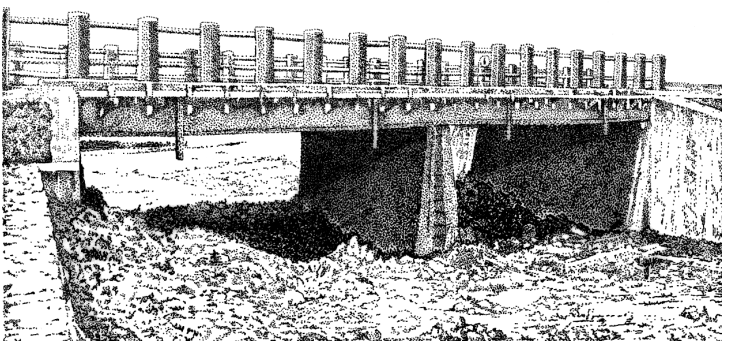
Rapid Field Classification Booklet



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RAPID FIELD CLASSIFICATION BOOKLET

Purpose. Bridge and vehicle classification allows vehicle operators to avoid bridge failure due to overloading. Vehicle operators may drive across bridges without restrictions if their vehicles' class numbers are less than or equal to the bridge class number. *Field Manual (FM) 5-170* shows classifications for standard vehicles and the procedure for classifying vehicles. Refer to *FM 3-34.343* for a complete discussion of bridge classification procedures. **This GTA provides a rapid field method of establishing bridge capacity in the field, but only as a temporary measure. An analytical classification must be performed as soon as possible in order to actually classify the bridge and post a classification sign**.

Bridge Signs. All classified vehicles and bridges in the theater of operations require classification signs. Bridge signs are circular with a yellow background and black inscriptions. Sign diameters are a minimum of 16 inches for one-lane bridges and 20 inches for two-lane bridges. A two-lane bridge classification sign has two numbers, side by side *(Figure 1)*. The number on the left is the bridge classification when both lanes are in service simultaneously. The number on the right indicates the classification if the bridge is carrying one-way traffic and the vehicles proceed along the centerline of the bridge. For bridges with separate classifications for wheeled and tracked vehicles (dual classification), use a special circular sign that indicates both classifications *(Figure 2, page 2)*. Classify bridges greater than class 50 as dual-classification bridges. Use a separate rectangular sign, if necessary, to show bridge width limitations *(Figure 1)*.

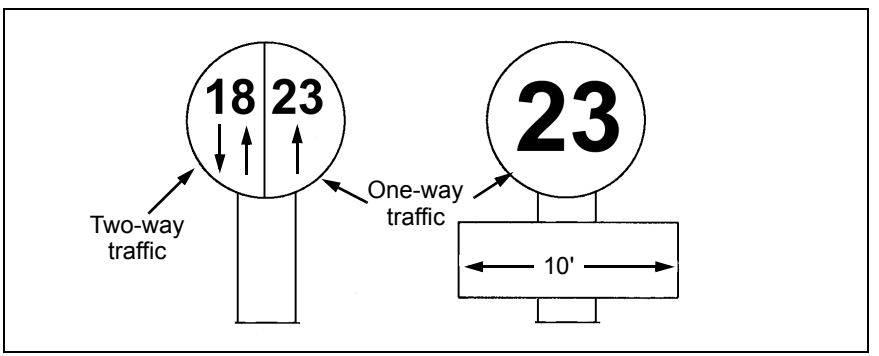


Figure 1. Bridge Classification Signs

Width and Height Restrictions. *Table 1, page 2,* lists width restrictions for bridges. If a one-lane bridge does not meet width requirements, post a rectangular warning sign under the classification sign showing the actual clear width. For a two-lane bridge, downgrade the two-way classification to the highest class for which it qualifies (one-way classification is not affected). If the minimum overhead clearance is less than 15 feet 6 inches, post a sign with the limited clearance.

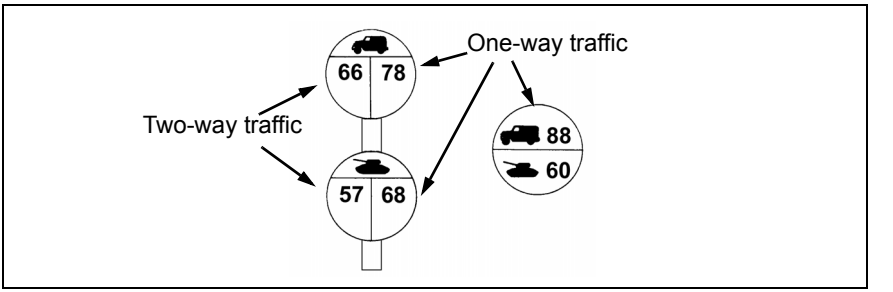


Figure 2. Dual-Classification Signs

Table 1. Minimum Roadway Widths (Curb-to-Curb)

Roadway Width (b_r)	Bridge Classification	
	One-Way Traffic	Two-Way Traffic
9' - 10'11" (2.75 m - 3.34 m)	12	0
11' - 13'1" (3.35 m - 3.99 m)	30	0
13'2" - 14'8" (4 m - 4.49 m)	60	0
14'9" - 16'4" (4.5 m - 4.99 m)	100	0
16'5" - 18' (-) (5 m - 5.4 m)	150	0
18' - 23'11" (5.5 m - 7.2 m)	150	30
24' - 26'11" (7.3 m - 8.1 m)	150	60
27' - 31'11" (8.2 m - 9.7 m)	150	100
Over 32' (9.8 m)	150	150
Minimum overhead clearance of all classes is 15 feet (4.5 meters)		

Notations and Classification Procedures. *Figure 3* lists notations used in the following figures and tables. *Figures 4 through 8, pages 4 through 8,* illustrate rapid field classification procedures for several bridges. *Figures 9 through 12, pages 22 through 25*, provide information on types of classification. *Figure 13, page 26,* provides information on profile factors for arch bridges. *Tables 2 and 3, pages 9 through 11,* provide data on stringer properties. *Tables 4 and 5, pages 12 through 19,* provide data on wheeled- and tracked-vehicle moment and shear. *Tables 6 and 7, page 20 and 21,* provide information on profile and arch factors. *Table 8, page 27,* provides a subset of military load classifications for common vehicles and vehicle combinations.

b	stringer width, in inches
b_d	concrete slab width, in feet
b_e	effective slab width, in feet
b_{e1}	effective slab width for one-lane traffic, in feet
b_{e2}	effective slab width for two-lane traffic, in feet
b_r	curb-to-curb roadway width, in feet
d	stringer depth, in inches
d_f	depth of fill, in feet
F_y	yield stress
ksi	kips per square inch
L	span length, in feet
L_c	maximum brace spacing, in feet
m	moment capacity per stringer, in ft-kips
m_{DL}	dead load bending moment per stringer, in ft-kips
m_{LL}	live load bending moment per stringer, in ft-kips
M_{LL}	live load bending moment per lane, in ft-kips
M_{LL1}	live load bending moment for one-lane traffic, in ft-kips
M_{LL2}	live load bending moment for two-lane traffic, in ft-kips
N_b	number of braces
N_L	number of lanes
N_S	number of stringers
N_1	effective number of stringers for one-lane traffic
N_2	effective number of stringers for two-lane traffic
PLC	provisional load classification
R	rise of arch, in feet
S_b	actual brace spacing, in feet
S_s	center-to-center stringer spacing, in inches
t_c	crown thickness, in feet
t_d	deck thickness, in inches
t_{eff}	effective deck thickness, in inches
t_f	flange thickness, in inches
t_w	web thickness, in inches
T_1	one-lane, tracked-vehicle classification
T_2	two-lane, tracked-vehicle classification
v	shear capacity per stringer, in kips
v_{DL}	dead load shear per stringer, in kips
V_{DL}	dead load shear for entire span, in kips
v_{LL}	live load shear per stringer, in kips
V_{LL}	live load shear per lane, in kips
W_s	stringer weight, in lbs/ft
W_1	one-lane, wheeled-vehicle classification
W_2	two-lane, wheeled-vehicle classification

Figure 3. Notations

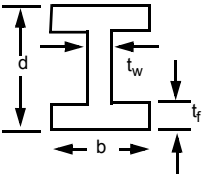
Map sheet Grid
Recon officer/NCO Unit Date

Bridge dimensions

L _____ ft
b_r _____ ft

N_L _____ *(2 if $b_r \geq 18$ ft)*
N_s _____
S_s _____ in
N_b _____
S_b _____ ft

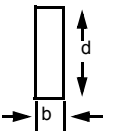
Deck: Single-layer, multilayer, or laminated
t_d _____ in



Stringer dimensions

Timber: *(Table 2, page 9)*
b _____ in
d _____ in

Steel: Type_____*(Table 3, page 10)*
d _____ in
b _____ in
t_w_____ in
t_f _____ in



Procedure

1. m _____
   a. Timber: Use 0.73*(m) (see Table 2 for m)*
   b. Steel: Use 0.83*(m) (see Table 3 for m)*
2. W_s _____ *(Table 3)*. Omit this step for timber stringer.
3. m_{DL}_____
   a. Timber: $m_{DL} = 0.0000434L^2[(b)(d)+(t_d)(S_s)]$
   b. Steel: $m_{DL} = 0.00013L^2[W_s+0.347(t_d)(S_s)]$
4. m_{LL} _____
   a. Timber: $m - m_{DL}$
   b. Steel: $\frac{m - m_{DL}}{1.15}$
5. N_1 _____ $\left(\frac{60}{S_S}\right) + 1$
6. N_2 _____ $0.375N_s$; calculate only if $b_r \geq 18$ ft
7. M_{LL1} _____ $(N_1)m_{LL}$
8. M_{LL2} _____ *(smaller of N_1 or N_2)*m_{LL}
9. Moment classification (*Table 4, page 12*):
   T_1____T_2____W_1____W_2____
10. Do not perform Steps 10-14 for steel stringer bridge.
    v _____ Use *0.63(v) (see Table 2 for v)*
11. v_{DL} _____, *where* $v_{DL} = 0.000174L[(b)(d)+(t_d)(S_s)]$
12. v_{LL} _____$(v - v_{DL})$
13. V_{LL} ___ $5.33(v_{LL})\frac{(\text{smaller of } N_1 \text{ or } N_2)}{(\text{smaller of } N_1 \text{ or } N_2) + 1}$
14. Shear classification *(Table 5, page 16)*:
    T_1____ T_2____ W_1____ W_2____
15. Width classification *(Table 1, page 2)*:
    T_1____ T_2____ W_1____ W_2____
16. Deck classification *(Figure 9, page 22)*:
    T_1____ T_2____ W_1____ W_2____
    a. Single layer: $t_{eff} = t_d$
    b. Multilayer: $t_{eff} = t_d - 2''$
    c. Laminated: $t_{eff} = t_d$
    Use $S_s = 0.75(S_s)$ for laminated decks.
17. $N_{b(required)}$ _____
    a. Timber: 3 required if $d \geq 2(b)$
    b. Steel: $\left(\frac{L}{L_c}\right) + 1$ *(L_c in Table 3)*
    Add braces if $N_b < N_{b(required)}$

18. **Final classification:**

	T_1	T_2	W_1	W_2
Moment (Step 9)				
Shear (Step 14)				
Width (Step 15)				
Deck (Step 16)				
Final				

Figure 4. Timber or Steel Stringer Bridge With Timber Deck

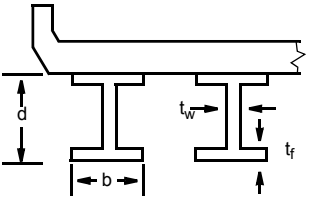
Map sheet Grid
Recon officer/NCO Unit Date

Bridge dimensions

L _____ ft
b_r _____ ft

N_L _____ *(2 if $b_r \geq 18$ ft)*

N_s _____
S_s _____ in
t_d _____ in (Do not include the wearing surface.)



