

4.7 MAXIMUM MOMENTS AND SHEARS FOR HL-93 AND P15 LOADS

4.7.1 GENERAL

This memo provides maximum simple span moment and shear values for HL-93 and P15 loads. The tables are intended to assist the structure designer in determining the vehicular live load demands for simple span bridge components.

Table 4.7.1 Maximum Simple Span Moments and Shears for the Design Truck, Design Tandem, and Permit Vehicle

Span Length (ft)	Design Truck		Design Tandem		Permit Vehicle (P15)	
	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)
1	8.0	32.0	6.3	25.0	13.5	54.0
2	16.0	32.0	12.5	25.0	27.0	54.0
3	24.0	32.0	18.8	25.0	40.5	54.0
4	32.0	32.0	25.0	25.0	54.0	54.0
5	40.0	32.0	31.3	30.0	67.5	54.0
6	48.0	32.0	37.5	33.3	81.0	54.0
7	56.0	32.0	44.0	35.7	94.5	54.0
8	64.0	32.0	56.0	37.5	108.0	54.0
9	72.0	32.0	68.0	38.9	121.5	54.0
10	80.0	32.0	80.0	40.0	135.0	54.0
11	88.0	32.0	92.0	40.9	148.5	54.0
12	96.0	32.0	104.0	41.7	162.0	54.0
13	104.0	32.0	116.0	42.3	175.5	54.0
14	112.0	32.0	128.0	42.9	189.0	54.0
15	120.0	34.1	140.0	43.3	202.5	54.0
16	128.0	36.0	152.0	43.8	216.0	54.0
17	136.0	37.6	164.0	44.1	229.5	54.0
18	144.0	39.1	176.0	44.4	243.0	54.0
19	152.0	40.4	188.0	44.7	256.5	56.8
20	160.0	41.6	200.0	45.0	270.0	59.4
21	168.0	42.7	212.5	45.2	283.5	61.7
22	176.0	43.6	225.0	45.5	297.0	63.8
23	184.0	44.5	237.5	45.7	310.5	65.7



Span Length (ft)	Design Truck		Design Tandem		Permit Vehicle (P15)	
	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)
24	192.0	45.3	250.0	45.8	324.0	67.5
25	204.8	46.1	262.5	46.0	337.5	69.1
26	220.2	46.8	275.0	46.2	351.0	70.6
27	235.5	47.4	287.5	46.3	364.5	72.0
28	250.9	48.0	300.0	46.4	378.0	73.3
29	266.2	48.8	312.5	46.6	391.5	74.5
30	281.6	49.6	325.0	46.7	405.0	75.6
31	297.0	50.3	337.5	46.8	418.5	76.6
32	312.3	51.0	350.0	46.9	440.6	77.6
33	327.7	51.6	362.5	47.0	466.6	78.5
34	343.0	52.2	375.0	47.1	492.5	79.4
35	358.4	52.8	387.5	47.1	518.4	80.2
36	375.7	53.3	400.0	47.2	544.3	81.0
37	393.0	53.8	412.5	47.3	570.2	83.2
38	410.2	54.3	425.0	47.4	596.2	85.3
39	427.5	54.8	437.5	47.4	622.1	87.2
40	444.8	55.2	450.0	47.5	648.0	89.1
42	479.4	56.0	475.0	47.6	729.0	92.6
44	513.9	56.7	500.0	47.7	810.0	95.7
46	548.5	57.4	525.0	47.8	891.0	98.6
48	584.0	58.0	550.0	47.9	972.0	101.3
50	620.0	58.6	575.0	48.0	1053.0	103.7
52	656.0	59.1	600.0	48.1	1134.0	105.9
54	692.0	59.6	625.0	48.1	1215.0	108.0
56	728.0	60.0	650.0	48.2	1296.0	111.9
58	764.0	60.4	675.0	48.3	1377.0	115.4
60	800.0	60.8	700.0	48.3	1458.0	118.8
62	836.0	61.2	725.0	48.4	1539.0	121.9
64	872.0	61.5	750.0	48.4	1620.0	124.9
66	908.0	61.8	775.0	48.5	1701.0	127.6
68	944.0	62.1	800.0	48.5	1782.0	130.2
70	980.0	62.4	825.0	48.6	1879.2	132.7
75	1070.0	63.0	887.5	48.7	2146.5	140.4



