.00018%	50	10	0.00217%	30	5	0.18242%
65	0	0.00079%	50	5	0.00356%	30	0	0.12402%
60	55	0.00018%	50	0	0.00597%	25	20	7.55825%
60	50	0.00005%	45	40	0.04532%	25	15	1.03461%
60	40	0.00028%	45	35	0.01743%	25	10	0.48850%
60	35	0.00028%	45	30	0.01572%	25	5	0.51920%
60	30	0.00023%	45	25	0.00305%	25	0	0.25003%
60	25	0.00023%	45	20	0.00393%	20	15	8.50782%
60	20	0.00009%	45	15	0.00486%	20	10	4.15861%
60	15	0.00032%	45	10	0.00495%	20	5	1.51622%
60	10	0.00009%	45	5	0.00953%	20	0	0.51620%
60	5	0.00042%	45	0	0.01175%	15	10	46.54512%
60	0	0.00106%	40	35	0.43439%	15	5	5.43747%
55	50	0.00111%	40	30	0.10511%	15	0	1.33800%
55	45	0.00102%	40	25	0.01864%	10	5	6.32961%
55	40	0.00199%	40	20	0.01142%	10	0	4.92035%
55	35	0.00092%	40	15	0.01244%	5	0	3.04372%
55	30	0.00069%	40	10	0.01438%			

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7.3.2.21 Total Vertical Bolster Load—Fully Loaded 110-ton High-Side Gondola, Unit Train Service

Test Date	March 2006–December 2007
Test Mode	Unit Train Coal Service—286,000 lb GRL
Max MPH	51
Average MPH	25.0
Recorded Mileage	8,480
Total Number of Cycles	4,127,085
Average Cycles/Mile	486.7
Track Class	

Travel Speed Distribution		
Range (mph)		Percent at Level
0	5	5.4
5	10	9.3
10	15	11.0
15	20	11.7
20	25	16.1
25	30	10.3
30	35	14.3
35	40	11.0
40	45	5.0
45	50	4.5
50	55	1.5

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Table 7.22 Fully loaded 110-ton high-side gondola in unit train service—total vertical bolster load (page 1 of 4) (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
285	275	0.00010%	255	105	0.00002%	230	220	0.00056%
280	270	0.00029%	255	95	0.00002%	230	215	0.00017%
280	265	0.00019%	255	90	0.00005%	230	210	0.00005%
280	260	0.00005%	255	85	0.00002%	230	205	0.00002%
280	250	0.00005%	250	245	0.00136%	230	195	0.00005%
280	245	0.00002%	250	240	0.00024%	230	130	0.00005%
280	65	0.00002%	250	235	0.00022%	230	125	0.00005%
275	270	0.00017%	250	230	0.00002%	230	120	0.00007%
275	265	0.00010%	250	220	0.00002%	230	115	0.00010%
275	260	0.00005%	250	210	0.00002%	230	110	0.00019%
275	255	0.00002%	250	130	0.00002%	230	105	0.00005%
275	250	0.00002%	250	115	0.00005%	230	90	0.00005%
275	245	0.00002%	250	100	0.00002%	230	85	0.00005%
275	220	0.00002%	245	240	0.00027%	225	220	0.00262%
275	80	0.00002%	245	235	0.00044%	225	215	0.00211%
270	265	0.00005%	245	230	0.00017%	225	210	0.00005%
270	260	0.00010%	245	225	0.00007%	225	200	0.00002%
270	255	0.00007%	245	220	0.00007%	225	130	0.00007%
270	250	0.00002%	245	215	0.00002%	225	125	0.00010%
270	245	0.00012%	245	210	0.00002%	225	120	0.00010%
270	240	0.00002%	245	190	0.00002%	225	115	0.00010%
270	235	0.00002%	245	125	0.00002%	225	110	0.00005%
270	215	0.00005%	245	105	0.00002%	225	105	0.00002%
270	105	0.00002%	245	90	0.00002%	225	100	0.00007%
270	90	0.00002%	240	235	0.00017%	225	90	0.00005%
265	260	0.00007%	240	230	0.00005%	225	85	0.00002%
265	255	0.00029%	240	225	0.00007%	220	215	0.00051%
265	250	0.00010%	240	220	0.00012%	220	210	0.00007%
265	245	0.00002%	240	215	0.00002%	220	205	0.00002%
265	240	0.00002%	240	205	0.00002%	220	200	0.00002%
265	235	0.00007%	240	115	0.00002%	220	150	0.00002%
265	225	0.00002%	240	110	0.00005%	220	135	0.00005%
265	220	0.00002%	240	105	0.00007%	220	130	0.00017%
265	195	0.00002%	240	100	0.00002%	220	125	0.00010%
265	130	0.00002%	240	95	0.00002%	220	120	0.00017%
260	255	0.00029%	240	75	0.00002%	220	115	0.00022%
260	250	0.00031%	235	230	0.00005%	220	110	0.00017%
260	245	0.00031%	235	225	0.00019%	220	105	0.00012%
260	240	0.00002%	235	220	0.00005%	220	100	0.00005%
260	235	0.00002%	235	210	0.00002%	220	95	0.00002%
260	230	0.00005%	235	155	0.00002%	220	90	0.00017%
260	220	0.00005%	235	135	0.00002%	220	85	0.00007%
260	80	0.00002%	235	130	0.00002%	220	80	0.00002%
255	250	0.00116%	235	120	0.00005%	215	210	0.00015%
255	245	0.00099%	235	115	0.00005%	215	205	0.00010%
255	240	0.00015%	235	110	0.00005%	215	195	0.00007%
255	235	0.00007%	235	105	0.00002%	215	185	0.00002%
255	230	0.00015%	235	95	0.00002%	215	165	0.00002%
255	225	0.00007%	235	80	0.00005%	215	155	0.00002%
255	220	0.00002%	230	225	0.00022%	215	145	0.00002%

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Table 7.22 Fully loaded 110-ton high-side gondola in unit train service—total vertical bolster load (page 2 of 4) (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
215	140	0.00012%	200	185	0.00012%	190	120	0.00194%
215	135	0.00015%	200	150	0.00005%	190	115	0.00172%
215	130	0.00017%	200	145	0.00044%	190	110	0.00170%
215	125	0.00017%	200	140	0.00090%	190	105	0.00131%
215	120	0.00034%	200	135	0.00143%	190	100	0.00068%
215	115	0.00022%	200	130	0.00119%	190	95	0.00024%
215	110	0.00029%	200	125	0.00099%	190	90	0.00010%
215	105	0.00017%	200	120	0.00107%	190	80	0.00002%
215	100	0.00005%	200	115	0.00080%	185	180	0.00330%
215	95	0.00012%	200	110	0.00046%	185	175	0.00024%
215	90	0.00005%	200	105	0.00056%	185	170	0.00027%
215	85	0.00007%	200	100	0.00044%	185	165	0.00007%
215	80	0.00005%	200	95	0.00029%	185	160	0.00010%
210	205	0.00015%	200	90	0.00015%	185	155	0.00063%
210	200	0.00005%	200	85	0.00007%	185	150	0.00448%
210	195	0.00005%	200	80	0.00002%	185	145	0.00708%
210	170	0.00002%	195	190	0.00065%	185	140	0.00632%
210	145	0.00002%	195	185	0.00007%	185	135	0.00737%
210	140	0.00024%	195	170	0.00002%	185	130	0.00732%
210	135	0.00029%	195	155	0.00002%	185	125	0.00414%
210	130	0.00046%	195	150	0.00017%	185	120	0.00322%
210	125	0.00061%	195	145	0.00097%	185	115	0.00337%
210	120	0.00044%	195	140	0.00189%	185	110	0.00325%
210	115	0.00029%	195	135	0.00194%	185	105	0.00141%
210	110	0.00027%	195	130	0.00170%	185	100	0.00092%
210	105	0.00010%	195	125	0.00194%	185	95	0.00044%
210	100	0.00012%	195	120	0.00143%	185	90	0.00012%
210	95	0.00005%	195	115	0.00063%	185	20	0.00002%
210	90	0.00012%	195	110	0.00065%	185	15	0.00002%
210	85	0.00002%	195	105	0.00109%	180	175	0.01321%
210	70	0.00002%	195	100	0.00085%	180	170	0.00065%
205	200	0.00019%	195	95	0.00024%	180	165	0.00056%
205	195	0.00005%	195	90	0.00010%	180	160	0.00036%
205	175	0.00002%	195	85	0.00010%	180	155	0.00395%
205	145	0.00019%	195	80	0.00002%	180	150	0.01524%
205	140	0.00044%	195	75	0.00005%	180	145	0.01354%
205	135	0.00063%	195	70	0.00002%	180	140	0.01354%
205	130	0.00070%	195	65	0.00002%	180	135	0.01517%
205	125	0.00046%	190	185	0.00126%	180	130	0.01105%
205	120	0.00078%	190	180	0.00019%	180	125	0.00790%
205	115	0.00061%	190	175	0.00015%	180	120	0.00647%
205	110	0.00039%	190	165	0.00005%	180	115	0.00649%
205	105	0.00019%	190	160	0.00002%	180	110	0.00405%
205	100	0.00017%	190	155	0.00007%	180	105	0.00189%
205	95	0.00024%	190	150	0.00116%	180	100	0.00078%
205	90	0.00019%	190	145	0.00325%	180	95	0.00029%
205	85	0.00005%	190	140	0.00286%	180	90	0.00012%
205	70	0.00002%	190	135	0.00305%	180	85	0.00007%
200	195	0.00010%	190	130	0.00349%	180	80	0.00002%
200	190	0.00007%	190	125	0.00286%	175	170	0.03467%

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Table 7.22 Fully loaded 110-ton high-side gondola in unit train service—total vertical bolster load (page 3 of 4) (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
175	165	0.00296%	165	85	0.00002%	145	100	0.00133%
175	160	0.00259%	165	55	0.00002%	145	95	0.00017%
175	155	0.03293%	160	155	4.76423%	145	90	0.00005%
175	150	0.04008%	160	150	0.98593%	145	85	0.00002%
175	145	0.03012%	160	145	0.91440%	145	70	0.00002%
175	140	0.03351%	160	140	0.44385%	145	50	0.00002%
175	135	0.02971%	160	135	0.20407%	140	135	34.83224%
175	130	0.01732%	160	130	0.10843%	140	130	5.96671%
175	125	0.01570%	160	125	0.10099%	140	125	0.50808%
175	120	0.01253%	160	120	0.06084%	140	120	0.14058%
175	115	0.01066%	160	115	0.01849%	140	115	0.06780%
175	110	0.00472%	160	110	0.00511%	140	110	0.02370%
175	105	0.00213%	160	105	0.00216%	140	105	0.00351%
175	100	0.00053%	160	100	0.00172%	140	100	0.00036%
175	95	0.00029%	160	95	0.00048%	140	95	0.00007%
175	90	0.00012%	160	90	0.00019%	140	90	0.00005%
175	85	0.00005%	155	150	6.21158%	140	75	0.00002%
175	80	0.00002%	155	145	1.45371%	135	135	5.61122%
170	165	0.22987%	155	140	0.74123%	135	130	5.02255%
170	160	0.12253%	155	135	0.36995%	135	125	0.99477%
170	155	0.21548%	155	130	0.26680%	135	120	0.26869%
170	150	0.09094%	155	125	0.23125%	135	115	0.08803%
170	145	0.09760%	155	120	0.06627%	135	110	0.01650%
170	140	0.11061%	155	115	0.01580%	135	105	0.00204%
170	135	0.05391%	155	110	0.00606%	135	100	0.00022%
170	130	0.03613%	155	105	0.00383%	135	95	0.00005%
170	125	0.02784%	155	100	0.00194%	135	55	0.00002%
170	120	0.02152%	155	95	0.00090%	130	125	0.80376%
170	115	0.01432%	155	90	0.00015%	130	120	0.39413%
170	110	0.00521%	150	145	4.64912%	130	115	0.06821%
170	105	0.00160%	150	140	1.67624%	130	110	0.00943%
170	100	0.00068%	150	135	0.98256%	130	105	0.00121%
170	95	0.00019%	150	130	0.92358%	130	100	0.00029%
170	90	0.00019%	150	125	0.41855%	130	95	0.00007%
170	85	0.00010%	150	120	0.06629%	130	90	0.00005%
165	160	1.97146%	150	115	0.01771%	130	75	0.00002%
165	155	0.38049%	150	110	0.01071%	130	70	0.00002%
165	150	0.27034%	150	105	0.00560%	130	65	0.00002%
165	145	0.38865%	150	100	0.00179%	130	60	0.00007%
165	140	0.27618%	150	95	0.00036%	125	125	0.11725%
165	135	0.10538%	150	90	0.00002%	125	120	0.22120%
165	130	0.06591%	150	50	0.00002%	125	115	0.08759%
165	125	0.04771%	145	140	4.94938%	125	110	0.00722%
165	120	0.03734%	145	135	4.88073%	125	105	0.00061%
165	115	0.01747%	145	130	3.33705%	125	100	0.00019%
165	110	0.00582%	145	125	0.48766%	125	95	0.00007%
165	105	0.00119%	145	120	0.06801%	125	90	0.00012%
165	100	0.00070%	145	115	0.03639%	125	85	0.00002%
165	95	0.00051%	145	110	0.01752%	125	80	0.00007%
165	90	0.00019%	145	105	0.00606%	125	60	0.00002%

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Table 7.22 Fully loaded 110-ton high-side gondola in unit train service—total vertical bolster load (page 4 of 4) (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
125	50	0.00002%	115	105	0.00400%	110	60	0.00002%
120	115	0.05728%	115	100	0.00157%	105	100	0.00499%
120	110	0.00785%	115	95	0.00048%	105	95	0.00104%
120	105	0.00138%	115	90	0.00019%	105	90	0.00024%
120	100	0.00058%	115	85	0.00005%	105	85	0.00002%
120	95	0.00022%	115	80	0.00002%	100	95	0.00029%
120	90	0.00015%	110	105	0.00780%	100	90	0.00007%
120	85	0.00010%	110	100	0.00645%	95	90	0.00005%
120	80	0.00002%	110	95	0.00051%	85	70	0.00002%
120	70	0.00002%	110	90	0.00007%			
115	110	0.00950%	110	85	0.00002%			

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7.3.2.22 Total Center-Plate Load—Fully Loaded 110-ton High-Side Gondola, Unit Train Service

Test Date	March 2006–December 2007
Test Mode	Unit Train Coal Service—286,000 lb GRL
Max MPH	51
Average MPH	25.0
Recorded Mileage	8,480
Total Number of Cycles	5,408,502
Average Cycles/Mile	637.8
Track Class	Various

Travel Speed Distribution		
Range (mph)		Percent at Level
0	5	5.4
5	10	9.3
10	15	11.0
15	20	11.7
20	25	16.1
25	30	10.3
30	35	14.3
35	40	11.0
40	45	5.0
45	50	4.5
50	55	1.5

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Table 7.23 Fully loaded 110-ton high side gondola in unit train service—total center-plate load (kip) (page 1 of 4)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
280	65	0.000018%	220	120	0.000129%	205	130	0.000536%
275	80	0.000018%	220	115	0.000166%	205	125	0.000351%
270	105	0.000018%	220	110	0.000129%	205	120	0.000592%
270	90	0.000018%	220	105	0.000092%	205	115	0.000444%
260	80	0.000018%	220	100	0.000037%	205	110	0.000259%
255	105	0.000018%	220	95	0.000018%	205	105	0.000111%
255	95	0.000018%	220	90	0.000111%	205	100	0.000074%
255	90	0.000037%	220	85	0.000037%	205	95	0.000129%
255	85	0.000018%	220	80	0.000018%	205	90	0.000092%
250	115	0.000037%	220	70	0.000018%	205	85	0.000037%
250	100	0.000018%	220	65	0.000018%	205	80	0.000055%
245	125	0.000018%	215	210	0.000037%	205	75	0.000037%
245	105	0.000018%	215	145	0.000018%	205	70	0.000037%
245	90	0.000018%	215	140	0.000092%	205	55	0.000018%
240	115	0.000018%	215	135	0.000111%	200	195	0.000055%
240	110	0.000037%	215	130	0.000129%	200	190	0.000018%
240	105	0.000055%	215	125	0.000129%	200	185	0.000018%
240	100	0.000018%	215	120	0.000259%	200	150	0.000037%
240	95	0.000018%	215	115	0.000166%	200	145	0.000333%
240	75	0.000018%	215	110	0.000222%	200	140	0.000684%
240	55	0.000018%	215	105	0.000111%	200	135	0.001091%
240	50	0.000018%	215	100	0.000018%	200	130	0.000906%
235	135	0.000018%	215	95	0.000055%	200	125	0.000758%
235	130	0.000018%	215	90	0.000018%	200	120	0.000814%
235	120	0.000037%	215	85	0.000018%	200	115	0.000536%
235	115	0.000037%	215	70	0.000018%	200	110	0.000222%
235	110	0.000037%	215	65	0.000055%	200	105	0.000222%
235	105	0.000018%	215	60	0.000018%	200	100	0.000166%
235	95	0.000018%	210	205	0.000037%	200	95	0.000166%
235	80	0.000037%	210	145	0.000018%	200	90	0.000037%
230	225	0.000018%	210	140	0.000185%	200	85	0.000074%
230	130	0.000037%	210	135	0.000222%	200	80	0.000018%
230	125	0.000037%	210	130	0.000351%	200	75	0.000037%
230	120	0.000055%	210	125	0.000462%	200	70	0.000018%
230	115	0.000074%	210	120	0.000333%	200	60	0.000037%
230	110	0.000148%	210	115	0.000222%	200	55	0.000018%
230	105	0.000037%	210	110	0.000203%	200	50	0.000018%
230	90	0.000037%	210	105	0.000055%	200	45	0.000018%
230	85	0.000037%	210	100	0.000037%	195	190	0.000481%
225	130	0.000055%	210	95	0.000018%	195	185	0.000037%
225	125	0.000074%	210	90	0.000092%	195	170	0.000018%
225	120	0.000074%	210	85	0.000018%	195	155	0.000018%
225	115	0.000074%	210	70	0.000055%	195	150	0.000129%
225	110	0.000037%	210	65	0.000018%	195	145	0.000740%
225	105	0.000018%	205	200	0.000111%	195	140	0.001442%
225	100	0.000055%	205	195	0.000018%	195	135	0.001479%
220	150	0.000018%	205	175	0.000018%	195	130	0.001294%
220	135	0.000037%	205	145	0.000148%	195	125	0.001479%
220	130	0.000129%	205	140	0.000333%	195	120	0.001072%
220	125	0.000074%	205	135	0.000481%	195	115	0.000370%

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Table 7.23 Fully loaded 110-ton high side gondola in unit train service—total center-plate load (kip) (page 2 of 4)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
195	110	0.000259%	185	125	0.002866%	175	105	0.000573%
195	105	0.000333%	185	120	0.001257%	175	100	0.000481%
195	100	0.000333%	185	115	0.000610%	175	95	0.000462%
195	95	0.000074%	185	110	0.001091%	175	90	0.000851%
195	90	0.000092%	185	105	0.000481%	175	85	0.000666%
195	85	0.000129%	185	100	0.000240%	175	80	0.000499%
195	80	0.000129%	185	95	0.000259%	175	75	0.000314%
195	75	0.000074%	185	90	0.000333%	175	70	0.000129%
195	70	0.000055%	185	85	0.000148%	175	65	0.000092%
195	65	0.000037%	185	80	0.000129%	170	165	0.175354%
195	60	0.000037%	185	75	0.000129%	170	160	0.093427%
195	55	0.000055%	185	70	0.000074%	170	155	0.164371%
195	50	0.000018%	185	65	0.000111%	170	150	0.069261%
195	40	0.000018%	180	175	0.010040%	170	145	0.074364%
190	185	0.000961%	180	170	0.000444%	170	140	0.083812%
190	180	0.000092%	180	165	0.000370%	170	135	0.035241%
190	175	0.000111%	180	160	0.000240%	170	130	0.009762%
190	165	0.000018%	180	155	0.003014%	170	125	0.004049%
190	160	0.000018%	180	150	0.011611%	170	120	0.006120%
190	155	0.000055%	180	145	0.010336%	170	115	0.005122%
190	150	0.000887%	180	140	0.010336%	170	110	0.001294%
190	145	0.002478%	180	135	0.011537%	170	105	0.000777%
190	140	0.002182%	180	130	0.007987%	170	100	0.001331%
190	135	0.002330%	180	125	0.003513%	170	95	0.001350%
190	130	0.002662%	180	120	0.000998%	170	90	0.001683%
190	125	0.002126%	180	115	0.001812%	170	85	0.001257%
190	120	0.001072%	180	110	0.001572%	170	80	0.000906%
190	115	0.000518%	180	105	0.000518%	170	75	0.000555%
190	110	0.000684%	180	100	0.000425%	170	70	0.000222%
190	105	0.000703%	180	95	0.000296%	170	65	0.000037%
190	100	0.000314%	180	90	0.000370%	170	20	0.000018%
190	95	0.000129%	180	85	0.000370%	165	160	1.503670%
190	90	0.000129%	180	80	0.000314%	165	155	0.287141%
190	85	0.000166%	180	75	0.000222%	165	150	0.203809%
190	80	0.000129%	180	70	0.000203%	165	145	0.294518%
190	75	0.000018%	180	65	0.000092%	165	140	0.202034%
190	70	0.000037%	180	60	0.000074%	165	135	0.044744%
190	65	0.000037%	175	170	0.026366%	165	130	0.009319%
190	60	0.000074%	175	165	0.002219%	165	125	0.009041%
185	180	0.002496%	175	160	0.001978%	165	120	0.012721%
185	175	0.000166%	175	155	0.025146%	165	115	0.004807%
185	170	0.000203%	175	150	0.030563%	165	110	0.001886%
185	165	0.000055%	175	145	0.022982%	165	105	0.002348%
185	160	0.000092%	175	140	0.025571%	165	100	0.002570%
185	155	0.000481%	175	135	0.022021%	165	95	0.003125%
185	150	0.003421%	175	130	0.009467%	165	90	0.002607%
185	145	0.005399%	175	125	0.003513%	165	85	0.001646%
185	140	0.004826%	175	120	0.002404%	165	80	0.001368%
185	135	0.005621%	175	115	0.003642%	165	75	0.000777%
185	130	0.005510%	175	110	0.001516%	165	70	0.000259%