Stringer dimensions

Type: _____ *(Table 3, page 10)*
b _____ in
d _____ in
t_f _____ in
t_w _____ in

Procedure

1. m _____ Use *0.83(m) (see Table 3 for m)*
2. W_s _____ *(Table 3)*
3. m_{DL} _____ $0.00013L^2[W_s + (t_d)(S_s)]$
4. m_{LL} _____ $\frac{m - m_{DL}}{1.15}$
5. N_1 _____ $\frac{60}{S_S} + 1$
6. N_2 _____ $0.375N_s$; calculate only if $b_r \geq 18$ ft
7. M_{LL1} _____ $(N_1)m_{LL}$
8. M_{LL2} _____ *(smaller of N_1 or N_2)m_{LL}*
9. Moment classification *(Table 4, page 12):*

   T_1 _____ T_2 _____ W_1 _____ W_2 _____
10. Width classification *(Table 1, page 2)*
    T_1 _____ T_2 _____ W_1 _____ W_2 _____
11. Deck classification:
    T_1 _____ T_2 _____ W_1 _____ W_2 _____

    a. $t_d < 5$ *in:* Class 40
    b. $t_d \geq 5$ *in:* Class 150

12. **Final classification:**

	T_1	T_2	W_1	W_2
Moment (Step 9)				
Width (Step 10)				
Deck (Step 11)				
Final				

Figure 5. Steel Stringer Bridge With Concrete Deck

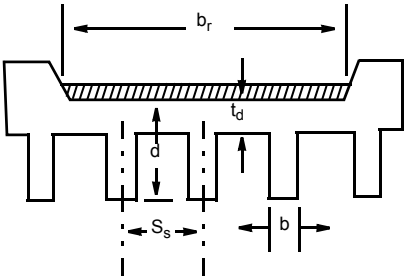
Map sheet Grid
Recon officer/NCO Unit Date

Bridge dimensions

L _____ ft
b_r _____ ft

t_d _____ in (Do not include the wearing surface.)

N_s _____
S_s _____ in



Stringer dimensions

b_____*in*
d_____*in*

Procedure

1. m _____ $0.0116(S_s)(d^2)$
2. m_{DL} _____ $0.00013\ L^2[(b)(d) + (t_d)(S_s)]$
3. m_{LL} _____ $\frac{m - m_{DL}}{1.15}$
4. N_1 _____ $\frac{60}{S_S} + 1$
5. N_2 _____ $0.375N_s$; calculate only if $b_r \geq 18$ *ft*
6. M_{LL1} _____ $(N_1)m_{LL}$
7. M_{LL2} _____ *(smaller of* N_1 *or* $N_2)m_{LL}$
8. Moment classification *(Table 4, page 12):* T_1 _____ T_2 _____ W_1 _____ W_2 _____
9. Width classification *(Table 1, page 2):* T_1 _____ T_2 _____ W_1 _____ W_2 _____

10. **Final classification:**

	T_1	T_2	W_1	W_2
Moment (Step 8)				
Width (Step 9)				
Final				

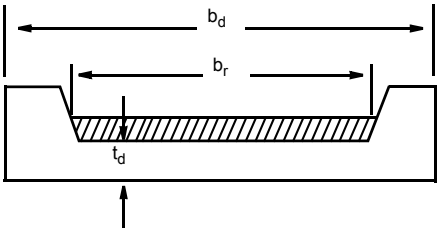
Figure 6. Reinforced Concrete T-Beam With Asphalt Wearing Surface

Map sheet Grid
Recon officer/NCO Unit Date

Bridge dimensions

L _____ ft
b_d _____ ft
b_r_____ ft

t_d _____ in (Do not include the wearing surface.)



Procedure

1. m_{LL} _____ *(Figure 10, page 23)*
2. b_e _____
   a. One lane:

$$b_{e1} = \frac{L}{0.75 + \frac{L}{b_d}}$$

   b. Two lane:

$$b_{e2} = \frac{L}{0.25 + \frac{2L}{b_d}}$$

   (Calculate b_{e2} only if $b_r \geq$ 18 ft)

3. M_{LL1} _____ $(b_{e1})m_{LL}$
4. M_{LL2} _____ $(b_{e2})m_{LL}$
5. Moment classification *(Table 4, page 12):*

   T_1 _____ T_2 _____ W_1 _____ W_2 _____

6. Width classification *(Table 1, page 2):*

   T_1 _____ T_2 _____ W_1 _____ W_2 _____

7. **Final classification:**

	T_1	T_2	W_1	W_2
Moment (Step 5)				
Width (Step 6)				
Final				

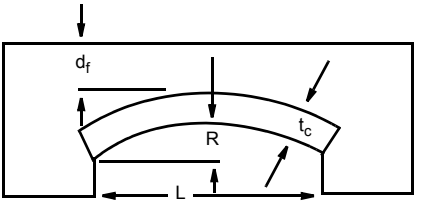
Figure 7. Reinforced Concrete-Slab Bridge With Asphalt Wearing Surface

Map sheet	Grid	
Recon officer/NCO	Unit	Date

Bridge dimensions

L _____ ft
t_c _____ ft
d_f _____ ft

b_r _____ ft
R _____ ft



Procedure

1. PLC ____ *(Figure 11, page 24)*
2. Arch factors:
   a. Span-to-rise ratio ($SR = \frac{L}{R}$) _____
   b. Profile factors *(Table 6, page 20)* ____
   c. Material factors *(Table 7, page 20)* _____
   d. Joint factors *(Table 7)* _____
   e. Deformations *(Table 7)* _____
   f. Crack factors *(Table 7)* _____
   g. Abutment size factors *(Table 7)* ____
   h. Abutment fault factors *(Table 7)* ____
3. Classification of arch factors:
   T_1 _____ *(PLC x product of factors 2b through 2h)*
   T_2 _____ *(0.9T_1)*
   W_1 _____ *(Figure 12, page 25)*
   W_2 _____ *(Figure 12)*
4. Width classification *(Table 1, page 2):*
   T_1 _____ T_2 _____ W_1 _____ W_2 _____

5. **Final classification:**

	T_1	T_2	W_1	W_2
Factors (Step 3)				
Width (Step 4)				
Final				

Figure 8. Masonry Arch Bridge

Table 2. Properties of Timber Stringers

Rectangular Stringers				Rectangular Stringers			
Nominal Size (b x d, in)[1]	m (ft-kips)[2]	v (kips)[3]	L_m (ft)[4]	Nominal Size (b x d, in)[1]	m (ft-kips)[2]	v (kips)[3]	L_m (ft)[4]
4 x 6	4.80	2.40	7.14	16 x 16	136.50	25.60	19.10
4 x 8	8.53	3.20	9.50	16 x 18	172.80	28.80	21.50
4 x 10*	13.33	4.00	11.90	16 x 20	213.00	32.00	23.80
4 x 12*	19.20	4.80	14.30	16 x 22	258.00	35.20	26.20
6 x 8	12.80	4.40	9.50	16 x 24	307.00	38.40	28.60
6 x 10	20.00	6.00	11.90	18 x 18	194.40	32.40	21.50
6 x 12	28.80	7.20	14.30	18 x 20	240.00	36.00	23.80
6 x 14*	39.20	8.40	16.70	18 x 22	290.00	39.60	26.20
6 x 16*	51.20	9.60	19.10	18 x 24	346.00	43.20	28.60
6 x 18*	64.80	10.80	21.50	Round stringers (nominal size is diameter)			
8 x 8	17.07	6.40	11.90				
8 x 10	26.70	8.00	11.90	8	10.05	5.70	9.50
8 x 12	38.40	9.60	14.30	9	14.31	7.20	10.70
8 x 14	52.30	11.20	16.70	10	19.63	8.80	11.90
8 x 16	68.30	12.80	19.10	11	26.10	10.60	13.10
8 x 18*	86.40	14.40	21.50	12	33.90	12.70	14.30
8 x 20*	106.70	16.40	23.80	13	43.10	15.00	15.50
8 x 22*	129.10	17.60	26.20	14	53.90	17.40	16.70
8 x 24*	153.60	19.20	28.60	15	67.50	20.20	17.80
10 x 10	33.30	10.00	11.90	16	80.40	22.60	19.10
10 x 12	48.00	12.00	14.30	17	98.20	26.00	20.20
10 x 14	65.30	14.00	16.70	18	114.50	28.60	21.50
10 x 16	85.30	16.00	19.10	19	137.10	32.40	22.60
10 x 18	108.00	18.00	21.50	20	157.10	35.40	23.80
10 x 20	133.30	20.00	23.80	21	185.20	39.60	24.90
10 x 22*	161.30	22.00	26.20	22	209.00	42.70	26.20
10 x 24*	192.00	24.00	28.60	23	243.00	47.60	27.30
12 x 12	57.60	14.40	14.30	24	271.00	50.80	28.60
12 x 14	78.40	16.80	16.70	25	312.00	56.20	29.70
12 x 16	102.40	19.20	19.10	26	351.00	60.80	30.90
12 x 18	129.60	21.60	21.50	27	393.00	65.60	32.10
12 x 20	160.00	24.00	23.80	28	439.00	70.50	33.30
12 x 22	193.60	26.40	26.20	29	487.00	75.60	34.50
12 x 24	230.00	28.80	28.60	30	540.00	81.00	35.70
14 x 14	81.50	19.60	16.70	31	595.00	86.40	36.80
14 x 16	119.50	22.40	19.10	32	655.00	92.10	38.00
14 x 18	151.20	25.20	21.50	33	718.00	98.00	39.20
14 x 20	186.70	28.00	23.80	34	786.00	104.00	40.40
14 x 22	226.00	30.80	26.20	35	857.00	110.20	41.60
14 x 24	269.00	33.60	28.60	36	933.00	116.60	42.80

NOTES:

* A minimum of three lateral braces is required.

