Steel Gables and Arches

AMERICAN INSTITUTE OF STEEL CONSTRUCTION

AIA FILE NO. 13C

PART 1

STEEL GABLES

STEEL GABLES NOMENCLATURE

L = Span length, feet

h = Height of column from base to eave, feet

f = Vertical distance from eave to ridge of gable, feet

W_v = Vertical load exclusive of wind, lbs per lin ft of horizontal projection

W_h = Wind load, lbs per lin ft of vertical projection

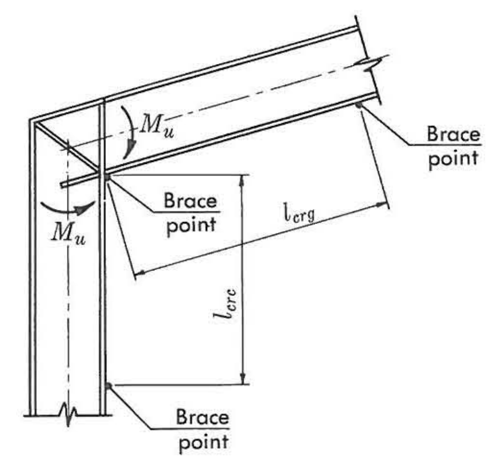
M_u = Plastic moment required, kip-ft

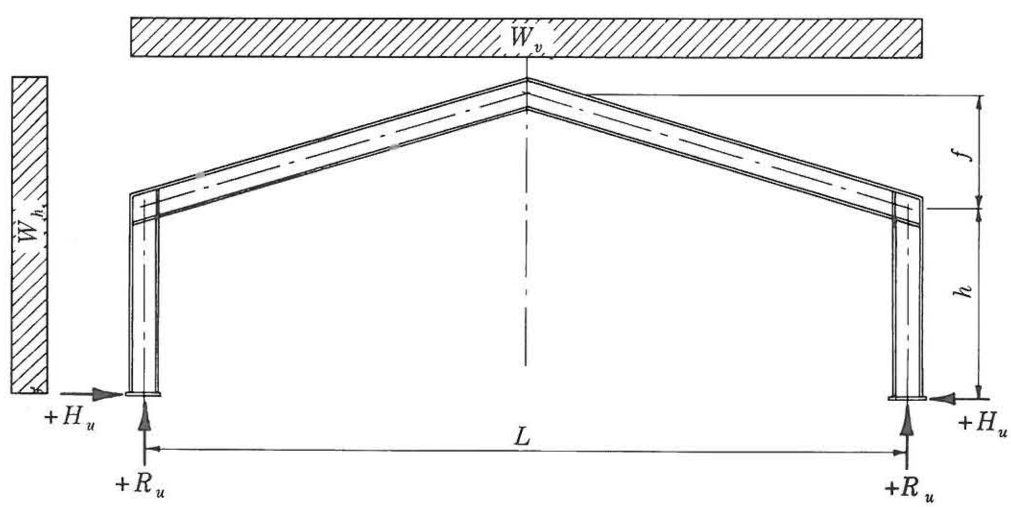
H_u = Maximum horizontal reaction, kips

R_u = Maximum vertical reaction, kips

l_{crg} = Maximum permissible weak-axis unbraced distance from eave for girder

l_{crc} = Maximum permissible weak-axis unbraced distance down from eave for column





STEEL GABLES

INTRODUCTION

The economy, adaptability, and clean architectural appearance of the single span steel rigid frame has firmly established this type of structural element in modern construction. Until about twenty years ago, design calculations were somewhat arduous, relying for the most part upon classical elastic methods of analysis for indeterminate structures or upon moment distribution methods. *Single Span Rigid Frames in Steel** simplified design calculations to a great degree by making available systematized non-dimensional coefficients. Such coefficients render satisfactory results due to the proportionality of single span rigid frame structures.

The plastic method of analysis, which resulted from many years of research, further simplified design procedures while at the same time providing additional opportunities for economy. The method is based upon the way a frame would actually work close to its ultimate capacity in supporting the required types of loading when that loading is *increased* above actual requirements by a specified load factor; thus it is more logical.

The facility for handling repetitious calculations with speed and accuracy that has been provided by electronic computers makes possible even further reductions in the amount of calculation effort required of designers. By selecting a range of spans, column heights, roof slopes and loading conditions and employing an electronic computer to accomplish the routine calculations, complete tables of designs covering the selected range may be prepared.

The information presented in this section is the product of such a procedure.** It is presented as an aid to designers and may be employed in several ways. When physical dimensions and loading match those tabulated, the most economical WF section may be selected directly by inspection, in much the same manner as beams are selected from standard beam tables. **All sections shown are based on A36 steel.** Also the tables may be employed in preliminary layout and cost estimating work, thus eliminating the necessity for design calculations at this early stage of a job. Within limits, design moments may be interpolated from the tables for frames of dimensions intermediate between those tabulated.

SCOPE

The tables presented herein encompass single span pinned-base rigid frames fabricated of straight prismatic steel sections in a range of spans from 50 to 150 feet, in steps of 10 feet. For each span, column heights are varied between 12 feet and 20 feet in increments of 2 feet. Also, flat roofs as well as slopes of 3 on 12, 6 on 12, and 9 on 12 are presented for each span and column height. It is felt that this range of dimensions, plus the intermediate dimensions for which values may be interpolated, will cover nearly all single span frames which will be encountered in everyday practice.

DESIGN CRITERIA

The vertical loading employed consists of total loads of 500, 1,000, and 1,500 pounds per lineal foot of span. In combination with these vertical loads, horizontal loads***—expressed as ratios of horizontal-to-vertical load—have been applied. Ratios of 0.0, 0.50, 0.75, and 1.00 were included in the computations. Additionally, for each frame of particular proportions, a critical value of the ratio of horizontal-to-vertical load is tabulated. For ratios of horizontal-to-vertical load less than the critical ratio, vertical load only will govern the design, at a load factor of 1.85. For ratios larger than the critical value, horizontal plus vertical load will govern the design at a load factor of 1.40.

*American Institute of Steel Construction, 1948.

** "Fast Design of Steel Rigid Frames," Ira Hooper and P. C. Wang—ENGINEERING NEWS-RECORD, November 14, 1963.

*** Wind loading has been applied in accordance with the recommendations of the American Standards Association. For roof slopes steeper than 30° from horizontal the wind load is taken normal to the windward slope.

USE OF TABLES

The design information presented in Tables 1 to 11 includes the selection of member sizes and the tabulation of critical unbraced lengths for the columns and the rafter or girder member. Thus for any case where the physical dimensions and required loading of the structure match, to a reasonable degree, the dimensions and a loading increment of the table, design of the primary members is complete, leaving only the necessity of providing the details.

For the cases where physical dimensions of the structure fall between the tabulated values of the tables, interpolation may be employed with sufficient accuracy in lieu of a complete structural analysis; moments and horizontal and vertical reactions are tabulated, in addition to the member sizes, for this purpose.

The following limitations on interpolations for moments and reactions should be borne in mind:

1. Interpolations to determine intermediate values of M_u, H_u, and R_u, for vertical loads other than those tabulated, may be made in every case on a straight line basis without error.

2. Interpolations to determine intermediate values of M_u, H_u, and R_u, for spans other than those tabulated, may be made directly on the basis of span length L, rendering results which are sufficiently accurate. Maximum error (involving moments only) would not exceed 0.5 percent and would occur in moments for short spans.

3. Interpolations for intermediate values of M_u, H_u, and R_u at heights other than those tabulated may be on the basis of a straight line with a maximum error of 0.25%.

4. Interpolations for intermediate values of M_u, H_u, and R_u at roof slopes other than those tabulated must be made with care, since slight changes in roof slope can produce marked changes in the ratio f/h, which is an important factor in the solution of single span rigid frames by the plastic design method. Also, for roof slopes greater than 30 degrees, horizontal loading above the eave line is applied normal to the roof surface rather than against the vertical projection of the sloping roof. Interpolation for intermediate values of roof slope may involve maximum errors ranging from approximately 2.5% for short spans with long columns to 10% for long spans with short columns. Interpolation errors are greatest with small roof slopes.

5. Interpolation for intermediate values of the ratio of horizontal load to vertical load may be made with no appreciable error. Such interpolations must be made with due regard for the critical ratio. Different load factors are used above and below this ratio; thus interpolations between values which appear in the tables on opposite sides of the critical ratio are meaningless.

The tabulated values of moments and reactions may also be employed in selecting members other than the least weight sections, in cases where architectural considerations dictate the use of shallower sections than those shown in the tables.

Equations employed in the calculation of values included in the tables vary slightly from those published in the AISC manual *Plastic Design in Steel*. These variations are brought about by the fact that *Plastic Design in Steel* was prepared for ordinary computation procedures. Thus the simplification of converting uniformly distributed horizontal loads to equivalent concentrated loads at the eaves was employed. Since electronic computers were used in calculation of the tables presented herein it was not necessary to resort to such simplifications. In addition, in accordance with the American Standards Association recommendation on wind load, these loads were applied normal to the roof surface for all slopes steeper than 30°. Except for the case of all flat roof frames, and for gabled frames with zero horizontal loads, slight variations between results will be observed if tabulated values are compared with values calculated by the formulas contained in the Appendix to *Plastic Design in Steel*. These differences are inconsequential; however, this explanation is provided for the benefit of those who may attempt to achieve an exact correlation of results.

FOUNDATION NOTES

Unless favorable foundation conditions are available at a relatively slight distance below the column bases, it is recommended that these bases be connected in the plane of the bent by means of a tie proportioned to provide the maximum horizontal reaction H_u. If a tie is not used each foundation should be designed to resist the outward overturning effect of the force H_u.

DESIGN EXAMPLE No. 1

Given:

Span: 60′-0
Slope: 3 on 12
Column height at eaves: 12′-0
Girt spacing: 4′-0
Total vertical load: 1,000 lbs per lin ft of horizontal projection
Wind load: 750 lbs per lin ft of vertical projection
Steel: A36

Solution:

Enter Table 2 where $\frac{2f}{L} = 0.25$, $W_h/W_v = 0.75$ and $W_v = 1{,}000$ and read, for 12 ft column height, 18 WF 55 as the most economical wide flange section to satisfy the given conditions. Critical unbraced length about the weak axis, adjacent to the knee, equals 4.8 ft (l_{crc}) for the columns and 5.0 ft (l_{crg}) for the girder.

DESIGN EXAMPLE No. 2

Given:

Span: 80′-0
Slope: 6 on 12
Column height at eaves: 16′-0
Girt spacing: 4′-0 o.c.
Total vertical load: 1,250 lbs per lin ft of horizontal projection
Wind load: 600 lbs per lin ft of vertical projection
Steel: A36

Solution:

Selection of a section cannot be made directly from the tables since values based on the given load of 1,250 kips per foot have not been tabulated. However, interpolations between tabulated moment and reaction values permit solution with a minimum of calculation.

$$\frac{2f}{L} = 0.5\ ;\ \frac{W_h}{W_v} = \frac{600}{1{,}250} = 0.48$$

From Table 4, Critical Ratio $\frac{W_h}{W_v} = 0.61 > 0.48$

∴ Wind not critical

Enter Table 4 where $\frac{2f}{L} = 0.5$ and $\frac{W_h}{W_v} = 0.0$:

When $W_v = 1{,}500$, $M_u = 710$ k-ft
When $W_v = 1{,}000$, $M_u = 473$ k-ft
When $W_v = 1{,}250$, $M_u = 592$ k-ft (by interpolation)

Required plastic modulus, $Z_x = \frac{592 \times 12''}{36 \text{ ksi}}$

$= 197.3$ in.^{3}

From AISC *Manual of Steel Construction*, p. 2-8:
Try **24 WF 76:** $Z_x = 200.1$ in.^{3}, $A = 22.37$ in.^{2}, $r_x = 9.68$ in., $r_y = 1.85$ in., $d/w = 54.3$

Check Column: (AISC Spec. Sect. 2.3)

$P = R_u = 1.25$ k/ft $\times$ 40 ft $\times$ 1.85 $= 92.5$ kips
$P_y = 22.37$ sq. in. $\times$ 36 ksi $= 805$ kips

$$\frac{2 \times 92.5}{805} + \frac{16 \times 12}{70 \times 9.68} = 0.513 < 1.0 \qquad \text{(Formula 20)}$$

$$\frac{P}{P_y} = \frac{92.5}{805} = 0.115 < 0.15 \qquad \text{(Formula 21)}$$

Check minimum web thickness: (AISC Spec. Sect. 2.6)

$70 - (100 \times 0.115) = 58.5 > 54.3$ (Formula 25)
Use 24 WF 76

Check lateral bracing: (AISC Spec. Sect. 2.8)

Where $M{:}M_p = 12$ ft$:$16 ft,

$$l_{crc} = \left(60 - 40\frac{M}{M_p}\right) r_y = \left(60 - 40\frac{12}{16}\right) r_y$$

$= 30 r_y$; Use $35\, r_y$

$$l_{crc} = \frac{35 \times 1.85}{12} = 5.4 > 4.0 \text{ ft}$$

DESIGN EXAMPLE No. 3

Given:

Span: 136′-0
Column height: 18′-0
Roof slope: $\frac{2f}{L} = 0.5$
Vertical load: 1,000 lbs per lin ft of horizontal projection
Horizontal load: 1,000 lbs per lin ft of vertical projection
Steel: A36
Column bracing: None below knee

Solution:

Selection of section cannot be made directly from the tables since values based upon the given 136′-0 span have not been tabulated. However, interpolation between tabulated moment and reaction values permits solution with a minimum of calculation.

Enter Tables 9 and 10 where $\frac{2f}{L} = 0.5$, $\frac{W_h}{W_v} = 1.00$ and $W_v = 1{,}000$:

For 140′-0 span $M_u = 1{,}301$ k-ft;
Critical Ratio $= 0.82$; Wind governs
For 130′-0 span $M_u = 1{,}172$ k-ft;
Critical Ratio $= 0.78$; Wind governs
For 136′-0 span $M_u = 1{,}249$ k-ft (by interpolation); Wind governs

For 140′-0 span $R_u = 129$ kips; Wind does not govern

For 130′-0 span $R_u = 120$ kips; Wind does not govern

For 136′-0 span $R_u = 125$ kips (by interpolation); Wind does not govern

Required plastic modulus, $Z_x = 1{,}249 \times \frac{12}{36}$
$= 416.3 \text{ in.}^3$

From AISC *Manual of Steel Construction*, p. 2-7:
Try **33 WF 130**, $Z_x = 466.0 \text{ in.}^3$, $A = 38.26 \text{ in.}^2$, $d/w = 57.1$, $r_x = 13.23$ in., $r_y = 2.29$ in.

Check column: (AISC Spec. Sect. 2.3)

$P = R_u = 125$ kips

$P_y = 38.26 \times 36 = 1{,}377$ kips

$$\frac{2 \times 125}{1{,}377} + \frac{18 \times 12}{70 \times 13.23} = 0.181 + 0.233 < 1.00 \qquad \text{(Formula 20)}$$

$$\frac{P}{P_y} = \frac{125}{1{,}377} = 0.091 < 0.15 \qquad \text{(Formula 21)}$$

Investigate stability of column without lateral support:

$$l_{crc} = \left(60 - 40\,\frac{0}{1{,}249}\right) 2.29 = 137.4 \text{ in.} < 18'\text{-}0 \qquad \text{(Formula 26)}$$

Use heavier section columns to insure elastic behavior, so that hinge would form in the rafter. (33 WF 130 satisfactory for rafters.)

Moment required to produce hinge in rafter

$$= \frac{466 \times 36}{12} = 1{,}400 \text{ k-ft}$$

For column to remain elastic,

Req'd $S = 1.12 Z_x = 1.12 \times 466 = 522 \text{ in.}^3$

From AISC *Manual of Steel Construction*, p. 1-7:

Try **36 WF 160**, $S = 541.0 \text{ in.}^3$, $A = 47.09 \text{ in.}^2$, $r_y = 2.42$ in., $d/A_f = 2.94$

Check bending stresses: (AISC Spec. Sect. 1.5.1.4.5, p. 5-67)

$$\frac{M_1}{M_2} = \frac{0}{1{,}400} = 0\ ;\ C_b = 1.75$$

$$F_b = \left[22{,}000 - \frac{0.679}{1.75}\left(\frac{18 \times 12}{2.42}\right)^2\right] 1.67$$

$= 31{,}600$ psi (Formula 4)

$$F_b = \frac{12{,}000{,}000 \times 1.67}{18 \times 12 \times 2.94} = 31{,}500 \qquad \text{(Formula 5)}$$

$$f_b = \frac{1{,}400 \times 12}{541} = 31.1 \text{ ksi} < 31.6 \text{ ksi (O.K.)}$$

Check compressive stresses:

Combined gravity loading and wind on 52 ft horizontal projection:

$$P = 1.40\left[1.0 \times \frac{136}{2} + 1.0 \times 52 \times \frac{26}{136}\right]$$

$= 109$ kips

$$f_a = \frac{109}{47.09} = 2.32 \text{ ksi}$$

$$\frac{L}{r_y} = \frac{18 \times 12}{2.42} = 89.3$$

From AISC Spec. Sect. 1.5.1.3,

$$F_a = \left[1 - \frac{(l/r)^2}{2C_c^2}\right] F_y \quad \text{(Formula 1; F.S.} = 1.0)$$

$$= \left[1 - 0.5\left(\frac{89.3}{126.1}\right)^2\right] 36.0 = 27.0 \text{ ksi}$$

Check combined bending and axial stresses: (AISC Spec. Sect. 1.6.1)

$$\frac{f_a}{F_a} = \frac{2.32}{27.0} = 0.086 < 0.15 \text{ (O.K.)}$$

$$0.086 + \frac{31.1}{31.6} = 1.073 > 1.0 \text{ (Too high)} \qquad \text{(Formula 6)}$$

Repeating the above analysis it will be found that a 36 WF 170 will fully satisfy the conditions.

DESIGN EXAMPLE No. 4

Given:

Frames: 20′-0 o.c.
Span: 100′-0
Column height at eaves: 20′-0
Roof slope: 3 on 12
Wind load: 25 lbs per sq ft
Gravity load:

Roofing	5 lbs per sq ft
Insulation	1
Decking	2
Purlins	2
Ceiling & Mech.	5
Frame	5
Live	30
	50 lbs per sq ft

Steel: A36

$W_h = 25 \times 20 = 500$ lbs per lin ft of vertical projection

$W_v = 50 \times 20 = 1{,}000$ lbs per lin ft of horizontal projection

$$\frac{W_h}{W_v} = 0.5$$

Solution:

Enter Table 6 where $h = 20$, $\frac{2f}{L} = 0.25$, and $W_v = 1{,}000$:

Wind not critical when $\frac{W_h}{W_v} < 0.61$ (Critical Ratio)

Obtain following information:

Main material req'd = 27 WF 102

$M_u = 893$ k-ft

Critical unbraced length: $l_{crc} = 6'\text{-}0$, $l_{crg} = 6'\text{-}0$

Reactions: $H_u = 44$ kips, $R_u = 92$ kips

Check maximum purlin spacing:

Refer to AISC Spec. Sect. 1.5.1.4.1 and *Manual of Steel Construction,* p. 1-9.

For compact section $12L_c \leqslant 13b_f$ and $\frac{545}{d/A_f}$:

$$13b_f = \frac{13 \times 10.018}{12} = 10.9 \text{ ft}$$

$$\frac{545}{d/A_f} = \frac{545}{3.27 \times 12} = 13.9 \text{ ft}$$

Use purlins spaced 5'-9 o.c., determined by span limitation of roof deck.

Check columns:

$l_{crc} = 6'\text{-}0$

Brace column laterally (20'-0 − 6'-0) = 14'-0 above base.

For 27 WF 102, $S = 266.3$, $A = 30.01$,

$r_x = 10.96$, $r_y = 2.08$ (AISC *Manual,* p. 1-9)

$Z = 304.4$ (AISC *Manual,* p. 2-7)

$P = R_u = 92$ kips

$P_y = 30.01 \times 36 = 1{,}080$ kips

$$\frac{P}{P_y} = \frac{92}{1{,}080} = 0.085 < 0.15 \text{ (O.K.)}$$

$$(2 \times 0.085) + \frac{20 \times 12}{70 \times 10.96} = 0.170 + 0.313 < 1.0 \text{ (O.K.)}$$

(Formula 20)

Check lateral bracing requirement below braced point:

(Since vertical load governs, load factor = 1.85. Multiply normal working stresses by 1.67 in dealing with ultimate loads.)

$$f_a = \frac{92}{30.01} = 3.06 \text{ ksi}$$

$$M_p \text{ for 27 WF 102} = \frac{304.4 \times 36}{12} = 912 \text{ k-ft}$$

$$f_b = \frac{912 \times 12}{266.3} \times \frac{14}{20} = 28.8 \text{ ksi}$$

$$\frac{L}{r_y} = \frac{14 \times 12}{2.08} = 80.8$$

$$F_a = \left[1 - \frac{(l/r)^2}{2C_c^2}\right] F_y$$

(Formula 1; F.S. = 1.0)

$$= \left[1 - 0.5\,\frac{80.8^2}{126.1^2}\right] 36 = 28.6 \text{ ksi}$$

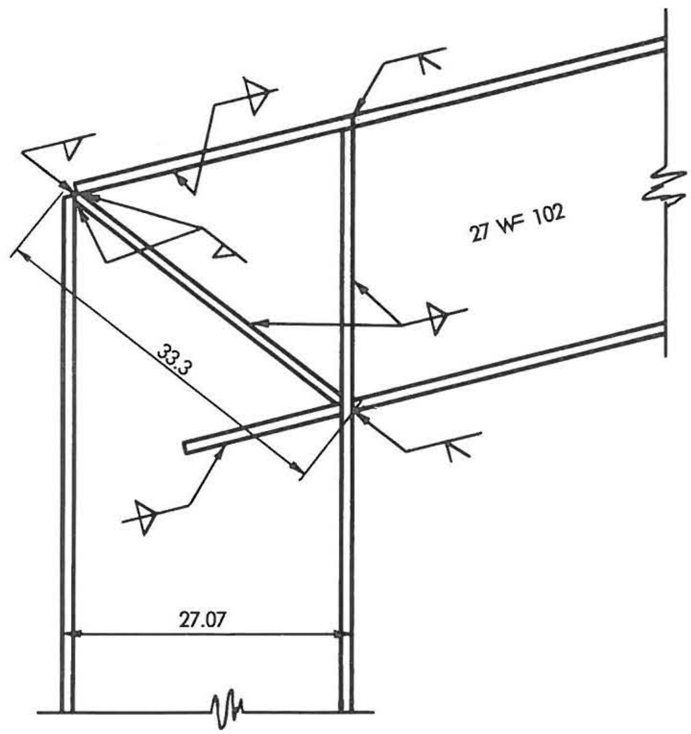
$$F_b = \frac{12{,}000{,}000 \times 1.67}{14 \times 12 \times 3.27} = 36.6 > 36.0;$$

Use 36.0 ksi (Formula 5)

$$\frac{3.06}{28.6} + \frac{28.8}{36.0} = 0.106 + 0.800 = 0.907 \text{ (O.K.)}$$

(Formula 6)

Investigate web thickness at knee: AISC Spec. Sect. 2.4.



$$\text{Req'd } w = \frac{23{,}000 M_p}{A_{bc} F_y}$$

$$= \frac{23\,(912)}{(27.07)\,(27.07)\,(36)} = 0.795 \text{ in.}$$

Actual $w = 0.518 < 0.795$

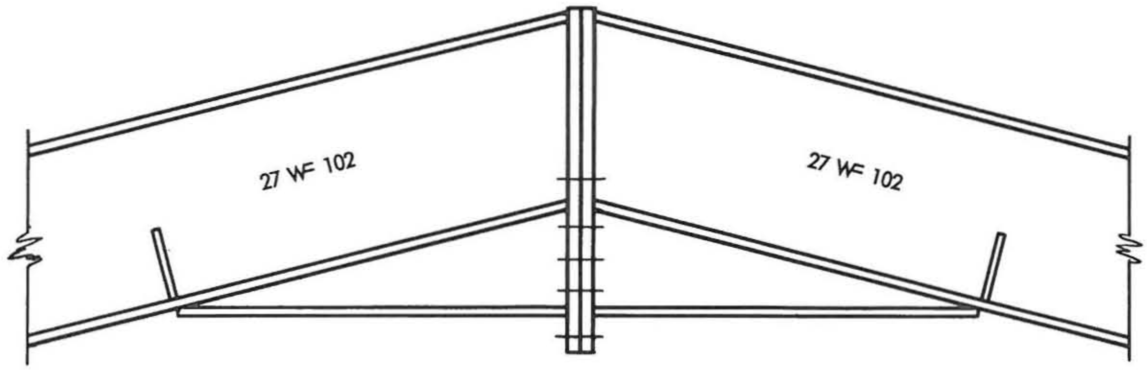
∴ Provide diagonal stiffeners to carry excess web shear:

$$\frac{(0.795 - 0.518)}{0.795} \times \frac{912\,(12)}{27.07} = 141 \text{ kips}$$