Span Length (ft)	Design Truck		Design Tandem		Permit Vehicle (P15)	
	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)
80	1160.0	63.6	950.0	48.8	2484.0	148.5
85	1250.0	64.1	1012.5	48.8	2821.5	155.6
90	1340.0	64.5	1075.0	48.9	3159.0	162.0
95	1430.0	64.9	1137.5	48.9	3496.5	170.5
100	1520.0	65.3	1200.0	49.0	3834.0	178.2
110	1698.9	65.9	1318.2	49.1	4594.9	192.4
120	1880.0	66.4	1450.0	49.2	5508.0	207.9
130	2059.1	66.8	1569.2	49.2	6380.3	221.8
140	2240.0	67.2	1700.0	49.3	7398.0	234.8
150	2419.2	67.5	1820.0	49.3	8377.1	246.1
160	2600.0	67.8	1950.0	49.4	9392.0	256.0
170	2779.3	68.0	2070.6	49.4	10397.6	264.7
180	2960.0	68.3	2200.0	49.4	11412.0	272.4
190	3139.4	68.5	2321.1	49.5	12418.1	279.3
200	3320.0	68.6	2450.0	49.5	13432.0	285.6
220	3680.0	68.9	2700.0	49.5	15452.0	296.3
240	4040.0	69.2	2950.0	49.6	17472.0	305.3
260	4400.0	69.4	3200.0	49.6	19492.0	312.9
280	4760.0	69.6	3450.0	49.6	21512.0	319.4
300	5120.0	69.8	3700.0	49.7	23532.0	325.0

NOTE: P15 values based on single 54 kip axles.
 Moment and shear values do not include IM.
 Moment and shear values do not include the Design Lane Load.

Table 4.7.2 Maximum Simple Span Moments and Shears for HL-93 Loading

Span Length (ft)	Controlled by either Design Truck and Design Lane Load or Design Tandem and Design Lane Load ^c			
	without IM		with IM	
	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)
1	8.1 ^a	32.3 ^a	10.7 ^a	42.9 ^a
2	16.3 ^a	32.6 ^a	21.6 ^a	43.2 ^a
3	24.7 ^a	33.0 ^a	32.6 ^a	43.5 ^a
4	33.3 ^a	33.3 ^a	43.8 ^a	43.8 ^a
5	42.0 ^a	33.6 ^a	55.2 ^a	44.2 ^a
6	50.9 ^a	35.3 ^b	66.7 ^a	46.3 ^b
7	59.9 ^a	38.0 ^b	78.4 ^a	49.7 ^b
8	69.1 ^a	40.1 ^b	90.2 ^a	52.4 ^b
9	78.5 ^a	41.8 ^b	102.2 ^a	54.6 ^b
10	88.0 ^a	43.2 ^b	114.4 ^a	56.4 ^b
11	101.3 ^b	44.4 ^b	131.7 ^b	57.9 ^b
12	115.1 ^b	45.5 ^b	149.4 ^b	59.3 ^b
13	129.0 ^b	46.5 ^b	167.3 ^b	60.4 ^b
14	143.1 ^b	47.3 ^b	185.3 ^b	61.5 ^b
15	157.3 ^b	48.1 ^b	203.5 ^b	62.4 ^b
16	171.7 ^b	48.9 ^b	221.8 ^b	63.3 ^b
17	186.2 ^b	49.6 ^b	240.3 ^b	64.1 ^b
18	200.9 ^b	50.2 ^b	259.0 ^b	64.9 ^b
19	216.4 ^b	50.8 ^b	278.3 ^b	65.6 ^b
20	232.0 ^b	51.4 ^b	298.0 ^b	66.3 ^b
21	247.8 ^b	52.0 ^b	317.9 ^b	66.9 ^b
22	263.7 ^b	52.5 ^b	338.0 ^b	67.5 ^b
23	279.8 ^b	53.0 ^b	358.2 ^b	68.1 ^b
24	296.1 ^b	53.5 ^b	378.6 ^b	68.6 ^b
25	312.5 ^b	54.1 ^a	399.1 ^b	69.3 ^a
26	329.1 ^b	55.1 ^a	419.8 ^b	70.5 ^a
27	345.8 ^b	56.0 ^a	440.7 ^b	71.7 ^a
28	362.7 ^b	57.0 ^a	461.7 ^b	72.8 ^a
29	379.8 ^b	58.1 ^a	482.9 ^b	74.2 ^a
30	397.0 ^b	59.2 ^a	504.3 ^b	75.6 ^a