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Table 7.23 Fully loaded 110-ton high side gondola in unit train service—total center-plate load (kip) (page 3 of 4)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
165	65	0.000092%	150	105	0.024203%	135	95	0.035537%
165	60	0.000055%	150	100	0.022428%	135	90	0.015272%
165	55	0.000018%	150	95	0.014181%	135	85	0.005565%
160	155	3.622981%	150	90	0.008283%	135	80	0.001775%
160	150	0.727392%	150	85	0.005159%	135	75	0.000536%
160	145	0.672238%	150	80	0.001978%	135	70	0.000259%
160	140	0.271332%	150	75	0.000555%	135	65	0.000203%
160	135	0.057779%	150	70	0.000074%	135	60	0.000037%
160	130	0.015050%	150	65	0.000037%	135	55	0.000018%
160	125	0.031377%	145	140	2.450161%	130	125	31.934554%
160	120	0.020079%	145	135	1.509568%	130	120	9.495938%
160	115	0.004992%	145	130	1.709031%	130	115	1.906831%
160	110	0.004253%	145	125	0.193658%	130	110	0.537801%
160	105	0.005343%	145	120	0.072793%	130	105	0.209836%
160	100	0.005269%	145	115	0.085310%	130	100	0.096515%
160	95	0.005769%	145	110	0.064417%	130	95	0.037238%
160	90	0.003883%	145	105	0.049108%	130	90	0.013312%
160	85	0.002792%	145	100	0.035407%	130	85	0.005251%
160	80	0.001572%	145	95	0.021281%	130	80	0.002478%
160	75	0.000610%	145	90	0.012647%	130	75	0.000924%
160	70	0.000333%	145	85	0.005362%	130	70	0.000610%
160	65	0.000037%	145	80	0.001867%	130	65	0.000148%
160	60	0.000018%	145	75	0.000444%	130	60	0.000074%
155	150	4.663010%	145	70	0.000203%	130	55	0.000074%
155	145	0.859905%	145	65	0.000092%	130	50	0.000018%
155	140	0.290210%	140	135	0.330387%	125	120	6.571136%
155	135	0.084571%	140	130	2.090339%	125	115	3.277063%
155	130	0.057576%	140	125	0.376444%	125	110	0.709586%
155	125	0.097550%	140	120	0.417990%	125	105	0.232689%
155	120	0.017602%	140	115	0.293667%	125	100	0.074180%
155	115	0.008487%	140	110	0.149099%	125	95	0.024166%
155	110	0.011408%	140	105	0.089951%	125	90	0.009910%
155	105	0.010890%	140	100	0.052917%	125	85	0.004142%
155	100	0.010299%	140	95	0.029417%	125	80	0.002015%
155	95	0.009393%	140	90	0.013479%	125	75	0.000740%
155	90	0.006268%	140	85	0.005380%	125	70	0.000314%
155	85	0.003716%	140	80	0.001830%	125	65	0.000092%
155	80	0.001720%	140	75	0.000481%	125	60	0.000092%
155	75	0.000666%	140	70	0.000185%	125	50	0.000018%
155	70	0.000259%	140	65	0.000018%	120	115	2.179383%
155	65	0.000111%	140	60	0.000018%	120	110	1.042211%
155	55	0.000018%	140	55	0.000074%	120	105	0.140335%
150	145	3.092723%	140	45	0.000018%	120	100	0.028677%
150	140	0.381030%	135	130	3.307348%	120	95	0.009282%
150	135	0.166627%	135	125	3.008486%	120	90	0.003476%
150	130	0.374318%	135	120	3.041415%	120	85	0.001313%
150	125	0.181418%	135	115	1.011592%	120	80	0.000647%
150	120	0.023334%	135	110	0.304040%	120	75	0.000222%
150	115	0.024628%	135	105	0.150060%	120	70	0.000166%
150	110	0.028788%	135	100	0.078266%	120	65	0.000111%

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Table 7.23 Fully loaded 110-ton high side gondola in unit train service—total center-plate load (kip) (page 4 of 4)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
120	60	0.000037%	105	80	0.000111%	90	70	0.000185%
115	110	0.493279%	105	70	0.000018%	90	65	0.000037%
115	105	0.102376%	105	65	0.000018%	90	60	0.000129%
115	100	0.010502%	100	95	0.012887%	90	55	0.000148%
115	95	0.003199%	100	90	0.004068%	90	50	0.000055%
115	90	0.000684%	100	85	0.001035%	85	80	0.002034%
115	85	0.000314%	100	80	0.000148%	85	75	0.000961%
115	80	0.000092%	100	75	0.000092%	85	70	0.000444%
115	75	0.000074%	100	70	0.000018%	85	65	0.000314%
115	70	0.000018%	100	65	0.000037%	85	60	0.000296%
115	65	0.000018%	100	55	0.000037%	85	55	0.000148%
110	105	0.106314%	95	90	0.007322%	85	50	0.000222%
110	100	0.022076%	95	85	0.003716%	80	75	0.001109%
110	95	0.001997%	95	80	0.000629%	80	70	0.001054%
110	90	0.000407%	95	75	0.000314%	80	65	0.001017%
110	85	0.000148%	95	70	0.000074%	80	60	0.000943%
110	80	0.000092%	95	65	0.000018%	80	55	0.000573%
110	70	0.000018%	95	60	0.000055%	80	50	0.000351%
110	65	0.000018%	95	55	0.000074%	75	70	0.001720%
105	100	0.021799%	95	50	0.000055%	75	65	0.001904%
105	95	0.007507%	90	85	0.006934%	75	60	0.001276%
105	90	0.001091%	90	80	0.001701%	75	55	0.000721%
105	85	0.000333%	90	75	0.000758%	75	50	0.000518%

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7.3.2.23 Coupler Load—Fully Loaded 110-ton High-Side Gondola in Unit Train Service

Test Date	March 2006–December 2007
Test Mode	Unit Train Coal Service—286,000 lb GRL
Max MPH	51
Average MPH	25.0
Recorded Mileage	8,480
Total Number of Cycles	1,341,332
Average Cycles/Mile	153.8
Track Class	Various

Travel Speed Distribution		
Range (mph)		Percent at Level
0	5	5.4
5	10	9.3
10	15	11.0
15	20	11.7
20	25	16.1
25	30	10.3
30	35	14.3
35	40	11.0
40	45	5.0
45	50	4.5
50	55	1.5