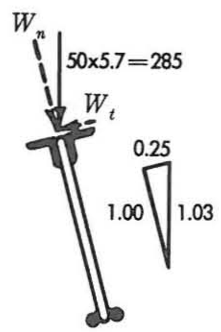
$$\text{Compression in stiffener} = 141 \times \frac{33.3}{27.07} = 174 \text{ kips}$$

$$\text{Req'd. } A = \frac{174}{36} = 4.83 \text{ in.}^2$$

Use 2 Plates 4 × ⅝



Purlin design (using normal design loads and stresses):



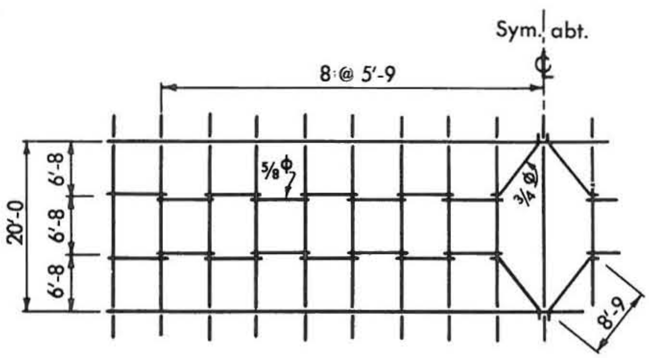
Span: 20′-0

Spacing: 5′-9

$$W_n = \frac{50 \times 5.7}{1.03} = 277 \text{ lbs/ft}$$

Capacity of 12 J 6 open web steel joist is 300 lbs/ft (AISC *Manual*, p. 5-232)

Design Bridging:



Max. tension in two lines of bridging

$$= 0.277 \times \frac{3}{12} \times \frac{20}{3} \times 8.5 = 4.0 \text{ kips}$$

Allowable tension, A36 threaded rod = 14 ksi

$$\text{Req'd area } A = \frac{4.0}{14} = 0.29 \text{ in.}^2$$

Use 5/8″ diam.; Gross area = 0.31 in.²

Tension in diagonal bridging member at

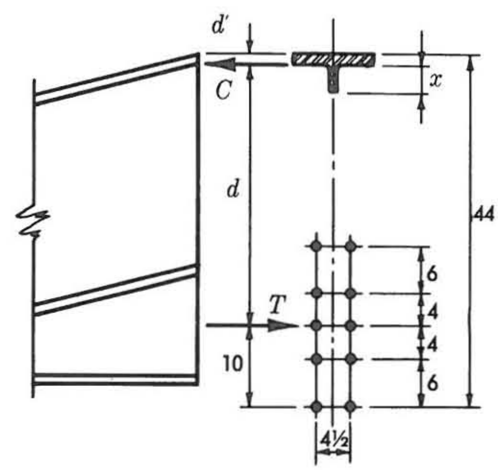
$$\text{ridge} = 4.0 \times \frac{8.75}{5.67} = 6.2 \text{ kips}$$

$$\text{Req'd } A = \frac{6.2 \text{ kips}}{14} = 0.44 \text{ in.}^2$$

Use 3/4″ diam.; Gross area = 0.44 in.²

Design of Ridge Splice:

Moment at ridge:



$$M_u = 92 \times \frac{50}{2} - 44\ (20 + 12.5) = 870 \text{ k-ft}$$

Try 10 — 7/8″ diam. H.T. bolts (Elastic proof load = 36 kips)

$$C = -T = \frac{870 \times 12}{d} = 10 \times 36 = 360 \text{ kips}$$

$$\text{Req'd } d = \frac{870 \times 12}{360} = 29 \text{ in. (minimum)}$$

P_y for top flange =

$10.0 \times 0.827 \times 36.0 \text{ ksi} = 298$ kips

Req'd P_y for web = 360 − 298 = 62 kips

$$x = \frac{62}{0.518 \times 36 \text{ ksi}} = 3.32 \text{ in.}$$

$d' \cong 1.0$ in.

$d \cong 44.0 - 1.0 - 10 \cong 33 > 29$ (O.K.)

Thickness of end plates:

$M = 36 \text{ kips} \times 2.25 = 81 \text{ k-in.}$

$\text{Req'd } Z = \frac{81}{36} = 2.25 \text{ in.}^3$

$\text{Req'd thickness} = \sqrt{\frac{4 \times 2.25}{4}} = 1.5 \text{ in.}$

Use 10 x 1½ Plate

Tie Rod Design:

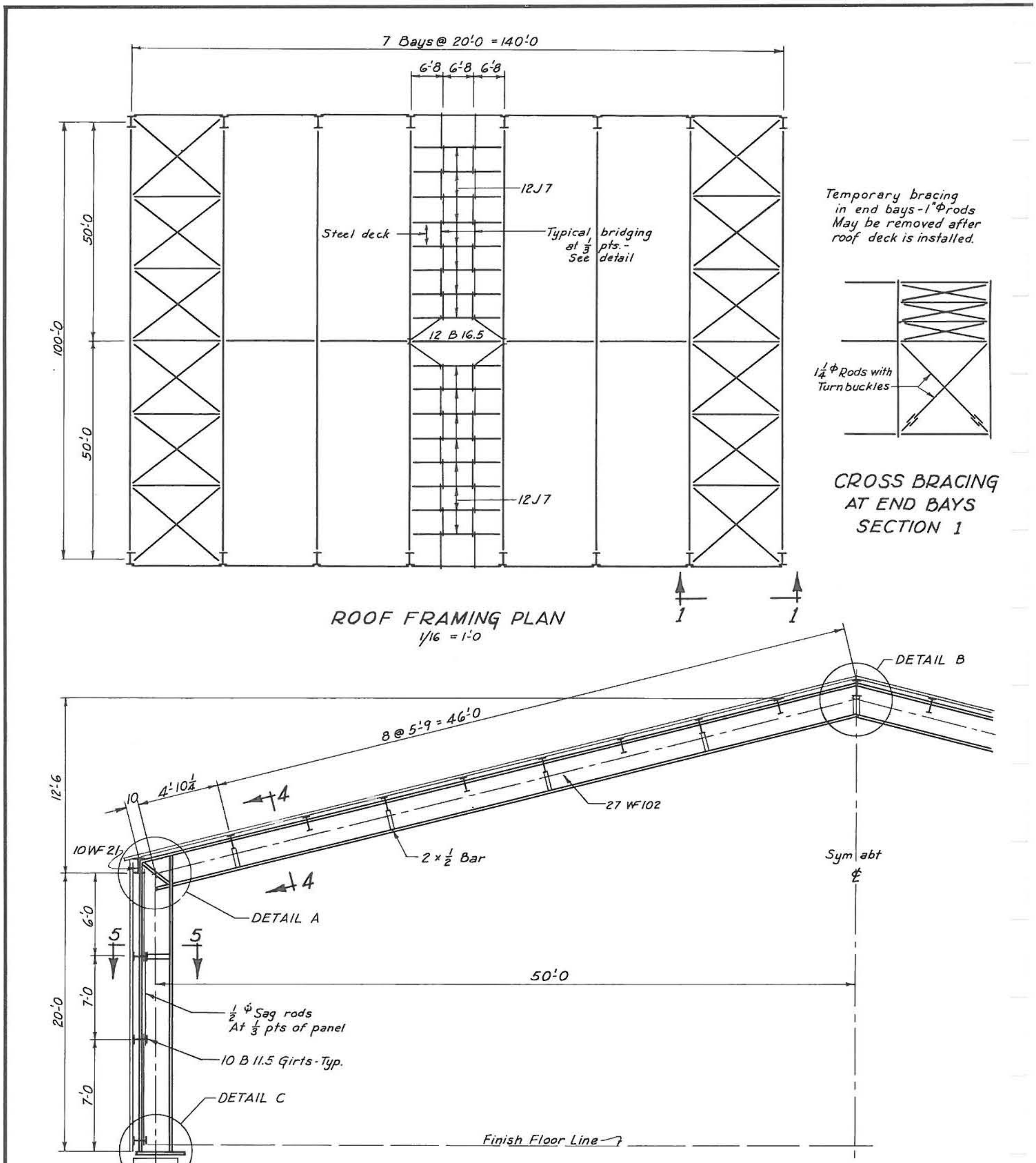
$H_u = 44 \text{ kips}$

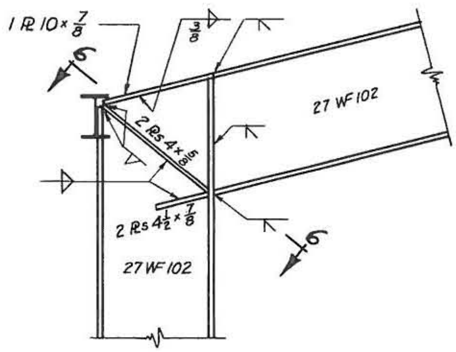
$\text{Req'd } A = \frac{44 \text{ kips}}{36} = 1.22 \text{ in.}^2$

Use 1¼″ diam. upset rod

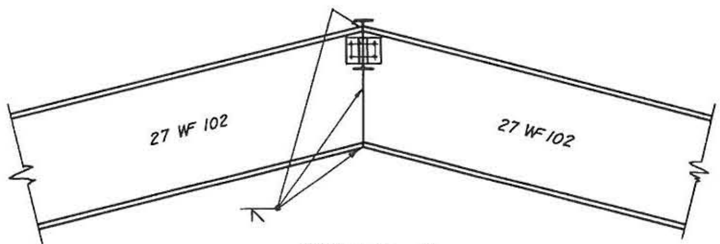
$A = 1.227 \text{ in.}^2$

NOTES

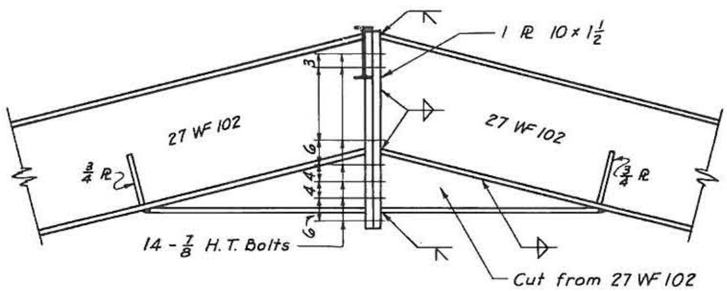

7 Bays @ 20'-0 = 140'-0
6'-8 6'-8 6'-8
50'-0
100'-0
50'-0
12J7
Steel deck
Typical bridging at 1/3 pts.- See detail
12 B 16.5
12J7
Temporary bracing in end bays - 1" Φ rods May be removed after roof deck is installed.
1 1/4 Φ Rods with Turnbuckles
CROSS BRACING AT END BAYS SECTION 1
1
1
ROOF FRAMING PLAN
1/16 = 1'-0
DETAIL B
8 @ 5'-9 = 46'-0
12'-6
10
4'-10 1/4
4
27 WF 102
10 WF 21
2 × 1/2 Bar
Sym abt ℄
4
DETAIL A
6'-0
5
5
50'-0
20'-0
7'-0
1/2 Φ Sag rods At 1/3 pts of panel
7'-0
10 B 11.5 Girts - Typ.
DETAIL C
Finish Floor Line
TRANSVERSE SECTION
3/16 = 1'-0



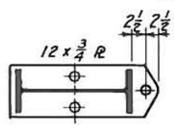
DETAIL A



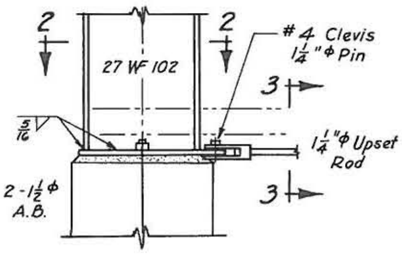
DETAIL B



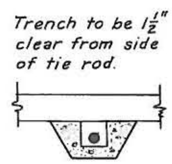
ALTERNATE DETAIL B



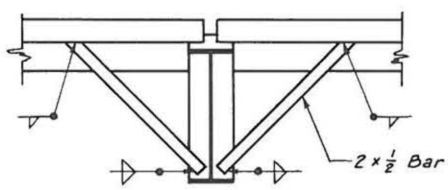
SECTION 2



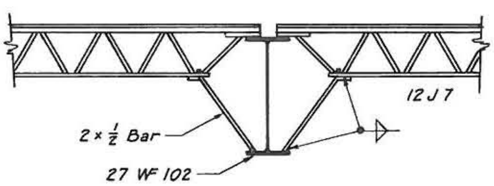
DETAIL C



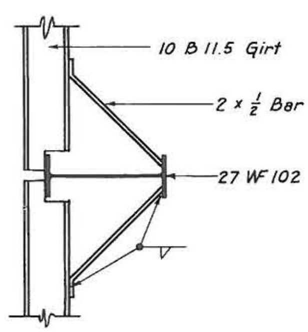
SECTION 3



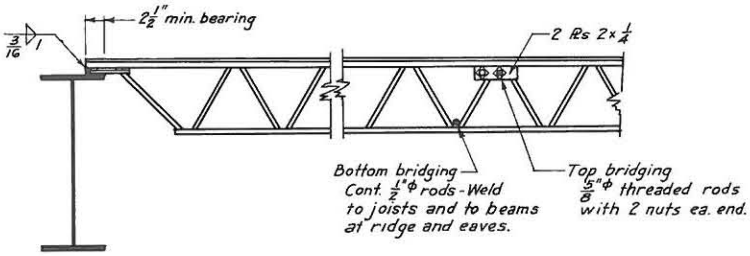
SECTION 6



SECTION 4



SECTION 5



TYPICAL SHORT SPAN JOIST DETAILS

STRUCTURAL DETAILS
DESIGN EXAMPLE NO. 4

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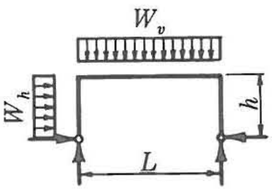
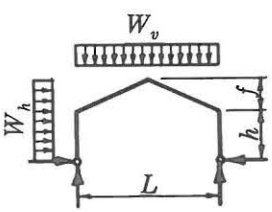
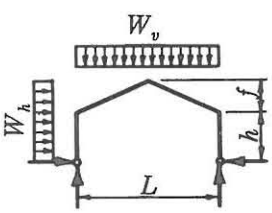
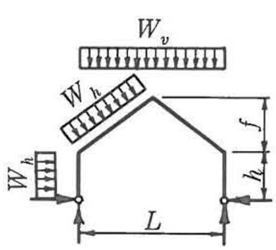
GABLE DESIGN DATA

TABLE 1 50 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	h = 12 ft.						h = 14 ft.					
			M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
		500	144	12	23	14 WF 34	4.2	7.7	144	10	23	14 WF 34	4.2	7.7
.00	.00	1000	289	24	46	18 WF 50	4.7	5.7	289	20	46	18 WF 50	4.6	5.7
		1500	433	36	69	21 WF 68	5.4	5.4	433	30	69	21 WF 68	4.9	5.4
		500	115	9	23	14 WF 30	4.1	7.8	119	8	23	14 WF 30	4.1	7.7
.25	.00	1000	231	19	46	16 WF 45	4.4	5.8	238	17	46	16 WF 45	4.4	5.7
		1500	347	28	69	18 WF 60	4.9	5.6	357	25	69	18 WF 60	4.7	5.4
Critical Ratio														
		500	115	9	23	14 WF 30	4.1	7.8	119	8	23	14 WF 30	4.1	7.7
.25	.75	1000	231	19	46	16 WF 45	4.4	5.8	238	17	46	16 WF 45	4.4	5.7
		1500	347	28	69	18 WF 60	4.9	5.6	357	25	69	18 WF 60	4.7	5.4
Critical Ratio									$W_h/W_v = 0.83$					
		500	115	9	23	14 WF 30	4.1	7.8	**125**	**8**	23	**14 WF 30**	4.1	5.7
.25	1.00	1000	231	19	46	16 WF 45	4.4	5.8	**251**	**17**	46	**16 WF 50**	4.4	4.4
		1500	347	28	69	18 WF 60	4.9	5.6	**377**	**26**	69	**21 WF 62**	4.9	4.9
		500	97	8	23	14 WF 30	4.1	7.8	102	7	23	14 WF 30	4.1	7.6
.50	.00	1000	195	16	46	16 WF 40	4.3	5.6	204	14	46	16 WF 40	4.3	5.4
		1500	293	24	69	18 WF 50	4.7	5.2	307	21	69	18 WF 55	4.6	5.1
Critical Ratio									$W_h/W_v = 0.46$					
		500	97	8	23	14 WF 30	4.1	7.8	**105**	**7**	23	**14 WF 30**	4.1	5.6
.50	.50	1000	195	16	46	16 WF 40	4.3	5.6	**210**	**15**	46	**16 WF 40**	4.3	4.3
		1500	293	24	69	18 WF 50	4.7	5.2	**316**	**22**	69	**18 WF 55**	4.6	4.6
Critical Ratio			$W_h/W_v = 0.52$											
		500	**109**	**9**	23	**14 WF 30**	4.1	5.4	**120**	**8**	23	**14 WF 30**	4.1	5.2
.50	.75	1000	**219**	**18**	46	**16 WF 45**	4.4	4.4	**241**	**17**	46	**16 WF 45**	4.4	4.4
		1500	**328**	**27**	69	**18 WF 55**	4.8	4.6	**362**	**25**	69	**18 WF 60**	4.7	4.7
		500	**122**	**10**	23	**14 WF 30**	4.1	5.0	**137**	**9**	23	**14 WF 30**	4.1	4.8
.50	1.00	1000	**245**	**20**	46	**16 WF 45**	4.4	4.4	**274**	**19**	46	**16 WF 50**	4.4	4.4
		1500	**368**	**30**	69	**21 WF 62**	5.4	4.9	**411**	**29**	69	**21 WF 62**	4.9	4.9
		500	85	7	23	14 WF 30	4.1	7.4	90	6	23	14 WF 30	4.1	7.2
.75	.00	1000	170	14	46	16 WF 36	4.2	4.7	180	12	46	16 WF 36	4.2	4.5
		1500	256	21	69	16 WF 50	4.4	4.4	271	19	69	16 WF 50	4.4	4.4
Critical Ratio			$W_h/W_v = 0.20$						$W_h/W_v = 0.19$					
		500	**118**	**9**	23	**14 WF 30**	4.1	4.5	**129**	**9**	**23**	**14 WF 30**	4.1	4.4
.75	.50	1000	**237**	**19**	46	**16 WF 45**	4.4	4.4	**259**	**18**	**46**	**16 WF 50**	4.4	4.4
		1500	**356**	**29**	69	**18 WF 60**	4.9	4.7	**389**	**27**	**70**	**21 WF 62**	4.9	4.9
		500	**147**	**12**	**25**	**14 WF 34**	4.2	4.3	**162**	**11**	**26**	**14 WF 34**	4.2	4.2
.75	.75	1000	**294**	**24**	**51**	**18 WF 50**	4.7	4.6	**325**	**23**	**52**	**18 WF 55**	4.6	4.6
		1500	**442**	**36**	**77**	**21 WF 68**	5.4	4.9	**488**	**34**	**79**	**21 WF 73**	5.1	5.1
		500	**176**	**14**	**28**	**16 WF 36**	4.2	4.2	**196**	**14**	**29**	**16 WF 40**	4.3	4.3
.75	1.00	1000	**353**	**29**	**56**	**18 WF 60**	4.9	4.7	**392**	**28**	**58**	**21 WF 62**	4.9	4.9
		1500	**529**	**44**	**85**	**24 WF 76**	6.3	5.3	**589**	**42**	**88**	**24 WF 76**	5.5	5.3

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

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GABLE DESIGN DATA

TABLE 1 50 FT. SPAN

h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
144	9	23	14 WF 34	4.2	7.7	144	8	23	14 WF 34	4.2	7.7	144	7	23	14 WF 34	4.2	7.7
289	18	46	18 WF 50	4.6	5.7	289	16	46	18 WF 50	4.6	5.7	289	14	46	18 WF 50	4.6	5.7
433	27	69	21 WF 68	4.9	5.4	433	24	69	21 WF 68	4.9	5.4	433	21	69	21 WF 68	4.9	5.4
121	7	23	14 WF 30	4.1	7.6	123	6	23	14 WF 30	4.1	7.5	125	6	23	14 WF 30	4.1	7.5
243	15	46	16 WF 45	4.4	5.6	247	13	46	16 WF 50	4.4	5.7	251	12	46	16 WF 50	4.4	5.6
365	22	69	18 WF 60	4.7	5.3	371	20	69	21 WF 62	4.9	6.1	376	18	69	21 WF 62	4.9	6.0
$W_h/W_v = 0.69$						$W_h/W_v = 0.59$						$W_h/W_v = 0.51$					
124	7	23	14 WF 30	4.1	5.8	133	7	23	14 WF 30	4.1	5.6	142	7	23	14 WF 34	4.2	5.8
249	15	46	16 WF 50	4.4	4.4	266	14	46	16 WF 50	4.4	4.4	284	14	46	18 WF 50	4.6	4.6
373	23	69	21 WF 62	4.9	4.9	399	22	69	21 WF 62	4.9	4.9	426	21	69	21 WF 62	4.9	4.9
136	8	23	14 WF 30	4.1	5.5	147	8	23	14 WF 34	4.2	5.7	160	10	23	14 WF 34	4.2	5.5
273	17	46	16 WF 50	4.4	4.4	295	17	46	18 WF 50	4.6	4.6	320	20	46	18 WF 55	4.6	4.6
409	25	69	21 WF 62	4.9	4.9	443	26	69	21 WF 68	4.9	4.9	480	31	69	21 WF 73	5.1	5.1
106	6	23	14 WF 30	4.1	7.5	109	6	23	14 WF 30	4.1	7.3	111	5	23	14 WF 30	4.1	7.2
212	13	46	16 WF 40	4.3	5.2	218	12	46	16 WF 45	4.4	5.3	223	11	46	16 WF 45	4.4	5.2
318	19	69	18 WF 55	4.6	4.9	327	18	69	18 WF 55	4.6	4.7	335	16	69	18 WF 60	4.7	4.8
$W_h/W_v = 0.40$						$W_h/W_v = 0.35$						$W_h/W_v = 0.32$					
113	7	23	14 WF 30	4.1	5.4	121	6	23	14 WF 30	4.1	5.3	130	6	23	14 WF 30	4.1	5.1
227	14	46	16 WF 45	4.4	4.4	243	13	46	16 WF 45	4.4	4.4	260	13	46	16 WF 50	4.4	4.4
340	21	69	18 WF 60	4.7	4.7	365	20	69	18 WF 60	4.7	4.7	390	19	69	21 WF 62	4.9	4.9
132	8	23	14 WF 30	4.1	5.0	144	8	23	14 WF 34	4.2	5.1	156	9	23	14 WF 34	4.2	5.0
264	16	46	16 WF 50	4.4	4.4	288	16	46	18 WF 50	4.6	4.6	313	18	46	18 WF 55	4.6	4.6
396	24	69	21 WF 62	4.9	4.9	432	24	69	21 WF 68	4.9	4.9	469	27	69	21 WF 68	4.9	4.9
152	10	23	14 WF 34	4.2	4.9	168	12	24	16 WF 36	4.2	4.7	185	13	24	16 WF 36	4.2	4.5
304	20	46	18 WF 55	4.6	4.6	336	24	48	18 WF 60	4.7	4.7	370	26	49	21 WF 62	4.9	4.9
456	31	69	21 WF 68	4.9	4.9	504	36	72	21 WF 73	5.1	5.1	555	40	74	24 WF 76	5.3	5.3
94	5	23	14 WF 30	4.1	7.0	97	5	23	14 WF 30	4.1	6.9	101	5	23	14 WF 30	4.1	6.7
188	11	46	16 WF 36	4.2	4.3	195	10	46	16 WF 40	4.3	4.6	202	10	46	16 WF 40	4.3	4.4
283	17	69	18 WF 50	4.6	4.6	293	16	69	18 WF 50	4.6	4.6	303	15	69	18 WF 55	4.6	4.6
$W_h/W_v = 0.18$						$W_h/W_v = 0.17$						$W_h/W_v = 0.16$					
140	8	23	14 WF 30	4.1	4.3	151	8	24	14 WF 34	4.2	4.5	162	8	24	14 WF 34	4.2	4.4
281	17	47	18 WF 50	4.6	4.6	303	16	48	18 WF 55	4.6	4.6	325	16	49	18 WF 55	4.6	4.6
422	26	71	21 WF 62	4.9	4.9	455	25	73	21 WF 68	4.9	4.9	488	24	74	21 WF 73	5.1	5.1
178	11	27	16 WF 36	4.2	4.2	193	10	27	16 WF 40	4.3	4.3	210	10	28	16 WF 40	4.3	4.3
356	22	54	18 WF 60	4.7	4.7	387	21	55	21 WF 62	4.9	4.9	420	21	57	21 WF 62	4.9	4.9
534	33	81	24 WF 76	5.3	5.3	581	32	83	24 WF 76	5.3	5.3	630	31	85	24 WF 84	5.5	5.5
216	13	30	16 WF 40	4.3	4.3	237	13	31	16 WF 45	4.4	4.4	258	14	32	16 WF 50	4.4	4.4
432	27	60	21 WF 68	4.9	4.9	474	26	62	21 WF 68	4.9	4.9	516	28	64	24 WF 76	5.3	5.3
649	40	90	24 WF 84	5.5	5.5	711	39	93	24 WF 94	5.6	5.6	775	42	97	27 WF 94	5.9	5.9