[1] If d > 2b, bracing is required at the midspan and at both ends.

[2] Moment capacity for rectangular stringers not listed is $\frac{b(d^2)}{30}$. Moment capacity for round stringers not listed is $0.02(d^3)$.

[3] Shear capacity for rectangular stringers not listed is $\frac{b(d)}{10}$. Shear capacity for round stringers not listed is $0.09(d^2)$.

[4] Maximum span length for stringers not listed is 1.19d.

Table 3. Properties of Steel Stringers

(F_y = 36 ksi, f_b = 27 ksi, f_v = 16.5 ksi)

Nominal Size	d (in)	W_s (lbs/ft)	b (in)	t_f (in)	t_w (in)	m (ft-kips)	v (kips)	L_m (ft)	L_c (ft)
W39x211	39.250	211	11.750	1.438	0.75	1,770	450	100	12.4
W37x206	36.750	206	11.750	1.438	0.75	1,656	425	95	12.4
W36x300	36.750	300	16.625	1.688	0.94	2,486	520	94	17.6
W36x194	36.500	194	12.125	1.250	0.81	1,492	431	93	12.8
W36x182	36.375	182	12.125	1.187	0.75	1,397	406	93	12.8
W36x170	36.125	170	12.000	1.125	1.06	1,302	381	92	12.7
W36x160	36.000	160	12.000	1.000	1.06	1,217	365	92	12.7
W36x230	35.875	230	16.500	1.250	0.75	1,879	421	91	17.4
W36x150	35.875	150	12.000	0.937	0.62	1,131	350	91	12.7
W36x201	35.375	201	11.750	1.438	0.75	1,545	402	90	12.4
W33x196	33.375	196	11.750	1.438	0.75	1,433	377	85	12.4
W33x220	33.250	220	15.750	1.250	0.81	1,661	392	85	16.6
W33x141	33.250	141	11.500	0.937	0.62	1,005	313	85	12.1
W33x130	33.125	130	11.500	0.875	0.56	911	300	85	12.1
W33x200	33.000	200	15.575	1.125	0.56	1,506	362	84	16.6
W31x180	31.500	180	11.750	1.312	0.75	1,327	327	80	12.4
W30x124	30.125	124	10.500	0.937	0.68	797	273	77	11.1
W30x116	30.000	116	10.500	0.875	0.62	738	263	76	11.1
W30x108	29.875	108	10.500	0.750	0.56	672	255	76	11.1
W30x175	29.500	175	11.750	1.312	0.56	1,156	304	75	12.4
W27x171	27.500	171	11.750	1.312	0.68	1,059	282	70	12.4
W27x102	27.125	102	10.000	0.812	0.68	599	217	69	10.6
W27x94	26.875	94	10.000	0.750	0.50	546	205	68	10.6
W26x157	25.500	157	11.750	1.250	0.50	915	237	65	12.4
W24x94	24.250	94	9.000	0.875	0.62	497	191	62	9.5
W24x84	24.125	84	9.000	0.750	0.50	442	174	61	9.5
W24x100	24.000	100	12.000	0.750	0.50	560	173	61	12.7
S24x120	24.000	120	8.000	1.125	0.50	564	286	61	8.4
S24x106	24.000	106	7.875	1.125	1.18	527	224	61	8.3
S24x80	24.000	80	7.000	0.875	0.62	391	183	61	7.4
W24x76	23.875	76	9.000	0.687	0.50	394	163	61	9.5
W24x153	23.625	153	11.750	0.250	0.43	828	217	60	12.4
S24x134	23.625	134	8.500	1.250	0.62	634	283	60	9.0
S22x75	22.000	75	7.000	0.812	0.81	308	168	56	7.4
W21x139	21.625	139	11.750	1.187	0.50	699	198	55	12.4
S21x112	21.625	112	7.875	1.187	0.62	495	238	55	8.3
W21x73	21.250	73	8.250	0.750	0.75	338	148	54	8.7
W21x68	21.125	68	8.250	0.687	0.50	315	140	54	8.7
W21x62	21.000	62	8.250	0.625	0.43	284	130	53	8.7
S20x85	20.000	85	7.125	0.937	0.37	337	195	51	7.5
S20x65	20.000	65	6.500	0.812	0.68	245	132	51	6.9
W20x134	19.625	134	11.750	1.187	0.43	621	177	50	12.4
W18x60	18.250	60	7.500	0.687	0.62	243	115	46	7.9
S18x86	18.250	86	7.000	1.000	0.43	326	184	46	7.4
W18x55	18.125	55	7.500	0.625	0.37	220	108	46	7.9
S18x80	18.000	80	8.000	0.937	0.50	292	133	46	8.4
W18x50	18.000	50	7.500	0.562	0.37	200	99	46	7.9
S18x55	18.000	55	6.000	0.687	0.50	199	126	46	6.3
S18x122	17.750	122	11.750	1.062	0.56	648	145	45	12.4

Table 3. Properties of Steel Stringers (continued)

(F_y = 36 ksi, f_b = 27 ksi, f_v = 16.5 ksi)

Nominal Size	d (in)	W_s (lbs/ft)	b (in)	t_f (in)	t_w (in)	m (ft-kips)	v (kips)	L_m (ft)	L_c (ft)
S18x62	17.750	62	6.875	0.750	0.37	238	100	45	7.3
S18x77	17.750	77	6.625	0.937	0.62	281	163	45	7.0
W16x112	16.750	112	11.750	1.000	0.56	450	136	42	12.4
S16x70	16.750	70	6.500	0.937	0.62	238	146	42	6.9
W16x50	16.250	50	7.125	0.625	0.37	181	94	41	7.5
W16x45	16.125	45	7.000	0.562	0.37	163	85	41	7.4
W16x64	16.000	64	8.500	0.687	0.43	234	106	40	9.0
W16x40	16.000	40	7.000	0.500	0.31	145	75	40	7.4
S16x50	16.000	50	6.000	0.687	0.43	155	105	40	6.3
W16x36	15.875	36	7.000	0.437	0.31	127	74	40	7.4
W16x110	15.750	110	11.750	1.000	0.56	345	127	40	12.4
S16x62	15.750	62	6.125	0.875	0.56	200	129	40	6.5
S16x45	15.750	45	5.375	0.625	0.43	150	104	40	5.7
W15x103	15.000	103	11.750	0.937	0.56	369	121	38	12.4
S15x56	15.000	56	5.875	0.812	0.50	173	110	38	6.2
S15x43	15.000	43	5.500	0.625	0.43	132	93	38	5.8
W14x101	14.250	101	11.750	0.937	0.56	344	114	36	12.4
S14x40	14.250	40	5.375	0.375	0.37	119	83	36	5.7
S14x51	14.125	51	5.625	0.750	0.50	150	104	36	5.9
S14x70	14.000	70	8.000	0.937	0.43	204	87	35	8.4
S14x57	14.000	57	6.000	0.875	0.50	153	101	35	6.3
W14x34	14.000	34	6.750	0.437	0.31	121	78	35	7.1
W14x30	13.875	30	6.750	0.375	0.25	109	61	35	7.1
W14x92	13.375	92	11.750	0.875	0.50	297	96	34	12.4
S14x46	13.375	46	5.375	0.687	0.50	126	99	34	5.7
S13x35	13.000	35	5.000	0.625	0.37	85	72	33	5.3
S13x41	12.625	41	5.125	0.687	0.37	108	104	32	5.4
W12x36	12.250	36	6.625	0.565	0.31	103	56	31	7.0
S12x65	12.000	65	8.000	0.937	0.43	182	73	30	8.4
W12x27	12.000	27	6.500	0.375	0.25	76	44	30	6.9
S12x50	12.000	50	5.500	0.687	0.68	113	120	30	5.8
S12x32	12.000	32	5.000	0.562	0.37	81	62	30	5.3
S12x34	11.250	34	4.750	0.625	0.43	81	72	28	5.0
W11x76	11.000	76	11.000	0.812	0.50	202	67	28	11.6
S10x29	10.625	29	4.750	0.562	0.31	67	48	27	5.0
W10x25	10.125	25	5.750	0.437	0.25	59	38	25	6.1
S10x40	10.000	40	6.000	0.687	0.37	92	53	25	6.3
S10x35	10.000	35	5.000	0.500	0.62	65	88	25	5.3
S10x25	10.000	25	4.625	0.500	0.31	55	46	25	4.9
W10x21	9.875	21	5.750	0.312	0.25	48	36	25	6.1
W10x59	9.250	59	9.500	0.687	0.43	132	56	23	10.0
S9x25	9.500	25	4.500	0.500	0.31	51	43	24	4.8
S9x50	9.000	50	7.000	0.812	0.37	103	45	23	7.4
S8x35	8.000	35	6.000	0.625	0.31	65	34	20	6.3
S8x28	8.000	28	5.000	0.562	0.31	49	35	20	5.3
W8x31	8.000	31	8.000	0.437	0.31	61	33	20	8.4
W8x44	7.875	44	7.875	0.625	0.75	81	40	20	8.3
W7x35	7.125	35	7.125	0.562	0.37	58	37	18	7.5
W6x31	6.250	31	6.250	0.562	0.37	45	31	16	6.6

Table 4. Wheeled- and Tracked-Vehicle Moment (M_{LL} in kip-feet)