Span Length (ft)	Controlled by either Design Truck and Design Lane Load or Design Tandem and Design Lane Load ^c			
	without IM		with IM	
	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)
31	414.4 ^b	60.2 ^a	525.8 ^b	76.8 ^a
32	431.9 ^b	61.2 ^a	547.4 ^b	78.1 ^a
33	449.6 ^b	62.2 ^a	569.2 ^b	79.2 ^a
34	467.5 ^b	63.1 ^a	591.2 ^b	80.4 ^a
35	485.5 ^b	64.0 ^a	613.4 ^b	81.4 ^a
36	503.7 ^b	64.9 ^a	635.7 ^b	82.5 ^a
37	522.0 ^b	65.7 ^a	658.1 ^b	83.4 ^a
38	540.5 ^b	66.5 ^a	680.8 ^b	84.4 ^a
39	559.2 ^b	67.2 ^a	703.6 ^b	85.3 ^a
40	578.0 ^b	68.0 ^a	726.5 ^b	86.2 ^a
42	617.1 ^a	69.4 ^a	774.2 ^a	87.9 ^a
44	666.9 ^a	70.8 ^a	835.8 ^a	89.5 ^a
46	717.3 ^a	72.1 ^a	898.1 ^a	91.1 ^a
48	768.3 ^a	73.4 ^a	961.0 ^a	92.5 ^a
50	820.0 ^a	74.6 ^a	1024.6 ^a	93.9 ^a
52	872.3 ^a	75.7 ^a	1088.8 ^a	95.2 ^a
54	925.3 ^a	76.8 ^a	1153.6 ^a	96.5 ^a
56	978.9 ^a	77.9 ^a	1219.1 ^a	97.7 ^a
58	1033.1 ^a	79.0 ^a	1285.2 ^a	98.9 ^a
60	1088.0 ^a	80.0 ^a	1352.0 ^a	100.1 ^a
62	1143.5 ^a	81.0 ^a	1419.4 ^a	101.2 ^a
64	1199.7 ^a	82.0 ^a	1487.4 ^a	102.3 ^a
66	1256.5 ^a	82.9 ^a	1556.1 ^a	103.3 ^a
68	1313.9 ^a	83.9 ^a	1625.4 ^a	104.4 ^a
70	1372.0 ^a	84.8 ^a	1695.4 ^a	105.4 ^a
75	1520.0 ^a	87.0 ^a	1873.1 ^a	107.8 ^a
80	1672.0 ^a	89.2 ^a	2054.8 ^a	110.2 ^a
85	1828.0 ^a	91.3 ^a	2240.5 ^a	112.4 ^a
90	1988.0 ^a	93.3 ^a	2430.2 ^a	114.6 ^a
95	2152.0 ^a	95.3 ^a	2623.9 ^a	116.8 ^a
100	2320.0 ^a	97.3 ^a	2821.6 ^a	118.8 ^a

Span Length (ft)	Controlled by either Design Truck and Design Lane Load or Design Tandem and Design Lane Load ^c			
	without IM		with IM	
	Moment (kip-ft)	Shear (kip)	Moment (kip-ft)	Shear (kip)
110	2658.9 ^a	101.1 ^a	3219.5 ^a	122.8 ^a
120	3032.0 ^a	104.8 ^a	3652.4 ^a	126.7 ^a
130	3403.1 ^a	108.4 ^a	4082.6 ^a	130.5 ^a
140	3808.0 ^a	112.0 ^a	4547.2 ^a	134.2 ^a
150	4211.2 ^a	115.5 ^a	5009.5 ^a	137.8 ^a
160	4648.0 ^a	119.0 ^a	5506.0 ^a	141.4 ^a
170	5083.3 ^a	122.4 ^a	6000.5 ^a	144.9 ^a
180	5552.0 ^a	125.9 ^a	6528.8 ^a	148.4 ^a
190	6019.4 ^a	129.3 ^a	7055.4 ^a	151.9 ^a
200	6520.0 ^a	132.6 ^a	7615.6 ^a	155.3 ^a
220	7552.0 ^a	139.3 ^a	8766.4 ^a	162.1 ^a
240	8648.0 ^a	146.0 ^a	9981.2 ^a	168.8 ^a
260	9808.0 ^a	152.6 ^a	11260.0 ^a	175.5 ^a
280	11032.0 ^a	159.2 ^a	12602.8 ^a	182.2 ^a
300	12320.0 ^a	165.8 ^a	14009.6 ^a	188.8 ^a

Note: a. controlled by Design Truck + Design Lane Load
 b. controlled by Design Tandem + Design Lane Load
 c. multiple presence factor, m, has not been included

4.7.2 REFERENCES

1. AASHTO, (2017). *AASHTO LRFD Bridge Design Specifications*, 8th Edition, American Association of State Highway and Transportation Officials, Washington DC.
2. Caltrans, (2019). *California Amendments to AASHTO LRFD Bridge Design Specifications - 8th Edition*, California Department of Transportation, Sacramento, CA.