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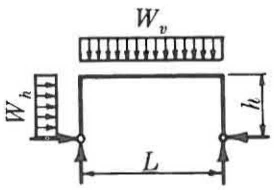
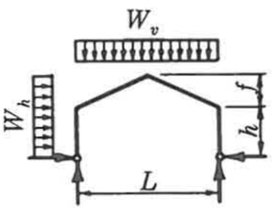
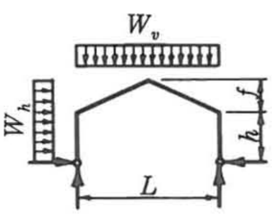
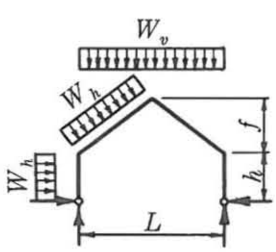
GABLE DESIGN DATA

TABLE 2 60 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	h = 12 ft.						h = 14 ft.					
			M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
.00	.00	500	208	17	27	16 WF 40	4.3	6.6	208	14	27	16 WF 40	4.3	6.6
		1000	416	34	55	21 WF 62	5.4	5.0	416	29	55	21 WF 62	4.9	5.0
		1500	624	52	83	24 WF 84	6.6	5.5	624	44	83	24 WF 84	5.7	5.5
.25	.00	500	160	13	27	14 WF 34	4.2	6.9	166	11	27	16 WF 36	4.2	6.7
		1000	321	26	55	18 WF 55	4.8	5.0	332	23	55	18 WF 55	4.6	4.9
		1500	482	40	83	21 WF 73	5.7	5.1	498	35	83	21 WF 73	5.1	5.1
Critical Ratio														
.25	.75	500	160	13	27	14 WF 34	4.2	6.9	166	11	27	16 WF 36	4.2	6.7
		1000	321	26	55	18 WF 55	4.8	5.0	332	23	55	18 WF 55	4.6	4.9
		1500	482	40	83	21 WF 73	5.7	5.1	498	35	83	21 WF 73	5.1	5.1
Critical Ratio														
.25	1.00	500	160	13	27	14 WF 34	4.2	6.9	166	11	27	16 WF 36	4.2.	6.7
		1000	321	26	55	18 WF 55	4.8	5.0	332	23	55	18 WF 55	4.6	4.9
		1500	482	40	83	21 WF 73	5.7	5.1	498	35	83	21 WF 73	5.1	5.1
.50	.00	500	133	11	27	14 WF 30	4.1	6.5	139	9	27	14 WF 30	4.1	6.4
		1000	266	22	55	16 WF 50	4.4	4.6	279	19	55	18 WF 50	4.6	4.8
		1500	399	33	83	21 WF 62	5.4	4.9	419	29	83	21 WF 62	4.9	4.9
Critical Ratio														
.50	.50	500	133	11	27	14 WF 30	4.1	6.5	139	9	27	14 WF 30	4.1	6.4
		1000	266	22	55	16 WF 50	4.4	4.6	279	19	55	18 WF 50	4.6	4.8
		1500	399	33	83	21 WF 62	5.4	4.9	419	29	83	21 WF 62	4.9	4.9
Critical Ratio			$W_h/W_v = 0.61$						$W_h/W_v = 0.54$					
.50	.75	500	**141**	**11**	27	**14 WF 30**	4.1	4.9	**155**	**11**	27	**14 WF 34**	4.2	5.0
		1000	**283**	**23**	55	**18 WF 50**	4.7	4.6	**310**	**22**	55	**18 WF 55**	4.6	4.6
		1500	**424**	**35**	83	**21 WF 62**	5.4	4.9	**465**	**33**	83	**21 WF 68**	4.9	4.9
.50	1.00	500	**156**	**13**	27	**14 WF 34**	4.2	4.9	**173**	**12**	27	**16 WF 36**	4.2	4.6
		1000	**313**	**26**	55	**18 WF 55**	4.8	4.6	**346**	**24**	55	**18 WF 60**	4.7	4.7
		1500	**469**	**39**	83	**21 WF 68**	5.4	4.9	**520**	**37**	83	**24 WF 76**	5.5	5.3
.75	.00	500	114	9	27	14 WF 30	4.1	6.3	121	8	27	14 WF 30	4.1	6.1
		1000	229	19	55	16 WF 45	4.4	4.4	243	17	55	16 WF 45	4.4	4.4
		1500	343	28	83	18 WF 60	4.9	4.7	365	26	83	18 WF 60	4.7	4.7
Critical Ratio			$W_h/W_v = 0.22$						$W_h/W_v = 0.21$					
.75	.50	500	**154**	**12**	27	**14 WF 34**	4.2	4.3	**168**	**12**	27	**16 WF 36**	4.2	4.2
		1000	**308**	**25**	55	**18 WF 55**	4.8	4.6	**336**	**24**	55	**18 WF 60**	4.7	4.7
		1500	**462**	**38**	83	**21 WF 68**	5.4	4.9	**504**	**36**	83	**21 WF 73**	5.1	5.1
.75	.75	500	**189**	**15**	**30**	**16 WF 36**	4.2	4.2	**208**	**14**	**30**	**16 WF 40**	4.3	4.3
		1000	**378**	**31**	**60**	**21 WF 62**	5.4	4.9	**417**	**29**	**61**	**21 WF 62**	4.9	4.9
		1500	**568**	**47**	**90**	**24 WF 76**	6.3	5.3	**625**	**44**	**92**	**24 WF 84**	5.7	5.5
.75	1.00	500	**225**	**18**	**33**	**16 WF 45**	4.4	4.4	**249**	**17**	**34**	**16 WF 50**	4.4	4.4
		1000	**450**	**37**	**66**	**21 WF 68**	5.4	4.9	**498**	**35**	**68**	**21 WF 73**	5.1	5.1
		1500	**676**	**56**	**99**	**24 WF 94**	6.8	5.6	**748**	**53**	**102**	**24 WF 94**	5.8	5.6

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

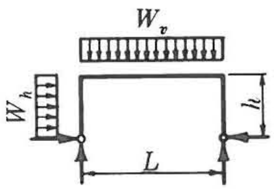
GABLE DESIGN DATA

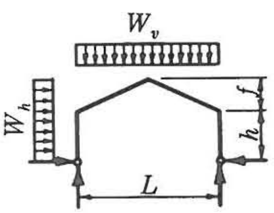
TABLE 2 60 FT. SPAN

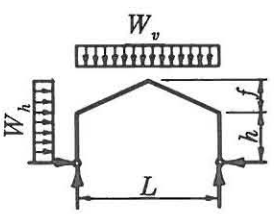
h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
208	13	27	16 WF 40	4.3	6.6	208	11	27	16 WF 40	4.3	6.6	208	10	27	16 WF 40	4.3	6.6
416	26	55	21 WF 62	4.9	5.0	416	23	55	21 WF 62	4.9	5.0	416	20	55	21 WF 62	4.9	5.0
624	39	83	24 WF 84	5.5	5.5	624	34	83	24 WF 84	5.5	5.5	624	31	83	24 WF 84	5.5	5.5
170	10	27	16 WF 36	4.2	6.6	173	9	27	16 WF 36	4.2	6.6	176	8	27	16 WF 36	4.2	6.5
340	21	55	18 WF 60	4.7	5.0	347	19	55	18 WF 60	4.7	4.9	352	17	55	18 WF 60	4.7	4.8
510	31	83	21 WF 73	5.1	5.1	520	28	83	24 WF 76	5.3	5.3	529	26	83	24 WF 76	5.3	5.3
												$W_h/W_v = 0.66$					
170	10	27	16 WF 36	4.2	6.6	173	9	27	16 WF 36	4.2	6.6	**183**	**9**	27	**16 WF 36**	4.2	5.2
340	21	55	18 WF 60	4.7	5.0	347	19	55	18 WF 60	4.7	4.9	**366**	**18**	55	**18 WF 60**	4.7	4.7
510	31	83	21 WF 73	5.1	5.1	520	28	83	24 WF 76	5.3	5.3	**550**	**27**	83	**24 WF 76**	5.3	5.3
$W_h/W_v = 0.88$						$W_h/W_v = 0.76$											
176	**11**	27	**16 WF 36**	4.2	5.3	**188**	**10**	27	**16 WF 36**	4.2	5.1	**201**	**10**	27	**16 WF 40**	4.3	5.3
352	**22**	55	**18 WF 60**	4.7	4.7	**377**	**20**	55	**21 WF 62**	4.9	4.9	**403**	**20**	55	**21 WF 62**	4.9	4.9
529	**33**	83	**24 WF 76**	5.3	5.3	**566**	**31**	83	**24 WF 76**	5.3	5.3	**605**	**30**	83	**24 WF 84**	5.5	5.5
145	9	27	14 WF 34	4.2	6.7	150	8	27	14 WF 34	4.2	6.6	154	7	27	14 WF 34	4.2	6.5
291	18	55	18 WF 50	4.6	4.6	300	16	55	18 WF 50	4.6	4.6	308	15	55	18 WF 55	4.6	4.6
436	27	83	21 WF 68	4.9	4.9	450	25	83	21 WF 68	4.9	4.9	462	23	83	21 WF 68	4.9	4.9
$W_h/W_v = 0.48$						$W_h/W_v = 0.43$						$W_h/W_v = 0.38$					
147	**9**	27	**14 WF 34**	4.2	5.2	**157**	**8**	27	**14 WF 34**	4.2	5.1	**167**	**8**	27	**16 WF 36**	4.2	4.9
295	**18**	55	**18 WF 50**	4.6	4.6	**315**	**17**	55	**18 WF 55**	4.6	4.6	**334**	**16**	55	**18 WF 55**	4.6	4.6
443	**27**	83	**21 WF 68**	4.9	4.9	**472**	**26**	83	**21 WF 68**	4.9	4.9	**502**	**25**	83	**21 WF 73**	5.1	5.1
168	**10**	27	**16 WF 36**	4.2	4.8	**182**	**10**	27	**16 WF 36**	4.2	4.7	**196**	**9**	27	**16 WF 40**	4.3	4.8
337	**21**	55	**18 WF 60**	4.7	4.7	**364**	**20**	55	**18 WF 60**	4.7	4.7	**392**	**19**	55	**21 WF 62**	4.9	4.9
505	**31**	83	**21 WF 73**	5.1	5.1	**546**	**30**	83	**24 WF 76**	5.3	5.3	**588**	**29**	83	**24 WF 76**	5.3	5.3
190	**11**	27	**16 WF 36**	4.2	4.5	**208**	**11**	27	**16 WF 40**	4.3	4.6	**226**	**13**	**28**	**16 WF 45**	4.4	4.6
380	**23**	55	**21 WF 62**	4.9	4.9	**416**	**23**	55	**21 WF 62**	4.9	4.9	**453**	**26**	**56**	**21 WF 68**	4.9	4.9
571	**35**	83	**24 WF 76**	5.3	5.3	**624**	**34**	83	**24 WF 84**	5.5	5.5	**679**	**39**	**84**	**24 WF 94**	5.6	5.6
127	7	27	14 WF 30	4.1	5.9	133	7	27	14 WF 30	4.1	5.8	137	6	27	14 WF 30	4.1	5.7
255	15	55	16 WF 50	4.4	4.4	266	14	55	16 WF 50	4.4	4.4	275	13	55	16 WF 50	4.4	4.4
383	23	83	21 WF 62	4.9	4.9	399	22	83	21 WF 62	4.9	4.9	413	20	83	21 WF 62	4.9	4.9
$W_h/W_v = 0.20$						$W_h/W_v = 0.19$						$W_h/W_v = 0.18$					
181	**11**	**27**	**16 WF 36**	4.2	4.2	**195**	**10**	**28**	**16 WF 40**	4.3	4.3	**208**	**10**	**28**	**16 WF 40**	4.3	4.3
363	**22**	**55**	**18 WF 60**	4.7	4.7	**390**	**21**	**56**	**21 WF 62**	4.9	4.9	**416**	**20**	**57**	**21 WF 62**	4.9	4.9
545	**34**	**83**	**24 WF 76**	5.3	5.3	**585**	**32**	**85**	**24 WF 76**	5.3	5.3	**624**	**31**	**86**	**24 WF 84**	5.5	5.5
227	**14**	**31**	**16 WF 45**	4.4	4.4	**245**	**13**	**32**	**16 WF 45**	4.4	4.4	**264**	**13**	**32**	**16 WF 50**	4.4	4.4
454	**28**	**62**	**21 WF 68**	4.9	4.9	**491**	**27**	**64**	**21 WF 73**	5.1	5.1	**528**	**26**	**65**	**24 WF 76**	5.3	5.3
681	**42**	**94**	**24 WF 94**	5.6	5.6	**736**	**40**	**96**	**24 WF 94**	5.6	5.6	**792**	**39**	**98**	**27 WF 94**	5.9	5.9
273	**17**	**34**	**16 WF 50**	4.4	4.4	**297**	**16**	**35**	**18 WF 50**	4.6	4.6	**321**	**16**	**36**	**18 WF 55**	4.6	4.6
546	**34**	**69**	**24 WF 76**	5.3	5.3	**594**	**33**	**71**	**24 WF 76**	5.3	5.3	**643**	**32**	**73**	**24 WF 84**	5.5	5.5
819	**51**	**104**	**27 WF 94**	5.9	5.9	**891**	**49**	**107**	**27 WF 102**	6.0	6.0	**964**	**48**	**110**	**30 WF 108**	6.0	6.0

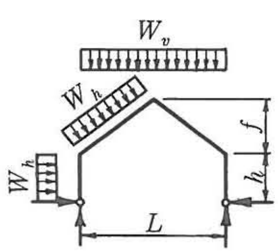
GABLE DESIGN DATA

TABLE 3 70 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	h = 12 ft.						h = 14 ft.					
			M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
.00	.00	500	283	23	32	18 WF 50	4.7	6.3	283	20	32	18 WF 50	4.6	6.3
		1000	566	47	64	24 WF 76	6.3	5.3	566	40	64	24 WF 76	5.5	5.3
		1500	849	70	97	27 WF 102	8.2	6.0	849	60	97	27 WF 102	6.8	6.0
.25	.00	500	211	17	32	16 WF 40	4.3	6.3	218	15	32	16 WF 45	4.4	6.4
		1000	422	35	64	21 WF 62	5.4	4.9	437	31	64	21 WF 68	4.9	4.9
		1500	634	52	97	24 WF 84	6.6	5.5	656	46	97	24 WF 84	5.7	5.5
Critical Ratio														
.25	1.00	500	211	17	32	16 WF 40	4.3	6.3	218	15	32	16 WF 45	4.4	6.4
		1000	422	35	64	21 WF 62	5.4	4.9	437	31	64	21 WF 68	4.9	4.9
		1500	634	52	97	24 WF 84	6.6	5.5	656	46	97	24 WF 84	5.7	5.5
.50	.00	500	171	14	32	16 WF 36	4.2	6.0	181	12	32	16 WF 36	4.2	5.9
		1000	343	28	64	18 WF 60	4.9	4.7	362	25	64	18 WF 60	4.7	4.7
		1500	515	42	97	21 WF 73	5.7	5.1	543	38	97	24 WF 76	5.5	5.3
Critical Ratio														
.50	.50	500	171	14	32	16 WF 36	4.2	6.0	181	12	32	16 WF 36	4.2	5.9
		1000	343	28	64	18 WF 60	4.9	4.7	362	25	64	18 WF 60	4.7	4.7
		1500	515	42	97	21 WF 73	5.7	5.1	543	38	97	24 WF 76	5.5	5.3
Critical Ratio			W_h/W_v = 0.68						W_h/W_v = 0.61					
.50	.75	500	**176**	**14**	32	**16 WF 36**	4.2	4.7	**192**	**13**	32	**16 WF 40**	4.3	4.8
		1000	**353**	**29**	64	**18 WF 60**	4.9	4.7	**385**	**27**	64	**21 WF 62**	4.9	4.9
		1500	**529**	**44**	97	**24 WF 76**	6.3	5.3	**578**	**41**	97	**24 WF 76**	5.5	5.3
.50	1.00	500	**193**	**16**	32	**16 WF 40**	4.3	4.7	**213**	**15**	32	**16 WF 40**	4.3	4.6
		1000	**386**	**32**	64	**21 WF 62**	5.4	4.9	**426**	**30**	64	**21 WF 62**	4.9	4.9
		1500	**580**	**48**	97	**24 WF 76**	6.3	5.3	**639**	**45**	97	**24 WF 84**	5.7	5.5
.75	.00	500	146	12	32	14 WF 34	4.2	5.9	155	11	32	14 WF 34	4.2	5.7
		1000	292	24	64	18 WF 50	4.7	4.6	311	22	64	18 WF 55	4.6	4.6
		1500	438	36	97	21 WF 68	5.4	4.9	467	33	97	21 WF 68	4.9	4.9
Critical Ratio			W_h/W_v = 0.23						W_h/W_v = 0.22					
.75	.50	500	**192**	**16**	32	**16 WF 40**	4.3	4.3	**209**	**14**	32	**16 WF 40**	4.3	4.3
		1000	**384**	**32**	64	**21 WF 62**	5.4	4.9	**419**	**29**	64	**21 WF 62**	4.9	4.9
		1500	**576**	**48**	97	**24 WF 76**	6.3	5.3	**629**	**44**	97	**24 WF 84**	5.7	5.5
.75	.75	500	**234**	**19**	34	**16 WF 45**	4.4	4.4	**257**	**18**	35	**16 WF 50**	4.4	4.4
		1000	**469**	**39**	69	**21 WF 68**	5.4	4.9	**515**	**36**	70	**21 WF 73**	5.1	5.1
		1500	**704**	**58**	103	**24 WF 94**	6.8	5.6	**773**	**55**	105	**27 WF 94**	6.6	5.9
.75	1.00	500	**277**	**23**	37	**16 WF 50**	4.4	4.4	**306**	**21**	38	**18 WF 55**	4.6	4.6
		1000	**555**	**46**	75	**24 WF 76**	6.3	5.3	**613**	**43**	77	**24 WF 84**	5.7	5.5
		1500	**833**	**69**	113	**24 WF 100**	12.0	7.6	**920**	**65**	116	**30 WF 108**	6.7	6.0

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

TABLE 3 70 FT. SPAN

h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
283	17	32	18 WF 50	4.6	6.3	283	15	32	18 WF 50	4.6	6.3	283	14	32	18 WF 50	4.6	6.3
566	35	64	24 WF 76	5.3	5.3	566	31	64	24 WF 76	5.3	5.3	566	28	64	24 WF 76	5.3	5.3
849	53	97	27 WF 102	6.1	6.0	849	47	97	27 WF 102	6.0	6.0	849	42	97	27 WF 102	6.0	6.0
225	14	32	16 WF 45	4.4	6.3	230	12	32	16 WF 45	4.4	6.2	234	11	32	16 WF 45	4.4	6.2
450	28	64	21 WF 68	4.9	4.9	460	25	64	21 WF 68	4.9	4.9	468	23	64	21 WF 68	4.9	4.9
675	42	97	24 WF 94	5.6	5.6	690	38	97	24 WF 94	5.6	5.6	703	35	97	24 WF 94	5.6	5.6
									$W_h/W_v = 0.92$						$W_h/W_v = 0.81$		
225	14	32	16 WF 45	4.4	6.3	**235**	**13**	32	**16 WF 45**	4.4	5.1	**249**	**12**	32	**16 WF 50**	4.4	5.1
450	28	64	21 WF 68	4.9	4.9	**471**	**26**	64	**21 WF 68**	4.9	4.9	**499**	**24**	64	**21 WF 73**	5.1	5.1
675	42	97	24 WF 94	5.6	5.6	**706**	**39**	97	**24 WF 94**	5.6	5.6	**749**	**37**	97	**24 WF 94**	5.6	5.6
189	11	32	16 WF 36	4.2	5.8	196	10	32	16 WF 40	4.3	6.0	201	10	32	16 WF 40	4.3	6.0
378	23	64	21 WF 62	4.9	4.9	392	21	64	21 WF 62	4.9	4.9	403	20	64	21 WF 62	4.9	4.9
567	35	97	24 WF 76	5.3	5.3	588	32	97	24 WF 76	5.3	5.3	605	30	97	24 WF 84	5.5	5.5
									$W_h/W_v = 0.49$						$W_h/W_v = 0.45$		
189	11	32	16 WF 36	4.2	5.8	**197**	**10**	32	**16 WF 40**	4.3	4.9	**208**	**10**	32	**16 WF 40**	4.3	4.8
378	23	64	21 WF 62	4.9	4.9	**394**	**21**	64	**21 WF 62**	4.9	4.9	**417**	**20**	64	**21 WF 62**	4.9	4.9
567	35	97	24 WF 76	5.3	5.3	**591**	**32**	97	**24 WF 76**	5.3	5.3	**626**	**31**	97	**24 WF 84**	5.5	5.5
			$W_h/W_v = 0.55$														
208	**13**	32	**16 WF 40**	4.3	4.7	**224**	**12**	32	**16 WF 45**	4.4	4.7	**239**	**11**	32	**16 WF 45**	4.4	4.6
417	**26**	64	**21 WF 62**	4.9	4.9	**448**	**24**	64	**21 WF 68**	4.9	4.9	**479**	**23**	64	**21 WF 73**	5.1	5.1
625	**39**	97	**24 WF 84**	5.5	5.5	**672**	**37**	97	**24 WF 94**	5.6	5.6	**719**	**35**	97	**24 WF 94**	5.6	5.6
232	**14**	32	**16 WF 45**	4.4	4.6	**252**	**14**	32	**16 WF 50**	4.4	4.6	**272**	**13**	32	**16 WF 50**	4.4	4.5
465	**29**	64	**21 WF 68**	4.9	4.9	**505**	**28**	64	**21 WF 73**	5.1	5.1	**545**	**27**	64	**24 WF 76**	5.3	5.3
698	**43**	97	**24 WF 94**	5.6	5.6	**757**	**42**	97	**24 WF 94**	5.6	5.6	**818**	**40**	97	**27 WF 94**	5.9	5.9
164	10	32	16 WF 36	4.2	5.5	171	9	32	16 WF 36	4.2	5.4	178	8	32	16 WF 36	4.2	5.3
328	20	64	18 WF 55	4.6	4.6	343	19	64	18 WF 60	4.7	4.7	356	17	64	18 WF 60	4.7	4.7
493	30	97	21 WF 73	5.1	5.1	515	28	97	21 WF 73	5.1	5.1	535	26	97	24 WF 76	5.3	5.3
			$W_h/W_v = 0.21$						$W_h/W_v = 0.20$						$W_h/W_v = 0.19$		
226	**14**	32	**16 WF 45**	4.4	4.4	**242**	**13**	**32**	**16 WF 45**	4.4	4.4	**257**	**12**	**32**	**16 WF 50**	4.4	4.4
452	**28**	64	**21 WF 68**	4.9	4.9	**484**	**26**	**64**	**21 WF 73**	5.1	5.1	**515**	**25**	**65**	**21 WF 73**	5.1	5.1
679	**42**	97	**24 WF 94**	5.6	5.6	**726**	**40**	**97**	**24 WF 94**	5.6	5.6	**773**	**38**	**98**	**27 WF 94**	5.9	5.9
280	**17**	**35**	**18 WF 50**	4.6	4.6	**301**	**16**	**36**	**18 WF 50**	4.6	4.6	**323**	**16**	**37**	**18 WF 55**	4.6	4.6
560	**35**	**71**	**24 WF 76**	5.3	5.3	**603**	**33**	**72**	**24 WF 84**	5.5	5.5	**647**	**32**	**74**	**24 WF 84**	5.5	5.5
840	**52**	**107**	**27 WF 102**	6.1	6.0	**905**	**50**	**109**	**27 WF 102**	6.0	6.0	**970**	**48**	**111**	**30 WF 108**	6.0	6.0
334	**20**	**39**	**18 WF 55**	4.6	4.6	**362**	**20**	**40**	**18 WF 60**	4.7	4.7	**390**	**19**	**41**	**21 WF 62**	4.9	4.9
669	**41**	**79**	**24 WF 84**	5.5	5.5	**725**	**40**	**80**	**24 WF 94**	5.6	5.6	**780**	**39**	**82**	**27 WF 94**	5.9	5.9
1004	**62**	**118**	**30 WF 108**	6.0	6.0	**1087**	**60**	**121**	**30 WF 116**	6.1	6.1	**1171**	**58**	**123**	**30 WF 124**	6.3	6.3