Class	Wheeled/ Tracked	Span Length (feet)										
		4	6	8	10	12	14	16	18	20	25	30
4	W	4.96	7.44	9.92	12.40	14.88	17.92	21.40	25.60	30.00	41.00	52.20
	T	2.64	6.00	9.92	14.00	18.00	22.10	25.90	29.90	34.00	44.00	54.00
8	W	10.96	16.44	21.90	27.40	32.90	38.30	43.60	49.30	54.80	71.00	93.60
	T	4.88	11.04	19.04	27.00	35.00	43.10	50.90	59.00	66.80	87.00	106.80
12	W	16.00	24.00	32.00	40.00	48.00	56.00	64.00	72.00	80.80	112.50	145.20
	T	5.44	12.00	21.30	33.00	44.90	57.10	69.10	81.00	92.80	123.00	153.00
16	W	20.00	30.00	40.00	50.00	60.00	70.00	80.00	92.50	105.20	144.00	184.20
	T	7.12	15.96	28.50	44.00	60.00	75.90	91.80	108.00	124.00	164.00	204.00
20	W	22.00	33.00	44.00	55.00	70.80	87.40	104.00	121.00	137.60	188.50	241.00
	T	8.88	20.00	35.50	55.00	74.90	94.90	114.90	135.00	154.80	205.00	255.00
24	W	24.00	36.00	48.00	64.00	83.30	102.80	122.60	142.20	162.00	223.00	285.00
	T	10.64	24.00	42.70	66.00	90.00	114.00	137.90	162.00	186.00	246.00	306.00
30	W	26.70	40.40	53.90	70.40	91.70	113.10	134.70	156.60	178.00	246.00	316.00
	T	10.88	24.50	43.70	68.20	97.40	127.40	157.40	187.60	218.00	293.00	367.00
40	W	34.00	51.00	68.00	85.00	108.30	133.80	159.40	185.00	210.00	277.00	359.00
	T	13.36	30.00	53.30	83.40	120.00	158.90	200.00	240.00	280.00	380.00	480.00
50	W	40.00	60.00	80.00	100.00	125.00	154.30	183.70	213.00	243.00	320.00	415.00
	T	15.36	34.60	61.60	96.20	138.50	187.60	237.00	288.00	338.00	463.00	587.00
60	W	46.00	69.00	92.00	115.00	138.00	170.00	205.00	240.00	276.00	365.00	474.00
	T	17.12	38.50	68.60	107.20	154.30	210.00	270.00	330.00	390.00	540.00	690.00
70	W	51.00	76.40	101.90	127.40	157.90	198.20	239.00	280.00	322.00	426.00	557.00
	T	18.64	42.00	74.70	116.60	168.00	229.00	298.00	368.00	438.00	613.00	787.00
80	W	56.00	84.00	112.00	140.00	180.50	227.00	273.00	320.00	368.00	486.00	636.00
	T	20.00	45.00	80.00	125.00	180.00	245.00	320.00	400.00	480.00	680.00	880.00
90	W	60.00	90.00	120.00	151.80	203.00	225.00	308.00	360.00	414.00	547.00	716.00
	T	21.20	47.60	84.60	132.40	190.60	259.00	339.00	427.00	518.00	743.00	967.00
100	W	64.00	96.00	128.00	160.00	203.00	259.00	317.00	375.00	434.00	581.00	765.00
	T	22.20	50.00	89.00	138.80	199.90	272.00	356.00	450.00	550.00	800.00	1,050.00
120	W	72.00	108.00	144.00	180.00	243.00	311.00	380.00	450.00	520.00	697.00	918.00
	T	24.00	54.00	96.00	150.00	216.00	294.00	384.00	486.00	600.00	900.00	1,200.00
150	W	84.00	126.00	168.00	210.00	253.00	331.00	410.00	491.00	572.00	777.00	1,032.00
	T	25.00	56.30	100.00	156.20	225.00	306.00	400.00	506.00	625.00	975.00	1,350.00

NOTES:

1. If the span length falls between two lengths listed in this table, use the column pertaining to the longer of the two.

2. If the moment value (in kip-feet) falls between two MLC rows, use the row pertaining to the lower and therefore more conservative MLC.

Table 4. Wheeled- and Tracked-Vehicle Moment (M_{LL} in kip-feet) (continued)

Class	Wheeled/ Tracked	Span Length (feet)									
		35	40	45	50	55	60	70	80	90	100
4	W	63.70	75.20	86.40	97.00	108.90	120.00	142.80	164.80	187.20	210.00
	T	63.70	73.80	83.70	94.00	103.40	114.00	134.40	153.60	174.60	194.00
8	W	116.20	138.40	161.10	183.00	206.00	228.00	273.00	318.00	364.00	408.00
	T	126.70	147.20	167.40	187.00	207.00	227.00	267.00	307.00	347.00	386.00
12	W	180.60	218.00	256.00	293.00	331.00	368.00	444.00	518.00	592.00	668.00
	T	182.70	213.00	243.00	273.00	303.00	332.00	393.00	453.00	513.00	572.00
16	W	229.00	275.00	321.00	367.00	414.00	460.00	552.00	645.00	736.00	830.00
	T	244.00	284.00	324.00	364.00	404.00	444.00	524.00	603.00	684.00	764.00
20	W	299.00	359.00	419.00	479.00	539.00	599.00	718.00	838.00	958.00	1,078.00
	T	305.00	355.00	405.00	455.00	505.00	554.00	655.00	755.00	855.00	954.00
24	W	353.00	422.00	492.00	562.00	633.00	702.00	843.00	982.00	1,121.00	1,262.00
	T	366.00	426.00	486.00	546.00	606.00	666.00	785.00	906.00	1,026.00	1,146.00
30	W	398.00	482.00	567.00	652.00	737.00	822.00	991.00	1,162.00	1,130.00	1,500.00
	T	442.00	518.00	592.00	667.00	743.00	817.00	967.00	1,117.00	1,267.00	1,418.00
40	W	442.00	553.00	671.00	788.00	905.00	1,022.00	1,257.00	1,493.00	1,728.00	1,962.00
	T	580.00	680.00	780.00	880.00	980.00	1,080.00	1,280.00	1,480.00	1,679.00	1,880.00
50	W	511.00	656.00	800.00	945.00	1,090.00	1,235.00	1,525.00	1,814.00	2,100.00	2,390.00
	T	713.00	838.00	962.00	1,087.00	1,212.00	1,338.00	1,588.00	1,837.00	2,090.00	2,340.00
60	W	584.00	740.00	914.00	1,089.00	1,263.00	1,438.00	1,786.00	2,140.00	2,490.00	2,840.00
	T	840.00	990.00	1,140.00	1,290.00	1,440.00	1,590.00	1,890.00	2,190.00	2,490.00	2,790.00
70	W	688.00	856.00	1,057.00	1,257.00	1,458.00	1,658.00	2,060.00	2,460.00	2,870.00	3,270.00
	T	963.00	1,138.00	1,312.00	1,478.00	1,662.00	1,837.00	2,190.00	2,540.00	2,890.00	3,240.00
80	W	786.00	936.00	1,103.00	1,332.00	1,561.00	1,790.00	2,250.00	2,710.00	3,170.00	3,630.00
	T	1,080.00	1,280.00	1,480.00	1,680.00	1,880.00	2,080.00	2,480.00	2,880.00	3,280.00	3,680.00
90	W	884.00	1,053.00	1,242.00	1,499.00	1,757.00	2,010.00	2,530.00	3,050.00	3,560.00	4,080.00
	T	1,193.00	1,418.00	1,643.00	1,867.00	2,090.00	2,320.00	2,770.00	3,220.00	3,670.00	4,120.00
100	W	953.00	1,140.00	1,328.00	1,543.00	1,828.00	2,110.00	2,690.00	3,260.00	3,830.00	4,410.00
	T	1,300.00	1,550.00	1,800.00	2,050.00	2,300.00	2,550.00	3,050.00	3,550.00	4,050.00	4,550.00
120	W	1,143.00	1,368.00	1,593.00	1,851.00	2,195.00	2,540.00	3,230.00	3,910.00	4,600.00	5,290.00
	T	1,500.00	1,800.00	2,100.00	2,400.00	2,700.00	3,000.00	3,600.00	4,200.00	4,800.00	5,400.00
150	W	1,297.00	1,562.00	1,827.00	2,092.00	2,405.00	2,830.00	3,670.00	4,520.00	5,560.00	6,210.00
	T	1,725.00	2,100.00	2,478.00	2,850.00	3,230.00	3,600.00	4,350.00	5,100.00	5,850.00	6,600.00

NOTES:

1. If the span length falls between two lengths listed in this table, use the column pertaining to the longer of the two.

2. If the moment value (in kip-feet) falls between two MLC rows, use the row pertaining to the lower and therefore more conservative MLC.

Table 4. Wheeled- and Tracked-Vehicle Moment (M_{LL} in kip-feet) (continued)

Class	Wheeled/ Tracked	Span Length (feet)									
		110	120	130	140	150	160	170	180	190	200
4	W	233	254	278	270	321	346	367	389	414	448
	T	213	233	255	274	294	314	333	353	391	428
8	W	453	499	543	588	633	678	724	767	813	880
	T	427	468	507	546	588	627	666	706	775	852
12	W	744	818	892	969	1,044	1,117	1,193	1,267	1,341	1,416
	T	634	694	754	812	873	934	993	1,051	1,136	1,248
16	W	922	1,015	1,108	1,198	1,293	1,386	1,476	1,570	1,661	1,752
	T	845	924	1,004	1,084	1,164	1,245	1,323	1,404	1,516	1,664
20	W	1,199	1,318	1,438	1,557	1,677	1,798	1,918	2,040	2,160	2,280
	T	1,054	1,154	1,256	1,355	1,455	1,555	1,656	1,753	1,896	2,080
24	W	1,401	1,543	1,682	1,823	1,962	2,100	2,240	2,380	2,520	2,660
	T	1,265	1,385	1,505	1,627	1,746	1,866	1,986	2,110	2,280	2,500
30	W	1,670	1,841	2,010	2,180	2,350	2,520	2,690	2,860	3,030	3,200
	T	1,566	1,718	1,867	2,020	2,170	2,310	2,470	2,620	2,790	3,070
40	W	2,200	2,430	2,670	2,900	3,140	3,370	3,610	3,840	4,080	4,310
	T	2,080	2,280	2,480	2,680	2,880	3,080	3,280	3,480	3,680	4,050
50	W	2,680	2,970	3,260	3,550	3,840	4,130	4,420	4,710	5,000	5,290
	T	2,590	2,840	3,090	3,340	3,590	3,840	4,090	4,340	4,590	5,020
60	W	3,190	3,540	3,880	4,230	4,580	4,930	5,280	5,630	5,990	6,330
	T	3,090	3,390	3,690	4,000	4,290	4,590	4,890	5,190	5,490	5,970
70	W	3,670	4,070	4,470	4,880	5,280	5,680	6,080	6,490	6,890	7,290
	T	3,590	3,940	4,290	4,640	4,990	5,340	5,690	6,040	6,390	6,900
80	W	4,090	4,550	5,010	5,460	5,930	6,380	6,840	7,300	7,760	8,820
	T	4,080	4,480	4,880	5,280	5,680	6,080	6,480	6,880	7,280	7,810
90	W	4,600	5,110	5,630	6,150	6,670	7,180	7,700	8,220	8,730	9,250
	T	4,570	5,020	5,470	5,920	6,370	6,820	7,270	7,720	8,170	8,700
100	W	4,980	5,560	6,130	6,710	7,280	7,860	8,430	9,000	9,580	10,160
	T	5,050	5,550	6,050	6,550	7,050	7,550	8,050	8,550	9,050	9,570
120	W	5,980	6,670	7,360	8,050	8,740	9,430	10,120	10,810	11,500	12,180
	T	6,000	6,600	7,200	7,800	8,400	9,000	9,600	10,200	10,800	11,400
150	W	7,060	7,910	8,760	9,600	10,450	11,300	12,150	13,000	13,850	14,700
	T	7,350	8,100	8,850	9,600	10,350	11,100	11,850	12,600	13,350	14,100

NOTES:

1. If the span length falls between two lengths listed in this table, use the column pertaining to the longer of the two.