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 1 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
430	-250	0.00007%	250	190	0.00007%	230	-205	0.00007%
410	390	0.00007%	250	90	0.00007%	230	-260	0.00007%
410	310	0.00007%	250	-50	0.00007%	230	-270	0.00007%
395	365	0.00015%	250	-100	0.00007%	225	215	0.00164%
385	365	0.00007%	250	-160	0.00007%	225	205	0.00060%
380	250	0.00007%	250	-180	0.00007%	225	-385	0.00007%
360	300	0.00007%	250	-220	0.00007%	220	210	0.00075%
360	290	0.00007%	250	-410	0.00007%	220	200	0.00045%
360	-130	0.00007%	245	225	0.00007%	220	190	0.00030%
360	-230	0.00007%	245	155	0.00007%	220	180	0.00015%
350	220	0.00007%	245	-315	0.00007%	220	170	0.00022%
350	-230	0.00007%	240	230	0.00037%	220	150	0.00007%
340	320	0.00022%	240	220	0.00015%	220	140	0.00007%
340	-120	0.00007%	240	210	0.00015%	220	130	0.00007%
340	-150	0.00007%	240	180	0.00007%	220	70	0.00007%
330	-120	0.00007%	240	140	0.00007%	220	30	0.00007%
320	310	0.00015%	240	110	0.00007%	220	-70	0.00007%
320	250	0.00007%	240	70	0.00007%	220	-90	0.00007%
310	290	0.00015%	240	-70	0.00007%	220	-110	0.00007%
310	-210	0.00007%	240	-110	0.00007%	220	-130	0.00007%
310	-290	0.00007%	240	-120	0.00007%	220	-135	0.00007%
280	-210	0.00007%	240	-160	0.00007%	220	-180	0.00022%
270	200	0.00007%	240	-170	0.00007%	220	-190	0.00007%
270	110	0.00007%	240	-210	0.00007%	220	-220	0.00015%
270	100	0.00007%	240	-240	0.00007%	220	-230	0.00007%
270	-10	0.00007%	235	225	0.00097%	215	205	0.00104%
270	-80	0.00007%	235	215	0.00067%	215	195	0.00239%
265	-255	0.00007%	230	220	0.00015%	215	185	0.00007%
260	220	0.00015%	230	200	0.00015%	215	165	0.00015%
260	20	0.00007%	230	190	0.00015%	215	-175	0.00007%
260	-150	0.00007%	230	170	0.00007%	215	-225	0.00015%
260	-220	0.00007%	230	-10	0.00007%	215	-325	0.00007%
260	-240	0.00007%	230	-90	0.00007%	210	200	0.00089%
260	-260	0.00007%	230	-110	0.00007%	210	190	0.00127%
250	240	0.00007%	230	-160	0.00007%	210	180	0.00097%
250	230	0.00067%	230	-180	0.00007%	210	170	0.00015%
250	220	0.00015%	230	-200	0.00007%	210	160	0.00007%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 2 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
210	130	0.00007%	200	30	0.00007%	190	175	0.00231%
210	70	0.00007%	200	20	0.00015%	190	170	0.00872%
210	60	0.00007%	200	0	0.00007%	190	165	0.00127%
210	30	0.00007%	200	-80	0.00015%	190	160	0.00335%
210	20	0.00007%	200	-100	0.00007%	190	155	0.00030%
210	10	0.00007%	200	-110	0.00007%	190	150	0.00060%
210	-10	0.00015%	200	-130	0.00015%	190	145	0.00007%
210	-30	0.00007%	200	-135	0.00007%	190	140	0.00037%
210	-90	0.00007%	200	-150	0.00007%	190	120	0.00015%
210	-130	0.00015%	200	-170	0.00007%	190	115	0.00007%
210	-150	0.00037%	200	-180	0.00007%	190	110	0.00022%
210	-160	0.00007%	200	-220	0.00015%	190	100	0.00015%
210	-190	0.00007%	200	-240	0.00007%	190	80	0.00007%
210	-200	0.00015%	200	-260	0.00015%	190	75	0.00007%
210	-210	0.00007%	200	-265	0.00007%	190	70	0.00007%
210	-220	0.00015%	195	185	0.01297%	190	50	0.00015%
210	-230	0.00007%	195	180	0.00075%	190	40	0.00007%
205	195	0.00417%	195	175	0.00768%	190	30	0.00015%
205	185	0.00358%	195	170	0.00045%	190	25	0.00007%
205	180	0.00015%	195	165	0.00224%	190	10	0.00007%
205	175	0.00082%	195	160	0.00037%	190	-10	0.00007%
205	165	0.00015%	195	155	0.00157%	190	-20	0.00007%
205	155	0.00007%	195	150	0.00015%	190	-45	0.00007%
205	150	0.00007%	195	145	0.00030%	190	-50	0.00007%
205	140	0.00007%	195	140	0.00022%	190	-90	0.00007%
205	135	0.00007%	195	135	0.00022%	190	-100	0.00022%
205	-85	0.00007%	195	125	0.00007%	190	-130	0.00015%
205	-115	0.00007%	195	115	0.00015%	190	-165	0.00007%
205	-165	0.00007%	195	95	0.00007%	190	-190	0.00022%
205	-180	0.00007%	195	85	0.00015%	190	-195	0.00007%
205	-195	0.00007%	195	75	0.00007%	185	175	0.04309%
205	-210	0.00007%	195	55	0.00007%	185	170	0.00760%
205	-220	0.00007%	195	45	0.00015%	185	165	0.04220%
205	-235	0.00007%	195	35	0.00007%	185	160	0.00037%
205	-245	0.00007%	195	5	0.00007%	185	155	0.01059%
205	-285	0.00015%	195	-75	0.00007%	185	150	0.00030%
200	190	0.00276%	195	-105	0.00007%	185	145	0.00283%
200	185	0.00082%	195	-125	0.00007%	185	140	0.00007%
200	180	0.00358%	195	-135	0.00007%	185	135	0.00067%
200	175	0.00015%	195	-145	0.00007%	185	130	0.00007%
200	170	0.00164%	195	-155	0.00015%	185	125	0.00007%
200	165	0.00022%	195	-165	0.00007%	185	120	0.00007%
200	160	0.00075%	195	-195	0.00007%	185	115	0.00030%
200	155	0.00015%	195	-235	0.00007%	185	105	0.00037%
200	150	0.00022%	195	-245	0.00015%	185	95	0.00007%
200	140	0.00030%	195	-255	0.00015%	185	85	0.00007%
200	135	0.00015%	195	-265	0.00007%	185	80	0.00007%
200	110	0.00007%	195	-275	0.00007%	185	75	0.00007%
200	100	0.00015%	195	-595	0.00007%	185	65	0.00007%
200	60	0.00007%	190	180	0.01051%	185	60	0.00007%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 3 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
185	55	0.00015%	180	40	0.00007%	175	-65	0.00007%
185	35	0.00015%	180	30	0.00015%	175	-75	0.00007%
185	25	0.00022%	180	20	0.00007%	175	-80	0.00007%
185	20	0.00007%	180	0	0.00015%	175	-85	0.00007%
185	15	0.00015%	180	-5	0.00007%	175	-95	0.00022%
185	5	0.00022%	180	-10	0.00022%	175	-105	0.00007%
185	-5	0.00007%	180	-45	0.00007%	175	-115	0.00007%
185	-15	0.00007%	180	-60	0.00022%	175	-125	0.00007%
185	-65	0.00007%	180	-70	0.00015%	175	-135	0.00007%
185	-95	0.00007%	180	-80	0.00015%	175	-145	0.00022%
185	-100	0.00007%	180	-90	0.00015%	175	-155	0.00007%
185	-105	0.00007%	180	-100	0.00015%	175	-165	0.00022%
185	-115	0.00007%	180	-110	0.00030%	175	-185	0.00007%
185	-120	0.00007%	180	-120	0.00007%	175	-195	0.00022%
185	-125	0.00022%	180	-130	0.00015%	175	-215	0.00015%
185	-145	0.00007%	180	-140	0.00007%	175	-225	0.00007%
185	-155	0.00015%	180	-145	0.00007%	175	-235	0.00007%
185	-160	0.00007%	180	-150	0.00022%	175	-245	0.00007%
185	-165	0.00037%	180	-160	0.00007%	175	-255	0.00007%
185	-170	0.00007%	180	-170	0.00015%	170	160	0.02960%
185	-175	0.00015%	180	-185	0.00007%	170	155	0.00634%
185	-180	0.00007%	180	-190	0.00007%	170	150	0.02244%
185	-190	0.00007%	180	-200	0.00015%	170	145	0.00253%
185	-195	0.00015%	180	-210	0.00007%	170	140	0.01044%
185	-200	0.00015%	180	-215	0.00007%	170	135	0.00075%
185	-205	0.00007%	180	-230	0.00007%	170	130	0.00224%
185	-215	0.00015%	180	-240	0.00007%	170	125	0.00030%
185	-235	0.00015%	175	165	0.06225%	170	120	0.00082%
185	-245	0.00022%	175	160	0.00634%	170	115	0.00015%
185	-275	0.00007%	175	155	0.03944%	170	110	0.00060%
185	-355	0.00007%	175	150	0.00149%	170	100	0.00052%
180	170	0.02900%	175	145	0.01722%	170	90	0.00067%
180	165	0.00626%	175	140	0.00157%	170	80	0.00052%
180	160	0.01610%	175	135	0.00298%	170	70	0.00022%
180	155	0.00171%	175	130	0.00045%	170	65	0.00007%
180	150	0.00395%	175	125	0.00060%	170	40	0.00007%
180	145	0.00030%	175	120	0.00015%	170	30	0.00022%
180	140	0.00313%	175	115	0.00045%	170	25	0.00007%
180	135	0.00052%	175	105	0.00022%	170	20	0.00022%
180	130	0.00060%	175	65	0.00007%	170	0	0.00015%
180	125	0.00015%	175	45	0.00007%	170	-10	0.00007%
180	120	0.00007%	175	35	0.00007%	170	-40	0.00007%
180	110	0.00022%	175	25	0.00007%	170	-50	0.00007%
180	105	0.00015%	175	20	0.00007%	170	-70	0.00007%
180	95	0.00007%	175	15	0.00015%	170	-90	0.00007%
180	90	0.00015%	175	5	0.00015%	170	-100	0.00015%
180	80	0.00037%	175	0	0.00015%	170	-105	0.00007%
180	75	0.00007%	175	-15	0.00007%	170	-110	0.00022%
180	60	0.00015%	175	-35	0.00007%	170	-115	0.00007%
180	45	0.00007%	175	-55	0.00007%	170	-120	0.00007%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 4 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
170	-130	0.00015%	160	110	0.00179%	155	75	0.00045%
170	-140	0.00015%	160	105	0.00030%	155	65	0.00022%
170	-150	0.00007%	160	100	0.00089%	155	55	0.00007%
170	-160	0.00015%	160	95	0.00022%	155	50	0.00015%
170	-180	0.00007%	160	90	0.00075%	155	45	0.00015%
170	-210	0.00022%	160	80	0.00030%	155	35	0.00015%
170	-230	0.00007%	160	75	0.00007%	155	25	0.00022%
165	155	0.06300%	160	70	0.00022%	155	15	0.00015%
165	150	0.00708%	160	60	0.00030%	155	5	0.00022%
165	145	0.07135%	160	50	0.00015%	155	0	0.00022%
165	140	0.00388%	160	45	0.00007%	155	-5	0.00007%
165	135	0.02184%	160	40	0.00022%	155	-15	0.00007%
165	130	0.00097%	160	30	0.00037%	155	-25	0.00015%
165	125	0.00291%	160	20	0.00015%	155	-55	0.00007%
165	120	0.00045%	160	10	0.00015%	155	-80	0.00007%
165	115	0.00089%	160	0	0.00037%	155	-95	0.00007%
165	105	0.00030%	160	-10	0.00015%	155	-105	0.00007%
165	95	0.00007%	160	-15	0.00007%	155	-115	0.00007%
165	85	0.00022%	160	-30	0.00007%	155	-120	0.00007%
165	70	0.00007%	160	-40	0.00007%	155	-125	0.00015%
165	60	0.00007%	160	-70	0.00022%	155	-130	0.00007%
165	55	0.00007%	160	-80	0.00015%	155	-135	0.00037%
165	40	0.00007%	160	-90	0.00037%	155	-145	0.00030%
165	35	0.00015%	160	-100	0.00030%	155	-150	0.00015%
165	25	0.00022%	160	-110	0.00045%	155	-165	0.00007%
165	15	0.00015%	160	-115	0.00007%	155	-175	0.00007%
165	-5	0.00015%	160	-120	0.00007%	155	-185	0.00015%
165	-30	0.00007%	160	-130	0.00022%	155	-195	0.00007%
165	-55	0.00007%	160	-135	0.00007%	155	-220	0.00007%
165	-105	0.00007%	160	-140	0.00030%	155	-235	0.00007%
165	-125	0.00007%	160	-150	0.00007%	150	140	0.05763%
165	-135	0.00007%	160	-160	0.00022%	150	135	0.01640%
165	-140	0.00007%	160	-170	0.00015%	150	130	0.04100%
165	-145	0.00007%	160	-175	0.00007%	150	125	0.00872%
165	-165	0.00015%	160	-180	0.00015%	150	120	0.01566%
165	-185	0.00007%	160	-185	0.00007%	150	115	0.00164%
165	-190	0.00007%	160	-190	0.00007%	150	110	0.00805%
165	-205	0.00007%	155	145	0.12473%	150	105	0.00030%
165	-215	0.00007%	155	140	0.01528%	150	100	0.00358%
165	-225	0.00015%	155	135	0.09423%	150	95	0.00022%
165	-255	0.00007%	155	130	0.00514%	150	90	0.00157%
165	-275	0.00007%	155	125	0.02408%	150	85	0.00015%
160	150	0.04555%	155	120	0.00127%	150	80	0.00052%
160	145	0.01178%	155	115	0.00805%	150	70	0.00089%
160	140	0.02818%	155	110	0.00037%	150	65	0.00007%
160	135	0.00306%	155	105	0.00112%	150	60	0.00045%
160	130	0.00842%	155	100	0.00007%	150	50	0.00045%
160	125	0.00149%	155	95	0.00112%	150	45	0.00007%
160	120	0.00395%	155	85	0.00015%	150	40	0.00015%
160	115	0.00015%	155	80	0.00007%	150	30	0.00022%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 5 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
150	20	0.00045%	145	10	0.00007%	140	-50	0.00022%
150	10	0.00052%	145	5	0.00030%	140	-60	0.00015%
150	5	0.00007%	145	0	0.00007%	140	-70	0.00022%
150	0	0.00045%	145	-5	0.00022%	140	-80	0.00037%
150	-10	0.00060%	145	-35	0.00015%	140	-90	0.00037%
150	-20	0.00007%	145	-75	0.00007%	140	-95	0.00007%
150	-25	0.00007%	145	-85	0.00007%	140	-100	0.00067%
150	-30	0.00007%	145	-95	0.00022%	140	-110	0.00030%
150	-40	0.00015%	145	-100	0.00007%	140	-115	0.00007%
150	-50	0.00007%	145	-105	0.00007%	140	-120	0.00052%
150	-60	0.00022%	145	-115	0.00022%	140	-130	0.00015%
150	-70	0.00015%	145	-135	0.00022%	140	-140	0.00037%
150	-80	0.00030%	145	-145	0.00022%	140	-145	0.00015%
150	-100	0.00022%	145	-155	0.00007%	140	-150	0.00015%
150	-105	0.00007%	145	-165	0.00022%	140	-155	0.00007%
150	-110	0.00037%	145	-185	0.00007%	140	-160	0.00007%
150	-115	0.00007%	145	-195	0.00015%	140	-170	0.00015%
150	-120	0.00030%	145	-215	0.00015%	140	-190	0.00007%
150	-125	0.00015%	145	-265	0.00007%	140	-200	0.00007%
150	-130	0.00022%	140	130	0.11317%	140	-210	0.00007%
150	-135	0.00007%	140	125	0.02222%	140	-260	0.00007%
150	-140	0.00022%	140	120	0.04973%	135	125	0.17184%
150	-150	0.00015%	140	115	0.00656%	135	120	0.01759%
150	-160	0.00007%	140	110	0.02356%	135	115	0.14172%
150	-165	0.00007%	140	105	0.00261%	135	110	0.00872%
150	-170	0.00007%	140	100	0.01379%	135	105	0.03519%
150	-180	0.00007%	140	95	0.00134%	135	100	0.00410%
150	-220	0.00007%	140	90	0.00500%	135	95	0.00910%
150	-230	0.00007%	140	85	0.00022%	135	90	0.00082%
145	135	0.15842%	140	80	0.00306%	135	85	0.00440%
145	130	0.02363%	140	75	0.00037%	135	80	0.00045%
145	125	0.12689%	140	70	0.00224%	135	75	0.00209%
145	120	0.00567%	140	65	0.00015%	135	70	0.00015%
145	115	0.02557%	140	60	0.00097%	135	65	0.00082%
145	110	0.00149%	140	55	0.00007%	135	60	0.00007%
145	105	0.00462%	140	50	0.00037%	135	55	0.00082%
145	100	0.00067%	140	45	0.00022%	135	50	0.00015%
145	95	0.00127%	140	40	0.00089%	135	45	0.00045%
145	90	0.00015%	140	35	0.00007%	135	35	0.00022%
145	85	0.00075%	140	30	0.00052%	135	30	0.00007%
145	75	0.00030%	140	20	0.00060%	135	25	0.00045%
145	70	0.00007%	140	10	0.00052%	135	20	0.00007%
145	65	0.00015%	140	5	0.00007%	135	15	0.00037%
145	55	0.00045%	140	0	0.00075%	135	5	0.00082%
145	45	0.00045%	140	-5	0.00007%	135	0	0.00030%
145	35	0.00022%	140	-10	0.00067%	135	-5	0.00007%
145	30	0.00007%	140	-20	0.00022%	135	-15	0.00007%
145	25	0.00022%	140	-25	0.00007%	135	-35	0.00007%
145	20	0.00015%	140	-30	0.00015%	135	-40	0.00007%
145	15	0.00030%	140	-40	0.00022%	135	-45	0.00022%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 6 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
135	-65	0.00007%	130	-90	0.00045%	125	-155	0.00007%
135	-85	0.00015%	130	-100	0.00030%	125	-165	0.00015%
135	-95	0.00007%	130	-110	0.00037%	125	-190	0.00007%
135	-100	0.00007%	130	-120	0.00015%	125	-205	0.00022%
135	-105	0.00030%	130	-130	0.00015%	125	-225	0.00015%
135	-115	0.00022%	130	-140	0.00007%	120	110	0.18303%
135	-125	0.00045%	130	-150	0.00007%	120	105	0.05055%
135	-135	0.00030%	130	-160	0.00022%	120	100	0.12294%
135	-145	0.00022%	130	-170	0.00007%	120	95	0.02490%
135	-155	0.00022%	130	-205	0.00007%	120	90	0.06344%
135	-160	0.00015%	130	-215	0.00007%	120	85	0.00753%
135	-165	0.00015%	130	-220	0.00007%	120	80	0.02967%
135	-175	0.00015%	125	115	0.24558%	120	75	0.00283%
135	-185	0.00015%	125	110	0.04920%	120	70	0.01506%
135	-195	0.00015%	125	105	0.21039%	120	65	0.00112%
135	-205	0.00007%	125	100	0.01931%	120	60	0.00857%
135	-235	0.00007%	125	95	0.05606%	120	55	0.00089%
130	120	0.10065%	125	90	0.00649%	120	50	0.00470%
130	115	0.02662%	125	85	0.01983%	120	45	0.00015%
130	110	0.07918%	125	80	0.00253%	120	40	0.00276%
130	105	0.01469%	125	75	0.01021%	120	35	0.00022%
130	100	0.04026%	125	70	0.00104%	120	30	0.00201%
130	95	0.00514%	125	65	0.00649%	120	25	0.00022%
130	90	0.02244%	125	60	0.00067%	120	20	0.00112%
130	85	0.00149%	125	55	0.00291%	120	15	0.00007%
130	80	0.01238%	125	50	0.00015%	120	10	0.00097%
130	75	0.00112%	125	45	0.00164%	120	5	0.00037%
130	70	0.00492%	125	40	0.00030%	120	0	0.00171%
130	65	0.00052%	125	35	0.00060%	120	-5	0.00030%
130	60	0.00261%	125	25	0.00045%	120	-10	0.00142%
130	55	0.00045%	125	15	0.00060%	120	-20	0.00022%
130	50	0.00253%	125	5	0.00104%	120	-30	0.00052%
130	45	0.00015%	125	0	0.00030%	120	-40	0.00007%
130	40	0.00089%	125	-5	0.00037%	120	-45	0.00007%
130	35	0.00007%	125	-15	0.00007%	120	-50	0.00045%
130	30	0.00045%	125	-20	0.00007%	120	-55	0.00007%
130	25	0.00007%	125	-25	0.00007%	120	-60	0.00022%
130	20	0.00075%	125	-35	0.00007%	120	-70	0.00067%
130	10	0.00082%	125	-55	0.00022%	120	-80	0.00037%
130	0	0.00082%	125	-65	0.00007%	120	-85	0.00007%
130	-5	0.00015%	125	-75	0.00015%	120	-90	0.00060%
130	-10	0.00060%	125	-85	0.00022%	120	-100	0.00045%
130	-20	0.00007%	125	-95	0.00052%	120	-110	0.00052%
130	-30	0.00037%	125	-100	0.00022%	120	-115	0.00007%
130	-35	0.00007%	125	-105	0.00022%	120	-120	0.00022%
130	-40	0.00015%	125	-115	0.00022%	120	-130	0.00015%
130	-50	0.00015%	125	-120	0.00015%	120	-135	0.00007%
130	-60	0.00060%	125	-125	0.00022%	120	-140	0.00037%
130	-70	0.00037%	125	-135	0.00007%	120	-145	0.00007%
130	-80	0.00030%	125	-145	0.00007%	120	-150	0.00015%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 7 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
120	-155	0.00007%	110	85	0.03929%	105	45	0.00746%
120	-160	0.00015%	110	80	0.09192%	105	40	0.00030%
120	-180	0.00015%	110	75	0.02334%	105	35	0.00403%
120	-235	0.00007%	110	70	0.05047%	105	30	0.00007%
115	105	0.35062%	110	65	0.00798%	105	25	0.00149%
115	100	0.06769%	110	60	0.02155%	105	20	0.00030%
115	95	0.29180%	110	55	0.00194%	105	15	0.00134%
115	90	0.02289%	110	50	0.00939%	105	10	0.00007%
115	85	0.19704%	110	45	0.00037%	105	5	0.00164%
115	80	0.01349%	110	40	0.00552%	105	0	0.00015%
115	75	0.05040%	110	35	0.00045%	105	-5	0.00030%
115	70	0.00671%	110	30	0.00239%	105	-10	0.00007%
115	65	0.02490%	110	25	0.00015%	105	-15	0.00022%
115	60	0.00239%	110	20	0.00209%	105	-20	0.00007%
115	55	0.00962%	110	15	0.00007%	105	-25	0.00015%
115	50	0.00097%	110	10	0.00194%	105	-35	0.00030%
115	45	0.00291%	110	5	0.00007%	105	-45	0.00022%
115	40	0.00037%	110	0	0.00350%	105	-55	0.00007%
115	35	0.00157%	110	-5	0.00015%	105	-65	0.00007%
115	30	0.00007%	110	-10	0.00164%	105	-75	0.00015%
115	25	0.00075%	110	-20	0.00030%	105	-85	0.00045%
115	20	0.00015%	110	-30	0.00037%	105	-95	0.00045%
115	15	0.00082%	110	-35	0.00007%	105	-105	0.00022%
115	5	0.00134%	110	-40	0.00015%	105	-110	0.00015%
115	0	0.00030%	110	-50	0.00037%	105	-120	0.00015%
115	-5	0.00037%	110	-60	0.00045%	105	-125	0.00007%
115	-15	0.00015%	110	-70	0.00045%	105	-145	0.00022%
115	-20	0.00022%	110	-80	0.00045%	105	-165	0.00007%
115	-25	0.00015%	110	-90	0.00060%	105	-185	0.00007%
115	-35	0.00015%	110	-100	0.00067%	105	-195	0.00007%
115	-40	0.00015%	110	-110	0.00045%	105	-225	0.00007%
115	-45	0.00015%	110	-120	0.00037%	105	-255	0.00007%
115	-50	0.00007%	110	-130	0.00007%	100	90	0.34965%
115	-55	0.00007%	110	-135	0.00007%	100	85	0.11608%
115	-65	0.00015%	110	-140	0.00015%	100	80	0.24282%
115	-75	0.00015%	110	-150	0.00015%	100	75	0.06717%
115	-85	0.00015%	110	-160	0.00007%	100	70	0.11563%
115	-95	0.00022%	110	-170	0.00007%	100	65	0.01849%
115	-105	0.00030%	110	-180	0.00007%	100	60	0.05509%
115	-115	0.00015%	110	-210	0.00007%	100	55	0.00470%
115	-125	0.00022%	105	95	0.80852%	100	50	0.02371%
115	-135	0.00007%	105	90	0.09640%	100	45	0.00164%
115	-155	0.00007%	105	85	0.41108%	100	40	0.01252%
115	-170	0.00007%	105	80	0.05703%	100	35	0.00037%
115	-190	0.00007%	105	75	0.18034%	100	30	0.00671%
115	-195	0.00007%	105	70	0.02669%	100	25	0.00082%
115	-215	0.00007%	105	65	0.06859%	100	20	0.00410%
110	100	0.26399%	105	60	0.00582%	100	15	0.00007%
110	95	0.06874%	105	55	0.01953%	100	10	0.00313%
110	90	0.15358%	105	50	0.00164%	100	5	0.00015%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 8 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
100	0	0.00432%	95	-75	0.00045%	90	-150	0.00015%
100	-5	0.00007%	95	-85	0.00037%	90	-160	0.00022%
100	-10	0.00239%	95	-95	0.00030%	90	-170	0.00007%
100	-15	0.00007%	95	-100	0.00007%	90	-180	0.00007%
100	-20	0.00037%	95	-105	0.00037%	90	-190	0.00007%
100	-30	0.00052%	95	-110	0.00022%	85	75	0.61148%
100	-40	0.00015%	95	-115	0.00022%	85	70	0.14180%
100	-45	0.00007%	95	-125	0.00007%	85	65	0.49130%
100	-50	0.00052%	95	-135	0.00015%	85	60	0.05301%
100	-60	0.00060%	95	-140	0.00007%	85	55	0.22754%
100	-70	0.00022%	95	-145	0.00007%	85	50	0.02177%
100	-80	0.00015%	95	-165	0.00022%	85	45	0.05905%
100	-90	0.00067%	95	-225	0.00007%	85	40	0.00485%
100	-100	0.00030%	95	-280	0.00007%	85	35	0.01938%
100	-110	0.00022%	90	80	0.45224%	85	30	0.00104%
100	-120	0.00007%	90	75	0.10497%	85	25	0.00828%
100	-125	0.00007%	90	70	0.26772%	85	20	0.00007%
100	-130	0.00022%	90	65	0.04406%	85	15	0.00529%
100	-140	0.00015%	90	60	0.11876%	85	5	0.00537%
100	-150	0.00015%	90	55	0.02050%	85	0	0.00045%
100	-160	0.00007%	90	50	0.05882%	85	-5	0.00045%
100	-180	0.00015%	90	45	0.00619%	85	-15	0.00037%
100	-190	0.00015%	90	40	0.03504%	85	-20	0.00007%
100	-200	0.00022%	90	35	0.00149%	85	-25	0.00015%
100	-205	0.00007%	90	30	0.01402%	85	-35	0.00015%
100	-210	0.00007%	90	25	0.00060%	85	-45	0.00045%
95	85	0.58897%	90	20	0.00842%	85	-50	0.00015%
95	80	0.12860%	90	15	0.00030%	85	-55	0.00015%
95	75	0.45268%	90	10	0.00507%	85	-65	0.00030%
95	70	0.04794%	90	5	0.00015%	85	-70	0.00007%
95	65	0.18593%	90	0	0.00582%	85	-75	0.00037%
95	60	0.01610%	90	-5	0.00015%	85	-85	0.00030%
95	55	0.07336%	90	-10	0.00239%	85	-90	0.00007%
95	50	0.00470%	90	-15	0.00007%	85	-95	0.00037%
95	45	0.02378%	90	-20	0.00030%	85	-100	0.00007%
95	40	0.00164%	90	-30	0.00030%	85	-105	0.00022%
95	35	0.00768%	90	-40	0.00045%	85	-110	0.00022%
95	30	0.00142%	90	-45	0.00007%	85	-115	0.00007%
95	25	0.00283%	90	-50	0.00052%	85	-135	0.00007%
95	20	0.00015%	90	-60	0.00104%	85	-145	0.00007%
95	15	0.00082%	90	-70	0.00060%	85	-165	0.00007%
95	5	0.00209%	90	-80	0.00097%	85	-215	0.00007%
95	0	0.00052%	90	-90	0.00045%	80	70	0.57070%
95	-5	0.00037%	90	-95	0.00007%	80	65	0.11615%
95	-15	0.00007%	90	-100	0.00052%	80	60	0.34868%
95	-25	0.00015%	90	-110	0.00015%	80	55	0.05077%
95	-35	0.00022%	90	-115	0.00015%	80	50	0.15634%
95	-45	0.00007%	90	-120	0.00022%	80	45	0.01655%
95	-55	0.00007%	90	-140	0.00015%	80	40	0.06911%
95	-70	0.00007%	90	-145	0.00007%	80	35	0.00365%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 9 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
80	30	0.03429%	75	-45	0.00007%	65	55	0.54267%
80	25	0.00119%	75	-55	0.00022%	65	50	0.12980%
80	20	0.01782%	75	-65	0.00022%	65	45	0.46685%
80	15	0.00052%	75	-75	0.00022%	65	40	0.05450%
80	10	0.00820%	75	-85	0.00015%	65	35	0.20480%
80	5	0.00030%	75	-90	0.00007%	65	30	0.01446%
80	0	0.00962%	75	-95	0.00015%	65	25	0.07440%
80	-5	0.00015%	75	-105	0.00015%	65	20	0.00477%
80	-10	0.00470%	75	-110	0.00007%	65	15	0.02662%
80	-15	0.00007%	75	-115	0.00022%	65	10	0.00112%
80	-20	0.00030%	75	-135	0.00007%	65	5	0.01812%
80	-25	0.00007%	75	-145	0.00007%	65	0	0.00075%
80	-30	0.00037%	75	-160	0.00007%	65	-5	0.00089%
80	-35	0.00007%	75	-215	0.00015%	65	-15	0.00037%
80	-40	0.00052%	75	-235	0.00007%	65	-25	0.00015%
80	-50	0.00112%	70	60	0.63422%	65	-35	0.00030%
80	-55	0.00007%	70	55	0.11429%	65	-45	0.00030%
80	-60	0.00089%	70	50	0.39312%	65	-50	0.00007%
80	-70	0.00075%	70	45	0.05189%	65	-55	0.00007%
80	-75	0.00007%	70	40	0.17401%	65	-65	0.00022%
80	-80	0.00097%	70	35	0.01923%	65	-75	0.00015%
80	-85	0.00007%	70	30	0.08313%	65	-80	0.00022%
80	-90	0.00060%	70	25	0.00365%	65	-85	0.00030%
80	-95	0.00007%	70	20	0.04190%	65	-95	0.00022%
80	-100	0.00030%	70	15	0.00082%	65	-125	0.00015%
80	-110	0.00015%	70	10	0.02058%	65	-135	0.00007%
80	-120	0.00030%	70	5	0.00052%	65	-145	0.00007%
80	-130	0.00007%	70	0	0.01528%	65	-155	0.00015%
80	-140	0.00007%	70	-5	0.00022%	65	-195	0.00007%
80	-150	0.00022%	70	-10	0.00760%	65	-205	0.00007%
80	-170	0.00007%	70	-20	0.00060%	60	50	0.72942%
80	-220	0.00007%	70	-30	0.00052%	60	45	0.12130%
75	65	0.60887%	70	-40	0.00082%	60	40	0.52716%
75	60	0.13397%	70	-45	0.00015%	60	35	0.04749%
75	55	0.43434%	70	-50	0.00097%	60	30	0.21986%
75	50	0.05450%	70	-55	0.00007%	60	25	0.01677%
75	45	0.15790%	70	-60	0.00112%	60	20	0.11623%
75	40	0.01640%	70	-70	0.00097%	60	15	0.00440%
75	35	0.06576%	70	-75	0.00007%	60	10	0.05517%
75	30	0.00522%	70	-80	0.00052%	60	5	0.00119%
75	25	0.02751%	70	-90	0.00052%	60	0	0.03124%
75	20	0.00142%	70	-95	0.00022%	60	-5	0.00022%
75	15	0.01111%	70	-100	0.00052%	60	-10	0.00984%
75	10	0.00045%	70	-105	0.00007%	60	-15	0.00007%
75	5	0.00828%	70	-110	0.00022%	60	-20	0.00052%
75	0	0.00112%	70	-120	0.00007%	60	-25	0.00007%
75	-5	0.00075%	70	-125	0.00007%	60	-30	0.00082%
75	-15	0.00030%	70	-130	0.00015%	60	-40	0.00052%
75	-25	0.00030%	70	-135	0.00007%	60	-50	0.00075%
75	-35	0.00007%	70	-140	0.00030%	60	-55	0.00007%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 10 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
60	-60	0.00075%	50	-25	0.00007%	40	0	0.13091%
60	-70	0.00104%	50	-30	0.00089%	40	-5	0.00075%
60	-80	0.00067%	50	-40	0.00127%	40	-10	0.01946%
60	-90	0.00052%	50	-45	0.00007%	40	-20	0.00231%
60	-100	0.00045%	50	-50	0.00149%	40	-25	0.00015%
60	-110	0.00022%	50	-60	0.00142%	40	-30	0.00134%
60	-120	0.00030%	50	-65	0.00007%	40	-40	0.00112%
60	-130	0.00022%	50	-70	0.00067%	40	-50	0.00157%
60	-140	0.00015%	50	-75	0.00015%	40	-60	0.00082%
60	-220	0.00007%	50	-80	0.00060%	40	-65	0.00007%
55	45	0.60529%	50	-90	0.00045%	40	-70	0.00075%
55	40	0.11846%	50	-100	0.00030%	40	-80	0.00060%
55	35	0.50979%	50	-105	0.00007%	40	-90	0.00030%
55	30	0.04876%	50	-110	0.00015%	40	-100	0.00022%
55	25	0.21769%	50	-120	0.00015%	40	-110	0.00007%
55	20	0.02005%	50	-130	0.00015%	40	-120	0.00022%
55	15	0.08864%	50	-140	0.00007%	40	-130	0.00022%
55	10	0.00455%	50	-210	0.00007%	40	-140	0.00007%
55	5	0.04451%	45	35	0.63005%	35	25	0.66255%
55	0	0.00194%	45	30	0.14448%	35	20	0.17401%
55	-5	0.00283%	45	25	0.53432%	35	15	0.62923%
55	-10	0.00007%	45	20	0.06404%	35	10	0.05577%
55	-15	0.00045%	45	15	0.25199%	35	5	0.20323%
55	-25	0.00052%	45	10	0.02169%	35	0	0.00969%
55	-35	0.00015%	45	5	0.09781%	35	-5	0.00343%
55	-45	0.00030%	45	0	0.00388%	35	-10	0.00007%
55	-55	0.00007%	45	-5	0.00186%	35	-15	0.00075%
55	-65	0.00022%	45	-15	0.00097%	35	-20	0.00007%
55	-70	0.00007%	45	-25	0.00037%	35	-25	0.00112%
55	-75	0.00007%	45	-30	0.00007%	35	-35	0.00186%
55	-85	0.00007%	45	-35	0.00015%	35	-40	0.00007%
55	-95	0.00022%	45	-45	0.00037%	35	-45	0.00075%
55	-105	0.00022%	45	-55	0.00007%	35	-55	0.00015%
55	-110	0.00007%	45	-60	0.00007%	35	-65	0.00022%
55	-115	0.00007%	45	-65	0.00007%	35	-75	0.00007%
55	-135	0.00015%	45	-75	0.00015%	35	-85	0.00015%
55	-150	0.00007%	45	-85	0.00015%	35	-95	0.00022%
55	-165	0.00007%	45	-90	0.00007%	35	-100	0.00007%
50	40	0.93556%	45	-95	0.00007%	35	-105	0.00030%
50	35	0.13762%	45	-105	0.00007%	35	-115	0.00007%
50	30	0.81113%	45	-115	0.00007%	35	-120	0.00007%
50	25	0.05867%	45	-135	0.00007%	35	-170	0.00007%
50	20	0.39148%	45	-145	0.00015%	30	20	1.64568%
50	15	0.01968%	45	-165	0.00007%	30	15	0.15298%
50	10	0.16618%	40	30	1.33934%	30	10	1.19568%
50	5	0.00417%	40	25	0.15261%	30	5	0.04682%
50	0	0.06598%	40	20	1.37244%	30	0	0.37798%
50	-5	0.00067%	40	15	0.07739%	30	-5	0.00179%
50	-10	0.01349%	40	10	0.44978%	30	-10	0.03534%
50	-20	0.00112%	40	5	0.01648%	30	-15	0.00007%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 11 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
30	-20	0.00186%	20	-20	0.00365%	10	-50	0.00186%
30	-25	0.00007%	20	-25	0.00007%	10	-55	0.00007%
30	-30	0.00261%	20	-30	0.00350%	10	-60	0.00052%
30	-40	0.00201%	20	-40	0.00291%	10	-70	0.00082%
30	-50	0.00171%	20	-45	0.00007%	10	-75	0.00015%
30	-60	0.00149%	20	-50	0.00164%	10	-80	0.00067%
30	-65	0.00007%	20	-55	0.00007%	10	-90	0.00052%
30	-70	0.00067%	20	-60	0.00089%	10	-95	0.00007%
30	-80	0.00037%	20	-65	0.00007%	10	-100	0.00045%
30	-90	0.00045%	20	-70	0.00075%	10	-110	0.00007%
30	-95	0.00015%	20	-80	0.00075%	10	-160	0.00007%
30	-100	0.00015%	20	-85	0.00007%	10	-175	0.00007%
30	-110	0.00015%	20	-90	0.00045%	10	-190	0.00015%
30	-120	0.00007%	20	-100	0.00015%	10	-255	0.00007%
30	-125	0.00007%	20	-110	0.00015%	5	-5	0.65062%
30	-135	0.00007%	20	-130	0.00007%	5	-10	0.00112%
30	-140	0.00007%	20	-185	0.00007%	5	-15	0.36702%
30	-145	0.00007%	15	5	0.81151%	5	-20	0.00037%
30	-200	0.00007%	15	0	0.12122%	5	-25	0.02878%
30	-210	0.00007%	15	-5	0.11183%	5	-30	0.00030%
30	-270	0.00007%	15	-10	0.00007%	5	-35	0.00380%
25	15	0.73628%	15	-15	0.10795%	5	-40	0.00007%
25	10	0.13606%	15	-20	0.00052%	5	-45	0.00127%
25	5	0.59329%	15	-25	0.04898%	5	-50	0.00022%
25	0	0.03057%	15	-30	0.00007%	5	-55	0.00127%
25	-5	0.00783%	15	-35	0.00104%	5	-60	0.00007%
25	-10	0.00007%	15	-40	0.00015%	5	-65	0.00030%
25	-15	0.00246%	15	-45	0.00037%	5	-75	0.00052%
25	-20	0.00022%	15	-55	0.00022%	5	-85	0.00030%
25	-25	0.02363%	15	-65	0.00022%	5	-90	0.00007%
25	-30	0.00007%	15	-70	0.00007%	5	-95	0.00030%
25	-35	0.00664%	15	-75	0.00007%	5	-110	0.00007%
25	-40	0.00015%	15	-80	0.00007%	5	-115	0.00015%
25	-45	0.00082%	15	-85	0.00022%	5	-125	0.00007%
25	-65	0.00022%	15	-95	0.00037%	5	-145	0.00007%
25	-70	0.00007%	15	-100	0.00007%	5	-155	0.00007%
25	-75	0.00022%	15	-105	0.00060%	5	-165	0.00007%
25	-85	0.00007%	15	-125	0.00015%	5	-175	0.00007%
25	-95	0.00022%	15	-155	0.00015%	5	-255	0.00007%
25	-105	0.00045%	15	-195	0.00007%	5	-285	0.00007%
25	-125	0.00022%	15	-235	0.00007%	0	-10	0.73680%
25	-135	0.00007%	10	0	2.77664%	0	-15	0.11049%
25	-145	0.00007%	10	-5	0.09043%	0	-20	0.04436%
25	-155	0.00007%	10	-10	0.88621%	0	-25	0.00440%
20	10	1.65522%	10	-15	0.00194%	0	-30	0.00910%
20	5	0.14322%	10	-20	0.00708%	0	-35	0.00112%
20	0	1.57888%	10	-25	0.00015%	0	-40	0.00268%
20	-5	0.00753%	10	-30	0.00574%	0	-45	0.00037%
20	-10	0.08506%	10	-35	0.00022%	0	-50	0.00261%
20	-15	0.00030%	10	-40	0.00283%	0	-55	0.00030%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 12 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
0	-60	0.00097%	-10	-35	0.07127%	-15	-120	0.00007%
0	-65	0.00015%	-10	-40	0.41504%	-15	-125	0.00022%
0	-70	0.00089%	-10	-45	0.02237%	-15	-135	0.00015%
0	-75	0.00015%	-10	-50	0.12219%	-15	-145	0.00030%
0	-80	0.00052%	-10	-55	0.00276%	-15	-155	0.00007%
0	-85	0.00022%	-10	-60	0.04809%	-15	-160	0.00007%
0	-90	0.00037%	-10	-65	0.00082%	-15	-165	0.00022%
0	-95	0.00015%	-10	-70	0.02237%	-15	-170	0.00015%
0	-100	0.00067%	-10	-75	0.00015%	-15	-185	0.00007%
0	-105	0.00015%	-10	-80	0.01603%	-15	-205	0.00007%
0	-110	0.00030%	-10	-85	0.00052%	-15	-240	0.00007%
0	-120	0.00022%	-10	-90	0.00850%	-15	-245	0.00007%
0	-125	0.00022%	-10	-95	0.00007%	-20	-30	2.27535%
0	-140	0.00007%	-10	-100	0.00470%	-20	-35	0.47162%
0	-155	0.00007%	-10	-105	0.00015%	-20	-40	1.36514%
0	-180	0.00007%	-10	-110	0.00343%	-20	-45	0.03862%
-5	-15	1.45445%	-10	-115	0.00022%	-20	-50	0.37880%
-5	-20	0.12562%	-10	-120	0.00157%	-20	-55	0.00440%
-5	-25	0.57823%	-10	-125	0.00007%	-20	-60	0.10922%
-5	-30	0.03072%	-10	-130	0.00089%	-20	-65	0.00216%
-5	-35	0.16394%	-10	-140	0.00045%	-20	-70	0.03213%
-5	-40	0.00828%	-10	-150	0.00045%	-20	-75	0.00060%
-5	-45	0.05882%	-10	-155	0.00015%	-20	-80	0.01461%
-5	-50	0.00365%	-10	-160	0.00015%	-20	-85	0.00022%
-5	-55	0.02602%	-10	-170	0.00037%	-20	-90	0.00388%
-5	-60	0.00089%	-10	-180	0.00007%	-20	-95	0.00015%
-5	-65	0.00947%	-10	-190	0.00007%	-20	-100	0.00253%
-5	-70	0.00082%	-10	-195	0.00007%	-20	-110	0.00082%
-5	-75	0.00335%	-10	-200	0.00007%	-20	-120	0.00097%
-5	-80	0.00045%	-10	-210	0.00007%	-20	-130	0.00030%
-5	-85	0.00306%	-10	-220	0.00007%	-20	-150	0.00007%
-5	-90	0.00037%	-15	-25	1.16392%	-20	-155	0.00007%
-5	-95	0.00350%	-15	-30	0.35800%	-20	-160	0.00022%
-5	-100	0.00052%	-15	-35	0.83603%	-20	-170	0.00007%
-5	-105	0.00097%	-15	-40	0.12197%	-25	-35	1.05589%
-5	-110	0.00007%	-15	-45	0.20524%	-25	-40	0.18705%
-5	-115	0.00104%	-15	-50	0.00790%	-25	-45	0.52903%
-5	-125	0.00030%	-15	-55	0.05114%	-25	-50	0.03429%
-5	-135	0.00022%	-15	-60	0.00149%	-25	-55	0.18467%
-5	-145	0.00022%	-15	-65	0.01625%	-25	-60	0.00686%
-5	-155	0.00007%	-15	-70	0.00089%	-25	-65	0.06598%
-5	-165	0.00007%	-15	-75	0.00790%	-25	-70	0.00343%
-5	-175	0.00007%	-15	-80	0.00022%	-25	-75	0.03325%
-5	-185	0.00007%	-15	-85	0.00507%	-25	-80	0.00075%
-5	-205	0.00015%	-15	-90	0.00007%	-25	-85	0.01156%
-5	-215	0.00007%	-15	-95	0.00209%	-25	-90	0.00030%
-5	-235	0.00007%	-15	-100	0.00022%	-25	-95	0.00410%
-10	-20	2.35289%	-15	-105	0.00097%	-25	-100	0.00007%
-10	-25	0.42793%	-15	-110	0.00007%	-25	-105	0.00097%
-10	-30	1.48882%	-15	-115	0.00037%	-25	-115	0.00075%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 13 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
-25	-120	0.00015%	-35	-105	0.00209%	-45	-215	0.00007%
-25	-125	0.00067%	-35	-115	0.00104%	-45	-230	0.00007%
-25	-135	0.00015%	-35	-120	0.00007%	-50	-60	1.01891%
-25	-145	0.00015%	-35	-125	0.00030%	-50	-65	0.20472%
-25	-155	0.00022%	-35	-130	0.00007%	-50	-70	0.67455%
-25	-165	0.00007%	-35	-135	0.00037%	-50	-75	0.05957%
-25	-180	0.00007%	-35	-150	0.00007%	-50	-80	0.13882%
-25	-205	0.00007%	-35	-165	0.00015%	-50	-85	0.01185%
-25	-225	0.00007%	-35	-175	0.00007%	-50	-90	0.03004%
-25	-235	0.00007%	-35	-180	0.00007%	-50	-95	0.00239%
-30	-40	1.45616%	-35	-215	0.00007%	-50	-100	0.00910%
-30	-45	0.21687%	-40	-50	1.04948%	-50	-105	0.00089%
-30	-50	1.02257%	-40	-55	0.17132%	-50	-110	0.00246%
-30	-55	0.04123%	-40	-60	0.80562%	-50	-115	0.00015%
-30	-60	0.28695%	-40	-65	0.05741%	-50	-120	0.00082%
-30	-65	0.01252%	-40	-70	0.21262%	-50	-125	0.00015%
-30	-70	0.08685%	-40	-75	0.01006%	-50	-130	0.00037%
-30	-75	0.00291%	-40	-80	0.04227%	-50	-135	0.00007%
-30	-80	0.01983%	-40	-85	0.00239%	-50	-140	0.00015%
-30	-85	0.00037%	-40	-90	0.01148%	-50	-150	0.00007%
-30	-90	0.00507%	-40	-95	0.00060%	-50	-160	0.00022%
-30	-95	0.00015%	-40	-100	0.00321%	-50	-170	0.00007%
-30	-100	0.00261%	-40	-105	0.00037%	-50	-180	0.00015%
-30	-110	0.00089%	-40	-110	0.00097%	-50	-215	0.00007%
-30	-120	0.00022%	-40	-115	0.00015%	-55	-65	1.22706%
-30	-125	0.00007%	-40	-120	0.00052%	-55	-70	0.19816%
-30	-130	0.00037%	-40	-125	0.00007%	-55	-75	1.09660%
-30	-140	0.00037%	-40	-130	0.00052%	-55	-80	0.07731%
-30	-145	0.00015%	-40	-140	0.00015%	-55	-85	0.23089%
-30	-150	0.00007%	-40	-160	0.00015%	-55	-90	0.01603%
-30	-160	0.00007%	-40	-165	0.00007%	-55	-95	0.05092%
-30	-170	0.00007%	-40	-180	0.00007%	-55	-100	0.00417%
-30	-180	0.00007%	-45	-55	0.98618%	-55	-105	0.02281%
-30	-190	0.00007%	-45	-60	0.19317%	-55	-110	0.00045%
-30	-195	0.00007%	-45	-65	1.01220%	-55	-115	0.00984%
-30	-200	0.00007%	-45	-70	0.05599%	-55	-120	0.00022%
-30	-215	0.00007%	-45	-75	0.35196%	-55	-125	0.00224%
-30	-255	0.00007%	-45	-80	0.01185%	-55	-135	0.00030%
-35	-45	0.91491%	-45	-85	0.09468%	-55	-145	0.00022%
-35	-50	0.17475%	-45	-90	0.00239%	-55	-155	0.00007%
-35	-55	0.65099%	-45	-95	0.01670%	-55	-160	0.00007%
-35	-60	0.05040%	-45	-100	0.00052%	-55	-165	0.00007%
-35	-65	0.28777%	-45	-105	0.00440%	-55	-195	0.00007%
-35	-70	0.01148%	-45	-110	0.00045%	-55	-205	0.00007%
-35	-75	0.10758%	-45	-115	0.00231%	-55	-225	0.00007%
-35	-80	0.00239%	-45	-120	0.00037%	-55	-235	0.00007%
-35	-85	0.03377%	-45	-125	0.00089%	-55	-270	0.00007%
-35	-90	0.00045%	-45	-135	0.00052%	-60	-70	0.91335%
-35	-95	0.00783%	-45	-145	0.00022%	-60	-75	0.22075%
-35	-100	0.00030%	-45	-175	0.00007%	-60	-80	0.53342%