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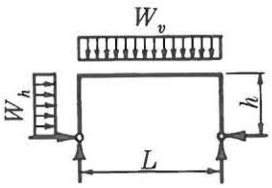
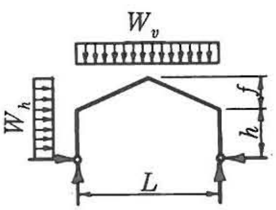
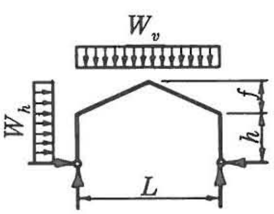
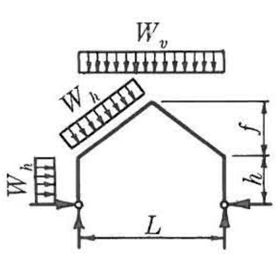
GABLE DESIGN DATA

TABLE 4 80 FT. SPAN









			h = 12 ft.						h = 14 ft.					
$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
		500	369	30	37	21 WF 62	5.4	6.4	369	26	37	21 WF 62	4.9	6.4
.00	.00	1000	739	61	74	24 WF 94	6.8	5.6	739	52	74	24 WF 94	5.8	5.6
		1500	1109	92	111	30 WF 116	8.5	6.1	1109	79	111	30 WF 116	7.1	6.1
		500	267	22	37	16 WF 50	4.4	5.9	277	19	37	16 WF 50	4.4	5.8
.25	.00	1000	534	44	74	24 WF 76	6.3	5.3	555	39	74	24 WF 76	5.5	5.3
		1500	801	66	111	27 WF 94	7.8	5.9	832	59	111	27 WF 94	6.6	5.9
Critical Ratio														
		500	267	22	37	16 WF 50	4.4	5.9	277	19	37	16 WF 50	4.4	5.8
.25	1.00	1000	534	44	74	24 WF 76	6.3	5.3	555	39	74	24 WF 76	5.5	5.3
		1500	801	66	111	27 WF 94	7.8	5.9	832	59	111	27 WF 94	6.6	5.9
		500	213	17	37	16 WF 40	4.3	5.8	226	16	37	16 WF 45	4.4	5.8
.50	.00	1000	426	35	74	21 WF 62	5.4	4.9	452	32	74	21 WF 68	4.9	4.9
		1500	640	53	111	24 WF 84	6.6	5.5	678	48	111	24 WF 94	5.8	5.6
Critical Ratio			$W_h/W_v = 0.75$						$W_h/W_v = 0.67$					
		500	**214**	**17**	37	**16 WF 40**	4.3	4.7	**233**	**16**	37	**16 WF 45**	4.4	4.7
.50	.75	1000	**428**	**35**	74	**21 WF 62**	5.4	4.9	**466**	**33**	74	**21 WF 68**	4.9	4.9
		1500	**642**	**53**	111	**24 WF 84**	6.6	5.5	**700**	**50**	111	**24 WF 94**	5.8	5.6
		500	**232**	**19**	37	**16 WF 45**	4.4	4.6	**255**	**18**	37	**16 WF 50**	4.4	4.5
.50	1.00	1000	**465**	**38**	74	**21 WF 68**	5.4	4.9	**511**	**36**	74	**21 WF 73**	5.1	5.1
		1500	**698**	**58**	111	**24 WF 94**	6.8	5.6	**767**	**54**	111	**27 WF 94**	6.6	5.9
		500	179	14	37	16 WF 36	4.2	5.3	192	13	37	16 WF 40	4.3	5.5
.75	.00	1000	359	29	74	18 WF 60	4.9	4.7	384	27	74	21 WF 62	4.9	4.9
		1500	538	44	111	24 WF 76	6.3	5.3	577	41	111	24 WF 76	5.5	5.3
Critical Ratio			$W_h/W_v = 0.24$						$W_h/W_v = 0.23$					
		500	**232**	**19**	37	**16 WF 45**	4.4	4.4	**253**	**18**	37	**16 WF 50**	4.4	4.4
.75	.50	1000	**465**	**38**	74	**21 WF 68**	5.4	4.9	**507**	**36**	74	**21 WF 73**	5.1	5.1
		1500	**697**	**58**	111	**24 WF 94**	6.8	5.6	**761**	**54**	111	**27 WF 94**	6.6	5.9
		500	**282**	**23**	**39**	**18 WF 50**	4.7	4.6	**310**	**22**	**39**	**18 WF 55**	4.6	4.6
.75	.75	1000	**565**	**47**	**78**	**24 WF 76**	6.3	5.3	**620**	**44**	**79**	**24 WF 84**	5.7	5.5
		1500	**848**	**70**	**117**	**27 WF 102**	8.2	6.0	**931**	**66**	**118**	**30 WF 108**	6.7	6.0
		500	**333**	**27**	**42**	**18 WF 55**	4.8	4.6	**367**	**26**	**43**	**21 WF 62**	4.9	4.9
.75	1.00	1000	**667**	**55**	**85**	**24 WF 84**	6.6	5.5	**735**	**52**	**86**	**24 WF 94**	5.8	5.6
		1500	**1000**	**83**	**128**	**30 WF 108**	8.0	6.0	**1103**	**78**	**130**	**30 WF 116**	7.1	6.1

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

TABLE 4 80 FT. SPAN

h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
369	23	37	21 WF 62	4.9	6.4	369	20	37	21 WF 62	4.9	6.4	369	18	37	21 WF 62	4.9	6.4
739	46	74	24 WF 94	5.6	5.6	739	41	74	24 WF 94	5.6	5.6	739	36	74	24 WF 94	5.6	5.6
1109	69	111	30 WF 116	6.3	6.1	1109	61	111	30 WF 116	6.1	6.1	1109	55	111	30 WF 116	6.1	6.1
286	17	37	18 WF 50	4.6	6.1	293	16	37	18 WF 50	4.6	6.0	299	14	37	18 WF 50	4.6	6.0
572	35	74	24 WF 76	5.3	5.3	586	32	74	24 WF 76	5.3	5.3	598	29	74	24 WF 76	5.3	5.3
858	53	111	27 WF 102	6.1	6.0	879	48	111	27 WF 102	6.0	6.0	897	44	111	27 WF 102	6.0	6.0
												$W_h/W_v = 0.96$					
286	17	37	18 WF 50	4.6	6.1	293	16	37	18 WF 50	4.6	6.0	**303**	**15**	**37**	**18 WF 55**	4.6	5.2
572	35	74	24 WF 76	5.3	5.3	586	32	74	24 WF 76	5.3	5.3	**606**	**30**	**74**	**24 WF 84**	5.5	5.5
858	53	111	27 WF 102	6.1	6.0	879	48	111	27 WF 102	6.0	6.0	**909**	**45**	**111**	**27 WF 102**	6.0	6.0
236	14	37	16 WF 45	4.4	5.7	245	13	37	16 WF 45	4.4	5.6	253	12	37	16 WF 50	4.4	5.6
473	29	74	21 WF 68	4.9	4.9	491	27	74	21 WF 73	5.1	5.1	507	25	74	21 WF 73	5.1	5.1
710	44	111	24 WF 94	5.6	5.6	737	40	111	24 WF 94	5.6	5.6	761	38	111	27 WF 94	5.9	5.9
$W_h/W_v = 0.61$						$W_h/W_v = 0.55$						$W_h/W_v = 0.51$					
251	**15**	37	**16 WF 50**	4.4	4.6	**269**	**14**	37	**16 WF 50**	4.4	4.6	**287**	**14**	37	**18 WF 50**	4.6	4.7
503	**31**	74	**21 WF 73**	5.1	5.1	**539**	**29**	74	**24 WF 76**	5.3	5.3	**575**	**28**	74	**24 WF 76**	5.3	5.3
755	**47**	111	**24 WF 94**	5.6	5.6	**809**	**44**	111	**27 WF 94**	5.9	5.9	**863**	**43**	111	**27 WF 102**	6.0	6.0
278	**17**	37	**18 WF 50**	4.6	4.7	**300**	**16**	37	**18 WF 50**	4.6	4.6	**323**	**16**	37	**18 WF 55**	4.6	4.6
556	**34**	74	**24 WF 76**	5.3	5.3	**601**	**33**	74	**24 WF 84**	5.5	5.5	**646**	**32**	74	**24 WF 84**	5.5	5.5
835	**52**	111	**27 WF 102**	6.1	6.0	**902**	**50**	111	**27 WF 102**	6.0	6.0	**970**	**48**	111	**30 WF 108**	6.0	6.0
203	12	37	16 WF 40	4.3	5.4	213	11	37	16 WF 40	4.3	5.2	222	11	37	16 WF 45	4.4	5.3
407	25	74	21 WF 62	4.9	4.9	426	23	74	21 WF 62	4.9	4.9	444	22	74	21 WF 68	4.9	4.9
611	38	111	24 WF 84	5.5	5.5	640	35	111	24 WF 84	5.5	5.5	666	33	111	24 WF 84	5.5	5.5
$W_h/W_v = 0.22$						$W_h/W_v = 0.21$						$W_h/W_v = 0.20$					
273	**17**	37	**16 WF 50**	4.4	4.4	**292**	**16**	37	**18 WF 50**	4.6	4.6	**311**	**15**	37	**18 WF 55**	4.6	4.6
547	**34**	74	**24 WF 76**	5.3	5.3	**585**	**32**	74	**24 WF 76**	5.3	5.3	**622**	**31**	74	**24 WF 84**	5.5	5.5
821	**51**	111	**27 WF 94**	5.9	5.9	**878**	**48**	111	**27 WF 102**	6.0	6.0	**933**	**46**	111	**30 WF 108**	6.0	6.0
336	**21**	**40**	**18 WF 60**	4.7	4.7	**362**	**20**	**40**	**18 WF 60**	4.7	4.7	**387**	**19**	**41**	**21 WF 62**	4.9	4.9
673	**42**	**80**	**24 WF 94**	5.6	5.6	**724**	**40**	**81**	**24 WF 94**	5.6	5.6	**774**	**38**	**82**	**27 WF 94**	5.9	5.9
1010	**63**	**120**	**30 WF 108**	6.0	6.0	**1087**	**60**	**122**	**30 WF 116**	6.1	6.1	**1161**	**58**	**124**	**30 WF 124**	6.3	6.3
400	**25**	**44**	**21 WF 62**	4.9	4.9	**432**	**24**	**45**	**21 WF 68**	4.9	4.9	**464**	**23**	**45**	**21 WF 68**	4.9	4.9
801	**50**	**88**	**27 WF 94**	5.9	5.9	**865**	**48**	**90**	**27 WF 102**	6.0	6.0	**929**	**46**	**91**	**30 WF 108**	6.0	6.0
1201	**75**	**132**	**30 WF 124**	6.5	6.3	**1298**	**72**	**135**	**33 WF 130**	6.6	6.6	**1393**	**69**	**137**	**33 WF 130**	6.6	6.6

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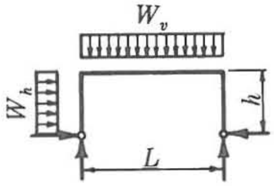
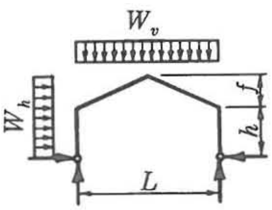
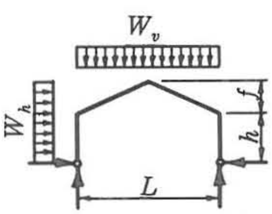
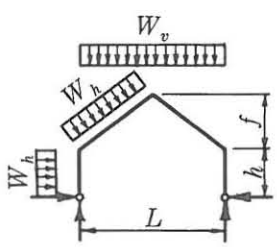
GABLE DESIGN DATA

TABLE 5 90 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	h = 12 ft. M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	h = 14 ft. M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
.00	.00	500	468	39	41	21 WF 68	5.4	5.8	468	33	41	21 WF 68	4.9	5.8
		1000	936	78	83	30 WF 108	8.0	6.0	936	66	83	30 WF 108	6.7	6.0
		1500	1404	117	124	33 WF 141	11.2	6.8	1404	100	124	33 WF 141	8.8	6.8
.25	.00	500	327	27	41	18 WF 55	4.8	5.9	341	24	41	18 WF 60	4.7	5.9
		1000	654	54	83	24 WF 84	6.6	5.5	682	48	83	24 WF 94	5.8	5.6
		1500	982	81	124	30 WF 108	8.0	6.0	1023	73	124	30 WF 108	6.7	6.0
.50	.00	500	257	21	41	16 WF 50	4.4	5.6	273	19	41	16 WF 50	4.4	5.4
		1000	515	42	83	21 WF 73	5.7	5.1	547	39	83	24 WF 76	5.5	5.3
		1500	773	64	124	27 WF 94	7.8	5.9	821	58	124	27 WF 94	6.6	5.9
Critical Ratio									W_h/W_v = 0.73					
.50	.75	500	257	21	41	16 WF 50	4.4	5.6	**276**	**19**	41	**16 WF 50**	4.4	4.5
		1000	515	42	83	21 WF 73	5.7	5.1	**553**	**39**	83	**24 WF 76**	5.5	5.3
		1500	773	64	124	27 WF 94	7.8	5.9	**829**	**59**	124	**27 WF 94**	6.6	5.9
Critical Ratio			W_h/W_v = 0.80											
.50	1.00	500	**274**	**22**	41	**16 WF 50**	4.4	4.4	**301**	**21**	41	**18 WF 50**	4.6	4.6
		1000	**549**	**45**	83	**24 WF 76**	6.3	5.3	**602**	**43**	83	**24 WF 84**	5.7	5.5
		1500	**824**	**68**	124	**27 WF 94**	7.8	5.9	**904**	**64**	124	**27 WF 102**	6.8	6.0
.75	.00	500	214	17	41	16 WF 40	4.3	5.2	231	16	41	16 WF 45	4.4	5.2
		1000	429	35	83	21 WF 62	5.4	4.9	462	33	83	21 WF 68	4.9	4.9
		1500	644	53	124	24 WF 84	6.6	5.5	693	49	124	24 WF 94	5.8	5.6
Critical Ratio			W_h/W_v = 0.24						W_h/W_v = 0.23					
.75	.50	500	**275**	**22**	41	**16 WF 50**	4.4	4.4	**300**	**21**	41	**18 WF 50**	4.6	4.6
		1000	**550**	**45**	83	**24 WF 76**	6.3	5.3	**601**	**42**	83	**24 WF 84**	5.7	5.5
		1500	**825**	**68**	124	**27 WF 94**	7.8	5.9	**901**	**64**	124	**27 WF 102**	6.8	6.0
.75	.75	500	**333**	**27**	**43**	**18 WF 55**	4.8	4.6	**365**	**26**	**44**	**18 WF 60**	4.7	4.7
		1000	**666**	**55**	**87**	**24 WF 84**	6.6	5.5	**731**	**52**	**88**	**24 WF 94**	5.8	5.6
		1500	**999**	**83**	**130**	**30 WF 108**	8.0	6.0	**1097**	**78**	**132**	**30 WF 116**	7.1	6.1
.75	1.00	500	**392**	**32**	**47**	**21 WF 62**	5.4	4.9	**432**	**30**	**48**	**21 WF 68**	4.9	4.9
		1000	**784**	**65**	**95**	**27 WF 94**	7.8	5.9	**864**	**61**	**96**	**27 WF 102**	6.8	6.0
		1500	**1176**	**98**	**142**	**30 WF 124**	9.0	6.3	**1296**	**92**	**144**	**33 WF 130**	8.3	6.6

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

TABLE 5 90 FT. SPAN

h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
468	29	41	21 WF 68	4.9	5.8	468	26	41	21 WF 68	4.9	5.8	468	23	41	21 WF 68	4.9	5.8
936	58	83	30 WF 108	6.0	6.0	936	52	83	30 WF 108	6.0	6.0	936	46	83	30 WF 108	6.0	6.0
1404	87	124	33 WF 141	7.6	6.8	1404	78	124	33 WF 141	6.9	6.8	1404	70	124	33 WF 141	6.8	6.8
352	22	41	18 WF 60	4.7	5.8	362	20	41	18 WF 60	4.7	5.8	370	18	41	21 WF 62	4.9	6.2
705	44	83	24 WF 94	5.6	5.6	724	40	83	24 WF 94	5.6	5.6	740	37	83	24 WF 94	5.6	5.6
1057	66	124	30 WF 116	6.3	6.1	1086	60	124	30 WF 116	6.1	6.1	1110	55	124	30 WF 116	6.1	6.1
287	17	41	18 WF 50	4.6	5.7	299	16	41	18 WF 50	4.6	5.6	310	15	41	18 WF 55	4.6	5.6
575	35	83	24 WF 76	5.3	5.3	599	33	83	24 WF 76	5.3	5.3	620	31	83	24 WF 84	5.5	5.5
863	53	124	27 WF 102	6.1	6.0	899	49	124	27 WF 102	6.0	6.0	930	46	124	30 WF 108	6.0	6.0
W_h/W_v = 0.66						W_h/W_v = 0.61						W_h/W_v = 0.56					
298	18	41	18 WF 50	4.6	4.7	318	17	41	18 WF 55	4.6	4.7	339	16	41	18 WF 60	4.7	4.7
596	37	83	24 WF 76	5.3	5.3	637	35	83	24 WF 84	5.5	5.5	678	33	83	24 WF 94	5.6	5.6
894	55	124	27 WF 102	6.1	6.0	956	53	124	30 WF 108	6.0	6.0	1017	50	124	30 WF 108	6.0	6.0
327	20	41	18 WF 55	4.6	4.6	352	19	41	18 WF 60	4.7	4.7	377	18	41	21 WF 62	4.9	4.9
654	40	83	24 WF 84	5.5	5.5	704	39	83	24 WF 94	5.6	5.6	755	37	83	24 WF 94	5.6	5.6
981	61	124	30 WF 108	6.0	6.0	1057	58	124	30 WF 116	6.1	6.1	1132	56	124	30 WF 124	6.3	6.3
245	15	41	16 WF 45	4.4	5.1	257	14	41	16 WF 50	4.4	5.1	268	13	41	16 WF 50	4.4	5.0
490	30	83	21 WF 73	5.1	5.1	515	28	83	21 WF 73	5.1	5.1	537	26	83	24 WF 76	5.3	5.3
735	45	124	24 WF 94	5.6	5.6	773	42	124	27 WF 94	5.9	5.9	806	40	124	27 WF 94	5.9	5.9
W_h/W_v = 0.23						W_h/W_v = 0.22						W_h/W_v = 0.21					
324	20	41	18 WF 55	4.6	4.6	346	19	41	18 WF 60	4.7	4.7	368	18	41	21 WF 62	4.9	4.9
648	40	83	24 WF 84	5.5	5.5	693	38	83	24 WF 94	5.6	5.6	736	36	83	24 WF 94	5.6	5.6
972	60	124	30 WF 108	6.0	6.0	1040	57	124	30 WF 116	6.1	6.1	1104	55	124	30 WF 116	6.1	6.1
396	24	44	21 WF 62	4.9	4.9	426	23	45	21 WF 62	4.9	4.9	455	22	45	21 WF 68	4.9	4.9
793	49	89	27 WF 94	5.9	5.9	852	47	90	27 WF 102	6.0	6.0	910	45	91	27 WF 102	6.0	6.0
1190	74	133	30 WF 124	6.5	6.3	1278	71	135	33 WF 130	6.6	6.6	1365	68	137	33 WF 130	6.6	6.6
470	29	49	21 WF 68	4.9	4.9	507	28	49	21 WF 73	5.1	5.1	543	27	51	24 WF 76	5.3	5.3
940	58	98	30 WF 108	6.0	6.0	1014	56	99	30 WF 108	6.0	6.0	1086	54	101	30 WF 116	6.1	6.1
1410	88	147	33 WF 141	7.6	6.8	1521	84	149	33 WF 141	6.9	6.8	1629	81	151	36 WF 150	6.9	6.9

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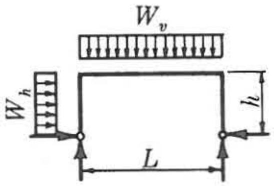
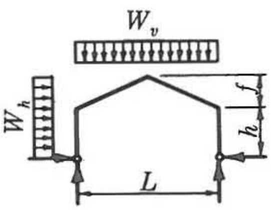
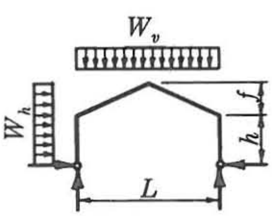
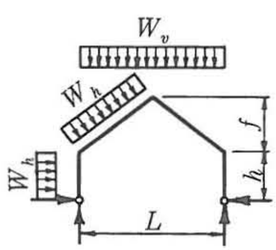
GABLE DESIGN DATA

TABLE 6 100 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	h = 12 ft.						h = 14 ft.					
			M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
		500	578	48	46	24 WF 76	6.3	6.2	578	41	46	24 WF 76	5.5	6.2
.00	.00	1000	1156	96	92	30 WF 124	9.0	6.3	1156	82	92	30 WF 124	7.4	6.3
		1500	1734	144	138	36 WF 150	11.7	6.9	1734	123	138	36 WF 150	9.1	6.9
		500	391	32	46	21 WF 62	5.4	6.1	409	29	46	21 WF 62	4.9	6.0
.25	.00	1000	783	65	92	27 WF 94	7.8	5.9	819	58	92	27 WF 94	6.6	5.9
		1500	1175	97	138	30 WF 124	9.0	6.3	1229	87	138	33 WF 130	8.3	6.6
		500	304	25	46	18 WF 55	4.8	5.7	324	23	46	18 WF 55	4.6	5.5
.50	.00	1000	608	50	92	24 WF 84	6.6	5.5	649	46	92	24 WF 84	5.7	5.5
		1500	913	76	138	30 WF 108	8.0	6.0	973	69	138	30 WF 108	6.7	6.0
Critical Ratio														
		500	304	25	46	18 WF 55	4.8	5.7	324	23	46	18 WF 55	4.6	5.5
.50	.75	1000	608	50	92	24 WF 84	6.6	5.5	649	46	92	24 WF 84	5.7	5.5
		1500	913	76	138	30 WF 108	8.0	6.0	973	69	138	30 WF 108	6.7	6.0
Critical Ratio			W_h/W_v = 0.85						W_h/W_v = 0.78					
		500	**318**	**26**	46	**18 WF 55**	4.8	4.6	**349**	**24**	46	**18 WF 60**	4.7	4.7
.50	1.00	1000	**637**	**53**	92	**24 WF 84**	6.6	5.5	**698**	**49**	92	**24 WF 94**	5.8	5.6
		1500	**955**	**79**	138	**30 WF 108**	8.0	6.0	**1047**	**74**	138	**30 WF 116**	7.1	6.1
		500	251	20	46	16 WF 50	4.4	5.2	271	19	46	16 WF 50	4.4	5.0
.75	.00	1000	503	41	92	21 WF 73	5.7	5.1	543	38	92	24 WF 76	5.5	5.3
		1500	755	62	138	24 WF 94	6.8	5.6	814	58	138	27 WF 94	6.6	5.9
Critical Ratio			W_h/W_v = 0.25						W_h/W_v = 0.24					
		500	**319**	**26**	46	**18 WF 55**	4.8	4.6	**349**	**24**	46	**18 WF 60**	4.7	4.7
.75	.50	1000	**638**	**53**	92	**24 WF 84**	6.6	5.5	**698**	**49**	92	**24 WF 94**	5.8	5.6
		1500	**958**	**79**	138	**30 WF 108**	8.0	6.0	**1047**	**74**	138	**30 WF 116**	7.1	6.1
		500	**385**	**32**	**48**	**21 WF 62**	5.4	4.9	**423**	**30**	**48**	**21 WF 62**	4.9	4.9
.75	.75	1000	**771**	**64**	**96**	**27 WF 94**	7.8	5.9	**847**	**60**	**97**	**27 WF 102**	6.8	6.0
		1500	**1157**	**96**	**144**	**30 WF 124**	9.0	6.3	**1271**	**90**	**145**	**33 WF 130**	8.3	6.6
		500	**453**	**37**	**52**	**21 WF 68**	5.4	4.9	**499**	**35**	**53**	**21 WF 73**	5.1	5.1
.75	1.00	1000	**906**	**75**	**105**	**27 WF 102**	8.2	6.0	**998**	**71**	**106**	**30 WF 108**	6.7	6.0
		1500	**1359**	**113**	**158**	**33 WF 130**	10.4	6.6	**1497**	**106**	**159**	**33 WF 141**	8.8	6.8