2. If the moment value (in kip-feet) falls between two MLC rows, use the row pertaining to the lower and therefore more conservative MLC.

Table 4. Wheeled- and Tracked-Vehicle Moment (M_{LL} in kip-feet) (continued)

Class	Wheeled/ Tracked	Span Length (feet)									
		210	220	230	240	250	260	270	280	290	300
4	W	491	532	579	619	665	733	799	868	934	1,002
	T	466	502	538	586	645	707	767	823	887	948
8	W	966	1,052	1,136	1,224	1,310	1,414	1,550	1,686	1,821	1,956
	T	924	1,003	1,076	1,162	1,285	1,404	1,523	1,641	1,763	1,884
12	W	1,491	1,593	1,734	1,877	2,020	2,160	2,310	2,450	2,660	2,890
	T	1,361	1,474	1,587	1,704	1,855	2,040	2,220	2,400	2,580	2,750
16	W	1,848	1,958	2,130	2,390	2,490	2,660	2,840	3,020	3,290	3,570
	T	1,814	1,967	2,120	2,270	2,480	2,710	2,950	3,200	3,430	3,680
20	W	2,400	2,540	2,770	3,000	3,230	3,460	3,690	3,920	4,270	4,630
	T	2,270	2,460	2,650	2,840	3,100	3,400	3,690	3,990	4,290	4,600
24	W	2,800	2,970	3,240	3,500	3,700	4,040	4,310	4,580	4,990	5,410
	T	2,720	2,950	3,170	3,400	3,720	4,070	4,430	4,790	5,160	5,510
30	W	3,370	3,590	3,910	4,240	4,570	4,890	5,220	5,550	6,020	6,530
	T	3,350	3,630	3,910	4,200	4,510	4,960	5,410	5,860	6,310	6,760
40	W	4,550	4,780	5,140	5,590	6,040	6,490	6,940	7,400	7,850	8,310
	T	4,430	4,800	5,180	5,560	5,940	6,520	7,120	7,720	8,320	8,920
50	W	5,580	5,870	6,370	6,930	7,480	8,030	8,590	9,150	9,710	10,270
	T	5,490	5,950	6,430	6,900	7,380	8,040	8,790	9,540	10,290	11,040
60	W	6,680	7,030	7,410	8,070	8,740	9,410	10,050	10,760	11,430	12,110
	T	6,530	7,090	7,650	8,220	8,800	9,510	10,410	11,310	12,210	13,110
70	W	7,690	8,100	8,500	9,260	10,030	10,800	11,570	12,350	13,130	13,910
	T	7,550	8,200	8,860	9,530	10,200	10,940	11,990	13,040	14,090	15,140
80	W	8,680	9,140	9,600	10,180	11,060	11,940	12,830	13,720	14,610	15,500
	T	8,550	9,300	10,060	10,810	11,580	12,340	13,520	14,720	15,920	17,120
90	W	9,770	10,290	10,810	11,450	12,450	13,440	14,430	15,440	16,440	17,440
	T	9,530	10,380	11,220	12,080	12,940	13,800	15,010	16,360	17,710	19,060
100	W	10,730	11,300	11,880	12,450	13,480	14,580	15,690	16,800	17,910	19,030
	T	10,500	11,440	12,380	13,330	14,280	15,230	16,450	17,950	19,450	21,000
120	W	12,870	13,570	14,260	14,940	16,170	17,490	18,820	20,200	21,500	22,800
	T	12,380	13,500	14,630	15,760	16,910	18,050	19,200	21,000	22,800	24,600
150	W	15,550	16,400	17,250	18,100	19,300	20,900	22,500	24,200	25,800	27,500
	T	14,910	16,320	17,720	19,140	20,600	22,000	23,400	24,700	27,200	29,400

NOTES:

1. If the span length falls between two lengths listed in this table, use the column pertaining to the longer of the two.

2. If the moment value (in kip-feet) falls between two MLC rows, use the row pertaining to the lower and therefore more conservative MLC.

Table 5. Wheeled- and Tracked-Vehicle Shear (V_{LL} in kips)

Class	Wheeled/ Tracked	Span Length (feet)									
		4	6	8	10	12	14	16	18	20	25
4	W	5.00	5.00	5.26	5.60	5.84	6.28	6.62	6.88	7.10	7.48
	T	2.66	4.00	5.00	5.60	6.00	6.28	6.50	6.66	6.80	7.04
8	W	11.00	11.00	11.00	11.00	11.00	11.00	11.26	12.00	12.60	13.68
	T	4.92	7.38	9.50	10.80	11.66	12.28	12.76	13.12	13.40	13.92
12	W	16.00	16.00	16.00	16.00	16.66	17.14	18.26	19.12	19.80	21.04
	T	5.34	8.00	10.66	13.20	15.00	16.28	17.24	18.00	18.60	19.68
16	W	20.00	20.00	20.00	20.80	21.66	22.28	23.50	24.44	25.20	26.56
	T	7.12	10.66	14.22	17.60	20.00	21.72	23.00	24.00	24.80	26.24
20	W	22.00	22.66	25.50	27.20	28.34	29.14	30.76	32.00	33.00	34.80
	T	8.88	13.34	17.78	22.00	25.00	27.14	28.76	30.00	31.00	32.80
24	W	24.00	26.66	30.00	32.00	33.34	34.28	36.26	37.78	39.00	41.20
	T	11.06	16.00	21.34	26.40	30.00	32.56	34.50	36.00	37.20	39.36
30	W	27.00	29.34	33.00	35.20	36.66	37.72	40.00	41.78	43.20	45.76
	T	10.92	16.36	21.82	27.28	32.50	36.44	39.38	41.66	43.50	46.80
40	W	34.00	34.66	39.00	41.60	43.34	44.58	45.50	47.78	49.60	53.44
	T	13.34	20.00	26.66	33.34	40.00	45.72	50.00	53.34	56.00	60.80
50	W	40.00	40.00	45.00	48.00	50.00	51.42	52.50	55.12	57.20	63.20
	T	15.38	23.08	30.76	38.46	46.16	53.56	59.38	63.88	67.50	74.00
60	W	46.00	46.00	49.50	54.00	57.00	59.14	60.76	62.88	65.40	71.04
	T	17.14	25.72	34.28	42.86	51.44	60.00	67.50	73.34	78.00	86.40
70	W	51.00	51.00	57.76	63.00	66.50	69.00	70.88	73.50	76.66	82.32
	T	18.66	28.00	37.34	46.66	56.00	65.34	74.38	81.66	87.50	98.00
80	W	56.00	56.00	66.00	72.00	76.00	78.86	81.00	84.00	87.60	94.08
	T	20.00	30.00	40.00	50.00	60.00	70.00	80.00	88.88	96.00	108.80
90	W	60.00	63.00	74.26	81.00	85.50	88.72	91.12	94.50	98.56	105.84
	T	21.18	31.76	42.36	52.94	63.52	74.12	84.70	95.00	103.50	118.80
100	W	64.00	64.00	75.00	84.00	90.00	94.28	97.50	100.00	105.00	114.00
	T	22.22	33.34	44.44	55.56	66.66	77.78	88.88	100.00	110.00	128.00
120	W	72.00	72.00	90.00	100.80	108.00	113.14	77.00	120.00	126.00	136.80
	T	24.00	36.00	48.00	60.00	72.00	84.00	96.00	108.00	120.00	144.00
150	W	84.00	84.00	94.50	109.20	119.00	126.00	131.26	135.34	140.80	155.04
	T	25.00	37.50	50.00	62.50	75.00	87.50	100.00	112.50	125.00	156.00

NOTES:

1. If the span length falls between two lengths listed in this table, use the column pertaining to the longer of the two.

2. If the shear value (in kips) falls between two MLC rows, use the row pertaining to the lower and therefore more conservative MLC.

Table 5. Wheeled- and Tracked-Vehicle Shear (V_{LL} in kips) (continued)