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Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
-60	-85	0.08492%	-70	-160	0.00007%	-85	-135	0.00060%
-60	-90	0.11429%	-70	-165	0.00007%	-85	-140	0.00015%
-60	-95	0.01588%	-70	-170	0.00007%	-85	-145	0.00015%
-60	-100	0.02319%	-70	-180	0.00015%	-85	-150	0.00007%
-60	-105	0.00328%	-70	-190	0.00007%	-85	-155	0.00060%
-60	-110	0.00522%	-70	-200	0.00022%	-85	-160	0.00007%
-60	-115	0.00082%	-75	-85	1.05731%	-85	-165	0.00015%
-60	-120	0.00171%	-75	-90	0.22120%	-85	-175	0.00007%
-60	-125	0.00007%	-75	-95	0.69588%	-85	-205	0.00015%
-60	-130	0.00022%	-75	-100	0.05480%	-90	-100	0.42510%
-60	-140	0.00022%	-75	-105	0.15395%	-90	-105	0.12048%
-60	-150	0.00007%	-75	-110	0.00641%	-90	-110	0.17609%
-60	-160	0.00022%	-75	-115	0.02520%	-90	-115	0.02594%
-60	-170	0.00015%	-75	-120	0.00104%	-90	-120	0.03787%
-60	-190	0.00007%	-75	-125	0.00335%	-90	-125	0.00313%
-60	-195	0.00007%	-75	-130	0.00022%	-90	-130	0.00634%
-65	-75	1.21961%	-75	-135	0.00037%	-90	-135	0.00037%
-65	-80	0.24379%	-75	-140	0.00007%	-90	-140	0.00127%
-65	-85	0.75030%	-75	-145	0.00015%	-90	-145	0.00022%
-65	-90	0.07530%	-75	-150	0.00007%	-90	-150	0.00037%
-65	-95	0.18101%	-75	-155	0.00007%	-90	-155	0.00015%
-65	-100	0.01290%	-75	-160	0.00022%	-90	-160	0.00045%
-65	-105	0.07001%	-75	-165	0.00015%	-90	-170	0.00015%
-65	-110	0.00164%	-75	-195	0.00015%	-90	-180	0.00007%
-65	-115	0.01752%	-75	-205	0.00007%	-90	-190	0.00015%
-65	-125	0.00253%	-75	-215	0.00007%	-90	-200	0.00007%
-65	-130	0.00007%	-80	-90	0.60395%	-90	-250	0.00007%
-65	-135	0.00030%	-80	-95	0.17960%	-95	-105	0.62833%
-65	-140	0.00007%	-80	-100	0.28554%	-95	-110	0.09714%
-65	-145	0.00030%	-80	-105	0.04838%	-95	-115	0.27652%
-65	-155	0.00007%	-80	-110	0.05711%	-95	-120	0.01976%
-65	-160	0.00015%	-80	-115	0.00455%	-95	-125	0.02378%
-65	-165	0.00015%	-80	-120	0.01006%	-95	-130	0.00231%
-65	-175	0.00015%	-80	-125	0.00007%	-95	-135	0.00321%
-65	-195	0.00007%	-80	-130	0.00246%	-95	-140	0.00022%
-65	-205	0.00007%	-80	-135	0.00015%	-95	-145	0.00045%
-65	-215	0.00007%	-80	-140	0.00075%	-95	-150	0.00030%
-70	-80	0.78064%	-80	-145	0.00015%	-95	-155	0.00037%
-70	-85	0.24610%	-80	-150	0.00015%	-95	-160	0.00022%
-70	-90	0.42130%	-80	-170	0.00007%	-95	-165	0.00022%
-70	-95	0.07097%	-80	-180	0.00007%	-95	-175	0.00007%
-70	-100	0.08529%	-80	-200	0.00007%	-95	-195	0.00007%
-70	-105	0.00924%	-85	-95	0.99081%	-95	-225	0.00007%
-70	-110	0.01707%	-85	-100	0.16961%	-100	-110	0.30112%
-70	-115	0.00119%	-85	-105	0.48303%	-100	-115	0.08551%
-70	-120	0.00298%	-85	-110	0.03601%	-100	-120	0.13755%
-70	-125	0.00015%	-85	-115	0.05711%	-100	-125	0.01484%
-70	-130	0.00067%	-85	-120	0.00373%	-100	-130	0.03251%
-70	-140	0.00022%	-85	-125	0.00514%	-100	-135	0.00149%
-70	-150	0.00015%	-85	-130	0.00052%	-100	-140	0.00500%

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Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
-100	-145	0.00015%	-115	-245	0.00007%	-135	-190	0.00007%
-100	-150	0.00104%	-120	-130	0.22165%	-135	-195	0.00007%
-100	-160	0.00052%	-120	-135	0.06195%	-140	-150	0.14851%
-100	-170	0.00007%	-120	-140	0.08350%	-140	-155	0.03385%
-100	-175	0.00007%	-120	-145	0.00746%	-140	-160	0.03854%
-100	-180	0.00015%	-120	-150	0.01223%	-140	-165	0.00455%
-100	-185	0.00007%	-120	-155	0.00060%	-140	-170	0.00403%
-100	-190	0.00007%	-120	-160	0.00186%	-140	-175	0.00149%
-105	-115	0.47348%	-120	-170	0.00015%	-140	-180	0.00149%
-105	-120	0.07411%	-120	-180	0.00022%	-140	-185	0.00007%
-105	-125	0.20495%	-120	-190	0.00007%	-140	-190	0.00007%
-105	-130	0.01320%	-120	-200	0.00007%	-140	-195	0.00007%
-105	-135	0.02274%	-120	-205	0.00007%	-140	-200	0.00007%
-105	-140	0.00119%	-120	-215	0.00007%	-140	-210	0.00007%
-105	-145	0.00134%	-125	-135	0.31879%	-145	-155	0.22030%
-105	-150	0.00030%	-125	-140	0.05092%	-145	-160	0.03213%
-105	-155	0.00030%	-125	-145	0.11571%	-145	-165	0.05703%
-105	-160	0.00015%	-125	-150	0.00723%	-145	-170	0.00582%
-105	-165	0.00037%	-125	-155	0.00656%	-145	-175	0.00373%
-105	-175	0.00022%	-125	-160	0.00127%	-145	-180	0.00119%
-105	-185	0.00015%	-125	-165	0.00097%	-145	-185	0.00045%
-105	-190	0.00015%	-125	-170	0.00030%	-145	-190	0.00030%
-105	-195	0.00007%	-125	-175	0.00022%	-145	-195	0.00060%
-105	-210	0.00007%	-125	-180	0.00007%	-145	-205	0.00015%
-110	-120	0.26720%	-125	-185	0.00022%	-145	-225	0.00007%
-110	-125	0.06352%	-125	-190	0.00007%	-150	-160	0.11444%
-110	-130	0.11757%	-125	-195	0.00007%	-150	-165	0.03191%
-110	-135	0.00947%	-130	-140	0.21002%	-150	-170	0.02632%
-110	-140	0.01938%	-130	-145	0.04891%	-150	-175	0.00328%
-110	-145	0.00097%	-130	-150	0.06680%	-150	-180	0.00403%
-110	-150	0.00283%	-130	-155	0.00708%	-150	-185	0.00037%
-110	-155	0.00037%	-130	-160	0.00701%	-150	-190	0.00075%
-110	-160	0.00075%	-130	-165	0.00075%	-150	-195	0.00007%
-110	-165	0.00007%	-130	-170	0.00112%	-150	-200	0.00030%
-110	-170	0.00015%	-130	-175	0.00030%	-150	-210	0.00015%
-110	-175	0.00015%	-130	-180	0.00015%	-155	-165	0.17311%
-110	-180	0.00015%	-130	-185	0.00007%	-155	-170	0.02922%
-110	-205	0.00015%	-130	-190	0.00015%	-155	-175	0.03810%
-115	-125	0.39036%	-130	-195	0.00007%	-155	-180	0.00350%
-115	-130	0.06262%	-130	-220	0.00007%	-155	-185	0.00261%
-115	-135	0.14672%	-130	-230	0.00007%	-155	-190	0.00015%
-115	-140	0.01051%	-135	-145	0.24684%	-155	-195	0.00045%
-115	-145	0.01029%	-135	-150	0.03832%	-155	-200	0.00007%
-115	-150	0.00067%	-135	-155	0.08246%	-155	-205	0.00030%
-115	-155	0.00157%	-135	-160	0.00432%	-155	-210	0.00007%
-115	-160	0.00015%	-135	-165	0.00604%	-155	-215	0.00015%
-115	-165	0.00060%	-135	-170	0.00075%	-155	-225	0.00007%
-115	-170	0.00007%	-135	-175	0.00104%	-160	-170	0.11339%
-115	-175	0.00037%	-135	-180	0.00022%	-160	-175	0.02319%
-115	-185	0.00007%	-135	-185	0.00030%	-160	-180	0.02766%