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

TABLE 6 100 FT. SPAN

h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
578	36	46	24 WF 76	5.3	6.2	578	32	46	24 WF 76	5.3	6.2	578	28	46	24 WF 76	5.3	6.2
1156	72	92	30 WF 124	6.5	6.3	1156	64	92	30 WF 124	6.3	6.3	1156	57	92	30 WF 124	6.3	6.3
1734	108	138	36 WF 150	7.8	6.9	1734	96	138	36 WF 150	7.0	6.9	1734	86	138	36 WF 150	6.9	6.9
424	26	46	21 WF 62	4.9	5.9	436	24	46	21 WF 68	4.9	5.8	446	22	46	21 WF 68	4.9	5.8
848	53	92	27 WF 102	6.1	6.0	872	48	92	27 WF 102	6.0	6.0	893	44	92	27 WF 102	6.0	6.0
1272	79	138	33 WF 130	7.2	6.6	1309	72	138	33 WF 130	6.6	6.6	1340	67	138	33 WF 130	6.6	6.6
341	21	46	18 WF 60	4.7	5.5	356	19	46	18 WF 60	4.7	5.4	370	18	46	21 WF 62	4.9	5.8
683	42	92	24 WF 94	5.6	5.6	713	39	92	24 WF 94	5.6	5.6	740	37	92	24 WF 94	5.6	5.6
1025	64	138	30 WF 108	6.0	6.0	1070	59	138	30 WF 116	6.1	6.1	1110	55	138	30 WF 116	6.1	6.1
$W_h/W_v = 0.72$						$W_h/W_v = 0.66$						$W_h/W_v = 0.61$					
346	**21**	46	**18 WF 60.**	4.7	4.7	**370**	**20**	46	**21 WF 62**	4.9	4.9	**393**	**19**	46	**21 WF 62**	4.9	4.9
693	**43**	92	**24 WF 94**	5.6	5.6	**741**	**41**	92	**24 WF 94**	5.6	5.6	**787**	**39**	92	**27 WF 94**	5.9	5.9
1040	**65**	138	**30 WF 116**	6.3	6.1	**1111**	**61**	138	**30 WF 116**	6.1	6.1	**1180**	**59**	138	**30 WF 124**	6.3	6.3
378	**23**	46	**21 WF 62**	4.9	4.9	**406**	**22**	46	**21 WF 62**	4.9	4.9	**435**	**21**	46	**21 WF 68**	4.9	4.9
757	**47**	92	**24 WF 94**	5.6	5.6	**813**	**45**	92	**27 WF 94**	5.9	5.9	**870**	**43**	92	**27 WF 102**	6.0	6.0
1135	**70**	138	**30 WF 124**	6.5	6.3	**1220**	**67**	138	**30 WF 124**	6.3	6.3	**1305**	**65**	138	**33 WF 130**	6.6	6.6
289	18	46	18 WF 50	4.6	5.2	304	16	46	18 WF 55	4.6	5.2	318	15	46	18 WF 55	4.6	5.1
578	36	92	24 WF 76	5.3	5.3	608	33	92	24 WF 84	5.5	5.5	636	31	92	24 WF 84	5.5	5.5
867	54	138	27 WF 102	6.1	6.0	913	50	138	30 WF 108	6.0	6.0	954	47	138	30 WF 108	6.0	6.0
$W_h/W_v = 0.23$						$W_h/W_v = 0.23$						$W_h/W_v = 0.22$					
377	**23**	46	**21 WF 62**	4.9	4.9	**403**	**22**	46	**21 WF 62**	4.9	4.9	**428**	**21**	46	**21 WF 62**	4.9	4.9
754	**47**	92	**24 WF 94**	5.6	5.6	**806**	**44**	92	**27 WF 94**	5.9	5.9	**856**	**42**	92	**27 WF 102**	6.0	6.0
1131	**70**	138	**30 WF 116**	6.3	6.1	**1209**	**67**	138	**30 WF 124**	6.3	6.3	**1284**	**64**	138	**33 WF 130**	6.6	6.6
459	**28**	**49**	**21 WF 68**	4.9	4.9	**493**	**27**	**49**	**21 WF 73**	5.1	5.1	**526**	**26**	**50**	**24 WF 76**	5.3	5.3
919	**57**	**98**	**30 WF 108**	6.0	6.0	**987**	**54**	**99**	**30 WF 108**	6.0	6.0	**1052**	**52**	**100**	**30 WF 116**	6.1	6.1
1378	**86**	**147**	**33 WF 130**	7.2	6.6	**1480**	**82**	**148**	**33 WF 141**	6.9	6.8	**1578**	**78**	**150**	**36 WF 150**	6.9	6.9
542	**33**	**53**	**24 WF 76**	5.3	5.3	**585**	**32**	**54**	**24 WF 76**	5.3	5.3	**626**	**31**	**55**	**24 WF 84**	5.5	5.5
1085	**67**	**107**	**30 WF 116**	6.3	6.1	**1170**	**65**	**109**	**30 WF 124**	6.3	6.3	**1252**	**62**	**110**	**33 WF 130**	6.6	6.6
1628	**101**	**161**	**36 WF 150**	7.8	6.9	**1755**	**97**	**163**	**36 WF 160**	7.3	7.0	**1878**	**93**	**165**	**36 WF 170**	7.1	7.1

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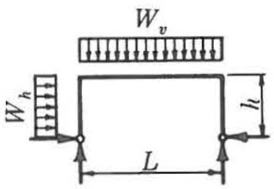
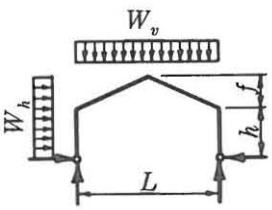
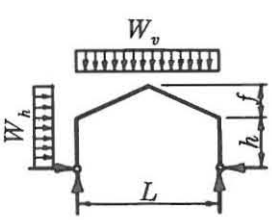
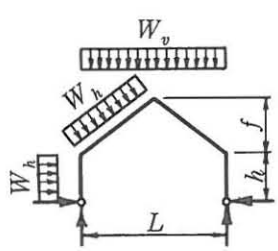
GABLE DESIGN DATA

TABLE 7 110 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	$h = 12$ ft.						$h = 14$ ft.					
			M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
		500	699	58	50	24 WF 94	6.8	6.1	699	49	50	24 WF 94	5.8	6.1
.00	.00	1000	1398	116	101	33 WF 141	11.2	6.8	1398	99	101	33 WF 141	8.8	6.8
		1500	2098	174	152	36 WF 182	12.0	7.2	2098	149	152	36 WF 182	9.9	7.2
		500	460	38	50	21 WF 68	5.4	5.7	482	34	50	21 WF 73	5.1	5.9
.25	.00	1000	921	76	101	30 WF 108	8.0	6.0	965	68	101	30 WF 108	6.7	6.0
		1500	1381	115	152	33 WF 130	10.4	6.6	1447	103	152	33 WF 141	8.8	6.8
		500	353	29	50	18 WF 60	4.9	5.5	377	26	50	21 WF 62	4.9	5.8
.50	.00	1000	706	58	101	24 WF 94	6.8	5.6	755	53	101	24 WF 94	5.8	5.6
		1500	1059	88	152	30 WF 116	8.5	6.1	1133	80	152	30 WF 124	7.4	6.3
Critical Ratio														
		500	353	29	50	18 WF 60	4.9	5.5	377	26	50	21 WF 62	4.9	5.8
.50	.75	1000	706	58	101	24 WF 94	6.8	5.6	755	53	101	24 WF 94	5.8	5.6
		1500	1059	88	152	30 WF 116	8.5	6.1	1133	80	152	30 WF 124	7.4	6.3
Critical Ratio			$W_h/W_v = 0.90$						$W_h/W_v = 0.82$					
		500	**364**	**30**	50	**18 WF 60**	4.9	4.7	**399**	**28**	50	**21 WF 62**	4.9	4.9
.50	1.00	1000	**728**	**60**	101	**24 WF 94**	6.8	5.6	**798**	**57**	101	**27 WF 94**	6.6	5.9
		1500	**1093**	**91**	152	**30 WF 116**	8.5	6.1	**1197**	**85**	152	**30 WF 124**	7.4	6.3
		500	289	24	50	18 WF 50	4.7	5.2	313	22	50	18 WF 55	4.6	5.1
.75	.00	1000	579	48	101	24 WF 76	6.3	5.3	627	44	101	24 WF 84	5.7	5.5
		1500	869	72	152	27 WF 102	8.2	6.0	941	67	152	30 WF 108	6.7	6.0
Critical Ratio			$W_h/W_v = 0.25$						$W_h/W_v = 0.24$					
		500	**365**	**30**	50	**18 WF 60**	4.9	4.7	**399**	**28**	50	**21 WF 62**	4.9	4.9
.75	.50	1000	**730**	**60**	101	**24 WF 94**	6.8	5.6	**799**	**57**	101	**27 WF 94**	6.6	5.9
		1500	**1095**	**91**	152	**30 WF 116**	8.5	6.1	**1199**	**85**	152	**30 WF 124**	7.4	6.3
		500	**440**	**36**	**53**	**21 WF 68**	5.4	4.9	**484**	**34**	**53**	**21 WF 73**	5.1	5.1
.75	.75	1000	**880**	**73**	**106**	**27 WF 102**	8.2	6.0	**968**	**69**	**106**	**30 WF 108**	6.7	6.0
		1500	**1321**	**110**	**160**	**33 WF 130**	10.4	6.6	**1452**	**103**	**159**	**33 WF 141**	8.8	6.8
		500	**516**	**43**	**58**	**24 WF 76**	6.3	5.3	**568**	**40**	**57**	**24 WF 76**	5.5	5.3
.75	1.00	1000	**1032**	**86**	**116**	**30 WF 108**	8.0	6.0	**1137**	**81**	**115**	**30 WF 124**	7.4	6.3
		1500	**1548**	**129**	**175**	**36 WF 150**	11.7	6.9	**1706**	**121**	**173**	**36 WF 150**	9.1	6.9

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

TABLE 7 110 FT. SPAN

h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
699	43	50	24 WF 94	5.6	6.1	699	38	50	24 WF 94	5.6	6.1	699	34	50	24 WF 94	5.6	6.1
1398	87	101	33 WF 141	7.6	6.8	1398	77	101	33 WF 141	6.9	6.8	1398	69	101	33 WF 141	6.8	6.8
2098	131	152	36 WF 182	8.4	7.2	2098	116	152	36 WF 182	7.5	7.2	2098	104	152	36 WF 182	7.2	7.2
500	31	50	21 WF 73	5.1	5.8	516	28	50	24 WF 76	5.3	6.3	529	26	50	24 WF 76	5.3	6.2
1001	62	101	30 WF 108	6.0	6.0	1032	57	101	30 WF 108	6.0	6.0	1058	52	101	30 WF 116	6.1	6.1
1502	93	152	33 WF 141	7.6	6.8	1548	86	152	36 WF 150	7.0	6.9	1588	79	152	36 WF 150	6.9	6.9
398	24	50	21 WF 62	4.9	5.7	417	23	50	21 WF 62	4.9	5.6	433	21	50	21 WF 68	4.9	5.5
797	49	101	27 WF 94	5.9	5.9	834	46	101	24 WF 100	8.5	7.6	866	43	101	27 WF 102	6.0	6.0
1196	74	152	30 WF 124	6.5	6.3	1251	69	152	33 WF 130	6.6	6.6	1300	65	152	33 WF 130	6.6	6.6
						$W_h/W_v = 0.70$						$W_h/W_v = 0.65$					
398	24	50	21 WF 62	4.9	5.7	**424**	**23**	50	**21 WF 62**	4.9	4.9	**450**	**22**	50	**21 WF 68**	4.9	4.9
797	49	101	27 WF 94	5.9	5.9	**849**	**47**	101	**27 WF 102**	6.0	6.0	**901**	**45**	101	**27 WF 102**	6.0	6.0
1196	74	152	30 WF 124	6.5	6.3	**1274**	**70**	152	**33 WF 130**	6.6	6.6	**1352**	**67**	152	**33 WF 130**	6.6	6.6
$W_h/W_v = 0.76$																	
432	**27**	50	**21 WF 68**	4.9	4.9	**464**	**25**	50	**21 WF 68**	4.9	4.9	**495**	**24**	50	**21 WF 73**	5.1	5.1
864	**54**	101	**27 WF 102**	6.1	6.0	**928**	**51**	101	**30 WF 108**	6.0	6.0	**991**	**49**	101	**30 WF 108**	6.0	6.0
1297	**81**	152	**33 WF 130**	7.2	6.6	**1392**	**77**	152	**33 WF 130**	6.6	6.6	**1486**	**74**	152	**33 WF 141**	6.8	6.8
334	20	50	18 WF 55	4.6	5.0	353	19	50	18 WF 60	4.7	5.0	370	18	50	21 WF 62	4.9	5.4
669	41	101	24 WF 84	5.5	5.5	706	39	101	24 WF 94	5.6	5.6	740	37	101	24 WF 94	5.6	5.6
1003	62	152	30 WF 108	6.0	6.0	1059	58	152	30 WF 116	6.1	6.1	1110	55	152	30 WF 116	6.1	6.1
$W_h/W_v = 0.24$						$W_h/W_v = 0.23$						$W_h/W_v = 0.22$					
432	**27**	50	**21 WF 68**	4.9	4.9	**462**	**25**	50	**21 WF 68**	4.9	4.9	**490**	**24**	50	**21 WF 73**	5.1	5.1
864	**54**	101	**27 WF 102**	6.1	6.0	**924**	**51**	101	**30 WF 108**	6.0	6.0	**981**	**49**	101	**30 WF 108**	6.0	6.0
1296	**81**	152	**33 WF 130**	7.2	6.6	**1386**	**77**	152	**33 WF 130**	6.6	6.6	**1471**	**73**	152	**33 WF 141**	6.8	6.8
524	**32**	**53**	**24 WF 76**	5.3	5.3	**563**	**31**	**54**	**24 WF 76**	5.3	5.3	**600**	**30**	**54**	**24 WF 84**	5.5	5.5
1049	**65**	**107**	**30 WF 116**	6.3	6.1	**1127**	**62**	**108**	**30 WF 116**	6.1	6.1	**1201**	**60**	**109**	**30 WF 124**	6.3	6.3
1574	**98**	**160**	**36 WF 150**	7.8	6.9	**1690**	**93**	**162**	**36 WF 150**	7.0	6.9	**1802**	**90**	**164**	**36 WF 160**	7.0	7.0
618	**38**	**58**	**24 WF 84**	5.5	5.5	**666**	**37**	**59**	**24 WF 84**	5.5	5.5	**712**	**35**	**60**	**24 WF 94**	5.6	5.6
1237	**77**	**117**	**33 WF 130**	7.2	6.6	**1332**	**74**	**118**	**33 WF 130**	6.6	6.6	**1424**	**71**	**120**	**33 WF 141**	6.8	6.8
1856	**116**	**175**	**36 WF 160**	8.1	7.0	**1999**	**111**	**177**	**36 WF 170**	7.4	7.1	**2137**	**106**	**180**	**36 WF 182**	7.2	7.2

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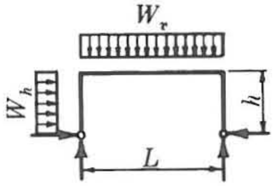
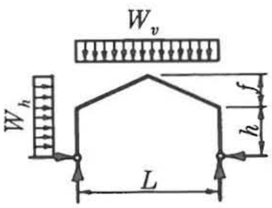
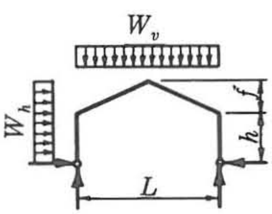
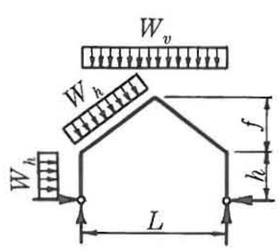
GABLE DESIGN DATA

TABLE 8 120 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	h = 12 ft.						h = 14 ft.					
			M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
		500	832	69	55	27 WF 94	7.8	6.4	832	59	55	27 WF 94	6.6	6.4
.00	.00	1000	1664	138	111	36 WF 150	11.7	6.9	1664	118	111	36 WF 150	9.1	6.9
		1500	2496	208	166	33 WF 220	12.0	10.1	2496	178	166	33 WF 220	14.0	10.1
		500	532	44	55	24 WF 76	6.3	6.2	559	39	55	24 WF 76	5.5	6.1
.25	.00	1000	1065	88	111	30 WF 116	8.5	6.1	1119	79	111	30 WF 116	7.1	6.1
		1500	1598	133	166	36 WF 150	11.7	6.9	1679	119	166	36 WF 150	9.1	6.9
		500	404	33	55	21 WF 62	5.4	5.6	433	30	55	21 WF 68	4.9	5.5
.50	.00	1000	808	67	111	27 WF 94	7.8	5.9	866	61	111	27 WF 102	6.8	6.0
		1500	1212	101	166	30 WF 124	9.0	6.3	1299	92	166	33 WF 130	8.3	6.6
Critical Ratio														
		500	404	33	55	21 WF 62	5.4	5.6	433	30	55	21 WF 68	4.9	5.5
.50	.75	1000	808	67	111	27 WF 94	7.8	5.9	866	61	111	27 WF 102	6.8	6.0
		1500	1212	101	166	30 WF 124	9.0	6.3	1299	92	166	33 WF 130	8.3	6.6
Critical Ratio			$W_h/W_v = 0.94$						$W_h/W_v = 0.87$					
		500	**411**	**34**	55	**21 WF 62**	5.4	4.9	**451**	**32**	55	**21 WF 68**	4.9	4.9
.50	1.00	1000	**823**	**68**	111	**27 WF 94**	7.8	5.9	**902**	**64**	111	**27 WF 102**	6.8	6.0
		1500	**1235**	**102**	166	**33 WF 130**	10.4	6.6	**1353**	**96**	166	**33 WF 130**	8.3	6.6
		500	329	27	55	18 WF 55	4.8	5.0	357	25	55	18 WF 60	4.7	5.0
.75	.00	1000	658	54	111	24 WF 84	6.6	5.5	714	51	111	24 WF 94	5.8	5.6
		1500	988	82	166	30 WF 108	8.0	6.0	1071	76	166	30 WF 116	7.1	6.1
Critical Ratio			$W_h/W_v = 0.25$						$W_h/W_v = 0.25$					
		500	**412**	**34**	55	**21 WF 62**	5.4	4.9	**452**	**32**	55	**21 WF 68**	4.9	4.9
.75	.50	1000	**825**	**68**	111	**27 WF 94**	7.8	5.9	**904**	**64**	111	**27 WF 102**	6.8	6.0
		1500	**1237**	**103**	166	**33 WF 130**	10.4	6.6	**1356**	**96**	166	**33 WF 130**	8.3	6.9
		500	**496**	**41**	**58**	**21 WF 73**	5.7	5.1	**546**	**39**	**58**	**24 WF 76**	5.5	5.3
.75	.75	1000	**993**	**82**	**117**	**30 WF 108**	8.0	6.0	**1092**	**78**	**116**	**30 WF 116**	7.1	6.1
		1500	**1489**	**124**	**175**	**33 WF 141**	11.2	6.8	**1638**	**117**	**174**	**36 WF 150**	9.1	6.9
		500	**581**	**48**	**64**	**24 WF 76**	6.3	5.3	**640**	**45**	**63**	**24 WF 84**	5.7	5.5
.75	1.00	1000	**1162**	**96**	**128**	**30 WF 124**	9.0	6.3	**1281**	**91**	**126**	**33 WF 130**	8.3	6.6
		1500	**1743**	**145**	**192**	**36 WF 160**	12.0	7.0	**1922**	**137**	**190**	**36 WF 170**	9.8	7.1

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

TABLE 8 120 FT. SPAN

h = 16 ft.

M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
832	52	55	27 WF 94	5.9	6.4
1664	104	111	36 WF 150	7.8	6.9
2496	156	166	33 WF 220	16.0	10.1
582	36	55	24 WF 76	5.3	6.0
1164	72	111	30 WF 124	6.5	6.3
1746	109	166	36 WF 160	8.1	7.0
458	28	55	21 WF 68	4.9	5.4
916	57	111	30 WF 108	6.0	6.0
1374	85	166	33 WF 130	7.2	6.6
458	28	55	21 WF 68	4.9	5.4
916	57	111	30 WF 108	6.0	6.0
1374	85	166	33 WF 130	7.2	6.6
$W_h/W_v = 0.80$					
488	**30**	55	**21 WF 73**	5.1	5.1
976	**61**	111	**30 WF 108**	6.0	6.0
1465	**91**	166	**33 WF 141**	7.6	6.8
381	23	55	21 WF 62	4.9	5.3
763	47	111	27 WF 94	5.9	5.9
1145	71	166	30 WF 124	6.5	6.3
$W_h/W_v = 0.24$					
488	**30**	55	**21 WF 73**	5.1	5.1
977	**61**	111	**30 WF 108**	6.0	6.0
1466	**91**	166	**33 WF 141**	7.6	6.8
592	**37**	**58**	**24 WF 76**	5.3	5.3
1185	**74**	**116**	**30 WF 124**	6.5	6.3
1777	**111**	**174**	**36 WF 160**	8.1	7.0
697	**43**	**63**	**24 WF 94**	5.6	5.6
1394	**87**	**126**	**33 WF 130**	7.2	6.6
2091	**130**	**190**	**36 WF 182**	8.4	7.2

h = 18 ft.

M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
832	46	55	27 WF 94	5.9	6.4
1664	92	111	36 WF 150	7.0	6.9
2496	138	166	33 WF 220	16.3	10.1
600	33	55	24 WF 84	5.5	6.2
1201	66	111	30 WF 124	6.3	6.3
1802	100	166	36 WF 160	7.3	7.0
480	26	55	21 WF 73	5.1	5.6
960	53	111	30 WF 108	6.0	6.0
1441	80	166	33 WF 141	6.9	6.8
$W_h/W_v = 0.75$					
481	**26**	55	**21 WF 73**	5.1	5.1
963	**53**	111	**30 WF 108**	6.0	6.0
1445	**80**	166	**33 WF 141**	6.9	6.8
524	**29**	55	**24 WF 76**	5.3	5.3
1048	**58**	111	**30 WF 116**	6.1	6.1
1572	**87**	166	**36 WF 150**	7.0	6.9
404	22	55	21 WF 62	4.9	5.2
808	44	111	27 WF 94	5.9	5.9
1212	67	166	30 WF 124	6.3	6.3
$W_h/W_v = 0.24$					
523	**29**	55	**24 WF 76**	5.3	5.3
1046	**58**	111	**30 WF 116**	6.1	6.1
1569	**87**	166	**36 WF 150**	7.0	6.9
636	**35**	**58**	**24 WF 84**	5.5	5.5
1272	**70**	**117**	**33 WF 130**	6.6	6.6
1909	**106**	**175**	**36 WF 170**	7.4	7.1
750	**41**	**64**	**24 WF 94**	5.6	5.6
1501	**83**	**128**	**33 WF 141**	6.9	6.8
2252	**125**	**192**	**36 WF 194**	7.7	7.2

h = 20 ft.