Class	Wheeled/ Tracked	Span Length (feet)										
		30	35	40	45	50	55	60	70	80	90	100
4	W	7.74	7.92	8.06	8.16	8.24	8.30	8.36	8.46	8.52	8.58	8.62
	T	7.20	7.32	7.40	7.46	7.52	7.56	7.60	7.66	7.70	7.74	7.76
8	W	14.40	14.92	15.30	15.60	15.84	16.04	16.20	16.46	16.66	16.80	16.92
	T	14.26	14.52	14.70	14.84	14.96	15.06	15.14	15.26	15.36	15.42	15.48
12	W	21.86	22.46	22.90	23.24	23.52	23.74	24.26	25.08	25.70	26.18	26.56
	T	20.40	20.92	21.30	21.60	21.84	22.04	22.20	22.46	22.64	22.80	22.92
16	W	27.46	28.12	28.60	28.98	29.28	29.52	29.74	30.68	31.48	32.08	32.58
	T	27.20	27.88	28.40	28.80	29.12	29.38	29.60	29.94	30.20	30.40	30.56
20	W	36.00	36.86	37.50	38.00	38.40	38.72	39.00	39.94	40.96	41.74	42.36
	T	34.00	34.86	35.50	36.00	36.40	36.72	37.00	37.44	37.76	38.00	38.20
24	W	42.66	43.72	44.50	45.12	45.60	46.00	46.34	46.92	48.06	48.94	49.64
	T	40.80	41.84	42.60	43.20	43.68	44.08	44.40	44.92	45.30	45.60	45.84
30	W	47.46	48.68	49.60	50.32	51.20	52.72	54.00	56.00	57.50	58.66	59.60
	T	49.00	50.56	51.76	52.66	53.40	54.00	54.50	55.28	55.88	56.34	56.70
40	W	57.86	61.02	63.40	65.24	66.72	68.84	70.94	74.22	76.70	78.62	80.16
	T	64.00	66.28	68.00	69.34	70.40	71.28	72.00	73.14	74.00	74.66	75.20
50	W	69.34	73.72	77.00	80.62	84.16	87.06	89.46	93.26	96.10	98.32	100.08
	T	78.34	81.44	83.76	85.56	87.00	88.18	89.16	90.72	91.88	92.78	93.50
60	W	79.86	84.18	90.90	94.58	97.52	99.92	102.86	108.18	112.16	115.24	117.72
	T	92.00	96.00	99.00	101.34	103.20	104.72	106.00	108.00	109.50	110.66	111.20
70	W	91.94	98.80	103.96	107.96	111.16	113.78	116.44	122.80	127.58	131.28	134.26
	T	105.00	110.00	113.76	116.66	119.00	120.92	122.50	125.00	126.88	128.34	129.50
80	W	98.40	106.52	113.20	118.40	122.56	125.96	128.80	133.26	139.40	144.36	148.32
	T	117.34	123.44	128.00	131.56	134.40	136.72	138.66	141.72	144.00	145.78	147.20
90	W	110.70	119.82	127.36	133.20	137.88	141.70	144.90	149.92	156.82	162.40	166.86
	T	129.00	136.28	141.76	146.00	149.40	152.18	154.50	158.14	160.88	163.00	164.70
100	W	120.04	129.14	138.00	144.88	150.40	154.90	158.66	164.58	169.38	176.12	181.50
	T	140.00	148.56	155.00	160.00	164.00	167.28	170.00	174.28	177.50	180.00	182.00
120	W	144.04	154.98	165.60	173.86	180.48	185.88	190.40	197.48	203.20	211.40	217.80
	T	160.00	171.42	180.00	186.66	192.00	196.36	200.00	205.80	210.00	213.40	216.00
150	W	165.96	171.32	178.90	191.52	202.40	210.80	218.00	229.40	243.20	254.00	262.60
	T	180.00	197.14	210.00	220.00	228.00	234.60	240.00	248.60	255.00	260.00	264.00

NOTES:

1. If the span length falls between two lengths listed in this table, use the column pertaining to the longer of the two.

2. If the shear value (in kips) falls between two MLC rows, use the row pertaining to the lower and therefore more conservative MLC.

Table 5. Wheeled- and Tracked-Vehicle Shear (V_{LL} in kips) (continued)

Class	Wheeled/ Tracked	Span Length (feet)									
		110	120	130	140	150	160	170	180	190	200
4	W	8.66	9.04	9.66	10.26	10.78	11.22	11.62	11.98	12.30	12.58
	T	7.88	8.54	9.12	9.60	10.02	10.40	10.72	11.02	11.28	11.52
8	W	17.02	17.50	18.56	19.80	20.88	21.82	22.66	23.40	24.06	24.66
	T	15.66	16.94	18.10	19.08	19.94	20.70	21.36	21.96	22.48	22.96
12	W	26.88	27.14	27.54	28.42	30.26	32.08	33.72	35.18	36.48	37.66
	T	23.04	24.40	26.20	27.78	29.12	30.30	31.34	32.26	33.10	33.84
16	W	33.00	33.30	33.78	34.82	37.10	39.34	41.38	43.18	44.82	46.28
	T	30.70	32.54	34.96	37.02	38.82	40.40	41.78	43.02	44.12	45.12
20	W	42.88	43.30	43.90	45.26	48.24	51.16	53.78	56.14	58.24	60.12
	T	38.38	40.66	43.70	46.28	48.54	50.50	52.24	53.78	55.16	56.40
24	W	50.22	50.70	51.42	53.02	56.56	59.96	63.02	65.74	67.34	70.36
	T	46.06	48.80	52.44	55.54	58.24	60.60	62.68	64.54	66.18	67.68
30	W	60.36	61.00	61.90	63.82	67.84	71.96	74.72	79.06	82.06	84.76
	T	57.00	59.10	63.70	67.72	71.20	74.26	76.94	79.34	81.48	83.40
40	W	81.42	82.46	83.36	85.72	88.48	93.50	98.72	103.68	108.12	112.12
	T	75.64	77.78	83.70	89.14	93.86	98.00	101.64	104.88	107.78	110.40
50	W	101.52	102.74	103.76	106.92	110.58	116.80	123.20	129.24	134.66	139.52
	T	94.08	96.16	103.08	110.00	116.00	121.26	125.88	130.00	133.68	137.00
60	W	119.74	121.42	122.86	124.82	127.14	134.36	141.98	149.48	156.34	162.52
	T	112.36	114.28	121.84	130.28	137.60	144.00	149.64	154.66	159.16	163.20
70	W	136.70	138.72	140.44	142.70	147.76	153.30	161.98	170.62	178.62	185.78
	T	130.46	132.22	140.00	150.00	158.66	166.26	172.94	178.88	184.20	189.00
80	W	151.56	154.26	156.56	158.52	163.42	168.70	175.90	185.24	194.86	203.60
	T	148.36	150.00	157.70	169.14	179.20	187.78	195.54	202.40	208.60	214.20
90	W	170.50	173.54	176.12	178.32	183.84	189.78	197.70	208.40	219.20	229.00
	T	166.08	167.64	175.12	187.72	199.20	209.20	218.20	226.00	233.00	239.40
100	W	185.90	189.58	192.70	195.36	200.00	207.00	213.80	224.40	235.80	247.00
	T	183.64	185.18	192.30	205.80	218.60	230.00	240.00	248.80	256.80	264.00
120	W	223.00	227.60	231.20	234.40	240.00	248.40	256.40	269.20	283.00	296.40
	T	218.20	220.00	226.20	240.00	256.00	270.00	282.40	293.40	303.20	312.00
150	W	269.60	275.40	280.40	284.60	289.60	299.60	309.60	320.60	336.40	352.60
	T	267.20	270.00	274.00	285.80	304.00	322.60	338.80	353.40	366.40	378.00

NOTES:

1. If the span length falls between two lengths listed in this table, use the column pertaining to the longer of the two.

2. If the shear value (in kips) falls between two MLC rows, use the row pertaining to the lower and therefore more conservative MLC.

Table 5. Wheeled- and Tracked-Vehicle Shear (V_{LL} in kips) (continued)

Class	Wheeled/ Tracked	Span Length (feet)									
		210	220	230	240	250	260	270	280	290	300
4	W	12.84	13.08	13.40	13.92	14.44	14.94	15.38	15.80	16.18	16.54
	T	11.74	12.10	12.62	13.10	13.54	13.94	14.32	14.66	14.98	15.28
8	W	25.20	25.68	26.20	27.06	28.08	29.08	30.00	30.86	31.66	32.40
	T	23.40	24.06	25.10	26.04	26.92	27.74	28.48	29.18	29.84	30.44
12	W	38.72	39.70	40.58	41.38	42.12	43.00	44.30	45.82	47.34	48.76
	T	34.52	35.16	36.46	37.94	39.32	40.56	41.74	42.82	43.82	44.76
16	W	47.60	48.80	49.88	50.90	51.82	52.86	54.44	56.32	58.20	59.96
	T	46.02	46.86	48.62	50.60	52.42	54.10	55.64	57.08	58.42	59.68
20	W	61.82	63.38	64.80	66.10	67.30	68.64	70.72	73.16	75.60	77.88
	T	57.52	58.58	60.78	63.24	65.52	67.62	69.56	71.36	73.04	74.60
24	W	72.34	74.14	75.80	77.30	78.68	80.28	82.72	85.58	88.42	91.08
	T	69.02	70.30	72.94	75.90	78.62	81.14	83.46	85.62	87.64	89.52
30	W	87.20	89.42	91.44	93.30	95.00	96.96	99.82	103.20	106.68	109.92
	T	85.14	86.72	88.94	92.62	96.12	99.34	102.34	105.10	107.68	110.10
40	W	115.74	119.02	122.02	124.76	127.30	129.64	132.42	135.40	139.62	144.08
	T	112.76	114.90	117.40	122.00	126.72	131.08	135.12	138.86	142.34	145.60
50	W	143.92	147.92	151.58	154.94	158.02	160.86	164.38	168.22	173.46	178.96
	T	140.00	142.72	145.48	150.62	156.60	162.12	167.22	171.96	176.38	180.50
60	W	168.12	173.20	177.84	182.10	186.02	189.64	192.98	197.20	201.84	207.74
	T	166.86	170.18	173.30	178.58	185.76	192.46	198.66	204.40	209.80	214.80
70	W	192.26	198.16	203.60	208.40	213.00	217.20	221.20	226.00	231.20	237.80
	T	193.34	197.28	200.80	206.20	214.20	222.20	229.40	236.20	242.60	248.60
80	W	211.40	218.40	225.00	231.00	236.40	241.40	246.20	250.60	256.20	262.00
	T	219.20	224.00	228.20	233.40	242.00	251.00	259.60	267.40	274.80	281.60
90	W	237.80	245.80	253.20	259.80	266.00	271.60	277.00	281.80	288.20	294.80
	T	245.20	250.40	255.20	260.20	269.00	279.40	289.00	298.00	306.40	314.20
100	W	257.20	266.40	274.80	282.60	289.60	296.20	302.20	307.80	313.60	321.20
	T	370.40	276.40	281.80	287.00	295.40	307.00	317.80	327.80	337.20	346.00
120	W	308.60	319.60	329.80	339.00	347.60	355.40	362.80	369.40	376.40	385.40
	T	320.00	327.20	334.00	340.00	348.00	360.00	373.40	385.80	397.20	408.00
150	W	368.20	382.40	395.54	407.20	418.20	428.80	437.60	446.20	454.20	463.00
	T	388.60	398.20	407.00	415.00	422.60	432.60	446.80	462.80	478.00	492.00

NOTES:

1. If the span length falls between two lengths listed in this table, use the column pertaining to the longer of the two.

2. If the shear value (in kips) falls between two MLC rows, use the row pertaining to the lower and therefore more conservative MLC.

Table 6. Profile Factors

Profile	Factor	Remarks
For a span-to-rise ratio up to 4	1.0	For a given load, a flat arch of steeper profile (although it has a very large rise) may fail due to the crown's action as a smaller, flatter arch.
For a span-to rise ratio over 4	See *Figure 13, page 26*.	