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Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
-160	-185	0.00261%	-185	-200	0.02199%	-220	-250	0.00067%
-160	-190	0.00216%	-185	-205	0.02237%	-220	-260	0.00007%
-160	-200	0.00060%	-185	-210	0.00104%	-225	-235	0.05457%
-160	-205	0.00007%	-185	-215	0.00112%	-225	-240	0.00082%
-160	-210	0.00030%	-185	-220	0.00015%	-225	-245	0.01938%
-160	-215	0.00007%	-185	-225	0.00075%	-225	-255	0.00022%
-160	-220	0.00007%	-185	-235	0.00082%	-225	-260	0.00007%
-160	-240	0.00007%	-185	-245	0.00015%	-225	-270	0.00007%
-160	-300	0.00007%	-190	-200	0.09073%	-230	-240	0.00641%
-165	-175	0.13457%	-190	-205	0.02102%	-230	-245	0.00089%
-165	-180	0.02199%	-190	-210	0.00932%	-230	-250	0.00104%
-165	-185	0.02848%	-190	-215	0.00075%	-230	-265	0.00007%
-165	-190	0.00142%	-190	-220	0.00045%	-230	-320	0.00007%
-165	-195	0.00082%	-190	-230	0.00015%	-235	-245	0.03280%
-165	-200	0.00030%	-190	-400	0.00007%	-235	-250	0.00037%
-165	-205	0.00075%	-195	-205	0.14277%	-235	-255	0.00335%
-165	-210	0.00007%	-195	-210	0.02281%	-235	-260	0.00007%
-165	-215	0.00007%	-195	-215	0.02087%	-235	-265	0.00007%
-165	-225	0.00030%	-195	-220	0.00015%	-240	-250	0.00313%
-165	-235	0.00015%	-195	-225	0.00112%	-240	-255	0.00015%
-165	-245	0.00007%	-195	-235	0.00037%	-240	-260	0.00060%
-165	-255	0.00007%	-195	-240	0.00007%	-240	-270	0.00015%
-170	-180	0.08193%	-195	-245	0.00037%	-240	-280	0.00007%
-170	-185	0.01789%	-195	-255	0.00007%	-245	-255	0.00641%
-170	-190	0.01767%	-200	-210	0.08141%	-245	-260	0.00045%
-170	-195	0.00157%	-200	-215	0.01379%	-245	-265	0.00089%
-170	-200	0.00239%	-200	-220	0.00492%	-245	-270	0.00007%
-170	-205	0.00045%	-200	-225	0.00015%	-250	-260	0.00186%
-170	-210	0.00022%	-200	-230	0.00007%	-250	-265	0.00037%
-170	-215	0.00022%	-205	-215	0.08037%	-250	-270	0.00015%
-170	-220	0.00007%	-205	-220	0.00470%	-250	-280	0.00007%
-175	-185	0.11996%	-205	-225	0.01133%	-255	-265	0.00365%
-175	-190	0.01789%	-205	-230	0.00030%	-255	-270	0.00060%
-175	-195	0.02266%	-205	-235	0.00112%	-255	-275	0.00045%
-175	-200	0.00075%	-205	-245	0.00112%	-255	-285	0.00007%
-175	-205	0.00119%	-205	-255	0.00045%	-255	-315	0.00007%
-175	-210	0.00037%	-210	-220	0.02520%	-255	-535	0.00015%
-175	-215	0.00045%	-210	-225	0.00417%	-260	-270	0.00097%
-175	-225	0.00015%	-210	-230	0.00171%	-260	-275	0.00022%
-175	-235	0.00022%	-210	-240	0.00030%	-260	-310	0.00015%
-175	-255	0.00007%	-210	-360	0.00007%	-265	-275	0.00164%
-180	-190	0.07478%	-215	-225	0.03750%	-265	-280	0.00022%
-180	-195	0.01588%	-215	-230	0.00082%	-265	-285	0.00007%
-180	-200	0.01364%	-215	-235	0.01282%	-265	-295	0.00007%
-180	-205	0.00142%	-215	-245	0.00216%	-265	-300	0.00007%
-180	-210	0.00134%	-215	-250	0.00007%	-270	-280	0.00045%
-180	-215	0.00007%	-215	-255	0.00030%	-270	-285	0.00015%
-180	-220	0.00007%	-220	-230	0.00664%	-270	-290	0.00007%
-180	-240	0.00007%	-220	-235	0.00089%	-270	-295	0.00007%
-185	-195	0.10989%	-220	-240	0.00246%	-275	-285	0.00089%

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Table 7.24 Fully loaded 110-ton high-side gondola in unit train service—coupler load (kip) (page 17 of 17)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
-275	-290	0.00082%	-285	-335	0.00030%	-315	-325	0.00992%
-275	-295	0.00022%	-290	-300	0.00022%	-315	-335	0.00850%
-275	-300	0.00007%	-295	-305	0.00045%	-315	-345	0.00097%
-275	-305	0.00007%	-295	-315	0.00082%	-325	-335	0.00239%
-275	-345	0.00007%	-295	-325	0.00119%	-325	-345	0.00015%
-280	-290	0.00142%	-295	-335	0.00104%	-345	-385	0.00007%
-280	-295	0.00030%	-300	-315	0.00007%	-355	-375	0.00007%
-285	-295	0.00060%	-305	-315	0.00470%	-365	-385	0.00015%
-285	-300	0.00007%	-305	-325	0.00924%	-375	-385	0.00007%
-285	-315	0.00015%	-305	-335	0.00186%			
-285	-325	0.00007%	-305	-345	0.00060%			

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7.3.2.24 Car Body Twist Moment—Fully Loaded 110-ton High-Side Gondola in Unit Train Service

Test Date	March 2006–December 2007
Test Mode	Unit Train Coal Service—286,000 lb GRL
Max MPH	51
Average MPH	25.0
Recorded Mileage	8,480
Total Number of Cycles	6,786,405
Average Cycles/Mile	800.3
Track Class	Various

Travel Speed Distribution		
Range (mph)		Percent at Level
0	5	5.4
5	10	9.3
10	15	11.0
15	20	11.7
20	25	16.1
25	30	10.3
30	35	14.3
35	40	11.0
40	45	5.0
45	50	4.5
50	55	1.5

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Table 7.25 Fully loaded 110-ton high-side gondola in unit train service—car body twist moment (in.-kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
2500	-1750	0.00003%	1500	-1000	0.00186%	500	-1750	0.00007%
2500	-2000	0.00004%	1500	-1250	0.00159%	500	-2000	0.00003%
2500	-2250	0.00001%	1500	-1500	0.00119%	250	0	32.54653%
2250	-750	0.00003%	1500	-1750	0.00060%	250	-250	12.71277%
2250	-1000	0.00004%	1500	-2000	0.00001%	250	-500	0.88819%
2250	-1250	0.00001%	1250	1000	0.03389%	250	-750	0.18944%
2250	-1500	0.00001%	1250	750	0.04021%	250	-1000	0.03114%
2250	-1750	0.00004%	1250	500	0.00606%	250	-1250	0.00451%
2250	-2000	0.00001%	1250	250	0.00430%	250	-1500	0.00071%
2000	1500	0.00003%	1250	0	0.00467%	250	-1750	0.00009%
2000	500	0.00003%	1250	-250	0.00418%	250	-2000	0.00001%
2000	0	0.00001%	1250	-500	0.00631%	0	-250	15.50326%
2000	-250	0.00003%	1250	-750	0.00734%	0	-500	4.70890%
2000	-500	0.00001%	1250	-1000	0.00728%	0	-750	0.23876%
2000	-750	0.00003%	1250	-1250	0.00463%	0	-1000	0.02324%
2000	-1000	0.00004%	1250	-1500	0.00221%	0	-1250	0.00474%
2000	-1250	0.00010%	1250	-1750	0.00031%	0	-1500	0.00074%
2000	-1500	0.00019%	1000	750	0.15932%	0	-1750	0.00019%
2000	-1750	0.00012%	1000	500	0.17641%	0	-2000	0.00003%
2000	-2000	0.00004%	1000	250	0.03066%	-250	-500	5.29864%
1750	1500	0.00035%	1000	0	0.01826%	-250	-750	2.45041%
1750	1250	0.00066%	1000	-250	0.02758%	-250	-1000	0.04332%
1750	1000	0.00021%	1000	-500	0.03760%	-250	-1250	0.00334%
1750	750	0.00009%	1000	-750	0.03678%	-250	-1500	0.00059%
1750	500	0.00010%	1000	-1000	0.01911%	-250	-1750	0.00016%
1750	250	0.00010%	1000	-1250	0.00868%	-500	-750	1.77957%
1750	0	0.00021%	1000	-1500	0.00165%	-500	-1000	0.29192%
1750	-250	0.00028%	1000	-1750	0.00018%	-500	-1250	0.00769%
1750	-500	0.00028%	750	500	0.99820%	-500	-1500	0.00065%
1750	-750	0.00025%	750	250	0.97924%	-500	-1750	0.00004%
1750	-1000	0.00037%	750	0	0.17361%	-750	-1000	0.29235%
1750	-1250	0.00063%	750	-250	0.20559%	-750	-1250	0.09109%
1750	-1500	0.00041%	750	-500	0.17040%	-750	-1500	0.00315%
1750	-1750	0.00018%	750	-750	0.08658%	-750	-1750	0.00009%
1750	-2000	0.00007%	750	-1000	0.03330%	-1000	-1250	0.08038%
1750	-2250	0.00001%	750	-1250	0.00927%	-1000	-1500	0.02565%
1750	-2500	0.00001%	750	-1500	0.00097%	-1000	-1750	0.00063%
1500	1250	0.00533%	750	-1750	0.00018%	-1250	-1500	0.01786%
1500	1000	0.00603%	500	250	4.50900%	-1250	-1750	0.00267%
1500	750	0.00134%	500	0	12.01751%	-1250	-2000	0.00004%
1500	500	0.00052%	500	-250	2.21431%	-1500	-1750	0.00165%
1500	250	0.00099%	500	-500	0.47368%	-1500	-2000	0.00040%
1500	0	0.00091%	500	-750	0.16235%	-1500	-2250	0.00001%
1500	-250	0.00130%	500	-1000	0.04606%	-1750	-2000	0.00010%
1500	-500	0.00108%	500	-1250	0.00600%	-2000	-2250	0.00001%
1500	-750	0.00140%	500	-1500	0.00105%			

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7.3.2.25 Total Side Bearing Load—Loaded 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	60
Average MPH	23.3
Recorded Mileage	14,787
Total Number of Cycles	10,489
Average Cycles/Mile	0.7
Track Class	Various

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Table 7.26 Loaded 100-ton hopper car—total side bearing load

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
80	-90	0.009534	20	-80	0.009534
80	-80	0.009534	20	-50	0.028601
70	-100	0.019068	20	-40	0.171608
70	-80	0.028601	20	-30	0.333683
70	-70	0.019068	20	-20	0.552960
70	-60	0.019068	20	-10	1.058262
60	-80	0.009534	20	0	1.134522
60	-70	0.009534	20	10	4.471351
60	-60	0.047669	10	-60	0.009534
60	-50	0.038135	10	-50	0.009534
50	-70	0.019068	10	-40	0.095338
50	-60	0.009534	10	-30	0.276480
50	-50	0.028601	10	-20	0.848508
50	-40	0.076270	10	-10	4.318810
50	-20	0.009534	10	0	12.994566
50	40	0.009534	0	-50	0.066737
40	-60	0.047669	0	-40	0.591095
40	-50	0.057203	0	-30	3.146153
40	-40	0.133473	0	-20	10.391839
40	-30	0.057203	0	-10	41.691296
40	-20	0.028601	-10	-60	0.019068
40	-10	0.009534	-10	-50	0.019068
40	0	0.028601	-10	-40	0.276480
40	10	0.162075	-10	-30	2.068834
40	20	0.038135	-10	-20	9.753075
40	30	0.076270	-20	-40	0.162075
30	-50	0.066737	-20	-30	1.267995
30	-40	0.276480	-30	-60	0.019068
30	-30	0.247879	-30	-50	0.038135
30	-20	0.181142	-30	-40	0.905711
30	-10	0.085804	-40	-50	0.066737
30	0	0.152541	-50	-60	0.019068
30	10	0.924778	-80	-90	0.009534
30	20	0.238345			

7.3.2.26 Total Vertical Bolster Load—Loaded 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	60
Average MPH	23.3
Recorded Mileage	14,787
Total Number of Cycles	1,871,250
Average Cycles/Mile	113
Track Class	Various

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Table 7.27 Loaded 100-ton hopper car—total vertical bolster load

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
300	0	0.000060	180	60	0.000239	150	110	0.181960
270	10	0.000060	180	70	0.001257	150	120	0.501301
270	20	0.000060	180	80	0.001556	150	130	0.902319
230	50	0.000120	180	90	0.002573	150	140	3.375019
230	60	0.000060	180	100	0.004069	140	50	0.000060
230	70	0.000120	180	110	0.002513	140	60	0.000359
230	80	0.000120	180	120	0.000718	140	70	0.002154
220	40	0.000120	180	160	0.000060	140	80	0.013702
220	50	0.000060	180	170	0.000359	140	90	0.044039
220	60	0.000299	170	40	0.000060	140	100	0.243590
220	70	0.000120	170	50	0.000359	140	110	0.762902
220	80	0.000060	170	60	0.000299	140	120	2.660763
220	90	0.000060	170	70	0.000598	140	130	15.655108
220	210	0.000060	170	80	0.002633	130	70	0.000778
210	40	0.000060	170	90	0.006402	130	80	0.013224
210	50	0.000060	170	100	0.010471	130	90	0.118714
210	60	0.000060	170	110	0.016634	130	100	0.637966
210	70	0.000120	170	120	0.010890	130	110	4.037696
210	80	0.000120	170	130	0.003291	130	120	24.082811
210	90	0.000120	170	140	0.000838	120	70	0.002390
200	50	0.000060	170	150	0.000239	120	80	0.004368
200	60	0.000120	170	160	0.002453	120	90	0.188482
200	70	0.000180	160	50	0.000180	120	100	3.272880
200	80	0.000479	160	60	0.001316	120	110	27.074286
200	90	0.000120	160	70	0.001376	110	80	0.000180
200	100	0.000299	160	80	0.003411	110	90	0.113747
200	190	0.000180	160	90	0.014301	110	100	15.441616
190	10	0.000060	160	100	0.026746	100	80	0.000120
190	50	0.000060	160	110	0.059297	100	90	0.033089
190	60	0.000180	160	120	0.092745	90	80	0.000539
190	60	0.000180	160	130	0.056784	80	70	0.000718
190	70	0.000359	160	140	0.078265	70	60	0.011309
190	80	0.000718	160	150	0.071563	60	50	0.003052
190	90	0.000778	150	50	0.000060	50	40	0.000060
190	100	0.000419	150	50	0.000299	40	20	0.001316
190	110	0.000120	150	70	0.003231	40	30	0.018190
180	20	0.000239	150	80	0.007120	30	20	0.000718
180	30	0.000060	150	90	0.021361			
180	40	0.000120	150	100	0.087599			

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7.3.2.27 Center Plate Load, Loaded 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	60
Average MPH	23.3
Recorded Mileage	14,787
Total Number of Cycles	1,776,626
Average Cycles/Mile	120.1
Track Class	Various

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Table 7.28 Loaded 100-ton hopper car—center plate load (page 1 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
300	0	0.000056	180	10	0.000056
280	30	0.000056	180	20	0.000056
270	40	0.000056	180	40	0.000056
260	0	0.000056	180	50	0.000338
240	50	0.000056	180	60	0.000394
240	90	0.000056	180	70	0.001238
230	50	0.000169	180	80	0.001914
230	60	0.000056	180	90	0.003715
220	40	0.000056	180	100	0.001801
220	50	0.000113	180	110	0.000957
220	60	0.000169	180	120	0.001970
220	70	0.000113	180	130	0.001069
220	90	0.000056	180	140	0.000338
220	100	0.000056	180	150	0.000113
210	50	0.000113	180	160	0.000056
210	60	0.000113	180	170	0.000281
210	70	0.000056	170	50	0.000113
210	80	0.000113	170	60	0.000844
210	110	0.000056	170	70	0.002533
210	200	0.000169	170	80	0.005066
200	30	0.000056	170	90	0.009344
200	50	0.000169	170	100	0.013227
200	60	0.000225	170	110	0.005009
200	70	0.000281	170	120	0.004221
200	80	0.000338	170	130	0.011989
200	90	0.000113	170	140	0.006304
200	100	0.000113	170	150	0.004221
200	110	0.000056	170	160	0.002758
200	190	0.000113	160	40	0.000056
190	0	0.000056	160	50	0.000113
190	10	0.000113	160	60	0.000450
190	40	0.000056	160	70	0.001407
190	50	0.000113	160	80	0.006754
190	60	0.000281	160	90	0.019925
190	70	0.000901	160	100	0.052234
190	80	0.001069	160	110	0.054429
190	90	0.000732	160	120	0.021107
190	100	0.000056	160	130	0.054542
190	110	0.000281	160	140	0.296348
190	120	0.000281	160	150	0.562470
190	170	0.000056	150	50	0.000225
190	180	0.000113	150	70	0.001069

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Table 7.28 Loaded 100-ton hopper car—center plate load (page 2 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
150	80	0.007317	120	60	0.000225
150	90	0.033322	120	70	0.000338
150	100	0.137170	120	80	0.002645
150	110	0.348244	120	90	0.028481
150	120	0.287173	120	100	2.358739
150	130	0.350946	120	110	31.195236
150	140	3.114722	110	20	0.000338
140	10	0.000056	110	30	0.000281
140	40	0.000056	110	40	0.000507
140	50	0.000056	110	50	0.000450
140	60	0.001520	110	60	0.000450
140	70	0.000732	110	70	0.000957
140	80	0.002871	110	80	0.001970
140	90	0.049982	110	90	0.012552
140	100	0.280419	110	100	5.288448
140	110	1.367760	100	80	0.000338
140	120	3.586065	100	90	0.011708
140	130	4.885550	90	70	0.000056
130	30	0.000056	90	80	0.009570
130	40	0.000113	80	60	0.000056
130	50	0.000113	80	70	0.001238
130	60	0.000113	70	60	0.001407
130	70	0.000788	60	50	0.003771
130	80	0.002927	50	40	0.000113
130	90	0.048125	40	10	0.001295
130	100	0.664799	40	20	0.009738
130	110	4.641773	40	30	0.009118
130	120	40.057030	30	10	0.000563
120	30	0.000056	30	20	0.038950
120	40	0.000169	20	10	0.000225
120	50	0.000338			

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7.3.2.28 Coupler Load, Loaded 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	60
Average MPH	23.3
Recorded Mileage	14,787
Total Number of Cycles	85,701
Average Cycles/Mile	5.8
Track Class	Various

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Table 7.29 Loaded 100-ton hopper car—coupler load (page 1 of 3)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
340	-40	0.001167	240	-80	0.001167	200	120	0.010502
320	60	0.001167	240	-40	0.002334	200	140	0.010502
320	280	0.004667	240	20	0.001167	200	180	0.376892
320	300	0.017503	240	120	0.001167	180	-380	0.001167
300	-500	0.001167	240	140	0.002334	180	-340	0.001167
300	-340	0.001167	240	160	0.003501	180	-280	0.003501
300	-320	0.001167	240	180	0.001167	180	-240	0.008168
300	180	0.002334	240	200	0.008168	180	-220	0.008168
300	260	0.001167	240	220	0.047841	180	-200	0.002334
300	280	0.024504	220	-300	0.001167	180	-180	0.007001
280	-220	0.001167	220	-280	0.002334	180	-160	0.007001
280	-140	0.001167	220	-240	0.001167	180	-140	0.009335
280	-20	0.001167	220	-220	0.002334	180	-120	0.012835
280	40	0.001167	220	-160	0.004667	180	-100	0.004667
280	60	0.001167	220	-140	0.009335	180	-80	0.005834
280	120	0.001167	220	-120	0.003501	180	-60	0.001167
280	160	0.001167	220	-100	0.002334	180	-40	0.003501
280	240	0.001167	220	-80	0.002334	180	-20	0.002334
280	260	0.003501	220	-20	0.002334	180	0	0.003501
260	-400	0.001167	220	20	0.001167	180	20	0.007001
260	-320	0.001167	220	40	0.002334	180	40	0.009335
260	-280	0.001167	220	80	0.004667	180	60	0.009335
260	-240	0.003501	220	100	0.002334	180	80	0.007001
260	-200	0.001167	220	140	0.001167	180	100	0.011668
260	-180	0.001167	220	160	0.025671	180	120	0.024504
260	-140	0.001167	220	180	0.072345	180	140	0.089847
260	-120	0.001167	220	200	0.117852	180	160	0.310381
260	-100	0.001167	200	-360	0.001167	160	-360	0.001167
260	-60	0.001167	200	-260	0.003501	160	-320	0.001167
260	80	0.001167	200	-240	0.002334	160	-300	0.002334
260	100	0.001167	200	-200	0.007001	160	-260	0.003501
260	140	0.002334	200	-180	0.008168	160	-240	0.004667
260	180	0.005834	200	-160	0.001167	160	-220	0.007001
260	200	0.007001	200	-140	0.004667	160	-200	0.004667
260	220	0.009335	200	-120	0.005834	160	-180	0.003501
260	240	0.030338	200	-100	0.002334	160	-160	0.008168
240	-360	0.001167	200	-80	0.008168	160	-140	0.017503
240	-340	0.001167	200	-60	0.001167	160	-120	0.021003
240	-240	0.005834	200	-20	0.001167	160	-100	0.022170
240	-220	0.002334	200	0	0.004667	160	-80	0.007001
240	-200	0.001167	200	20	0.008168	160	-60	0.004667
240	-180	0.001167	200	40	0.003501	160	-40	0.004667
240	-160	0.003501	200	60	0.004667	160	-20	0.003501
240	-140	0.001167	200	80	0.002334	160	0	0.005834
240	-120	0.001167	200	100	0.005834	160	20	0.007001

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Table 7.29 Loaded 100-ton hopper car—coupler load (page 2 of 3)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
160	40	0.010502	120	80	0.144689	60	-160	0.019836
160	60	0.001167	120	100	1.078167	60	-140	0.030338
160	80	0.016336	100	-360	0.001167	60	-120	0.064177
160	100	0.040840	100	-340	0.001167	60	-100	0.099182
160	120	0.086347	100	-320	0.001167	60	-80	0.127186
160	140	0.549585	100	-300	0.001167	60	-60	0.123686
140	-340	0.001167	100	-280	0.001167	60	-40	0.157524
140	-300	0.002334	100	-240	0.005834	60	-20	0.161025
140	-260	0.001167	100	-220	0.008168	60	0	0.359389
140	-240	0.008168	100	-200	0.008168	60	20	1.423554
140	-220	0.003501	100	-180	0.015169	60	40	6.662699
140	-200	0.016336	100	-160	0.018670	40	-280	0.002334
140	-180	0.014002	100	-140	0.030338	40	-260	0.003501
140	-160	0.019836	100	-120	0.059509	40	-240	0.004667
140	-140	0.028004	100	-100	0.050174	40	-220	0.005834
140	-120	0.024504	100	-80	0.075845	40	-200	0.012835
140	-100	0.022170	100	-60	0.073511	40	-180	0.016336
140	-80	0.015169	100	-40	0.061843	40	-160	0.019836
140	-60	0.011668	100	-20	0.053675	40	-140	0.051341
140	-40	0.015169	100	0	0.078179	40	-120	0.046674
140	-20	0.016336	100	20	0.136521	40	-100	0.068844
140	0	0.012835	100	40	0.136521	40	-80	0.133021
140	20	0.016336	100	60	0.359389	40	-60	0.155191
140	40	0.019836	100	80	1.703597	40	-40	0.271875
140	60	0.026837	80	-360	0.001167	40	-20	0.242704
140	80	0.032672	80	-300	0.001167	40	0	0.939312
140	100	0.115518	80	-260	0.002334	40	20	9.127082
140	120	0.786455	80	-240	0.002334	20	-340	0.002334
120	-380	0.001167	80	-220	0.007001	20	-320	0.001167
120	-300	0.003501	80	-200	0.012835	20	-240	0.002334
120	-280	0.001167	80	-180	0.004667	20	-220	0.011668
120	-260	0.003501	80	-160	0.024504	20	-200	0.018670
120	-240	0.010502	80	-140	0.036172	20	-180	0.016336
120	-220	0.007001	80	-120	0.046674	20	-160	0.021003
120	-200	0.018670	80	-100	0.079346	20	-140	0.038506
120	-180	0.012835	80	-80	0.093348	20	-120	0.056009
120	-160	0.014002	80	-60	0.138855	20	-100	0.066510
120	-140	0.029171	80	-40	0.121352	20	-80	0.119018
120	-120	0.044340	80	-20	0.108517	20	-60	0.168026
120	-100	0.065343	80	0	0.189029	20	-40	0.276543
120	-80	0.057176	80	20	0.353555	20	-20	0.393228
120	-60	0.051341	80	40	0.548418	20	0	5.571697
120	-40	0.033839	80	60	3.772418	0	-380	0.007001
120	-20	0.028004	60	-340	0.001167	0	-360	0.001167
120	0	0.025671	60	-280	0.007001	0	-340	0.002334
120	20	0.059509	60	-260	0.003501	0	-320	0.001167
120	40	0.050174	60	-240	0.004667	0	-260	0.002334
120	60	0.073511	60	-220	0.004667	0	-220	0.002334
			60	-200	0.014002	0	-200	0.021003
			60	-180	0.025671	0	-180	0.022170