M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
832	41	55	27 WF 94	5.9	6.4
1664	83	111	36 WF 150	6.9	6.9
2496	124	166	33 WF 220	13.8	10.1
617	30	55	24 WF 84	5.5	6.1
1234	61	111	33 WF 130	6.6	6.6
1851	92	166	36 WF 160	7.0	7.0
499	24	55	21 WF 73	5.1	5.5
999	49	111	30 WF 108	6.0	6.0
1499	74	166	33 WF 141	6.8	6.8
$W_h/W_v = 0.70$					
510	**25**	55	**21 WF 73**	5.1	5.1
1021	**51**	111	**30 WF 108**	6.0	6.0
1532	**76**	166	**33 WF 141**	6.8	6.8
558	**27**	55	**24 WF 76**	5.3	5.3
1117	**55**	111	**30 WF 116**	6.1	6.1
1676	**83**	166	**36 WF 150**	6.9	6.9
423	21	55	21 WF 62	4.9	5.1
847	42	111	27 WF 102	6.0	6.0
1271	63	166	33 WF 130	6.6	6.6
$W_h/W_v = 0.23$					
555	**27**	55	**24 WF 76**	5.3	5.3
1111	**55**	111	**30 WF 116**	6.1	6.1
1667	**83**	166	**36 WF 150**	6.9	6.9
678	**33**	**59**	**24 WF 94**	5.6	5.6
1356	**67**	**118**	**33 WF 130**	6.6	6.6
2034	**101**	**177**	**36 WF 182**	7.2	7.2
802	**40**	**64**	**27 WF 94**	5.9	5.9
1604	**80**	**129**	**36 WF 150**	6.9	6.9
2406	**120**	**194**	**33 WF 220**	13.8	10.1

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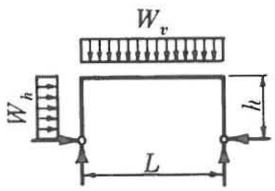
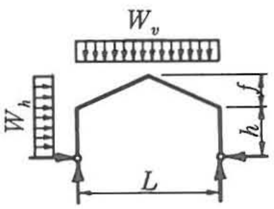
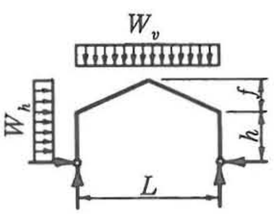
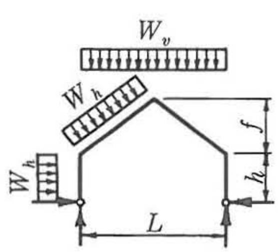
GABLE DESIGN DATA

TABLE 9 130 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v. lbs./ft.	h = 12 ft.						h = 14 ft.					
			M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
		500	976	81	60	30 WF 108	8.0	6.2	976	69	60	30 WF 108	6.7	6.2
.00	.00	1000	1953	162	120	36 WF 170	12.0	7.1	1953	139	120	36 WF 170	9.8	7.1
		1500	2930	244	180	36 WF 245	10.5	10.5	2930	209	180	36 WF 245	14.0	10.5
		500	608	50	60	24 WF 84	6.6	6.1	640	45	60	24 WF 84	5.7	6.0
.25	.00	1000	1216	101	120	30 WF 124	9.0	6.3	1281	91	120	33 WF 130	8.3	6.6
		1500	1825	152	180	36 WF 160	12.0	7.0	1921	137	180	36 WF 170	9.8	7.1
		500	456	38	60	21 WF 68	5.4	5.4	490	35	60	21 WF 73	5.1	5.5
.50	.00	1000	913	76	120	30 WF 108	8.0	6.0	981	70	120	30 WF 108	6.7	6.0
		1500	1369	114	180	33 WF 130	10.4	6.6	1471	105	180	33 WF 141	8.8	6.8
		500	456	38	60	21 WF 68	5.4	5.4	490	35	60	21 WF 73	5.1	5.5
.50	.75	1000	913	76	120	30 WF 108	8.0	6.0	981	70	120	30 WF 108	6.7	6.0
		1500	1369	114	180	33 WF 130	10.4	6.6	1471	105	180	33 WF 141	8.8	6.8
Critical Ratio			$W_h/W_v = 0.97$						$W_h/W_v = 0.90$					
		500	**460**	**38**	60	**21 WF 68**	5.4	4.9	**505**	**36**	60	**21 WF 73**	5.1	5.1
.50	1.00	1000	**921**	**76**	120	**30 WF 108**	8.0	6.0	**1010**	**72**	120	**30 WF 108**	6.7	6.0
		1500	**1382**	**115**	180	**33 WF 130**	10.4	6.6	**1515**	**108**	180	**33 WF 141**	8.8	6.8
		500	370	30	60	21 WF 62	5.4	5.4	402	28	60	21 WF 62	4.9	5.2
.75	.00	1000	740	61	120	24 WF 94	6.8	5.6	804	57	120	27 WF 94	6.6	5.9
		1500	1110	92	180	30 WF 116	8.5	6.1	1206	86	180	30 WF 124	7.4	6.3
Critical Ratio			$W_h/W_v = 0.26$						$W_h/W_v = 0.25$					
		500	**461**	**38**	60	**21 WF 68**	5.4	4.9	**506**	**36**	60	**21 WF 73**	5.1	5.1
.75	.50	1000	**922**	**76**	120	**30 WF 108**	8.0	6.0	**1012**	**72**	120	**30 WF 108**	6.7	6.0
		1500	**1383**	**115**	180	**33 WF 130**	10.4	6.6	**1518**	**108**	180	**33 WF 141**	8.8	6.8
		500	**554**	**46**	**63**	**24 WF 76**	6.3	5.3	**610**	**43**	**63**	**24 WF 84**	5.7	5.5
.75	.75	1000	**1108**	**92**	**127**	**30 WF 116**	8.5	6.1	**1220**	**87**	**126**	**30 WF 124**	7.4	6.3
		1500	**1663**	**138**	**190**	**36 WF 150**	11.7	6.9	**1830**	**130**	**189**	**36 WF 160**	9.5	7.0
		500	**648**	**54**	**69**	**24 WF 84**	6.6	5.5	**715**	**51**	**69**	**24 WF 94**	5.8	5.6
.75	1.00	1000	**1296**	**108**	**139**	**33 WF 130**	10.4	6.6	**1430**	**102**	**138**	**33 WF 141**	8.8	6.8
		1500	**1944**	**162**	**209**	**36 WF 170**	12.0	7.1	**2145**	**153**	**207**	**36 WF 182**	9.9	7.2

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

TABLE 9 130 FT. SPAN

h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
976	61	60	30 WF 108	6.0	6.2	976	54	60	30 WF 108	6.0	6.2	976	48	60	30 WF 108	6.0	6.2
1953	122	120	36 WF 170	8.3	7.1	1953	108	120	36 WF 170	7.4	7.1	1953	97	120	36 WF 170	7.1	7.1
2930	183	180	36 WF 245	16.0	10.5	2930	162	180	36 WF 245	18.0	10.5	2930	146	180	36 WF 245	15.2	10.5
667	41	60	24 WF 84	5.5	5.9	690	38	60	24 WF 94	5.6	6.0	709	35	60	24 WF 94	5.6	6.0
1334	83	120	33 WF 130	7.2	6.6	1380	76	120	33 WF 130	6.6	6.6	1419	70	120	33 WF 141	6.8	6.8
2002	125	180	36 WF 182	8.4	7.2	2070	115	180	36 WF 182	7.5	7.2	2129	106	180	36 WF 182	7.2	7.2
520	32	60	24 WF 76	5.3	5.9	546	30	60	24 WF 76	5.3	5.8	569	28	60	24 WF 76	5.3	5.7
1040	65	120	30 WF 116	6.3	6.1	1092	60	120	30 WF 116	6.1	6.1	1138	56	120	30 WF 124	6.3	6.3
1560	97	180	30 WF 150	7.8	6.9	1638	91	180	36 WF 150	7.0	6.9	1707	85	180	36 WF 150	6.9	6.9
520	32	60	24 WF 76	5.3	5.9	546	30	60	24 WF 76	5.3	5.8	**573**	**28**	60	**24 WF 76**	5.3	5.3
1040	65	120	30 WF 116	6.3	6.1	1092	60	120	30 WF 116	6.1	6.1	**1146**	**57**	120	**30 WF 124**	6.3	6.3
1560	97	180	30 WF 150	7.8	6.9	1638	91	180	36 WF 150	7.0	6.9	**1720**	**86**	180	**36 WF 150**	6.9	6.9
$W_h/W_v = 0.84$						$W_h/W_v = 0.78$						$W_h/W_v = 0.73$					
546	**34**	60	**24 WF 76**	5.3	5.3	**586**	**32**	60	**24 WF 76**	5.3	5.3	**624**	**31**	60	**24 WF 84**	5.5	5.5
1093	**68**	120	**30 WF 116**	6.3	6.1	**1172**	**65**	120	**30 WF 124**	6.3	6.3	**1249**	**62**	120	**33 WF 130**	6.6	6.6
1640	**102**	180	**36 WF 150**	7.8	6.9	**1759**	**97**	180	**36 WF 160**	7.3	7.0	**1873**	**93**	180	**36 WF 170**	7.1	7.1
430	26	60	21 WF 62	4.9	5.1	456	25	60	21 WF 68	4.9	5.0	479	23	60	21 WF 73	5.1	5.2
861	53	120	27 WF 102	6.1	6.0	913	50	120	30 WF 108	6.0	6.0	959	47	120	30 WF 108	6.0	6.0
1292	80	180	33 WF 130	7.2	6.6	1369	76	180	33 WF 130	6.6	6.6	1439	71	180	33 WF 141	6.8	6.8
$W_h/W_v = 0.25$						$W_h/W_v = 0.24$						$W_h/W_v = 0.23$					
547	**34**	60	**24 WF 76**	5.3	5.3	**586**	**32**	60	**24 WF 76**	5.3	5.3	**623**	**31**	60	**24 WF 84**	5.5	5.5
1095	**68**	120	**30 WF 116**	6.3	6.1	**1173**	**65**	120	**30 WF 124**	6.3	6.3	**1246**	**62**	120	**33 WF 130**	6.6	6.6
1643	**102**	180	**36 WF 150**	7.8	6.9	**1759**	**97**	180	**36 WF 160**	7.3	7.0	**1869**	**93**	180	**36 WF 160**	7.0	7.0
662	**41**	**62**	**24 WF 84**	5.5	5.5	**711**	**39**	**63**	**24 WF 94**	5.6	5.6	**758**	**37**	**63**	**24 WF 94**	5.6	5.6
1324	**82**	**125**	**33 WF 130**	7.2	6.6	**1423**	**79**	**126**	**33 WF 141**	6.9	6.8	**1516**	**75**	**127**	**33 WF 141**	6.8	6.8
1987	**124**	**187**	**36 WF 170**	8.3	7.1	**2134**	**118**	**189**	**36 WF 182**	7.5	7.2	**2275**	**113**	**190**	**36 WF 194**	7.2	7.2
778	**48**	**68**	**27 WF 94**	5.9	5.9	**837**	**46**	**68**	**27 WF 102**	6.0	6.0	**895**	**44**	**69**	**27 WF 102**	6.0	6.0
1556	**97**	**136**	**36 WF 150**	7.8	6.9	**1675**	**93**	**137**	**36 WF 150**	7.0	6.9	**1790**	**89**	**139**	**36 WF 160**	7.0	7.0
2334	**145**	**205**	**33 WF 220**	16.0	10.1	**2513**	**139**	**206**	**36 WF 230**	17.8	10.4	**2685**	**134**	**208**	**36 WF 230**	14.8	10.4

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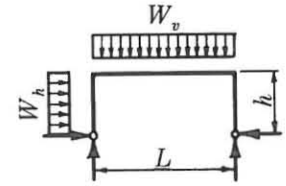
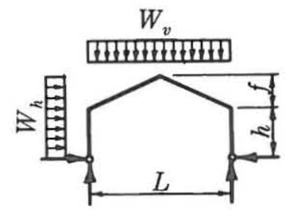
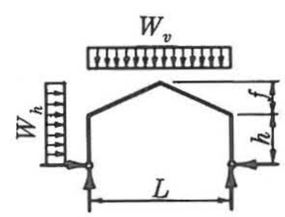
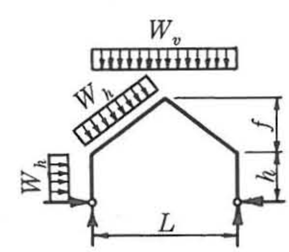
GABLE DESIGN DATA

TABLE 10 140 FT. SPAN









			h = 12 ft.						h = 14 ft.					
$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
		500	1132	94	64	30 WF 124	9.0	6.4	1132	80	64	30 WF 124	7.4	6.4
.00	.00	1000	2265	188	129	36 WF 194	12.0	7.2	2265	161	129	36 WF 194	10.1	7.2
		1500	3398	283	194	36 WF 280	10.7	10.7	3398	242	194	36 WF 280	14.0	10.7
		500	687	57	64	24 WF 94	6.8	6.0	725	51	64	24 WF 94	5.8	5.9
.25	.00	1000	1374	114	129	33 WF 130	10.4	6.6	1450	103	129	33 WF 141	8.8	6.8
		1500	2062	171	194	36 WF 182	12.0	7.2	2175	155	194	36 WF 194	10.1	7.2
		500	510	42	64	21 WF 73	5.7	5.4	549	39	64	24 WF 76	5.5	5.8
.50	.00	1000	1021	85	129	30 WF 108	8.0	6.0	1099	78	129	30 WF 116	7.1	6.1
		1500	1532	127	194	33 WF 141	11.2	6.8	1649	117	194	36 WF 150	9.1	6.9
Critical Ratio			$W_h/W_v = 1.00$						$W_h/W_v = 0.94$					
		500	**511**	**42**	64	**21 WF 73**	5.7	5.1	**560**	**40**	64	**24 WF 76**	5.5	5.3
.50	1.00	1000	**1022**	**85**	129	**30 WF 108**	8.0	6.0	**1120**	**80**	129	**30 WF 116**	7.1	6.1
		1500	**1533**	**127**	194	**33 WF 141**	11.2	6.8	**1681**	**120**	194	**36 WF 150**	9.1	6.9
		500	411	34	64	21 WF 62	5.4	5.2	448	32	64	21 WF 68	4.9	5.0
.75	.00	1000	823	68	129	27 WF 94	7.8	5.9	896	64	129	27 WF 102	6.8	6.0
		1500	1234	102	194	33 WF 130	10.4	6.6	1345	96	194	33 WF 130	8.3	6.6
Critical Ratio			$W_h/W_v = 0.26$						$W_h/W_v = 0.25$					
		500	**511**	**42**	64	**21 WF 73**	5.7	5.1	**561**	**40**	64	**24 WF 76**	5.5	5.3
.75	.50	1000	**1022**	**85**	129	**30 WF 108**	8.0	6.0	**1123**	**80**	129	**30 WF 116**	7.1	6.1
		1500	**1533**	**127**	194	**33 WF 141**	11.2	6.8	**1684**	**120**	194	**36 WF 150**	9.1	6.9
		500	**613**	**51**	**68**	**24 WF 84**	6.6	5.5	**675**	**48**	**68**	**24 WF 94**	5.8	5.6
.75	.75	1000	**1226**	**102**	**137**	**33 WF 130**	10.4	6.6	**1351**	**96**	**136**	**33 WF 130**	8.3	6.6
		1500	**1840**	**153**	**206**	**36 WF 160**	12.0	7.0	**2027**	**144**	**204**	**36 WF 182**	9.9	7.2
		500	**716**	**59**	**75**	**24 WF 94**	6.8	5.6	**791**	**56**	**74**	**27 WF 94**	6.6	5.9
.75	1.00	1000	**1433**	**119**	**150**	**33 WF 141**	11.2	6.8	**1582**	**113**	**149**	**36 WF 150**	9.1	6.9
		1500	**2149**	**179**	**226**	**36 WF 182**	12.0	7.2	**2373**	**169**	**224**	**33 WF 220**	14.0	10.1

Figures in light face indicate load factor of 1.85.
Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

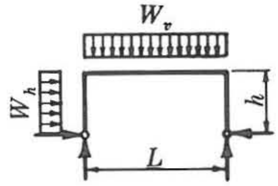
TABLE 10 140 FT. SPAN

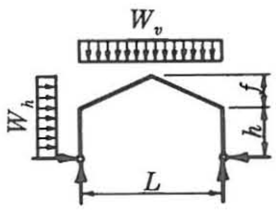
h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
1132	70	64	30 WF 124	6.5	6.4	1132	62	64	30 WF 124	6.3	6.4	1132	56	64	30 WF 124	6.3	6.4
2265	141	129	36 WF 194	8.6	7.2	2265	125	129	36 WF 194	7.7	7.2	2265	113	129	36 WF 194	7.2	7.2
3398	212	194	36 WF 280	16.0	10.7	3398	188	194	36 WF 280	18.0	10.7	3398	169	194	36 WF 280	16.0	10.7
756	47	64	24 WF 94	5.6	5.8	784	43	64	27 WF 94	5.9	6.4	807	40	64	27 WF 94	5.9	6.3
1513	94	129	33 WF 141	7.6	6.8	1568	87	129	36 WF 150	7.0	6.9	1614	80	129	36 WF 150	6.9	6.9
2270	141	194	36 WF 194	8.6	7.2	2352	130	194	33 WF 220	16.3	10.1	2422	121	194	33 WF 220	13.8	10.1
584	36	64	24 WF 76	5.3	5.7	614	34	64	24 WF 84	5.5	5.8	641	32	64	24 WF 84	5.5	5.7
1168	73	129	30 WF 124	6.5	6.3	1228	68	129	33 WF 130	6.6	6.6	1282	64	129	33 WF 130	6.6	6.6
1752	109	194	36 WF 160	8.1	7.0	1843	102	194	36 WF 160	7.3	7.0	1924	96	194	36 WF 170	7.1	7.1
$W_h/W_v = 0.87$						$W_h/W_v = 0.82$						$W_h/W_v = 0.77$					
606	**37**	64	**24 WF 84**	5.5	5.5	**650**	**36**	64	**24 WF 84**	5.5	5.5	**692**	**34**	64	**24 WF 94**	5.6	5.6
1213	**75**	129	**30 WF 124**	6.5	6.3	**1301**	**72**	129	**33 WF 130**	6.6	6.6	**1385**	**69**	129	**33 WF 130**	6.6	6.6
1820	**113**	194	**36 WF 160**	8.1	7.0	**1951**	**108**	194	**36 WF 170**	7.4	7.1	**2078**	**103**	194	**36 WF 182**	7.2	7.2
481	30	64	21 WF 73	5.1	5.2	510	28	64	21 WF 73	5.1	5.1	537	26	64	24 WF 76	5.3	5.4
962	60	129	30 WF 108	6.0	6.0	1021	56	129	30 WF 108	6.0	6.0	1074	53	129	30 WF 116	6.1	6.1
1443	90	194	33 WF 141	7.6	6.8	1532	85	194	33 WF 141	6.9	6.8	1612	80	194	36 WF 150	6.9	6.9
$W_h/W_v = 0.25$						$W_h/W_v = 0.24$						$W_h/W_v = 0.24$					
608	**38**	64	**24 WF 84**	5.5	5.5	**651**	**36**	64	**24 WF 84**	5.5	5.5	**692**	**34**	64	**24 WF 94**	5.6	5.6
1216	**76**	129	**30 WF 124**	6.5	6.3	**1303**	**72**	129	**33 WF 130**	6.6	6.6	**1385**	**69**	129	**33 WF 130**	6.6	6.6
1824	**114**	194	**36 WF 160**	8.1	7.0	**1954**	**108**	194	**36 WF 170**	7.4	7.1	**2077**	**103**	194	**36 WF 182**	7.2	7.2
734	**45**	**67**	**24 WF 94**	5.6	5.6	**788**	**43**	**67**	**27 WF 94**	5.9	5.9	**840**	**42**	**68**	**27 WF 102**	6.0	6.0
1468	**91**	**135**	**33 WF 141**	7.6	6.8	**1577**	**87**	**135**	**36 WF 150**	7.0	6.9	**1681**	**84**	**136**	**36 WF 150**	6.9	6.9
2202	**137**	**203**	**36 WF 194**	8.6	7.2	**2366**	**131**	**202**	**33 WF 220**	16.3	10.1	**2522**	**126**	**204**	**36 WF 230**	14.8	10.4
861	**53**	**74**	**27 WF 102**	6.1	6.0	**927**	**51**	**73**	**30 WF 108**	6.0	6.0	**990**	**49**	**74**	**30 WF 108**	6.0	6.0
1722	**107**	**148**	**36 WF 150**	7.8	6.9	**1854**	**103**	**147**	**36 WF 160**	7.3	7.0	**1981**	**99**	**148**	**36 WF 170**	7.1	7.1
2583	**161**	**222**	**36 WF 230**	16.0	10.4	**2782**	**154**	**221**	**36 WF 230**	17.8	10.4	**2972**	**148**	**223**	**36 WF 245**	15.2	10.5

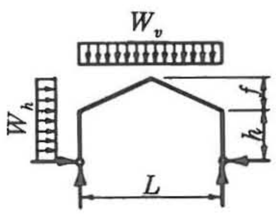
A36

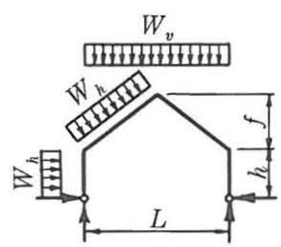
GABLE DESIGN DATA

TABLE 11 150 FT. SPAN









$\frac{2f}{L}$	$\frac{W_h}{W_v}$	W_v lbs./ft.	h = 12 ft.						h = 14 ft.					
			M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
.00	.00	500	1300	108	69	33 WF 130	10.4	6.7	1300	92	69	33 WF 130	8.3	6.7
		1000	2601	216	138	36 WF 230	12.0	10.4	2601	185	138	36 WF 230	14.0	10.4
.25	.00	500	769	64	69	27 WF 94	7.8	6.4	813	58	69	27 WF 94	6.6	6.3
		1000	1538	128	138	33 WF 141	11.2	6.8	1626	116	138	36 WF 150	9.1	6.9
		1500	2307	192	208	33 WF 220	12.0	10.1	2439	174	208	33 WF 220	14.0	10.1
.50	.00	500	566	47	69	24 WF 76	6.3	5.7	611	43	69	24 WF 84	5.7	5.8
		1000	1132	94	138	30 WF 124	9.0	6.3	1222	87	138	33 WF 130	8.3	6.6
		1500	1699	141	208	36 WF 150	11.7	6.9	1833	130	208	36 WF 160	9.5	7.0
Critical Ratio									$W_h/W_v = 0.97$					
.50	1.00	500	566	47	69	24 WF 76	6.3	5.7	**617**	**44**	69	**24 WF 84**	5.7	5.5
		1000	1132	94	138	30 WF 124	9.0	6.3	**1234**	**88**	138	**33 WF 130**	8.3	6.6
		1500	1699	141	208	36 WF 150	11.7	6.9	**1852**	**132**	208	**36 WF 160**	9.5	7.0
.75	.00	500	454	37	69	21 WF 68	5.4	5.0	495	35	69	21 WF 73	5.1	5.1
		1000	908	75	138	27 WF 102	8.2	6.0	991	70	138	30 WF 108	6.7	6.0
		1500	1362	113	208	33 WF 130	10.4	6.6	1486	106	208	33 WF 141	8.8	6.8
Critical Ratio			$W_h/W_v = 0.26$						$W_h/W_v = 0.26$					
.75	.50	500	**562**	**46**	69	**24 WF 76**	6.3	5.3	**618**	**44**	69	**24 WF 84**	5.7	5.5
		1000	**1124**	**93**	138	**30 WF 116**	8.5	6.1	**1236**	**88**	138	**33 WF 130**	8.3	6.6
		1500	**1686**	**140**	208	**36 WF 150**	11.7	6.9	**1854**	**132**	208	**36 WF 160**	9.5	7.0
.75	.75	500	**673**	**56**	**73**	**24 WF 94**	6.8	5.6	**743**	**53**	**73**	**24 WF 94**	5.8	5.6
		1000	**1347**	**112**	**147**	**33 WF 130**	10.4	6.6	**1486**	**106**	**146**	**33 WF 141**	8.8	6.8
		1500	**2021**	**168**	**221**	**36 WF 182**	12.0	7.2	**2229**	**159**	**220**	**36 WF 194**	10.1	7.2
.75	1.00	500	**786**	**65**	**81**	**27 WF 94**	7.8	5.9	**869**	**62**	**80**	**27 WF 102**	6.8	6.0
		1000	**1573**	**131**	**162**	**36 WF 150**	11.7	6.9	**1738**	**124**	**160**	**36 WF 150**	9.1	6.9
		1500	**2359**	**196**	**243**	**33 WF 220**	12.0	10.1	**2607**	**186**	**241**	**36 WF 230**	14.0	10.4

Figures in light face indicate load factor of 1.85.

Figures in bold face indicate load factor of 1.40 (governed by wind).