Table 7. Arch Factors

Material	Factor
Granite, white stone, and built-in course masonry	1.50
Concrete or blue engineering bricks	1.20
Good limestone masonry and building blocks	1.00
Poor masonry or brick (any kind)	0.50

Joint Factors	
Joint	**Factor**
Thin joints (1/10 inch or less)	1.25
Normal joints (width to 1/4 inch, pointed mortar)	1.00
Normal joints (unpointed mortar)	0.90
Joints over 1/4 inch wide (irregular good mortar)	0.80
Joints over 1/14 inch wide (mortar containing voids deeper than 1/10 of the ring thickness)	0.70
Joints 1/2 inch or more wide (poor mortar)	0.50

Deformations		
Condition	**Adjustment**	**Comment**
The rise over the affected portion is always positive	Span-to-rise ratio of affected portion to whole arch applied	Arch ring deformation may be due to partial failure of the ring (usually accompanied by a sag in the parapet) or movement at the abutment.
A flat section of profile exists	Maximum: class = 12	
A portion of the ring is sagging	Maximum: class = 5 (if the fill at the crown exceeds 18 inches)	

Abutment Size Factors		
Abutment	**Factor**	**Comment**
Both abutments are satisfactory	1.00	An abutment may be regarded as inadequate to resist the full thrust of the arch if— • The bridge is on a narrow embankment, particularly if the approaches slope steeply up to the bridge. • The bridge is on an embanked curve. • The abutment walls are very short and suggest little solid fill behind the arch.
One abutment is unsatisfactory	0.95	
Both abutments are unsatisfactory	0.90	
Both abutments are massive (clay fill suspected)	0.70	
Arch is supported on one abutment and one pier	0.90	
Arch is carried on two piers	0.80	

Table 7. Arch Factors (continued)

Abutment Fault Factors		
Type of Fault		**Factor**
Inward movement of one abutment		0.50
Outward spread of abutments		0.50
Vertical settlement of one abutment		0.50
Crack Factors		
Type of Crack	**Factor**	**Note**
Longitudinal cracks within 2 feet of the edge of the arch, wider than 1/4 inch and longer than 1/10 of the span, in bridges that are— • Wider than 20 feet between parapets. • Narrower than 20 feet between parapets.	 1.00 0.70	This type of longitudinal crack is due to an outward force on the spandrel walls caused by a lateral spread of the fill.
Longitudinal cracks in the middle third of the bridge with— • One small crack under 1/8 inch wide and shorter than 1/10 of the span. • Three or more small cracks as above. • One large crack wider than 1/4 inch and longer than 1/10 of the span.	 1.00 0.50 0.50	This type of longitudinal crack is due to varying amounts of susidence found along the length of the abutment. Large cracks are danger signs indicating that the arch ring has broken up into narrower, independent rings.
Lateral and diagonal cracks less than 1/8 inch wide and shorter than 1/10 of the arch width		Lateral cracks are usually found near the quarter points and result from permanent deformation of the arch, which may be caused by partial collapse of the arch or by abutment movement.
Lateral and diagonal cracks wider than 1/4 inch and longer than 1/10 of the arch width: Restrict load class to 12 or to the calculated class using all other applicable factors, whichever is less.	1.00	Diagonal cracks, usually starting near the sides of the arch near the spring lines and propagating toward the center of the arch at the crown, are probably due to the subsiding of one or both of the abutments. This indicates that the bridge is in a dangerous condition.
Cracks between the arch ring and spandrel or parapet wall greater than 1/10 of the span due to the fill spread	0.90	This type of crack is due to spreading of the fill pushing the wall outward or the movement of a flexible ring away from a stiff fill, so that the two act independently. The latter type of failure often produces cracks in the spandrel wall near the quarter points.
Cracks between the arch ring and spandrel or parapet wall due to a dropped ring: Reclassify from the nomograph, taking the crown thickness as that of the ring alone.		

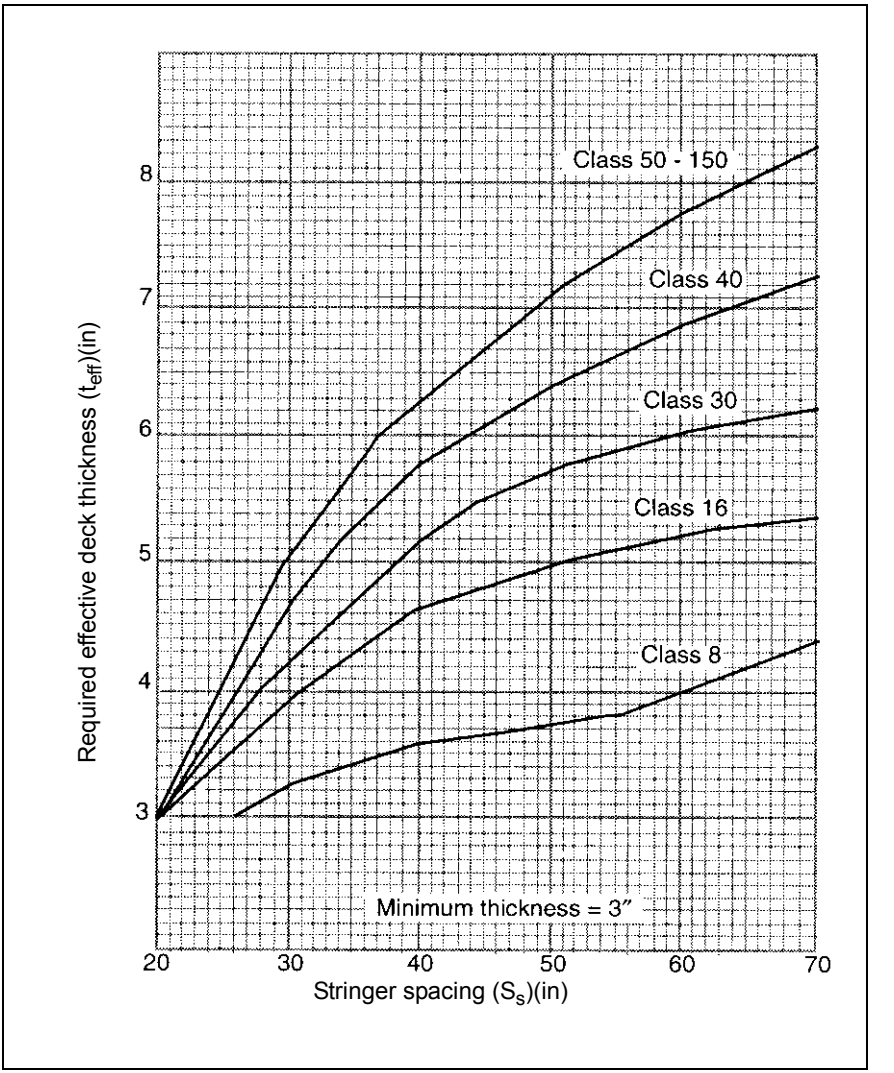


Figure 9. Timber Deck Classification

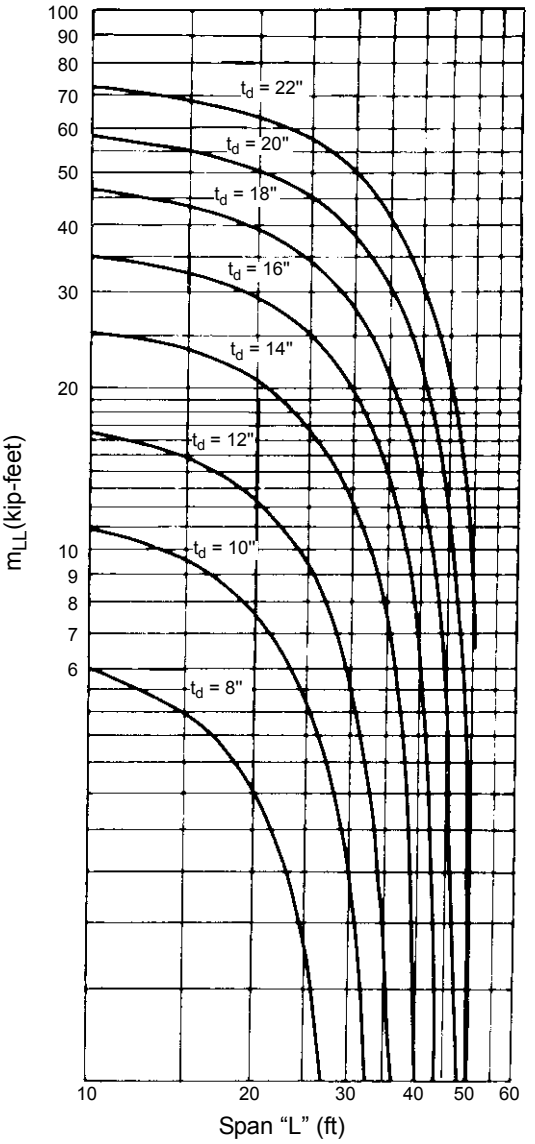


Figure 10. Live Load Moment for a 12-Inch Reinforced Concrete Strip

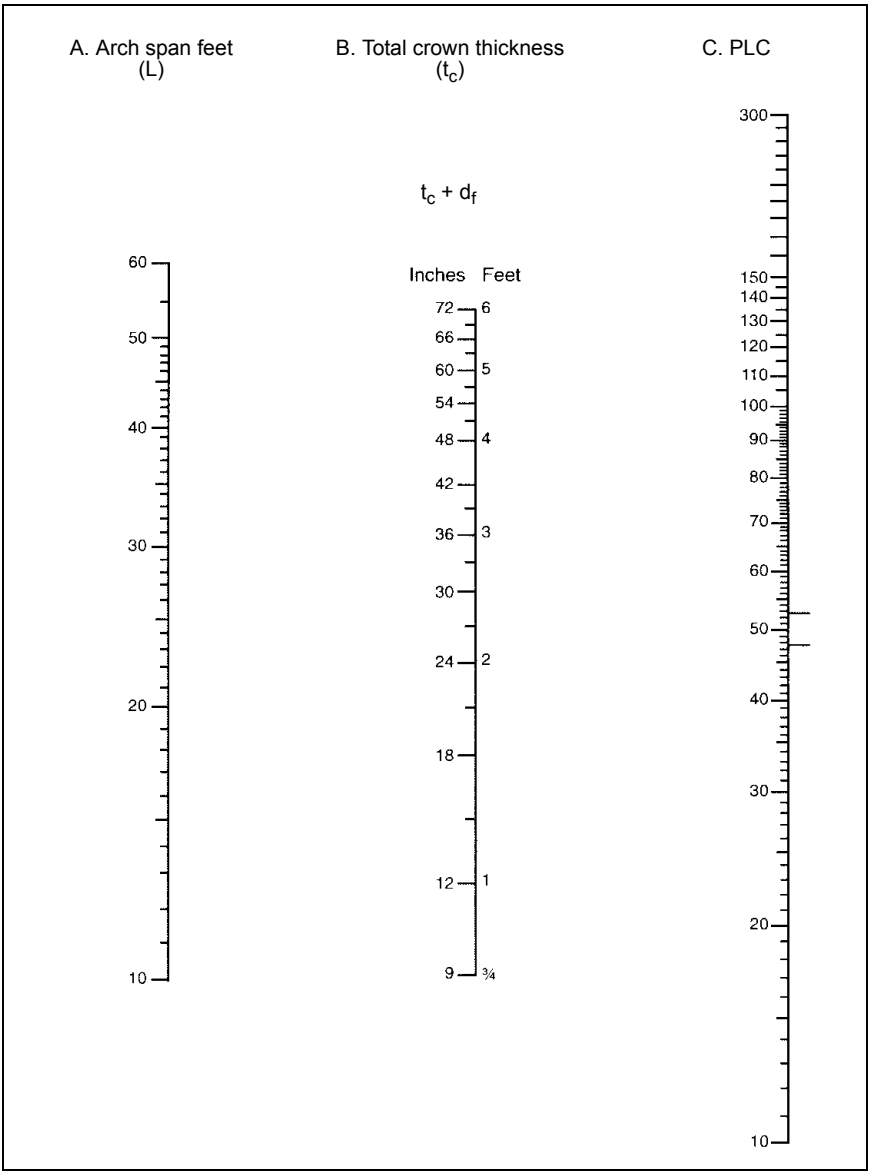


Figure 11. Masonry Arch Provisional Load Classification (PLC)