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Table 7.29 Loaded 100-ton hopper car—coupler load (page 3 of 3)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
0	-160	0.051341	-80	-260	0.002334	-180	-380	0.001167
0	-140	0.053675	-80	-220	0.010502	-180	-320	0.001167
0	-120	0.054842	-80	-200	0.016336	-180	-300	0.005834
0	-100	0.099182	-80	-180	0.012835	-180	-280	0.003501
0	-80	0.197197	-80	-160	0.038506	-180	-260	0.012835
0	-60	0.323217	-80	-140	0.079346	-180	-240	0.011668
0	-40	0.793456	-80	-120	0.364056	-180	-220	0.066510
0	-20	2.346530	-80	-100	3.887936	-180	-200	0.576423
-20	-260	0.001167	-100	-280	0.002334	-200	-300	0.002334
-20	-240	0.001167	-100	-240	0.002334	-200	-280	0.003501
-20	-220	0.011668	-100	-220	0.008168	-200	-260	0.003501
-20	-200	0.016336	-100	-200	0.028004	-200	-240	0.033839
-20	-180	0.028004	-100	-180	0.042007	-200	-220	0.289378
-20	-160	0.031505	-100	-160	0.172693	-220	-320	0.001167
-20	-140	0.057176	-100	-140	0.959149	-220	-300	0.002334
-20	-120	0.095681	-100	-120	4.907761	-220	-280	0.015169
-20	-100	0.143522	-120	-360	0.001167	-220	-260	0.008168
-20	-80	0.620763	-120	-340	0.001167	-220	-240	0.091014
-20	-60	2.144666	-120	-300	0.002334	-240	-320	0.001167
-20	-40	11.678977	-120	-280	0.001167	-240	-300	0.002334
-40	-340	0.001167	-120	-260	0.002334	-240	-280	0.023337
-40	-300	0.001167	-120	-220	0.008168	-240	-260	0.042007
-40	-260	0.003501	-120	-200	0.023337	-260	-320	0.002334
-40	-220	0.005834	-120	-180	0.170360	-260	-300	0.010502
-40	-200	0.003501	-120	-160	0.226368	-260	-280	0.058342
-40	-180	0.017503	-120	-140	3.253171	-280	-440	0.001167
-40	-160	0.031505	-140	-320	0.003501	-280	-400	0.001167
-40	-140	0.050174	-140	-300	0.002334	-280	-380	0.001167
-40	-120	0.081679	-140	-280	0.007001	-280	-340	0.001167
-40	-100	0.183195	-140	-260	0.002334	-280	-320	0.008168
-40	-80	0.984819	-140	-240	0.004667	-280	-300	0.036172
-40	-60	10.741998	-140	-220	0.010502	-300	-460	0.001167
-60	-340	0.002334	-140	-200	0.032672	-300	-360	0.003501
-60	-240	0.002334	-140	-180	0.287044	-300	-340	0.007001
-60	-220	0.003501	-140	-160	0.928811	-300	-320	0.012835
-60	-200	0.012835	-160	-320	0.001167	-320	-380	0.001167
-60	-180	0.017503	-160	-300	0.001167	-320	-360	0.010502
-60	-160	0.035005	-160	-280	0.004667	-320	-340	0.025671
-60	-140	0.039673	-160	-260	0.003501	-340	-380	0.002334
-60	-120	0.113184	-160	-240	0.009335	-340	-360	0.043173
-60	-100	0.645267	-160	-220	0.015169	-360	-380	0.005834
-60	-80	9.118913	-160	-200	0.144689			
-80	-300	0.002334	-160	-180	0.912475			

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7.3.2.29 Coupler Load—Loaded 100-Ton Hopper Car (Severe Environment)

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service (Severe Environment)
Max MPH	60
Average MPH	23.3
Recorded Mileage	5,625
Total Number of Cycles	24,180
Average Cycles/Mile	4.3
Track Class	Various

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Table 7.30 Loaded 100-ton hopper car—coupler load (severe environment) (page 1 of 3)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
340	-40	0.004134	240	-40	0.008268	200	180	1.289842
320	60	0.004134	240	20	0.004134	180	-380	0.004134
320	280	0.016536	240	120	0.004134	180	-340	0.004134
320	300	0.062012	240	140	0.004134	180	-280	0.008268
300	-500	0.004134	240	160	0.002868	180	-220	0.012402
300	-340	0.004134	240	180	0.004134	180	-200	0.004134
300	180	0.008268	240	200	0.082939	180	-180	0.024805
300	260	0.004134	240	220	0.169499	180	-160	0.016536
300	280	0.086816	220	-280	0.008268	180	-140	0.012402
280	-220	0.004134	220	-240	0.004134	180	-120	0.037207
280	-140	0.004134	220	-220	0.008268	180	-100	0.012402
280	-20	0.004134	220	-160	0.008268	180	-80	0.020671
280	40	0.004134	220	-140	0.024805	180	-40	0.004134
280	60	0.004134	220	-120	0.012402	180	-20	0.008268
280	120	0.004134	220	-100	0.008268	180	0	0.008268
280	160	0.004134	220	-80	0.008268	180	20	0.016536
280	240	0.004134	220	-20	0.008268	180	40	0.024805
280	260	0.012402	220	20	0.004134	180	60	0.020671
260	-400	0.004134	220	40	0.008268	180	80	0.016536
260	-320	0.004134	220	80	0.012402	180	100	0.028939
260	-280	0.004134	220	100	0.004134	180	120	0.070280
260	-240	0.004134	220	140	0.004134	180	140	0.310058
260	-200	0.004134	220	160	0.066146	180	160	1.004589
260	-180	0.004134	220	180	0.243913	160	-360	0.004134
260	-140	0.004134	220	200	0.380338	160	-320	0.004134
260	-120	0.004134	200	-360	0.004134	160	-300	0.004134
260	-100	0.004134	200	-260	0.004134	160	-260	0.012402
260	-60	0.004134	200	-240	0.008268	160	-240	0.012402
260	80	0.004134	200	-200	0.016536	160	-220	0.012402
260	100	0.004134	200	-180	0.016536	160	-200	0.004134
260	140	0.008268	200	-140	0.016536	160	-180	0.012402
260	180	0.016536	200	-120	0.020671	160	-160	0.008268
260	200	0.020671	200	-100	0.008268	160	-140	0.041341
260	220	0.020671	200	-80	0.020671	160	-120	0.041341
260	240	0.078548	200	-60	0.004134	160	-100	0.049609
240	-360	0.004134	200	-20	0.004134	160	-80	0.016536
240	-340	0.004134	200	0	0.008268	160	-60	0.012402
240	-240	0.004134	200	20	0.020671	160	-40	0.008268
240	-220	0.008268	200	40	0.012402	160	-20	0.008268
240	-200	0.004134	200	60	0.016536	160	0	0.008268
240	-180	0.004134	200	80	0.004134	160	20	0.012402
240	-160	0.012402	200	100	0.008268	160	40	0.016536
240	-140	0.004134	200	120	0.028939	160	60	0.024805
240	-120	0.004134	200	140	0.024805	160	80	0.028939
240	-80	0.004134	200	160	0.367936	160	100	0.103353

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Table 7.30 Loaded 100-ton hopper car—coupler load (severe environment) (page 2 of 3)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
160	120	0.248047	100	-160	0.033073	40	-260	0.008268
160	140	1.248501	100	-140	0.070280	40	-240	0.012402
140	-340	0.004134	100	-120	0.057878	40	-220	0.004134
140	-300	0.008268	100	-100	0.033073	40	-200	0.012402
140	-260	0.004134	100	-80	0.074414	40	-180	0.028939
140	-240	0.004134	100	-60	0.082682	40	-160	0.057878
140	-200	0.033073	100	-40	0.107487	40	-140	0.140560
140	-180	0.020671	100	-20	0.086816	40	-120	0.119889
140	-160	0.016536	100	0	0.086816	40	-100	0.144694
140	-140	0.045475	100	20	0.115755	40	-80	0.186035
140	-120	0.012402	100	40	0.128157	40	-60	0.202571
140	-100	0.037207	100	60	0.347265	40	-40	0.322461
140	-80	0.037207	100	80	2.323370	40	-20	0.285254
140	-60	0.028939	80	-360	0.004134	40	0	0.789615
140	-40	0.033073	80	-300	0.004134	40	20	3.968746
140	-20	0.041341	80	-260	0.008268	20	-340	0.008268
140	0	0.008268	80	-240	0.004134	20	-240	0.008268
140	20	0.028939	80	-220	0.012402	20	-220	0.004134
140	40	0.024805	80	-200	0.041341	20	-200	0.020671
140	60	0.049609	80	-180	0.012402	20	-180	0.012402
140	80	0.078548	80	-160	0.049609	20	-160	0.037207
140	100	0.248047	80	-140	0.074414	20	-140	0.082682
140	120	1.620571	80	-120	0.066146	20	-120	0.111621
120	-300	0.008268	80	-100	0.086816	20	-100	0.165364
120	-260	0.012402	80	-80	0.082682	20	-80	0.210840
120	-240	0.020671	80	-60	0.111621	20	-60	0.301790
120	-220	0.008268	80	-40	0.128157	20	-40	0.392741
120	-200	0.033073	80	-20	0.198437	20	-20	0.549839
120	-180	0.020671	80	0	0.173633	20	0	2.273761
120	-160	0.016536	80	20	0.173633	0	-320	0.004134
120	-140	0.041341	80	40	0.355534	0	-200	0.016536
120	-120	0.057878	80	60	3.642151	0	-180	0.012402
120	-100	0.057878	60	-340	0.004134	0	-160	0.033073
120	-80	0.090950	60	-280	0.004134	0	-140	0.082682
120	-60	0.095085	60	-240	0.008269	0	-120	0.119889
120	-40	0.045475	60	-220	0.012402	0	-100	0.194303
120	-20	0.045475	60	-200	0.028939	0	-80	0.281120
120	0	0.041341	60	-180	0.057878	0	-60	0.392741
120	20	0.074414	60	-160	0.066146	0	-40	0.835090
120	40	0.033073	60	-140	0.086816	0	-20	1.351854
120	60	0.124023	60	-120	0.128157	-20	-260	0.004134
120	80	0.223242	60	-100	1.148828	-20	-240	0.004134
120	100	1.943032	60	-80	0.157096	-20	-220	0.012402
100	-360	0.004134	60	-60	0.115755	-20	-200	0.020671
100	-340	0.004134	60	-40	0.152962	-20	-180	0.012402
100	-300	0.004134	60	-20	0.190169	-20	-160	0.020671
100	-280	0.004134	60	0	0.326595	-20	-140	0.041341
100	-220	0.020671	60	20	0.644921	-20	-120	0.000621
100	-200	0.028939	60	40	5.523172	-20	-100	0.186035
100	-180	0.028939	40	-280	0.004134	-20	-80	0.334863

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Table 7.30 Loaded 100-ton hopper car—coupler load (severe environment) (page 3 of 3)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
-20	-60	1.045930	-140	-320	0.012402	LEFT BLANK INTENTIONALLY		
-20	-40	6.788209	-140	-300	0.008268			
-40	-340	0.004134	-140	-280	0.020671			
-40	-300	0.004134	-140	-260	0.004134			
-40	-260	0.004134	-140	-240	0.012402			
-40	-220	0.008268	-140	-220	0.008268			
-40	-200	0.004134	-140	-200	0.020671			
-40	-180	0.016536	-140	-180	0.723469			
-40	-160	0.012402	-140	-160	0.979784			
-40	-140	0.041341	-160	-320	0.004134			
-40	-120	0.062012	-160	-300	0.004134			
-40	-100	0.194303	-160	-280	0.008268			
-40	-80	0.748274	-160	-260	0.012402			
-40	-60	6.977379	-160	-240	0.008268			
-60	-340	0.008268	-160	-220	0.008268			
-60	-240	0.004134	-160	-200	0.194303			
-60	-220	0.004134	-160	-180	1.525487			
-60	-200	0.024805	-180	-300	0.004134			
-60	-180	0.037207	-180	-280	0.012402			
-60	-160	0.037207	-180	-260	0.024805			
-60	-140	0.004134	-180	-240	0.004134			
-60	-120	0.062012	-180	-220	0.070280			
-60	-100	1.327049	-180	-200	1.236099			
-60	-80	11.025673	-200	-280	0.012402			
-80	-300	0.008268	-200	-240	0.016536			
-80	-260	0.004134	-200	-220	0.136426			
-80	-220	0.004134	-220	-320	0.004134			
-80	-200	0.004134	-220	-300	0.008268			
-80	-180	0.008268	-220	-280	0.012402			
-80	-160	0.028939	-220	-260	0.016536			
-80	-140	0.066146	-220	-240	0.012402			
-80	-120	0.851627	-240	-320	0.004134			
-80	-100	7.701848	-240	-300	0.008268			
-100	-240	0.004134	-240	-280	0.012402			
-100	-180	0.016536	-240	-260	0.028939			
-100	-160	0.028939	-260	-300	0.016536			
-100	-140	0.764810	-260	-280	0.037207			
-100	-120	7.507454	-280	-440	0.004134			
-120	-360	0.004134	-280	-400	0.004134			
-120	-340	0.004134	-280	-380	0.004134			
-120	-300	0.008268	-280	-340	0.004134			
-120	-280	0.004134	-280	-320	0.016536			
-120	-260	0.008268	-280	-300	0.008268			
-120	-220	0.012402	-300	-460	0.004134			
-120	-200	0.016536	-300	-360	0.004134			
-120	-180	0.442350	-300	-340	0.012402			
-120	-160	0.049609	-300	-320	0.008268			
-120	-140	5.192443	-340	-360	0.008268			

7.3.2.30 Car body Twist Moment—Loaded 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	60
Average MPH	23.3
Recorded Mileage	2,764
Total Number of Cycles	1,087,358
Average Cycles/Mile	393.4
Track Class	Various

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Table 7.31 Loaded 100-ton hopper car—car body twist moment (page 1 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
30	-30	0.001104	20	-2	0.000368
30	-28	0.002207	20	0	0.000184
28	-30	0.004782	20	8	0.000184
28	-28	0.008093	20	18	0.000184
28	-26	0.003495	18	-22	0.000552
28	-12	0.000184	18	-20	0.001104
26	-30	0.003311	18	-18	0.003863
26	-28	0.004782	18	-16	0.006989
26	-26	0.003863	18	-14	0.003127
26	-24	0.002023	18	-12	0.000920
26	-22	0.001288	18	-10	0.000552
26	-10	0.000184	18	-8	0.000736
24	-30	0.000184	18	-6	0.002023
24	-28	0.002391	18	-4	0.001839
24	-26	0.004414	18	-2	0.001288
24	-24	0.006989	18	0	0.000736
24	-22	0.003495	18	2	0.000184
24	-20	0.001288	18	10	0.000184
24	-10	0.000184	18	14	0.000552
24	-6	0.000184	18	16	0.001655
24	-2	0.000184	16	-20	0.000368
24	22	0.000368	16	-18	0.000368
22	-28	0.000368	16	-16	0.004966
22	-26	0.002943	16	-14	0.006254
22	-24	0.007357	16	-12	0.009197
22	-22	0.004782	16	-10	0.012507
22	-20	0.004966	16	-8	0.004966
22	-18	0.001655	16	-6	0.002207
22	-8	0.000184	16	-4	0.005334
22	-6	0.000368	16	-2	0.003495
22	-4	0.000184	16	0	0.002207
20	-26	0.000368	16	2	0.002207
20	-24	0.000368	16	4	0.000552
20	-22	0.003679	16	6	0.006070
20	-20	0.005886	16	8	0.009564
20	-18	0.004782	16	10	0.007357
20	-16	0.001471	16	12	0.000920
20	-14	0.000368	16	14	0.011588
20	-10	0.000184	14	-16	0.001471
20	-8	0.000368	14	-14	0.012140
20	-6	0.000736	14	-12	0.034027
20	-4	0.000368	14	-10	0.024647

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Table 7.31 Loaded 100-ton hopper car—car body twist moment (page 2 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
14	-8	0.018945	8	4	0.486316
14	-6	0.011220	8	6	1.183971
14	-4	0.011404	6	-16	0.029429
14	-2	0.021336	6	-14	0.026670
14	0	0.013979	6	-12	0.045247
14	2	0.027958	6	-10	0.072285
14	4	0.038258	6	-8	0.090862
14	6	0.024647	6	-6	0.216856
14	8	0.019129	6	-4	0.345240
14	10	0.018209	6	-2	0.430401
14	12	0.039545	6	0	0.460750
12	-14	0.002391	6	2	0.897588
12	-12	0.016370	6	4	2.215462
12	-10	0.049478	4	-16	0.000920
12	-8	0.053524	4	-14	0.004047
12	-6	0.025750	4	-12	0.007909
12	-4	0.015634	4	-10	0.057571
12	-2	0.033843	4	-8	0.077803
12	0	0.055180	4	-6	0.248308
12	2	0.204349	4	-4	0.682572
12	4	0.104657	4	-2	1.695670
12	6	0.071182	4	0	4.153738
12	8	0.057939	4	2	4.109042
12	10	0.092886	-2	-12	0.004782
10	-16	0.000368	2	-10	0.050581
10	-14	0.008093	2	-8	0.044879
10	-12	0.032004	2	-6	0.241503
10	-10	0.069894	2	-4	0.818866
10	-8	0.111647	2	-2	5.359596
10	-6	0.070630	2	0	33.416962
10	-4	0.041569	0	-12	0.000184
10	-2	0.056283	0	-10	0.010116
10	0	0.207291	0	-8	0.037522
10	2	0.234697	0	-6	0.190002
10	4	0.195888	0	-4	1.228850
10	6	0.141076	0	-2	34.112961
10	8	0.339355	-2	-8	0.016554
8	-16	0.031820	-2	-6	0.181357
8	-14	0.032188	-2	-4	2.211967
8	-12	0.068975	-4	-10	0.001655
8	-10	0.084609	-4	-8	0.021704
8	-8	0.102450	-4	-6	0.333837
8	-6	0.155790	-6	-10	0.000736
8	-4	0.143283	-6	-8	0.043592
8	-2	0.149169	-8	-10	0.005150
8	0	0.202509	-10	-12	0.000920
8	2	0.333653			

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7.3.2.31 Total Side Bearing Load—Empty 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	65
Average MPH	25.8
Recorded Mileage	6,829
Total Number of Cycles	27,631
Average Cycles/Mile	4.0
Track Class	Various

Table 7.32 Empty 100-ton hopper car—total side bearing load

Maximum Load	Minimum Load	Percent Occurrence
20	-40	0.007238
20	-30	0.025334
20	-20	0.836018
20	-10	0.955449
20	0	0.177337
20	10	0.025334
10	-30	0.003619
10	-20	2.124425
10	-10	25.181862
10	0	35.554268
0	-20	1.501936
0	-10	33.190983
-10	-40	0.007238
-10	-30	0.014476
-10	-20	0.394484

7.3.2.32 Total Vertical Bolster Load—Empty 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	65
Average MPH	25.8
Recorded Mileage	6,829
Total Number of Cycles	129,140
Average Cycles/Mile	18.9
Track Class	Various

Table 7.33 Empty 100-ton hopper car—total vertical bolster load

Maximum Load	Minimum Load	Percent Occurrence
270	0	0.000774
130	10	0.000774
60	10	0.000774
50	20	0.003872
50	30	0.002323
50	40	0.001549
40	0	0.003097
40	10	0.025554
40	20	0.316711
40	30	3.629394
30	0	0.011615
30	10	2.086108
30	20	57.062878
20	0	0.051107
20	10	35.530434
10	0	1.273037

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7.3.2.33 Center Plate Load—Empty 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	65
Average MPH	25.8
Recorded Mileage	6,829
Total Number of Cycles	249,282
Average Cycles/Mile	36.5
Track Class	Various

Table 7.34 Empty 100-ton hopper car—center plate load

Maximum Load	Minimum Load	Percent Occurrence
260	0	0.000401
130	0	0.000401
60	0	0.000401
60	50	0.000401
50	0	0.001203
50	10	0.000802
50	20	0.000401
40	0	0.029284
40	10	0.079829
40	20	0.116334
40	30	0.024069
30	0	0.763392
30	10	5.647018
30	20	30.398104
20	0	2.223586
20	10	58.974174
10	0	1.740198

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7.3.2.34 Coupler Load—Empty 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	65
Average MPH	25.8
Recorded Mileage	6,829
Total Number of Cycles	7,466
Average Cycles/Mile	1.1
Track Class	Various