GABLE DESIGN DATA

TABLE 11 150 FT. SPAN

h = 16 ft.						h = 18 ft.						h = 20 ft.					
M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.	M_u k.-ft.	H_u k.	R_u k.	Section	l_{crc} ft.	l_{crg} ft.
1300	81	69	33 WF 130	7.2	6.7	1300	72	69	33 WF 130	6.6	6.7	1300	65	69	33 WF 130	6.6	6.7
2601	162	138	36 WF 230	16.0	10.4	2601	144	138	36 WF 230	17.8	10.4	2601	130	138	36 WF 230	14.8	10.4
850	53	69	27 WF 102	6.1	6.4	881	48	69	27 WF 102	6.0	6.3	909	45	69	27 WF 102	6.0	6.3
1700	106	138	36 WF 150	7.8	6.9	1763	97	138	36 WF 160	7.3	7.0	1818	90	138	36 WF 160	7.0	7.0
2550	159	208	36 WF 230	16.0	10.4	2645	146	208	36 WF 230	17.8	10.4	2728	136	208	36 WF 230	14.8	10.4
650	40	69	24 WF 84	5.5	5.7	685	38	69	24 WF 94	5.6	5.7	716	35	69	24 WF 94	5.6	5.6
1300	81	138	33 WF 130	7.2	6.6	1370	76	138	33 WF 130	6.6	6.6	1432	71	138	33 WF 141	6.8	6.8
1950	121	208	36 WF 170	8.3	7.1	2055	114	208	36 WF 182	7.5	7.2	2148	107	208	36 WF 182	7.2	7.2
$W_h/W_v = 0.91$						$W_h/W_v = 0.85$						$W_h/W_v = 0.80$					
668	**41**	69	**24 WF 84**	5.5	5.5	**716**	**39**	69	**24 WF 94**	5.6	5.6	**763**	**38**	69	**27 WF 94**	5.9	5.9
1337	**83**	138	**33 WF 130**	7.2	6.6	**1433**	**79**	138	**33 WF 141**	6.9	6.8	**1526**	**76**	138	**33 WF 141**	6.8	6.8
2005	**125**	208	**36 WF 182**	8.4	7.2	**2150**	**119**	208	**36 WF 182**	7.5	7.2	**2289**	**114**	208	**36 WF 194**	7.2	7.2
532	33	69	24 WF 76	5.3	5.4	566	31	69	24 WF 76	5.3	5.3	596	29	69	24 WF 76	5.3	5.3
1065	66	138	30 WF 116	6.3	6.1	1132	62	138	30 WF 124	6.3	6.3	1193	59	138	30 WF 124	6.3	6.3
1598	99	208	36 WF 150	7.8	6.9	1699	94	208	36 WF 150	7.0	6.9	1790	89	208	36 WF 160	7.0	7.0
$W_h/W_v = 0.25$						$W_h/W_v = 0.25$						$W_h/W_v = 0.24$					
670	**41**	69	**24 WF 84**	5.5	5.5	**718**	**39**	69	**24 WF 94**	5.6	5.6	**764**	**38**	69	**27 WF 94**	5.9	5.9
1340	**83**	138	**33 WF 130**	7.2	6.6	**1437**	**79**	138	**33 WF 141**	6.9	6.8	**1528**	**76**	138	**33 WF 141**	6.8	6.8
2010	**125**	208	**36 WF 182**	8.4	7.2	**2155**	**119**	208	**36 WF 194**	7.7	7.2	**2292**	**114**	208	**36 WF 194**	7.2	7.2
807	**50**	**72**	**27 WF 94**	5.9	5.9	**868**	**48**	**72**	**27 WF 102**	6.0	6.0	**925**	**46**	**72**	**30 WF 108**	6.0	6.0
1615	**100**	**145**	**36 WF 150**	7.8	6.9	**1736**	**96**	**144**	**36 WF 150**	7.0	6.9	**1851**	**92**	**145**	**36 WF 160**	7.0	7.0
2422	**151**	**218**	**33 WF 220**	16.0	10.1	**2604**	**144**	**217**	**36 WF 230**	17.8	10.4	**2777**	**138**	**217**	**36 WF 230**	14.8	10.4
946	**59**	**79**	**30 WF 108**	6.0	6.0	**1019**	**56**	**79**	**30 WF 108**	6.0	6.0	**1089**	**54**	**79**	**30 WF 116**	6.1	6.1
1892	**118**	**159**	**36 WF 170**	8.3	7.1	**2038**	**113**	**158**	**36 WF 182**	7.5	7.2	**2178**	**108**	**158**	**36 WF 194**	7.2	7.2
2838	**177**	**239**	**36 WF 245**	16.0	10.5	**3058**	**169**	**237**	**36 WF 260**	18.0	10.6	**3267**	**163**	**237**	**36 WF 280**	16.0	10.7

PART 2

STEEL ARCHES

STEEL ARCHES NOMENCLATURE

L = Span length, ft

h = Rise of arch, ft

W_v = Vertical load exclusive of wind, lbs per lin ft of horizontal projection

W_h = Wind load, lbs per lin ft of vertical projection

I_x = Moment of inertia of cross-section of arch rib about neutral axis normal to the plane of the arch, in.^{4}

I_y = Moment of inertia of cross-section of arch rib about axis in the plane of the arch, in.^{4}

L_u = Maximum unsupported length of compression flange of the arch rib, in ft, for which full stress in bending is permitted

M = Maximum moment due to critical combination of dead load, live load and wind if any, kip-ft (+ indicates compression in top flange.)

M_D = Moment due to dead load, kip-ft

M_L = Moment due to live load, kip-ft

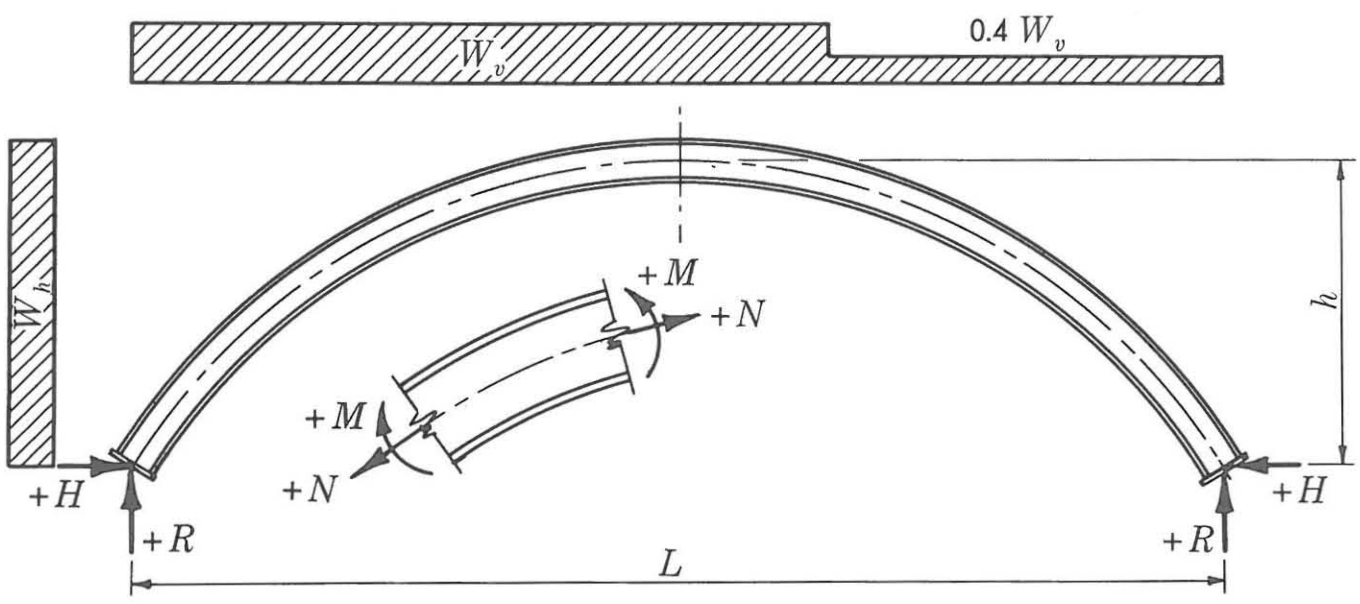
M_W = Moment due to wind load, kip-ft

N = Axial force concurrent with maximum moment, at a point of maximum moment, kips (+ indicates tension)

R = Maximum vertical reaction, kips (+ indicates upward). When wind load is critical, tabulated minus R-values indicate net uplift.

H = Maximum horizontal reaction, kips (+ indicates inward). When wind load is critical, tabulated minus H-values indicate net outward reaction.

Note: When wind load is critical, M, N, R, and H values given in Tables 12 and 13 have been multiplied by 1/1.33 in accordance with Sect. 1.5.6 of the AISC Specification. Hence, normal allowable stresses should be employed.



STEEL ARCHES

INTRODUCTION

The arch has been recognized as an efficient structural system for spanning long distances for two thousand years. Since the development of steel for construction approximately seventy-five years ago, however, arches have been used primarily on very long spans wherein dead weight of the structure constituted a considerable portion of the load to be supported, and where the economies to be realized from this structural system were adequate to justify the more involved analysis. Present day trends in architecture toward a greater freedom of form have increased the popularity of the arch for much shorter spans. Distances which could efficiently be spanned by steel girders and trusses in simple bending, or by indeterminate rigid frames, frequently employ the arch form to achieve an aesthetic effect. Since structural steel is equally effective in resisting compressive stresses as it is in resisting tensile and bending stresses, it is an ideal material for arch construction. Minimum weight of material is always realized and simple, clean structural details may readily be achieved.

Three-hinged arches are determinate structures and may be designed by a straightforward application of simple statics. Two-hinged arches and arches without hinges are indeterminate, frequently offering possibilities for greater economy in the use of material, but requiring more involved methods of analysis for their design. A number of papers have been published which greatly simplify the labor of designing arch structures through the presentation of influence curves for moments and reactions.*

Such curves are applicable to arches in general, but to further simplify the design effort required in proportioning a steel circular two-hinged arch, in the range of spans and roof rises applicable to a majority of buildings, the material in this section has been prepared.** Complete designs, including the most efficient material sizes, have been prepared for spans ranging from 80 feet to 180 feet. These spans have rise-to-span ratios of 1:3 and 1:4, and a live-load-to-total-load ratio of 0.6. **All sections shown are based on A36 steel.** The results are presented in Tables 12 and 13.

SCOPE

Only arches which are two-hinged and circular are encompassed by this booklet.

An infinite number of combinations of spans, rise-to-span ratios, and combinations of loads are possible. Accordingly, careful consideration was given to the range of spans and rise-to-span ratios which would encompass most building requirements. As rise-to-span ratio decreases, the clear usable floor area decreases. The height of end walls, the roof area, the maximum moment and the enclosed volume also decrease, and corresponding thrusts of the supporting arch increase.

For any given required clear width of floor, having a specified minimum headroom, the distance L, measured at the springline, must be increased as the rise-to-span ratio is decreased. Taking the foregoing relationship into consideration, maximum overall economy is generally realized when the rise of the arch is approximately one-fourth to one-third of span L. In order to reduce the required span and rise without reducing usable floor area, arch reactions could be provided at the top of buttresses; however, the cost of adequate buttresses and foundations for such arches with low rise-to-span ratios would more than offset the savings in roof area, end wall

* "Direct Design of Two-Hinged Arches of Constant Section," James Michalos—CIVIL ENGINEERING, Jan., 1956
"Direct Design of Hingeless Arches of Constant Section," James Michalos—CIVIL ENGINEERING, July, 1956
"Influence-Line Graphs for Maximum Moments in Two-Hinged Arches," Higgins and Davidson—CIVIL ENGINEERING, June, 1957
"Steel Arch Analyzed and Designed by Semigraphical Methods," Milo S. Ketchum—CIVIL ENGINEERING, Aug. 1952 (AISC Publication No. TR 204)

** "Two-Hinged Arches—Digital Computer Analysis and Design in Accordance with ASCE Report on Wind Forces," Hooper and Wang—CIVIL ENGINEERING, Dec., 1963 height and enclosed volume.

In consideration of the above factors a range of spans from 80 feet to 180 feet, in increments of 10 feet, with rise-to-span ratios of 1:4 and 1:3, has been selected. Vertical loads of 1,000 and 1,500 pounds per foot constitute a third variable. The ratio of horizontal load to vertical load was also studied. However, it was found that except in the case of very high horizontal loading, vertical load alone will govern the design. Also, since the change in required section for the case of high horizontal load as compared with the case of no horizontal load is minor, it is not necessary to tabulate solutions for a complete range of W_h/W_v values.

For a designer who is faced with a problem not covered directly by the tabulated variables, two means are provided. Maximum moments, thrusts, and reactions are tabulated, so that interpolation for intermediate span lengths and other magnitudes of vertical load may be performed. Additionally, non-dimensionalized moment coefficient tables are presented which will be of great assistance to designers in handling problems that may not be solved by interpolation.

DESIGN CRITERIA

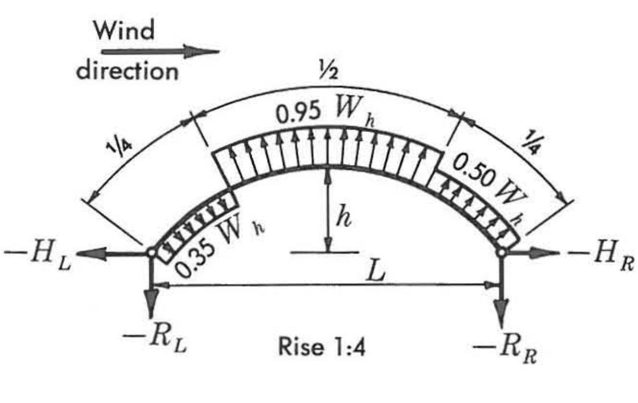
The vertical loadings tabulated (W_v) are total loads of 1,000 and 1,500 pounds per lineal foot of horizontal projection for the loaded portion of the span. Live load was taken as $0.6W_v$ and dead load was taken as $0.4W_v$. Horizontal loads expressed as the ratio of unit horizontal load to unit vertical load (W_h/W_v) were applied in accordance with the recommendations of the ASCE Task Committee on Wind Forces in its final report.*

The distribution of unit pressures resulting from winds against the side of a barrel arch roof is very complex. Observed conditions vary from relatively low positive (inward) pressure on the windward face to high negative (outward) pressure throughout the central portion of the roof to relatively low negative pressures on the leeward face. The rise-to-span ratio has an important effect as does the height of the springline above the ground.

The ASCE Task Committee on Wind Forces recommends a simplified procedure and presents pressure coefficients for three segments of circular arches; the center one-half and the windward and leeward one-quarters. Suction and positive pressure on the roof increase as the rise-to-span ratio increases. The recommendations as they apply to the case of rise-to-span ratios of 1:4 and 1:3 (Figure 1) were employed in the designs presented herein.

These designs are based upon the combination of loads that resulted in maximum moments in the arch rib, i.e., dead load ($0.4W_v$) throughout the entire span plus full wind load, if critical, plus live load ($0.6W_v$) throughout that portion of the span which would result in the largest total moment.

*ASCE Transactions, Vol. 126, Part II, Page 1124.



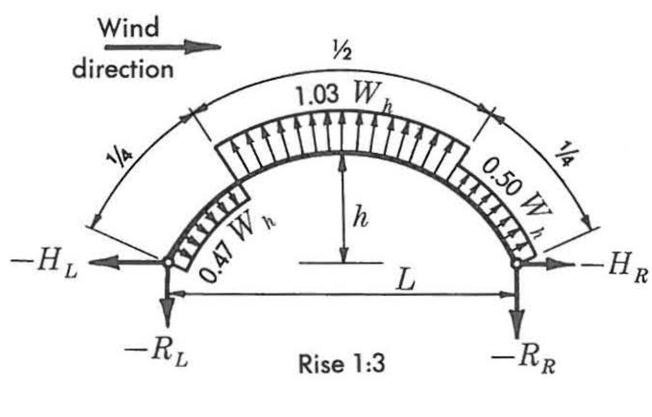


FIGURE 1

USE OF TABLES

The design information presented in the tables includes the selection of the most efficient flange and web plate material of A36 steel for the fabrication of a compact curved rib of constant cross-section. In cases where the physical dimensions and the loading on a particular structure are the same as those given in the tables, the required section may be read directly.

It will be noted in the tables that only for the cases of 160, 170, and 180 foot spans with a rise-to-span ratio of 1:3 are values tabulated for W_h/W_v intermediate between 0.00 and 1.00. For all other cases, when $W_h/W_v < 0.75$, wind is not critical and the design data for $W_h/W_v = 0.00$ should be used. When $W_h/W_v > 0.75$ for these cases, the data for $W_h/W_v = 1.0$ should be employed. For the cases of 160, 170, and 180 foot spans with 1:3 rise-to-span ratio when $W_h/W_v < 0.50$ the data for $W_h/W_v = 0.00$ should be used. When $0.50 < W_h/W_v < 0.75$ the data for $W_h/W_v = 0.75$ should be employed and when $W_h/W_v > 0.75$ the data for $W_h/W_v = 1.0$ should be used. Any excess in the required section resulting from this procedure is slight; hence, refinement beyond the rules given is unwarranted.

Certain interpolations in Tables 12 and 13 for intermediate values of M, N, R, and H are valid and may be used with confidence. For a given unit load, M varies as L^2 and N, R, and H vary as L. For a given span, M, N, R, and H vary as W_v. **Interpolation between values of $W_h/W_v = 0.00$ and 1.00 for values of M, N, R, and H should not be attempted since different factors of safety apply when wind does not govern than when wind does govern.** Also, interpolated or extrapolated values of M, N, R, and H at other rise-to-span ratios would not be accurate.

The values of M, N, R, and H for the case where wind governs ($W_h/W_v = 0.75$ and 1.00) have been reduced 25 percent in keeping with Sect. 1.5.6 of the AISC Specification; therefore, usual allowable stresses (not increased for wind) should be applied to all values of M, N, R, and H determined by the use of Tables 12 and 13. Once the maximum moment M and the concurrent thrust at the point of maximum moment N are known, a cross-section may be designed to resist the combined stresses. For compact sections, a unit stress of $0.66F_y$ may be used in determining the required section modulus (AISC Spec. Sect. 1.5.1.4.1) as was done in the case of the sections included in the tables.

As indicated in the table headings, Tables 12 and 13 have been calculated on the specific basis of dead load equal to 0.4 total load and live load equal to 0.6 total load. Tables 14 and 15 give non-dimensionalized coefficients for moment, thrust and reactions for dead, live and wind loads. The information contained in these latter tables may be used in determining critical moments, thrusts and reactions for arches having other ratios of dead load to live load. They are also useful in determining the requirements for field splices made in accordance with the AISC Specification Sect. 1.15.8.

In Tables 14 and 15 the columns headed "Dead Load" and "Wind Load" give coefficients for moment and the concurrent thrust at nineteen uniformly spaced points around the curve of the arch. The columns headed "Max. $+M_L$ and Concurrent N, H, & R . . ." give coefficients for the maximum positive moment and concurrent thrust at each point along the arch, together with corresponding H and R values, due to full or partial vertical live loads. The columns headed "Max. $-M_L$ and Concurrent N, H, & R . . ." give similar values for the case of maximum negative bending moment. For each point on the arch the loaded length of span is selected so as to give the maximum value for the moment and the corresponding thrust at that point, as well as the concurrent end reactions. Thus the information given does not reflect the same condition of vertical live load for any two points between springline and crown.

To make use of the information in a specific problem the coefficients tabulated must be multiplied by the product of dead, live or wind load, times L or L^2, as applicable. The quantities thus derived are then totaled algebraically at each successive point along the curve. By inspection of the totals, the magnitude and location of the critical moment may be found.

The required section is then selected and checked for adequacy under combined bending and axial force in accordance with Sect. 1.6 of the AISC Specification. The axial force to be employed is the algebraic sum of the N-values at the point of maximum moment. Since the preponderance of stress is caused by bending, the critical section is generally governed by critical moment rather than thrust.

The tie rod should be proportioned for the maximum live plus dead load horizontal reaction.

FOUNDATION NOTES

The ends of each arch should be inter-connected by a tie proportioned to resist in tension the horizontal force H produced by full live and dead load.

Foundations should be investigated for maximum soil pressure, overturning and uplift due to three loading conditions:

Case I. Dead plus full live load
Case II. Dead plus wind load
Case III. Dead plus full live plus wind load

Since in Cases II and III the ratio of horizontal to vertical load is not the same at the windward and leeward side, the foundations should be investigated for the conditions at both ends.

Exact values for the forces for which a foundation must be designed to resist uplift and concurrent overturning can be obtained using the coefficients given in Tables 14 or 15, as applicable.

If the horizontal wind reaction at the leeward foundation is less than the tension in the tie rod produced by dead load only, the foundations need be investigated for overturning and maximum soil pressure due only to the unbalanced horizontal wind reaction $(H_L - H_R)$. This force is in the direction of the wind and usually* can be prorated between the two foundations in proportion to their concurrent vertical reaction, augmented by the foundation plus earth overburden weight.

If the horizontal wind reaction at the leeward foundation is greater than the tension in the tie rod produced by dead load only, each foundation must be investigated for the overturning effects of an inward horizontal force (which is the algebraic sum of the dead load and wind reactions) acting in conjunction with the corresponding vertical reactions augmented by the weight of the foundation and overburden.

The values for R and H given in Tables 12 and 13 for the case where wind governs may be used to investigate the overturning effects of wind upon the foundations. The value for R in this case is the algebraic sum of the uplift due to wind and the downward reaction due only to dead load, which in every case results in a net uplift.

A tie rod should be provided to resist horizontal force H where W_h/W_v equals zero.

For the case where wind governs, the inward horizontal reaction on the leeward foundation, due to wind, will usually exceed the tension in the tie rod due only to dead load. These foundations should therefore be investigated for overturning effect using the R- and H-values tabulated for the case where wind governs. In making this investigation the value for R, which as tabulated is always negative, must be reversed by the additional weight of the foundation and overburden.

* The total horizontal wind force at the leeward foundation must not exceed the tie rod dead load tension in this case.

DESIGN EXAMPLE No. 5

Given:

Arch spacing: 20′-0 o.c.
Span: 120′-0
Dead load: 25 lbs/sq ft of horizontal projection
Live load: 40 lbs/sq ft of horizontal projection
Wind pressure: 20 lbs/sq ft
Steel: A36

Solution:

Ratio of live-to-total load $= \frac{40}{65} = 0.6$

$\frac{W_h}{W_v} = \frac{20}{65} = 0.31 < 0.75 \therefore$ Wind does not govern

$W_v = 65 \times 20 = 1{,}300$ lbs/ft

Try 1/3 rise:

Enter Table 13 where $L = 120$ ft, $\frac{W_h}{W_v} = 0$ and $W_v = 1{,}500$ lbs/ft

Obtain section: 2 flg. plates $8\frac{1}{4} \times \frac{3}{4}$ and web plate $25 \times \frac{1}{2}$

$H = 63$ kips

Req'd tie rod area: $63/22 = 2.87$ in.^{2}

Use 2″ diam. upset rod; $A = 3.142 > 2.87$ in.^{2}

Arc length: $120 \times 1.274 = 152.9$ ft (see Appendix)

Total weight of one arch:

152.9 (42.1 + 42.6) =	12,950 lbs
2″ diam. upset tie rod approx. =	1,300 lbs
	14,250 lbs

Try 1/4 rise:

Enter Table 12 where $L = 120$ ft, $\frac{W_h}{W_v} = 0$ and $W_v = 1{,}500$ lbs/ft

Obtain section: 2 flg. plates $8 \times \frac{3}{4}$ and web plate $23 \times \frac{1}{2}$

$H = 86$ kips

Req'd tie rod area: $86/22 = 3.91$ in.^{2}

Use $2\frac{1}{4}$″ diam. upset rod; $A = 3.976 > 3.91$ in.^{2}

Arc length: $120 \times 1.159 = 139.1$ ft

Total weight of one arch:

139.1 (40.8 + 39.1) =	11,110 lbs
$2\frac{1}{4}$″ diam. upset tie rod approx. =	1,650 lbs
	12,760 lbs

Saving in roof area using flatter arch:

$$\frac{100\ (152.9 - 139.1)}{152.9} = 9.0 \text{ percent}$$

Difference in weight of arches:

$$\frac{14{,}250 - 12{,}760}{20 \times 120} = 0.62 \text{ lbs per sq ft of floor area}$$

Headroom permitting, the flatter arch would prove more economical.

DESIGN EXAMPLE No. 6

Given:

Arch spacing: 25′-0 o.c.
Live load: 25 lbs/sq ft of horizontal projection
Dead load: 15 lbs/sq ft of horizontal projection
Wind pressure: 30 lbs/sq ft
Steel: A36

Required:

To design arch to provide 125 ft clear span with 9 ft headroom.