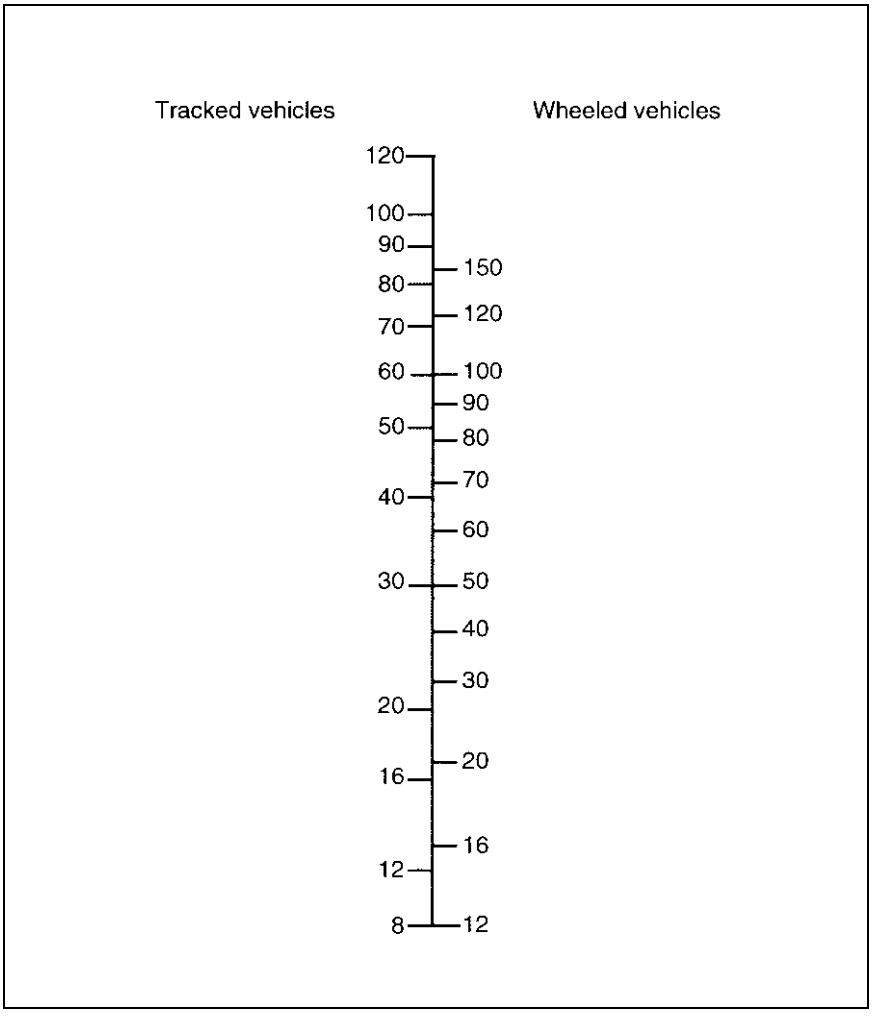


Figure 12. Bridge Class

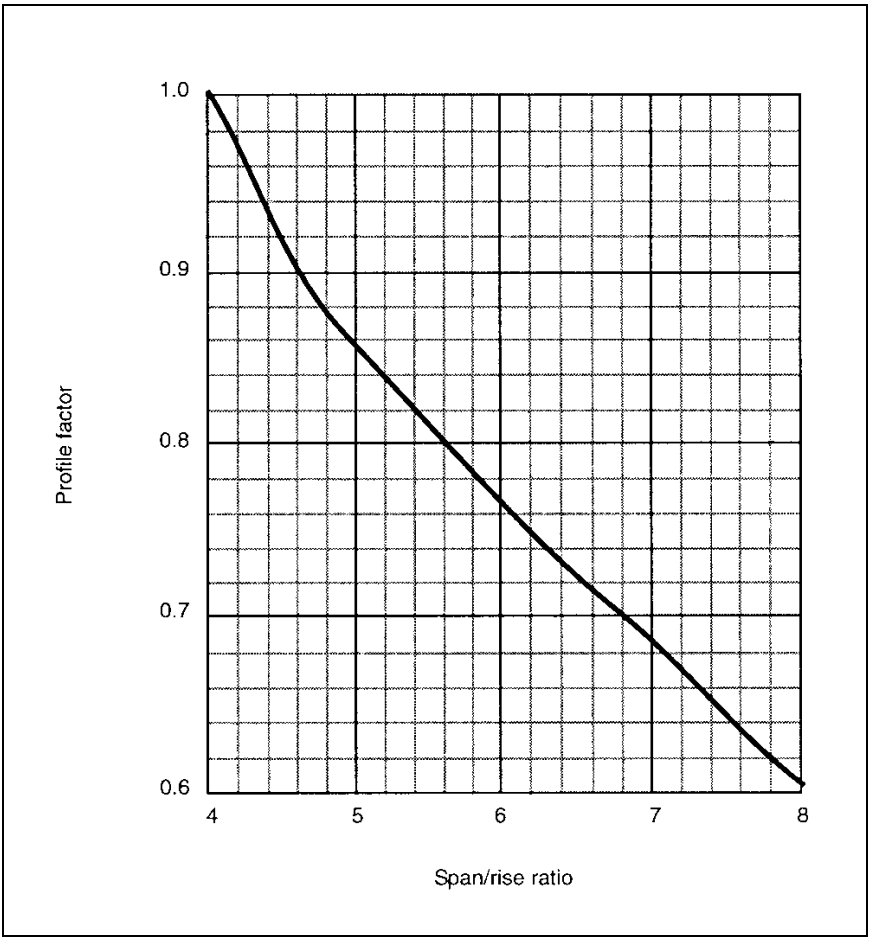


Figure 13. Profile Factors for Arch Bridges

Table 8. Military Load Classification Chart

Model	Item Description	LIN	MLC Empty	MLC Loaded
AVLB	AVLB, M60 chassis		43	58
CCE 130G	Grader, road	G74783	18	18
D7	Dozer, w/blade, w/winch	W76816	19	23
FLU-419	Small-emplacement excavator tractor	T34437	9	9
LMTV	Trailer, cargo, 2.5-ton	Z36068	<3	4
M1000	HET trailer	S70859	18	*
M1070	HET	T59048	18	*
M1070 & M1000	HET w/ Trailer		31	*
M1070 & M1000	HET w/ Trailer and M1A1 tank			96
M1070 & M1000	HET w/ Trailer and M1A1 tank w/ Minefield Clearing Blade			101
M1074	PLS w/crane	T41067	25	41
M1076	PLS trailer	T93761	8	26
M1078	Truck, cargo, 4x4 LMTV w/equipment w/ or w/o winch	T60081	9	12
M109 A4/A5	Howitzer, 155 mm, SP	K57667	28	28
M110A2	Howitzer, heavy, SP, 8-in.	K56981	28	31
M113A2/A3; M58	Carrier, personnel, Wolf (M113-based)	D12087 C18284 G87229	13	13
M149A2	Trailer, tank, water	W98825	2	4
M1A1	Tank, combat, 120-mm, w/o heavy armor kit	T13168	70	70
M1A1	Tank w/minefield clearing blade		79	79
M1A1	Tank w/roller		88	88
M1A2	Tank, combat, 120-mm, w/o heavy armor kit	T13305	70	70
M2	Cavalry fighting vehicle	J81750	21	25
M200A1	Chassis, trailer, 2.5-ton	E02807	<3	5
M2A1	Infantry/TOW/cavalry fighting vehicle	F40307	23	30
M2A2	Infantry/TOW/cavalry fighting vehicle	F40375	27	33
M3	Cavalry fighting vehicle	C76335	21	25
M35A2	Truck, cargo, 2.5-ton, 6x6, w/equipment	X40009	6	7
M54 series	Truck, cargo, 5-ton 6x6, w/winch, w/equipment	X40831 X40968	9	19
M548	Carrier, cargo, 6-ton	D11049	7	13
M577A1	Carrier, command post	D11538	11	12
M88A1	Vehicle (medium), recovery	ME1377	56	56

Table 8. Military Load Classification Chart (continued)

Model	Item Description	LIN	MLC Empty	MLC Loaded
M9 ACE	ACE	MB0589	17	30
M929A2	Truck, dump, 5-ton	X43708	10	16
M977	Truck, cargo (HEMTT)	T39518	18	28
M978	Truck, tanker (HEMTT)	T58161	18	25
M981	Fire support vehicle	C12155	14	14
M992	Carrier, ammo, tracked vehicle	C10908	22	29
M997	Truck, ambulance litter, 4x4	T38844	<3	4
M998 series	Truck, utility, cargo, troop carrier, 1.25-ton, (HMMWV)	T61494	<3	4

* The MLC is determined by the equipment being hauled.

Model: This field relates to the model description for an NSN. Vehicles contained in the table are sorted alphabetically and numerically by their model number.

LIN: This is a six-character alphanumeric identification assigned to a generic nomenclature to describe collectively all NSN items possessing the functional capability expressed by the LIN description. When multiple LINs are listed, the MLC of the heaviest vehicle is given in the MLC column.

This is only a partial listing of the MLC table. For a more complete listing, refer to http://www.wood.army.mil, Center for Lessons Learned.