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Table 7.35 Empty 100-ton hopper car—coupler load (page 1 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
240	-500	0.013394	120	-60	0.133941
240	-300	0.013394	120	-40	0.093758
220	40	0.013394	120	-20	0.026788
200	-260	0.013394	120	0	0.120546
180	-140	0.013394	120	20	0.026788
180	-100	0.013394	120	40	0.093758
180	-80	0.013394	120	60	0.053576
180	140	0.013394	120	80	0.107152
160	-300	0.013394	120	100	0.254487
160	-240	0.013394	100	-280	0.013394
160	-200	0.013394	100	-200	0.013394
160	-180	0.013394	100	-140	0.053576
160	-140	0.013394	100	-120	0.040182
160	-120	0.026788	100	-100	0.066970
160	-100	0.013394	100	-80	0.187517
160	20	0.013394	100	-60	0.187517
160	40	0.013394	100	-40	0.093758
160	60	0.013394	100	-20	0.200911
160	80	0.053576	100	0	0.334851
160	100	0.026788	100	20	0.442004
160	120	0.013394	100	40	0.281275
160	140	0.066970	100	60	0.254487
140	-200	0.013394	100	80	0.696491
140	-160	0.026788	80	-240	0.013394
140	-140	0.026788	80	-220	0.013394
140	-120	0.013394	80	-180	0.026788
140	-100	0.040182	80	-140	0.026788
140	-80	0.053576	80	-120	0.026788
140	-60	0.066970	80	-100	0.066970
140	-20	0.013394	80	-80	0.200911
140	0	0.013394	80	-60	0.348245
140	20	0.040182	80	-40	0.187517
140	40	0.026788	80	-20	0.254487
140	60	0.040182	80	0	0.763461
140	80	0.053576	80	20	1.459952
140	100	0.093758	80	40	2.183231
140	120	0.455398	80	60	3.107420
120	-220	0.013394	60	-180	0.013394
120	-140	0.026788	60	-160	0.026788
120	-120	0.026788	60	-140	0.013394
120	-100	0.026788	60	-120	0.053576
120	-80	0.120546	60	-100	0.080364

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Table 7.35 Empty 100-ton hopper car—coupler load (page 2 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
60	-80	0.120546	-20	-60	1.968926
60	-60	0.508974	-20	-40	9.643718
60	-40	0.629520	-40	-480	0.013394
60	-20	0.535762	-40	-260	0.013394
60	0	1.205465	-40	-200	0.026788
60	20	5.451380	-40	-140	0.026788
60	40	12.992231	-40	-120	0.080364
40	-480	0.013394	-40	-100	0.093785
40	-200	0.026788	-40	-80	0.549156
40	-160	0.026788	-40	-60	4.125368
40	-140	0.013394	-60	-180	0.013394
40	-100	0.013394	-60	-160	0.013394
40	-80	0.147335	-60	-140	0.013394
40	-60	0.361639	-60	-120	0.107152
40	-40	0.683097	-60	-100	0.361639
40	-20	0.830431	-60	-80	2.370747
40	0	2.183231	-80	-280	0.013394
40	20	21.845701	-80	-220	0.013394
20	-480	0.013394	-80	-200	0.026788
20	-260	0.013394	-80	-180	0.013394
20	-140	0.013394	-80	-140	0.053576
20	-120	0.013394	-80	-120	0.053576
20	-100	0.053576	-80	-100	0.776855
20	-80	0.053576	-100	-220	0.013394
20	-60	0.174123	-100	-200	0.040182
20	-40	0.642915	-100	-180	0.053576
20	-20	1.232253	-100	-160	0.013394
20	0	6.080900	-100	-140	0.080364
0	-500	0.026788	-100	-120	0.348245
0	-480	0.013394	-120	-260	0.013394
0	-300	0.013394	-120	-160	0.040182
0	-140	0.013394	-120	-140	0.080364
0	-120	0.080364	-140	-200	0.013394
0	-100	0.040182	-140	-180	0.013394
0	-80	0.174123	-140	-160	0.040182
0	-60	0.428610	-160	-180	0.040182
0	-40	1.553710	-180	-240	0.026788
0	-20	5.371015	-180	-220	0.026788
-20	-140	0.066970	-220	-240	0.026788
-20	-120	0.107152	-260	-300	0.013394
-20	-100	0.227699	-260	-280	0.013394
-20	-80	0.482186			

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7.3.2.35 Car body Twist Moment—Empty 100-Ton Hopper Car

Test Date	Dec. 1983–Oct. 1985
Test Mode	Unit Train and General Service
Max MPH	65
Average MPH	25.8
Recorded Mileage	1,212
Total Number of Cycles	263,461
Average Cycles/Mile	217.4
Track Class	Various

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Table 7.36 Empty 100-ton hopper car—car body twist moment (page 1 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
15	-14	0.000380	7	-6	0.007971
14	-15	0.000760	7	-5	0.002277
13	-14	0.000380	7	-4	0.002657
12	-14	0.002277	7	-3	0.006073
12	-13	0.001139	7	-2	0.002657
12	-12	0.001139	7	-1	0.001898
11	-15	0.000380	7	0	0.000380
11	-14	0.000759	6	-10	0.001518
11	-13	0.002657	6	-9	0.004934
11	-12	0.001139	6	-8	0.004934
11	-11	0.001139	6	-7	0.019358
11	-10	0.000380	6	-6	0.025431
11	-9	0.000759	6	-5	0.008730
10	-13	0.001518	6	-4	0.016321
10	-12	0.003416	6	-3	0.023153
10	-11	0.002657	6	-2	0.013664
10	-10	0.000759	6	-1	0.010628
10	-9	0.001518	6	0	0.004175
9	-12	0.000380	6	1	0.003416
9	-11	0.001518	6	2	0.000759
9	-10	0.002657	6	3	0.001139
9	-6	0.004555	6	5	0.000759
9	-8	0.003037	5	-11	0.000380
9	-7	0.000380	5	-10	0.000759
9	-6	0.001139	5	-9	0.000759
9	3	0.000759	5	-8	0.006832
9	5	0.000380	5	-7	0.021635
8	-10	0.005314	5	-6	0.040993
8	-9	0.009110	5	-5	0.044409
8	-8	0.009110	5	-4	0.032263
8	-7	0.004555	5	-3	0.085402
8	-6	0.003037	5	-2	0.083883
8	-5	0.000759	5	-1	0.050482
8	-4	0.001898	5	0	0.031883
8	-1	0.000380	5	1	0.020117
8	2	0.000380	5	2	0.006453
8	3	0.001139	5	3	0.006453
8	7	0.000380	5	4	0.007591
7	-10	0.001139	4	-9	0.001518
7	-9	0.009110	4	-8	0.003416
7	-8	0.014803	4	-7	0.009869
7	-7	0.008350	4	-6	0.023533

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Table 7.36 Empty 100-ton hopper car—car body twist moment (page 2 of 2)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
4	-5	0.075153	2	1	3.979337
4	-4	0.080847	1	-7	0.001139
4	-3	0.146891	1	-6	0.018599
4	-2	0.323388	1	-5	0.028847
4	-1	0.291884	1	-4	0.135504
4	0	0.169665	1	-3	1.042279
4	1	0.091095	1	-2	3.442255
4	2	0.059212	1	-1	9.061683
4	3	0.104000	1	0	19.701967
3	-8	0.000380	0	-7	0.000380
3	-7	0.003796	0	-6	0.000380
3	-6	0.017080	0	-5	0.006832
3	-5	0.071737	0	-4	0.074394
3	-4	0.190161	0	-3	0.799739
3	-3	0.293402	0	-2	7.099723
3	-2	0.860089	0	-1	23.970531
3	-1	1.566076	-1	-5	0.002657
3	0	1.073783	-1	-4	0.036818
3	1	0.615271	-1	-3	0.614892
3	2	0.701432	-1	-2	8.917449
2	-7	0.001139	-2	-5	0.001518
2	-6	0.012526	-2	-4	0.037577
2	-5	0.074015	-2	-3	0.941316
2	-4	0.246716	-3	-5	0.003796
2	-3	0.570862	-3	-4	0.048584
2	-2	1.554689	-4	-5	0.007591
2	-1	4.585498	-5	-6	0.000380
2	0	5.494172			

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7.3.2.36 Individual Side-Bearing Load—Fully Loaded 110-ton Tank Car

Test Date	August 2006–April 2007
Test Mode	General Service—286,000 lb GRL
Max MPH	53
Average MPH	25.0
Recorded Mileage	10,807
Total Number of Cycles	2,242,920
Average Cycles/Mile	207.5
Track Class	Various

Travel Speed Distribution		
Range (mph)		Percent at Level
0	10	19.4
10	20	16.6
20	30	21.0
30	40	30.1
40	50	12.6
50	60	0.3

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Table 7.37 Fully loaded 110-ton tank car—individual side-bearing load (kip)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
90	5	0.00002%	70	0	0.00009%	45	40	0.05758%
85	80	0.00002%	65	60	0.00147%	45	35	0.03701%
85	75	0.00002%	65	55	0.00100%	45	30	0.02724%
85	60	0.00002%	65	50	0.00027%	45	25	0.00878%
85	20	0.00002%	65	45	0.00045%	45	20	0.01017%
85	15	0.00002%	65	40	0.00096%	45	15	0.00704%
85	10	0.00002%	65	35	0.00078%	45	10	0.00453%
85	5	0.00002%	65	30	0.00045%	45	5	0.00312%
85	0	0.00002%	65	25	0.00040%	45	0	0.00212%
80	75	0.00004%	65	20	0.00009%	45	-5	0.00002%
80	70	0.00004%	65	15	0.00007%	40	35	0.13469%
80	65	0.00002%	65	10	0.00011%	40	30	0.13937%
80	45	0.00002%	65	5	0.00004%	40	25	0.04853%
80	40	0.00002%	65	0	0.00016%	40	20	0.04962%
80	35	0.00002%	60	55	0.00375%	40	15	0.02845%
80	30	0.00002%	60	50	0.00288%	40	10	0.01928%
80	25	0.00002%	60	45	0.00109%	40	5	0.00711%
80	10	0.00002%	60	40	0.00466%	40	0	0.00680%
80	0	0.00004%	60	35	0.00339%	35	30	0.72535%
75	70	0.00018%	60	30	0.00138%	35	25	0.40215%
75	65	0.00011%	60	25	0.00149%	35	20	0.33922%
75	60	0.00020%	60	20	0.00025%	35	15	0.20618%
75	55	0.00027%	60	15	0.00011%	35	10	0.12515%
75	50	0.00020%	60	10	0.00009%	35	5	0.04441%
75	45	0.00029%	60	5	0.00013%	35	0	0.02488%
75	40	0.00031%	60	0	0.00027%	30	25	3.00118%
75	35	0.00013%	55	50	0.01445%	30	20	1.91665%
75	30	0.00002%	55	45	0.01103%	30	15	0.82455%
75	25	0.00007%	55	40	0.00542%	30	10	0.42833%
75	20	0.00002%	55	35	0.00720%	30	5	0.22419%
75	15	0.00002%	55	30	0.00642%	30	0	0.09626%
75	10	0.00004%	55	25	0.00430%	25	20	4.43449%
75	5	0.00004%	55	20	0.00060%	25	15	3.68974%
75	0	0.00007%	55	15	0.00060%	25	10	1.76634%
70	65	0.00056%	55	10	0.00029%	25	5	0.90233%
70	60	0.00036%	55	5	0.00036%	25	0	0.31805%
70	55	0.00042%	55	0	0.00038%	20	15	7.78441%
70	50	0.00011%	50	45	0.02416%	20	10	6.83252%
70	45	0.00013%	50	40	0.01572%	20	5	3.05154%
70	40	0.00085%	50	35	0.01213%	20	0	0.87201%
70	35	0.00042%	50	30	0.00974%	15	10	14.20501%
70	30	0.00018%	50	25	0.00439%	15	5	10.61112%
70	25	0.00013%	50	20	0.00292%	15	0	2.23818%
70	20	0.00004%	50	15	0.00158%	10	5	15.07653%
70	15	0.00002%	50	10	0.00132%	10	0	6.86904%
70	10	0.00004%	50	5	0.00089%	5	0	12.24234%
70	5	0.00007%	50	0	0.00087%			

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7.3.2.37 Vertical Bolster Load—Fully Loaded 110-ton Tank Car

Test Date	August 2006–April 2007
Test Mode	General Service—286,000 lb GRL
Max MPH	53
Average MPH	25.0
Recorded Mileage	10,870
Total Number of Cycles	11,347,226
Average Cycles/Mile	1,104.6
Track Class	Various

Travel Speed Distribution		
Range (mph)		Percent at Level
0	10	19.4
10	20	16.6
20	30	21.0
30	40	30.1
40	50	12.6
50	60	0.3

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Table 7.38 Fully loaded 110-ton tank car—vertical bolster load (kip) (page 1 of 6)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
440	75	0.000009%	255	85	0.000009%	235	140	0.000009%
440	50	0.000009%	255	80	0.000009%	235	130	0.000009%
425	45	0.000009%	255	75	0.000009%	235	110	0.000009%
425	20	0.000009%	255	70	0.000009%	235	105	0.000009%
400	40	0.000009%	255	65	0.000009%	235	100	0.000018%
395	40	0.000009%	255	60	0.000009%	235	95	0.000009%
390	40	0.000009%	255	45	0.000009%	235	90	0.000009%
390	35	0.000009%	250	245	0.000009%	235	85	0.000009%
375	45	0.000009%	250	140	0.000009%	235	80	0.000009%
345	35	0.000009%	250	105	0.000009%	235	75	0.000009%
335	25	0.000009%	250	100	0.000009%	235	70	0.000009%
335	20	0.000009%	250	95	0.000009%	235	65	0.000009%
330	40	0.000009%	250	90	0.000009%	235	60	0.000009%
325	65	0.000009%	250	80	0.000009%	230	225	0.000009%
325	40	0.000009%	250	75	0.000009%	230	140	0.000009%
325	35	0.000009%	250	70	0.000009%	230	135	0.000009%
325	30	0.000009%	250	65	0.000009%	230	120	0.000009%
320	45	0.000009%	250	40	0.000009%	230	115	0.000009%
300	140	0.000009%	245	240	0.000009%	230	110	0.000018%
300	40	0.000009%	245	235	0.000009%	230	105	0.000018%
295	80	0.000009%	245	140	0.000009%	230	100	0.000018%
295	75	0.000009%	245	105	0.000009%	230	95	0.000018%
295	55	0.000009%	245	100	0.000009%	230	90	0.000018%
290	75	0.000009%	245	95	0.000009%	230	85	0.000018%
290	65	0.000009%	245	90	0.000009%	230	80	0.000018%
285	35	0.000009%	245	85	0.000009%	230	75	0.000026%
280	130	0.000009%	245	80	0.000009%	230	70	0.000018%
280	55	0.000009%	245	75	0.000009%	230	65	0.000009%
280	45	0.000009%	245	70	0.000009%	230	60	0.000009%
275	130	0.000009%	245	65	0.000009%	230	55	0.000009%
275	60	0.000009%	245	60	0.000009%	230	45	0.000009%
275	55	0.000009%	245	45	0.000009%	225	220	0.000009%
275	50	0.000009%	245	40	0.000009%	225	140	0.000009%
270	50	0.000009%	240	235	0.000009%	225	130	0.000009%
265	140	0.000009%	240	225	0.000009%	225	125	0.000018%
265	100	0.000009%	240	130	0.000009%	225	120	0.000018%
265	95	0.000009%	240	115	0.000009%	225	115	0.000009%
265	60	0.000009%	240	105	0.000009%	225	110	0.000026%
265	55	0.000009%	240	100	0.000009%	225	105	0.000035%
265	30	0.000009%	240	95	0.000009%	225	100	0.000035%
260	140	0.000009%	240	90	0.000009%	225	95	0.000062%
260	105	0.000009%	240	85	0.000018%	225	90	0.000053%
260	100	0.000009%	240	80	0.000009%	225	85	0.000026%
260	70	0.000009%	240	75	0.000018%	225	80	0.000026%
260	60	0.000009%	240	70	0.000009%	225	75	0.000018%
260	55	0.000009%	240	65	0.000009%	225	65	0.000009%
260	30	0.000009%	240	60	0.000009%	225	60	0.000009%
255	240	0.000009%	240	55	0.000009%	225	55	0.000009%
255	115	0.000009%	240	45	0.000009%	225	45	0.000009%
255	90	0.000009%	240	35	0.000009%	225	40	0.000009%

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Table 7.38 Fully loaded 110-ton tank car—vertical bolster load (kip) (page 2 of 6)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
220	215	0.000009%	210	140	0.000071%	205	30	0.000009%
220	210	0.000009%	210	135	0.000071%	200	195	0.009765%
220	140	0.000009%	210	130	0.000062%	200	190	0.002027%
220	135	0.000009%	210	125	0.000062%	200	185	0.000687%
220	130	0.000018%	210	120	0.000071%	200	180	0.000194%
220	125	0.000018%	210	115	0.000141%	200	175	0.000167%
220	120	0.000026%	210	110	0.000185%	200	170	0.000167%
220	115	0.000026%	210	105	0.000238%	200	165	0.000344%
220	110	0.000035%	210	100	0.000150%	200	160	0.000511%
220	105	0.000062%	210	95	0.000088%	200	155	0.000652%
220	100	0.000088%	210	90	0.000071%	200	150	0.000714%
220	95	0.000062%	210	85	0.000062%	200	145	0.000784%
220	90	0.000044%	210	80	0.000044%	200	140	0.000608%
220	85	0.000035%	210	75	0.000026%	200	135	0.000335%
220	80	0.000026%	210	70	0.000026%	200	130	0.000212%
220	75	0.000018%	210	65	0.000018%	200	125	0.000291%
220	65	0.000018%	210	60	0.000026%	200	120	0.000538%
215	210	0.000009%	210	55	0.000009%	200	115	0.001022%
215	205	0.000009%	210	20	0.000009%	200	110	0.000864%
215	200	0.000009%	205	200	0.003278%	200	105	0.000502%
215	145	0.000009%	205	195	0.002644%	200	100	0.000247%
215	140	0.000009%	205	190	0.000044%	200	95	0.000132%
215	135	0.000026%	205	185	0.000026%	200	90	0.000097%
215	130	0.000035%	205	180	0.000062%	200	85	0.000071%
215	125	0.000044%	205	175	0.000018%	200	80	0.000044%
215	120	0.000044%	205	170	0.000009%	200	75	0.000026%
215	115	0.000053%	205	165	0.000026%	200	70	0.000035%
215	110	0.000079%	205	160	0.000026%	200	65	0.000018%
215	105	0.000088%	205	155	0.000071%	200	60	0.000009%
215	100	0.000167%	205	150	0.000097%	200	55	0.000009%
215	95	0.000106%	205	145	0.000167%	195	190	0.009994%
215	90	0.000044%	205	140	0.000238%	195	185	0.004371%
215	85	0.000035%	205	135	0.000212%	195	180	0.001348%
215	80	0.000035%	205	130	0.000123%	195	175	0.001119%
215	75	0.000026%	205	125	0.000115%	195	170	0.001533%
215	70	0.000009%	205	120	0.000159%	195	165	0.002097%
215	65	0.000009%	205	115	0.000317%	195	160	0.002388%
215	60	0.000018%	205	110	0.000414%	195	155	0.002538%
215	55	0.000009%	205	105	0.000335%	195	150	0.002556%
215	45	0.000009%	205	100	0.000256%	195	145	0.002000%
210	205	0.000018%	205	95	0.000132%	195	140	0.001472%
210	200	0.000018%	205	90	0.000097%	195	135	0.000881%
210	195	0.000009%	205	85	0.000071%	195	130	0.001040%
210	190	0.000009%	205	80	0.000044%	195	125	0.002089%
210	185	0.000009%	205	75	0.000026%	195	120	0.002988%
210	180	0.000009%	205	70	0.000018%	195	115	0.002556%
210	170	0.000009%	205	65	0.000009%	195	110	0.001375%
210	155	0.000009%	205	60	0.000009%	195	105	0.000617%
210	150	0.000009%	205	55	0.000009%	195	100	0.000344%
210	145	0.000018%	205	40	0.000009%	195	95	0.000282%

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Table 7.38 Fully loaded 110-ton tank car—vertical bolster load (kip) (page 3 of 6)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
195	90	0.000123%	185	150	0.018630%	175	170	0.109066%
195	85	0.000079%	185	145	0.014065%	175	165	0.138298%
195	80	0.000062%	185	140	0.010998%	175	160	0.119659%
195	75	0.000044%	185	135	0.011324%	175	155	0.129115%
195	70	0.000035%	185	130	0.019591%	175	150	0.107877%
195	65	0.000026%	185	125	0.024270%	175	145	0.075525%
195	60	0.000018%	185	120	0.013342%	175	140	0.049951%
195	55	0.000009%	185	115	0.006001%	175	135	0.039904%
195	50	0.000009%	185	110	0.002441%	175	130	0.042019%
195	45	0.000009%	185	105	0.001102%	175	125	0.038036%
195	40	0.000009%	185	100	0.000670%	175	120	0.021864%
195	30	0.000009%	185	95	0.000300%	175	115	0.009456%
195	25	0.000009%	185	90	0.000150%	175	110	0.004521%
190	185	0.010884%	185	85	0.000115%	175	105	0.002327%
190	180	0.008416%	185	80	0.000079%	175	100	0.001005%
190	175	0.005226%	185	75	0.000044%	175	95	0.000485%
190	170	0.005279%	185	70	0.000026%	175	90	0.000282%
190	165	0.005649%	185	65	0.000009%	175	85	0.000194%
190	160	0.006698%	185	60	0.000009%	175	80	0.000159%
190	155	0.007738%	185	55	0.000009%	175	75	0.000106%
190	150	0.006927%	185	50	0.000009%	175	70	0.000035%
190	145	0.005279%	185	45	0.000009%	175	65	0.000009%
190	140	0.003745%	185	40	0.000009%	175	60	0.000018%
190	135	0.003754%	180	175	0.050761%	175	50	0.000009%
190	130	0.006777%	180	170	0.059786%	175	45	0.000018%
190	125	0.011712%	180	165	0.042733%	175	35	0.000009%
190	120	0.008866%	180	160	0.046320%	175	30	0.000009%
190	115	0.004362%	180	155	0.050973%	170	165	0.275345%
190	110	0.001789%	180	150	0.045817%	170	160	0.398961%
190	105	0.000740%	180	145	0.031788%	170	155	0.298170%
190	100	0.000432%	180	140	0.021723%	170	150	0.231863%
190	95	0.000273%	180	135	0.020921%	170	145	0.166719%
190	90	0.000115%	180	130	0.027372%	170	140	0.125009%
190	85	0.000097%	180	125	0.027496%	170	135	0.100685%
190	80	0.000071%	180	120	0.016885%	170	130	0.095750%
190	75	0.000044%	180	115	0.007385%	170	125	0.070061%
190	70	0.000044%	180	110	0.003102%	170	120	0.033585%
190	65	0.000009%	180	105	0.001674%	170	115	0.014206%
190	60	0.000018%	180	100	0.000802%	170	110	0.007553%
190	55	0.000009%	180	95	0.000405%	170	105	0.003728%
190	50	0.000009%	180	90	0.000203%	170	100	0.001666%
190	45	0.000009%	180	85	0.000132%	170	95	0.000696%
190	35	0.000009%	180	80	0.000097%	170	90	0.000397%
190	30	0.000009%	180	75	0.000106%	170	85	0.000238%
185	180	0.021803%	180	70	0.000035%	170	80	0.000194%
185	175	0.024253%	180	65	0.000026%	170	75	0.000123%
185	170	0.015951%	180	60	0.000018%	170	70	0.000053%
185	165	0.015836%	180	55	0.000009%	170	65	0.000035%
185	160	0.019071%	180	40	0.000009%	170	60	0.000044%
185	155	0.020075%	180	25	0.000009%	170	55	0.000018%

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Table 7.38 Fully loaded 110-ton tank car—vertical bolster load (kip) (page 4 of 6)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
170	50	0.000026%	160	60	0.000079%	150	55	0.000106%
170	45	0.000026%	160	55	0.000071%	150	50	0.000071%
170	40	0.000009%	160	50	0.000062%	150	45	0.000035%
170	35	0.000009%	160	45	0.000018%	150	40	0.000018%
170	30	0.000009%	160	40	0.000018%	150	30	0.000009%
165	160	0.818694%	160	35	0.000009%	145	140	5.719250%
165	155	0.789938%	160	25	0.000009%	145	135	5.048151%
165	150	0.466775%	155	150	2.835443%	145	130	2.786981%
165	145	0.372743%	155	145	2.787731%	145	125	1.546995%
165	140	0.321682%	155	140	1.761189%	145	120	0.612308%
165	135	0.279575%	155	135	1.263560%	145	115	0.190487%
165	130	0.221490%	155	130	0.694584%	145	110	0.060984%
165	125	0.121431%	155	125	0.356695%	145	105	0.024314%
165	120	0.050691%	155	120	0.205733%	145	100	0.012726%
165	115	0.025848%	155	115	0.096411%	145	95	0.007491%
165	110	0.013801%	155	110	0.035251%	145	90	0.004724%
165	105	0.006010%	155	105	0.012505%	145	85	0.002864%
165	100	0.002529%	155	100	0.004565%	145	80	0.001859%
165	95	0.001075%	155	95	0.002353%	145	75	0.001384%
165	90	0.000511%	155	90	0.001648%	145	70	0.000978%
165	85	0.000432%	155	85	0.001119%	145	65	0.000502%
165	80	0.000264%	155	80	0.000679%	145	60	0.000238%
165	75	0.000141%	155	75	0.000476%	145	55	0.000115%
165	70	0.000097%	155	70	0.000308%	145	50	0.000053%
165	65	0.000062%	155	65	0.000256%	145	45	0.000026%
165	60	0.000053%	155	60	0.000159%	145	40	0.000009%
165	55	0.000035%	155	55	0.000115%	140	135	7.237136%
165	50	0.000026%	155	50	0.000062%	140	130	5.985940%
165	45	0.000009%	155	45	0.000035%	140	125	2.127199%
165	40	0.000018%	155	40	0.000018%	140	120	0.709248%
165	35	0.000018%	155	35	0.000009%	140	115	0.229730%
160	155	1.399135%	155	25	0.000009%	140	110	0.074661%
160	150	1.399876%	150	145	5.029997%	140	105	0.036423%
160	145	0.905226%	150	140	4.345054%	140	100	0.021829%
160	140	0.801703%	150	135	2.097156%	140	95	0.012461%
160	135	0.673953%	150	130	1.273281%	140	90	0.007077%
160	130	0.428854%	150	125	0.800028%	140	85	0.004248%
160	125	0.195572%	150	120	0.418684%	140	80	0.003366%
160	120	0.092604%	150	115	0.148019%	140	75	0.002459%
160	115	0.050814%	150	110	0.048170%	140	70	0.001260%
160	110	0.023327%	150	105	0.016797%	140	65	0.000502%
160	105	0.009165%	150	100	0.007420%	140	60	0.000194%
160	100	0.003604%	150	95	0.004398%	140	55	0.000106%
160	95	0.001419%	150	90	0.002996%	140	50	0.000044%
160	90	0.000864%	150	85	0.001780%	140	45	0.000018%
160	85	0.000670%	150	80	0.001216%	140	40	0.000009%
160	80	0.000379%	150	75	0.000837%	135	130	6.090248%
160	75	0.000194%	150	70	0.000494%	135	125	3.127964%
160	70	0.000159%	150	65	0.000361%	135	120	0.858377%
160	65	0.000141%	150	60	0.000256%	135	115	0.274517%

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Table 7.38 Fully loaded 110-ton tank car—vertical bolster load (kip) (page 5 of 6)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
135	110	0.101073%	125	35	0.000009%	105	100	0.512989%
135	105	0.057247%	120	115	1.356834%	105	95	0.357709%
135	100	0.032493%	120	110	1.055069%	105	90	0.107401%
135	95	0.017608%	120	105	0.259050%	105	85	0.036661%
135	90	0.009315%	120	100	0.100439%	105	80	0.013078%
135	85	0.005552%	120	95	0.043420%	105	75	0.005631%
135	80	0.003948%	120	90	0.023865%	105	70	0.002776%
135	75	0.002318%	120	85	0.012417%	105	65	0.001260%
135	70	0.000987%	120	80	0.006671%	105	60	0.001234%
135	65	0.000361%	120	75	0.004063%	105	55	0.000749%
135	60	0.000176%	120	70	0.002371%	105	50	0.000247%
135	55	0.000062%	120	65	0.001807%	105	45	0.000044%
135	50	0.000035%	120	60	0.000908%	105	40	0.000009%
135	45	0.000018%	120	55	0.000273%	100	95	0.282051%
135	40	0.000009%	120	50	0.000044%	100	90	0.294398%
130	125	2.834870%	120	45	0.000026%	100	85	0.086356%
130	120	1.745238%	120	30	0.000009%	100	80	0.016973%
130	115	0.380948%	115	110	1.310470%	100	75	0.005711%
130	110	0.154364%	115	105	0.829093%	100	70	0.002177%
130	105	0.079755%	115	100	0.262972%	100	65	0.000872%
130	100	0.038388%	115	95	0.100941%	100	60	0.000353%
130	95	0.020111%	115	90	0.034907%	100	55	0.000141%
130	90	0.011694%	115	85	0.015096%	100	50	0.000035%
130	85	0.006786%	115	80	0.008178%	100	45	0.000018%
130	80	0.003701%	115	75	0.003825%	100	40	0.000009%
130	75	0.002000%	115	70	0.001868%	100	35	0.000009%
130	70	0.001154%	115	65	0.001577%	95	90	0.231960%
130	65	0.000511%	115	60	0.000643%	95	85	0.125097%
130	60	0.000291%	115	55	0.000212%	95	80	0.027073%
130	55	0.000150%	115	50	0.000106%	95	75	0.007332%
130	50	0.000053%	115	45	0.000035%	95	70	0.002556%
130	45	0.000026%	115	40	0.000018%	95	65	0.000837%
130	35	0.000009%	115	35	0.000009%	95	60	0.000229%
125	120	1.825618%	115	25	0.000009%	95	55	0.000088%
125	115	1.000897%	115	20	0.000009%	95	50	0.000009%
125	110	0.304823%	110	105	0.969127%	95	45	0.000009%
125	105	0.120382%	110	100	0.738648%	90	85	0.147428%
125	100	0.053440%	110	95	0.188636%	90	80	0.090586%
125	95	0.025627%	110	90	0.052048%	90	75	0.013457%
125	90	0.018419%	110	85	0.018657%	90	70	0.002811%
125	85	0.010646%	110	80	0.008231%	90	65	0.001022%
125	80	0.004486%	110	75	0.003287%	90	60	0.000458%
125	75	0.002529%	110	70	0.001472%	90	55	0.000159%
125	70	0.001657%	110	65	0.000978%	90	50	0.000026%
125	65	0.001040%	110	60	0.000723%	90	45	0.000009%
125	60	0.000714%	110	55	0.000590%	85	80	0.136245%
125	55	0.000326%	110	50	0.000335%	85	75	0.057679%
125	50	0.000088%	110	45	0.000106%	85	70	0.007949%
125	45	0.000026%	110	40	0.000018%	85	65	0.001058%
125	40	0.000009%	110	35	0.000009%	85	60	0.000370%

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Table 7.38 Fully loaded 110-ton tank car—vertical bolster load (kip) (page 6 of 6)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
85	55	0.000150%	75	40	0.000009%	60	30	0.000009%
85	50	0.000018%	70	65	0.138175%	55	50	0.050585%
85	45	0.000018%	70	60	0.053150%	55	45	0.027214%
85	40	0.000009%	70	55	0.002926%	55	40	0.002873%
80	75	0.155791%	70	50	0.000079%	55	35	0.000132%
80	70	0.060261%	70	45	0.000009%	55	30	0.000009%
80	65	0.004900%	65	60	0.060411%	50	45	0.061557%
80	60	0.000608%	65	55	0.014453%	50	40	0.025698%
80	55	0.000106%	65	50	0.001295%	50	35	0.002838%
80	50	0.000026%	65	45	0.000097%	50	30	0.000176%
80	45	0.000009%	65	40	0.000009%	50	25	0.000009%
80	35	0.000009%	65	35	0.000009%	45	40	0.037472%
75	70	0.127080%	65	30	0.000009%	45	35	0.003173%
75	65	0.048814%	60	55	0.043244%	45	30	0.000088%
75	60	0.004821%	60	50	0.020093%	40	35	0.000529%
75	55	0.000388%	60	45	0.001930%	40	30	0.000035%
75	50	0.000035%	60	40	0.000123%	35	30	0.000009%
75	45	0.000009%	60	35	0.000009%	35	20	0.000009%

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7.3.2.38 Center-Plate Load—Fully Loaded 110-ton Tank Car

Test Date	August 2006–April 2007
Test Mode	General Service—286,000 lb GRL
Max MPH	53
Average MPH	25.0
Recorded Mileage	11,148
Total Number of Cycles	7,139,031
Average Cycles/Mile	6,403.9
Track Class	Various

Travel Speed Distribution		
Range (mph)		Percent at Level
0	10	19.4
10	20	16.6
20	30	21.0
30	40	30.1
40	50	12.6
50	60	0.3

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Table 7.39 Fully loaded 110-ton tank car—center-plate load (kip) (page 1 of 5)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
430	65	0.000014%	240	25	0.000014%	215	65	0.000028%
430	60	0.000014%	235	60	0.000014%	215	60	0.000014%
415	20	0.000014%	235	50	0.000014%	215	55	0.000028%
415	15	0.000014%	235	45	0.000014%	215	50	0.000014%
335	20	0.000014%	235	40	0.000014%	215	40	0.000014%
335	15	0.000014%	235	35	0.000014%	215	35	0.000014%
330	25	0.000014%	230	125	0.000014%	215	30	0.000014%
330	20	0.000014%	230	65	0.000014%	215	25	0.000014%
320	25	0.000014%	230	60	0.000014%	210	205	0.004104%
315	55	0.000014%	230	55	0.000014%	210	200	0.002255%
315	35	0.000014%	230	50	0.000028%	210	195	0.000238%
305	25	0.000014%	225	200	0.000014%	210	190	0.000098%
300	55	0.000014%	225	115	0.000014%	210	185	0.000042%
290	20	0.000014%	225	85	0.000014%	210	180	0.000028%
285	280	0.000014%	225	80	0.000014%	210	175	0.000014%
285	275	0.000014%	225	70	0.000014%	210	160	0.000014%
285	270	0.000014%	225	65	0.000014%	210	125	0.000014%
285	95	0.000014%	225	60	0.000014%	210	85	0.000028%
285	40	0.000014%	225	55	0.000028%	210	80	0.000014%
280	115	0.000014%	225	50	0.000014%	210	75	0.000056%
280	35	0.000014%	225	35	0.000014%	210	70	0.000070%
280	30	0.000014%	225	30	0.000014%	210	65	0.000042%
280	25	0.000014%	220	200	0.000014%	210	60	0.000028%
275	270	0.000014%	220	195	0.000028%	210	55	0.000014%
275	50	0.000014%	220	190	0.000014%	210	50	0.000014%
275	45	0.000014%	220	185	0.000028%	210	45	0.000014%
270	40	0.000014%	220	180	0.000014%	210	40	0.000014%
270	35	0.000014%	220	85	0.000014%	210	35	0.000014%
270	20	0.000014%	220	80	0.000014%	205	200	0.003488%
270	15	0.000014%	220	75	0.000014%	205	195	0.001695%
265	45	0.000014%	220	70	0.000014%	205	190	0.000392%
265	35	0.000014%	220	65	0.000014%	205	185	0.000112%
265	30	0.000014%	220	60	0.000014%	205	180	0.000056%
260	250	0.000014%	220	55	0.000028%	205	175	0.000028%
260	40	0.000014%	220	50	0.000028%	205	170	0.000028%
255	90	0.000014%	220	45	0.000028%	205	165	0.000014%
255	85	0.000014%	220	40	0.000014%	205	160	0.000014%
250	125	0.000014%	220	35	0.000014%	205	125	0.000014%
250	50	0.000014%	220	30	0.000014%	205	100	0.000014%
250	35	0.000014%	215	210	0.000644%	205	95	0.000014%
250	30	0.000014%	215	205	0.000770%	205	90	0.000014%
245	125	0.000014%	215	200	0.000462%	205	85	0.000056%
245	80	0.000014%	215	195	0.000140%	205	80	0.000098%
245	75	0.000014%	215	190	0.000084%	205	75	0.000070%
245	70	0.000014%	215	185	0.000014%	205	70	0.000042%
245	65	0.000014%	215	180	0.000014%	205	65	0.000042%
245	55	0.000014%	215	100	0.000014%	205	60	0.000028%
245	40	0.000014%	215	90	0.000028%	205	55	0.000028%
240	65	0.000014%	215	75	0.000042%	205	50	0.000028%
240	55	0.000014%	215	70	0.000042%	205	45	0.000014%

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Table 7.39 Fully loaded 110-ton tank car—center-plate load (kip) (page 2 of 5)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
205	30	0.000014%	195	45	0.000014%	185	100	0.000168%
200	195	0.002381%	195	40	0.000028%	185	95	0.000406%
200	190	0.001247%	195	35	0.000028%	185	90	0.000378%
200	185	0.000476%	195	30	0.000014%	185	85	0.000616%
200	180	0.000210%	195	25	0.000014%	185	80	0.000378%
200	175	0.000070%	190	185	0.003656%	185	75	0.000364%
200	170	0.000042%	190	180	0.011892%	185	70	0.000252%
200	165	0.000028%	190	175	0.005239%	185	65	0.000154%
200	160	0.000014%	190	170	0.000154%	185	60	0.000084%
200	135	0.000014%	190	165	0.000056%	185	55	0.000028%
200	130	0.000014%	190	160	0.000014%	185	50	0.000014%
200	125	0.000014%	190	145	0.000014%	185	45	0.000014%
200	120	0.000014%	190	140	0.000028%	185	40	0.000014%
200	115	0.000014%	190	135	0.000028%	185	35	0.000014%
200	100	0.000028%	190	130	0.000014%	180	175	0.064785%
200	95	0.000014%	190	120	0.000028%	180	170	0.098501%
200	90	0.000028%	190	115	0.000014%	180	165	0.006836%
200	85	0.000056%	190	110	0.000014%	180	160	0.000490%
200	80	0.000168%	190	105	0.000028%	180	155	0.000028%
200	75	0.000084%	190	100	0.000070%	180	150	0.000154%
200	70	0.000112%	190	95	0.000210%	180	145	0.000336%
200	65	0.000098%	190	90	0.000252%	180	140	0.000196%
200	60	0.000042%	190	85	0.000294%	180	135	0.000070%
200	55	0.000042%	190	80	0.000238%	180	130	0.000028%
200	45	0.000028%	190	75	0.000182%	180	125	0.000042%
200	40	0.000014%	190	70	0.000154%	180	120	0.000042%
200	35	0.000014%	190	65	0.000098%	180	115	0.000042%
195	190	0.002269%	190	60	0.000042%	180	110	0.000084%
195	185	0.002409%	190	55	0.000056%	180	105	0.000280%
195	180	0.000686%	190	50	0.000014%	180	100	0.000518%
195	175	0.000504%	190	45	0.000014%	180	95	0.000770%
195	170	0.000070%	190	40	0.000014%	180	90	0.000882%
195	165	0.000028%	190	35	0.000014%	180	85	0.000840%
195	160	0.000014%	190	25	0.000014%	180	80	0.000630%
195	135	0.000014%	190	20	0.000014%	180	75	0.000420%
195	130	0.000014%	185	180	0.042093%	180	70	0.000280%
195	125	0.000014%	185	175	0.012943%	180	65	0.000126%
195	115	0.000014%	185	170	0.005113%	180	60	0.000070%
195	105	0.000014%	185	165	0.000588%	180	50	0.000014%
195	100	0.000028%	185	160	0.000014%	180	45	0.000014%
195	95	0.000070%	185	150	0.000014%	180	40	0.000014%
195	90	0.000098%	185	145	0.000042%	180	30	0.000014%
195	85	0.000196%	185	140	0.000084%	180	25	0.000014%
195	80	0.000196%	185	135	0.000042%	175	170	0.189494%
195	75	0.000126%	185	130	0.000014%	175	165	0.109721%
195	70	0.000098%	185	125	0.000028%	175	160	0.006864%
195	65	0.000084%	185	120	0.000014%	175	155	0.000995%
195	60	0.000070%	185	115	0.000028%	175	150	0.002283%
195	55	0.000042%	185	110	0.000028%	175	145	0.001345%
195	50	0.000014%	185	105	0.000140%	175	140	0.000448%

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Table 7.39 Fully loaded 110-ton tank car—center-plate load (kip) (page 3 of 5)

Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence	Maximum Load	Minimum Load	Percent Occurrence
175	135	0.000182%	165	130	0.001023%	155	120	0.013685%
175	130	0.000112%	165	125	0.000546%	155	115	0.020479%
175	125	0.000098%	165	120	0.000504%	155	110	0.033394%
175	120	0.000098%	165	115	0.000742%	155	105	0.033142%
175	115	0.000070%	165	110	0.002395%	155	100	0.026978%
175	110	0.000224%	165	105	0.003880%	155	95	0.019779%
175	105	0.000616%	165	100	0.004875%	155	90	0.011668%
175	100	0.000995%	165	95	0.005085%	155	85	0.004664%
175	95	0.001597%	165	90	0.004594%	155	80	0.001583%
175	90	0.001639%	165	85	0.003096%	155	75	0.000602%
175	85	0.001205%	165	80	0.001625%	155	70	0.000182%
175	80	0.000953%	165	75	0.000630%	155	65	0.000056%
175	75	0.000574%	165	70	0.000252%	155	60	0.000028%
175	70	0.000308%	165	65	0.000098%	155	55	0.000014%
175	65	0.000098%	165	60	0.000028%	155	50	0.000014%
175	60	0.000056%	165	55	0.000028%	155	45	0.000014%
175	55	0.000028%	165	50	0.000014%	155	40	0.000014%
175	50	0.000014%	165	45	0.000028%	155	30	0.000014%
175	45	0.000028%	165	40	0.000014%	155	25	0.000014%
170	165	0.176425%	165	35	0.000014%	150	145	0.319077%
170	160	0.097590%	165	30	0.000014%	150	140	0.095839%
170	155	0.012271%	165	25	0.000014%	150	135	0.030116%
170	150	0.007074%	160	155	0.485640%	150	130	0.034963%
170	145	0.002493%	160	150	0.188023%	150	125	0.064701%
170	140	0.000644%	160	145	0.008433%	150	120	0.113083%
170	135	0.000434%	160	140	0.002802%	150	115	0.141938%
170	130	0.000378%	160	135	0.002297%	150	110	0.136531%
170	125	0.000308%	160	130	0.002535%	150	105	0.101708%
170	120	0.000210%	160	125	0.002129%	150	100	0.061801%
170	115	0.000238%	160	120	0.002143%	150	95	0.035467%
170	110	0.000672%	160	115	0.003656%	150	90	0.018784%
170	105	0.001555%	160	110	0.007998%	150	85	0.005491%
170	100	0.002409%	160	105	0.010940%	150	80	0.001625%
170	95	0.002731%	160	100	0.011626%	150	75	0.000490%
170	90	0.002367%	160	95	0.010141%	150	70	0.000182%
170	85	0.002115%	160	90	0.007438%	150	65	0.000056%
170	80	0.001387%	160	85	0.004090%	150	60	0.000028%
170	75	0.000686%	160	80	0.001765%	150	55	0.000028%
170	70	0.000266%	160	75	0.000588%	150	50	0.000014%
170	65	0.000098%	160	70	0.000224%	150	45	0.000014%
170	60	0.000042%	160	65	0.000084%	150	15	0.000014%
170	55	0.000028%	160	60	0.000028%	150	10	0.000014%
170	50	0.000028%	160	55	0.000014%	145	140	0.249754%
170	45	0.000014%	160	50	0.000014%	145	135	0.194326%
165	160	0.176565%	155	150	0.483693%	145	130	0.186944%
165	155	0.117089%	155	145	0.147835%	145	125	0.312521%
165	150	0.013769%	155	140	0.007844%	145	120	0.534106%
165	145	0.003544%	155	135	0.007634%	145	115	0.574126%
165	140	0.001457%	155	130	0.008334%	145	110	0.436474%
165	135	0.000995%	155	125	0.009371%	145	105	0.269897%