Solution:

Determine required arch span L, using geometric properties given in Appendix:

For 1/4 rise:

$$125\text{ ft} = \sqrt{L^2 - 27L - 324}$$
$$L = 140.5\text{ ft}$$

For 1/3 rise:

$$125\text{ ft} = \sqrt{L^2 - 15L - 324}$$
$$L = 134.0\text{ ft}$$

The ground area for the 1/3 rise is 4½ percent less, while the arc length is 5 percent greater. The weight of arch would be substantially the same.

$$\frac{W_L}{W_L + W_D} = 0.625 \cong 0.6$$

$$W_v = 40 \times 25 = 1{,}000 \text{ lbs per ft}$$

$$\frac{W_h}{W_v} = \frac{30}{40} = 0.75 \quad \text{(Use 1.00)}$$

Refer to Table 12 or 13:

Note that the difference in weight, between a 130 ft and 140 ft arch, where $\frac{W_h}{W_v} = 1.00$ and $W_v = 1{,}000$ lbs per ft is approximately 10 percent. Using the section given for a 140 ft span and designing the tie rod and foundations for the corresponding reactions would not entail more than a 5 percent sacrifice of economy and, in most cases, would be satisfactory. The excess of steel would be less than 0.2 lbs per sq ft of roof.

DESIGN EXAMPLE No. 7

Given:

Arch spacing: 28′-0 o.c.
Span: 175′-0
Rise: 1/4 span
Dead load: 25 lbs/sq ft of horizontal projection
Live load: 25 lbs/sq ft of horizontal projection
Wind load: 30 lbs/sq ft of vertical projection
Steel: A36

Solution:

Since the given ratio of live-to-total load is less than 0.6, conservative values for required moment thrust and reactions could be obtained for the 175 ft span by interpolation of the values listed in Table 12 for 170 and 180 ft spans. However, a worth-while saving in weight can be realized (in this example about 17 percent) by computing the actual design requirements using the coefficients given in Table 14.

To proceed, tabulate the products of W_DL^2, W_LL^2 and W_WL^2 by the appropriate coefficients given in Table 14 and arrange in a manner similar to the following:

$$W_DL^2 = W_LL^2 = 28 \times 0.025 \times 175^2 = 21{,}400 \text{ k-ft}$$

$$W_WL^2 = 28 \times 0.030 \times 175^2 = 25{,}700 \text{ k-ft}$$

By inspection of the results tabulated below:

Max. M with wind: 683 k-ft, at pt. 4
Max. M w/o wind: −491 k-ft, at pt. 4

$$\frac{683}{491} = 1.39 > 1.33 \therefore \text{Wind governs.}$$

Pt. on Arch	M_D	$+M_L$	M_D+M_L	$-M_L$	M_D-M_L	M_W		Max. total $\pm M$	
						Windward	Leeward	$M_D+M_L+M_W$	$M_D-M_L+M_W$
1 (19)	−81	90	9	−171	−252	260	(−8)		
2 (18)	−117	173	56	−290	−407	428	(−3)	484	−410
3 (17)	−119	245	126	−364	−483	503	(−31)	629	−514
4 (16)	−97	298	201	−394	−491	482	(−75)	683	−566
5 (15)	−58	327	269	−386	−444	368	(−135)	637	−579
6 (14)	−14	335	321	−349	−363	216	(−191)		
7 (13)	30	316	346	−287	−257	85	(−224)		
8 (12)	66	276	342	−211	−145	−24	(−232)		
9 (11)	89	221	310	−133	−44	−112	(−216)		
10 (10)	97	220	317	−123	−26	−175	(−175)		

While, with respect to bending, wind loading governs, the margin is slight (1.39 as compared to permissible 1.33). Therefore, the design should be investigated for combined thrust and bending, with and without wind.

Thrust at pt. 4 concurrent with 683 k-ft moment:

Due to D.L. $= -0.583 \times 28 \times 0.025 \times 175$
$= -71.4$ kips

Due to L.L. $= -0.208 \times 28 \times 0.025 \times 175$
$= -25.5$ kips

Due to W.L. $= 0.463 \times 28 \times 0.030 \times 175$
$= 68.1$ kips

Total concurrent thrust
$= -71.4 - 25.5 + 68.1 = -28.8$ kips

Neglecting wind, thrust at pt. 4 concurrent with -491 k-ft moment:
$-71.4 - 25.5 = -96.9$ kips

Trial section:

Try: 2 flg. plates $9\frac{3}{4} \times \frac{3}{4}$ and $30 \times \frac{5}{8}$ web
(For guidance in selecting initial trial section, inspect Tables 12 and 13 in 170 to 180 ft span range.)

$A = 33.38$ in.^{2}

$S_x = 308$ in.^{3}

$r_y = 1.86$ in.

$L_u = 10.5$ ft

Assume 10 ft purlin spacing; $F_b = 24.0$ ksi

$$L/r_y = \frac{10 \times 12}{1.86} = 64;\ F_a = 17.04 \text{ ksi}$$

Check combined stresses:

With wind:

$$f_a = \frac{28.8}{33.38} = 0.86$$

$$f_b = \frac{683 \times 12}{308} = 26.6$$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.05 + 1.11 = 1.16 < 1.33$$

Without wind:

$$f_a = \frac{96.9}{33.38} = 2.91$$

$$f_b = \frac{491 \times 12}{308} = 19.1$$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.17 + 0.80 = 0.97 < 1.0$$

Note that wind loading does not govern for combined stress.

$$\frac{9.75}{1.50} = 6.5 < 8\tfrac{1}{2}$$

$$70 - (100 \times 0.17) = 53$$

$$\frac{31.5}{0.63} = 50 < 53$$

} O.K. for compact section

Base tie:

Maximum outward H is produced by full load over entire span.

From Table 14, footnote Ⓑ:

Max. H (D.L.) $= 0.482 \times 28 \times 0.025 \times 175$
$= 59$ kips

Max. H (L.L.) = Max. H (D.L.) $= 59$ kips

Total tension $= 118$ kips

$$\text{Req'd area} = \frac{118}{22} = 5.36 \text{ sq in.}$$

Use: $2\frac{5}{8}''$ diam. upset rod.

Analysis of foundation requirements:

Refer to Table 14:

Case I: Full live plus dead load, no wind

$R = 0.5 \times 28 \times (2 \times 0.025) \times 175$
$= 122.5$ kips

Case II: Dead load plus wind

Windward footing:

$$R = \frac{122.5}{2} - (0.223 \times 28 \times 0.030 \times 175)$$
$= 28.5$ kips

Leeward footing:

$$R = \frac{122.5}{2} - (0.341 \times 28 \times 0.030 \times 175)$$
$= 11.1$ kips

Rod tension due to dead load:

$H = 0.482 \times 28 \times 0.025 \times 175 = 59.0$ kips

Horizontal reaction due to wind:

$H = -0.268 \times 28 \times 0.030 \times 175$
$= -39.4$ kips (at leeward foundation)

$H = -0.424 \times 28 \times 0.030 \times 175$
$= -62.2$ kips (at windward foundation)

Since dead load tension in rod is greater than inward wind *load* at leeward foundation, the tie rod remains in tension and the total horizontal force to be taken by foundations is the difference between the windward and leeward forces, equalling

$62.2 - 39.4 = 22.8$ kips (in the direction of the wind)

Prorate between windward and leeward foundations in proportion to vertical reactions:

For windward foundation:

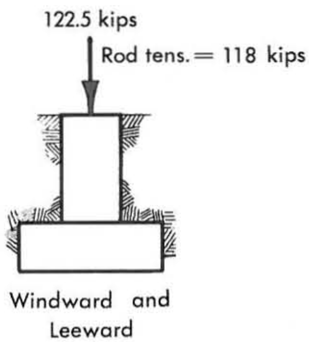
$$\frac{28.5}{39.6} \times 22.8 = 16.4 \text{ kips}$$

For leeward foundation:

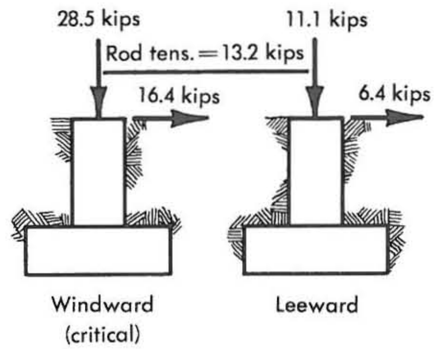
$$\frac{11.1}{39.6} \times 22.8 = 6.4 \text{ kips}$$

Net rod tension $= 59.0 - 39.4 - 6.4$
$= 13.2$ kips (O.K.)

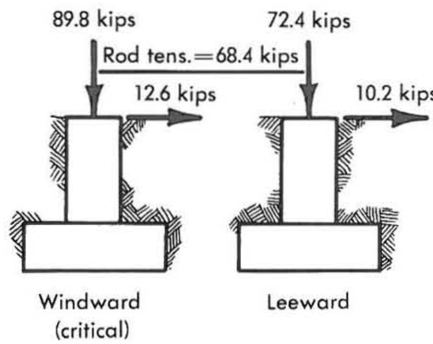
Case III: Repeat analysis adding live load forces.



CASE I

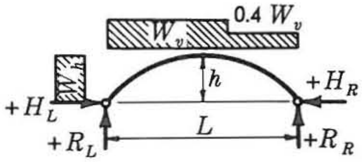


CASE II



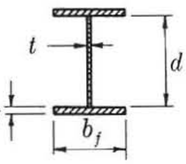
CASE III

NOTES



ARCH DESIGN DATA

TABLE 12 $h/L = 1/4$

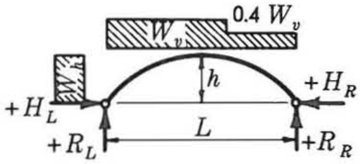


Note: Tables based on $W_D = 0.4W_V$ and $W_L = 0.6W_V$

L ft	W_h/W_v	W_v lbs/ft	Web d in.	Web t in.	Flange b_f in.	Flange t_f in.	I_x in.⁴	I_y in.⁴	L_C ft	M kip-ft	N kips	Windward R kips	Windward H kips	Leeward R kips	Leeward H kips
80	.00	1000	15	7/16	5 3/4	7/16	422	13	6.2	−82	−36	40	38	40	38
		1500	18	3/8	7	1/2	781	28	7.5	−123	−55	60	57	60	57
	1.00	**1000**	**18**	**7/16**	**5 1/4**	**7/16**	**603**	**10**	**5.5**	**121**	**6**	**−1**	**−14**	**−9**	**−5**
		1500	**20**	**1/2**	**6 1/4**	**1/2**	**989**	**20**	**6.7**	**181**	**9**	**−2**	**−21**	**−13**	**−7**
90	.00	1000	17	3/8	6	1/2	612	18	6.5	−104	−41	45	43	45	43
		1500	19	7/16	6 1/2	5/8	1032	28	7.0	−156	−61	67	65	67	65
	1.00	**1000**	**19**	**1/2**	**6 1/4**	**7/16**	**802**	**17**	**6.2**	**153**	**7**	**−2**	**−16**	**−10**	**−5**
		1500	**22**	**3/8**	**6 3/4**	**5/8**	**1412**	**32**	**7.3**	**229**	**10**	**−2**	**−23**	**−14**	**−8**
100	.00	1000	18	3/8	7	1/2	781	28	7.5	−128	−45	50	48	50	48
		1500	21	7/16	7 1/4	5/8	1397	39	7.8	−193	−68	75	72	75	72
	1.00	**1000**	**20**	**3/8**	**7 1/2**	**1/2**	**1037**	**35**	**8.1**	**189**	**7**	**−2**	**−17**	**−11**	**−6**
		1500	**23**	**3/8**	**8 1/4**	**5/8**	**1819**	**58**	**8.9**	**283**	**11**	**−3**	**−26**	**−16**	**−8**
110	.00	1000	19	7/16	6 1/4	5/8	1002	25	6.7	−155	−50	55	53	55	53
		1500	22	7/16	8 3/4	5/8	1787	69	9.4	−233	−75	82	79	82	79
	1.00	**1000**	**22**	**3/8**	**6 3/4**	**5/8**	**1412**	**32**	**7.3**	**228**	**8**	**−2**	**−19**	**−12**	**−6**
		1500	**25**	**7/16**	**8 3/4**	**5/8**	**2365**	**69**	**9.4**	**343**	**12**	**−3**	**−29**	**−17**	**−9**
120	.00	1000	20	7/16	7	5/8	1222	35	7.5	−185	−55	60	57	60	57
		1500	23	1/2	8	3/4	2199	64	8.6	−278	−82	90	86	90	86
	1.00	**1000**	**23**	**3/8**	**7 3/4**	**5/8**	**1731**	**48**	**8.3**	**272**	**9**	**−2**	**−21**	**−13**	**−7**
		1500	**26**	**7/16**	**8 1/2**	**3/4**	**2921**	**76**	**9.2**	**408**	**14**	**−3**	**−31**	**−19**	**−10**
130	.00	1000	21	7/16	8	5/8	1506	53	8.6	−217	−59	65	62	65	62
		1500	24	1/2	9	3/4	2643	91	9.7	−326	−89	97	93	97	93
	1.00	**1000**	**24**	**3/8**	**8 3/4**	**5/8**	**2090**	**69**	**9.4**	**319**	**10**	**−2**	**−23**	**−14**	**−7**
		1500	**28**	**7/16**	**9 1/4**	**3/4**	**3667**	**98**	**10.0**	**479**	**15**	**−3**	**−34**	**−21**	**−11**
140	.00	1000	22	1/2	8 1/2	5/8	1803	63	9.2	−252	−64	70	67	70	67
		1500	26	5/8	9	3/4	3330	91	9.7	−378	−96	105	101	105	101
	1.00	**1000**	**26**	**7/16**	**9**	**5/8**	**2634**	**75**	**9.4**	**370**	**10**	**−3**	**−24**	**−15**	**−8**
		1500	**29**	**1/2**	**10 1/4**	**3/4**	**4418**	**134**	**11.1**	**555**	**16**	**−4**	**−36**	**−22**	**−12**
150	.00	1000	23	1/2	8	3/4	2199	64	8.6	−290	−68	75	72	75	72
		1500	27	5/8	10	3/4	3912	125	10.8	−435	−103	112	108	112	108
	1.00	**1000**	**27**	**7/16**	**8 1/2**	**3/4**	**3172**	**76**	**9.2**	**425**	**11**	**−3**	**−26**	**−16**	**−8**
		1500	**31**	**1/2**	**11**	**3/4**	**5399**	**166**	**11.5**	**638**	**17**	**−4**	**−39**	**−24**	**−13**
160	.00	1000	25	1/2	8 1/4	3/4	2702	70	8.9	−329	−73	80	77	80	77
		1500	28	5/8	11 1/4	3/4	4630	177	12.1	−494	−110	120	115	120	115
	1.00	**1000**	**28**	**7/16**	**9 1/2**	**3/4**	**3744**	**107**	**10.2**	**484**	**12**	**−3**	**−28**	**−17**	**−9**
		1500	**32**	**1/2**	**10 3/4**	**7/8**	**6448**	**181**	**11.6**	**726**	**18**	**−4**	**−42**	**−25**	**−14**
170	.00	1000	26	5/8	8 1/4	3/4	3129	70	8.9	−372	−78	85	81	85	81
		1500	29	5/8	10 1/2	7/8	5370	168	11.3	−558	−117	127	122	127	122
	1.00	**1000**	**29**	**1/2**	**10**	**3/4**	**4335**	**125**	**10.8**	**546**	**13**	**−3**	**−30**	**−18**	**−10**
		1500	**33**	**5/8**	**11**	**7/8**	**7394**	**194**	**11.9**	**819**	**19**	**−5**	**−44**	**−27**	**−14**
180	.00	1000	27	5/8	9	3/4	3624	91	9.7	−417	−82	90	86	90	86
		1500	30	5/8	11 1/2	7/8	6202	221	12.4	−626	−123	135	130	135	130
	1.00	**1000**	**30**	**1/2**	**11**	**3/4**	**5025**	**166**	**11.9**	**612**	**14**	**−3**	**−31**	**−19**	**−10**
		1500	**35**	**5/8**	**11 3/4**	**7/8**	**8849**	**236**	**12.7**	**919**	**21**	**−5**	**−47**	**−29**	**−15**

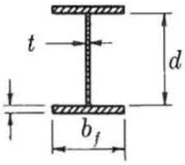
Values in light face type governed by vertical load.

Values in bold face type governed by combined vertical plus horizontal load. Tabulated moments and forces have been reduced 25 per cent in accordance with Sect. 1.5.6. of AISC Specification.



ARCH DESIGN DATA

TABLE 13 $h/L = 1/3$

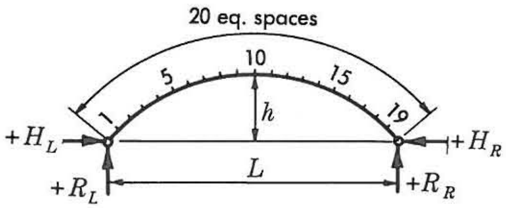


Note: Tables based on $W_D = 0.4W_V$ and $W_L = 0.6W_V$

L ft	W_h/W_v	W_v lbs/ft	Web d in.	Web t in.	Flange b_f in.	Flange t_f in.	I_x in.^{4}	I_y in.^{4}	L_C ft	M kip-ft	N kips	Windward R kips	Windward H kips	Leeward R kips	Leeward H kips
80	.00	1000	16	3/8	6 1/4	7/16	497	17	6.7	−98	−30	40	28	40	28
		1500	19	3/8	7 1/2	1/2	927	35	8.1	−147	−46	60	42	60	42
	1.00	**1000**	**19**	**1/2**	**5 3/4**	**7/16**	**761**	**13**	**6.2**	**147**	**8**	**−4**	**−15**	**−10**	**−2**
		1500	**22**	**3/8**	**6 1/2**	**5/8**	**1372**	**28**	**7.0**	**220**	**13**	**−6**	**−23**	**−15**	**−2**
90	.00	1000	18	3/8	6 1/4	1/2	717	20	6.7	−124	−34	45	31	45	31
		1500	20	7/16	7	5/8	1222	35	7.5	−186	−51	67	47	67	47
	1.00	**1000**	**20**	**3/8**	**7 1/2**	**1/2**	**1037**	**35**	**8.1**	**186**	**9**	**−4**	**−17**	**−11**	**−2**
		1500	**23**	**3/8**	**8**	**5/8**	**1775**	**53**	**8.6**	**279**	**14**	**−7**	**−26**	**−17**	**−3**
100	.00	1000	19	7/16	7	1/2	915	28	7.5	−153	−38	50	35	50	35
		1500	22	7/16	8	5/8	1667	53	8.6	−229	−57	75	52	75	52
	1.00	**1000**	**22**	**3/8**	**6 3/4**	**5/8**	**1412**	**32**	**7.3**	**230**	**11**	**−5**	**−19**	**−12**	**−2**
		1500	**25**	**7/16**	**9**	**5/8**	**2416**	**75**	**9.7**	**345**	**16**	**−7**	**−29**	**−18**	**−3**
110	.00	1000	20	7/16	6 3/4	5/8	1188	32	7.3	−185	−42	55	38	55	38
		1500	23	1/2	9	5/8	2076	75	9.7	−278	−63	82	57	82	57
	1.00	**1000**	**23**	**3/8**	**8**	**5/8**	**1775**	**53**	**8.6**	**278**	**12**	**−5**	**−21**	**−13**	**−2**
		1500	**27**	**7/16**	**8 1/2**	**3/4**	**3172**	**76**	**9.2**	**417**	**18**	**−8**	**−32**	**−20**	**−3**
120	.00	1000	21	7/16	7 3/4	5/8	1470	48	8.3	−220	−46	60	42	60	42
		1500	25	1/2	8 1/4	3/4	2702	70	8.9	−330	−69	90	63	90	63
	1.00	**1000**	**25**	**7/16**	**8 1/4**	**5/8**	**2262**	**58**	**8.9**	**331**	**13**	**−6**	**−23**	**−15**	**−2**
		1500	**28**	**7/16**	**10**	**3/4**	**3899**	**125**	**10.8**	**496**	**19**	**−9**	**−34**	**−22**	**−3**
130	.00	1000	23	1/2	7 3/4	5/8	1858	48	8.3	−258	−50	65	45	65	45
		1500	26	5/8	8 1/2	3/4	3196	76	9.2	−388	−75	97	68	97	68
	1.00	**1000**	**26**	**7/16**	**8**	**3/4**	**2787**	**64**	**8.6**	**388**	**14**	**−6**	**−25**	**−16**	**−2**
		1500	**30**	**1/2**	**10 1/2**	**3/4**	**4848**	**144**	**11.3**	**583**	**21**	**−10**	**−37**	**−24**	**−4**
140	.00	1000	24	1/2	8 3/4	5/8	2234	69	9.4	−300	−53	70	49	70	49
		1500	27	5/8	9 3/4	3/4	3840	115	10.5	−450	−80	105	73	105	73
	1.00	**1000**	**27**	**7/16**	**9 1/4**	**3/4**	**3388**	**98**	**10.0**	**450**	**15**	**−7**	**−27**	**−17**	**−3**
		1500	**31**	**1/2**	**10 1/4**	**7/8**	**5797**	**157**	**11.1**	**676**	**23**	**−10**	**−40**	**−26**	**−4**
150	.00	1000	25	1/2	8 1/4	3/4	2702	70	8.9	−344	−57	75	52	75	52
		1500	28	5/8	11	3/4	4552	166	11.9	−517	−86	112	78	112	78
	1.00	**1000**	**29**	**1/2**	**9 1/2**	**3/4**	**4169**	**107**	**10.2**	**517**	**16**	**−7**	**−29**	**−18**	**−3**
		1500	**33**	**5/8**	**10 1/4**	**7/8**	**7017**	**157**	**11.1**	**776**	**24**	**−11**	**−43**	**−27**	**−4**
160	.00	1000	26	5/8	8 1/4	3/4	3129	70	8.9	−392	−61	80	56	80	56
		1500	30	5/8	10	7/8	5576	145	10.8	−588	−92	120	84	120	84
	.75	**1000**	**27**	**7/16**	**9**	**3/4**	**3316**	**91**	**9.7**	**453**	**4**	**0**	**−19**	**−9**	**−12**
		1500	**31**	**1/2**	**10**	**7/8**	**5686**	**145**	**10.8**	**679**	**6**	**0**	**−28**	**−13**	**−19**
	1.00	**1000**	**30**	**1/2**	**10 1/2**	**3/4**	**4848**	**144**	**11.3**	**588**	**17**	**−8**	**−31**	**−20**	**−3**
		1500	**34**	**5/8**	**11 3/4**	**7/8**	**8299**	**236**	**12.7**	**883**	**26**	**−12**	**−46**	**−29**	**−5**
170	.00	1000	27	5/8	9 1/4	3/4	3696	98	10.0	−442	−65	85	59	85	59
		1500	31	5/8	11 1/4	7/8	6552	207	12.1	−664	−98	127	89	127	89
	.75	**1000**	**28**	**1/2**	**9 1/2**	**3/4**	**3859**	**107**	**10.2**	**511**	**4**	**0**	**−20**	**−9**	**−13**
		1500	**33**	**5/8**	**10**	**7/8**	**6892**	**145**	**10.8**	**767**	**7**	**0**	**−30**	**−14**	**−20**
	1.00	**1000**	**31**	**1/2**	**10**	**7/8**	**5686**	**145**	**10.8**	**664**	**18**	**−8**	**−32**	**−21**	**−3**
		1500	**36**	**5/8**	**12 1/2**	**7/8**	**9866**	**284**	**13.2**	**997**	**28**	**−12**	**−49**	**−31**	**−5**
180	.00	1000	28	5/8	10	3/4	4242	125	10.8	−496	−69	90	63	90	63
		1500	32	3/4	11 1/2	7/8	7485	221	12.4	−744	−103	135	94	135	94
	.75	**1000**	**30**	**1/2**	**10**	**3/4**	**4670**	**125**	**10.8**	**573**	**5**	**0**	**−21**	**−10**	**−14**
		1500	**34**	**5/8**	**11**	**7/8**	**7900**	**194**	**11.9**	**860**	**7**	**0**	**−32**	**−15**	**−21**
	1.00	**1000**	**32**	**1/2**	**11**	**7/8**	**6566**	**194**	**11.9**	**745**	**19**	**−9**	**−34**	**−22**	**−3**
		1500	**37**	**5/8**	**12 1/4**	**1**	**1482**	**306**	**13.2**	**1117**	**29**	**−13**	**−52**	**−33**	**−5**

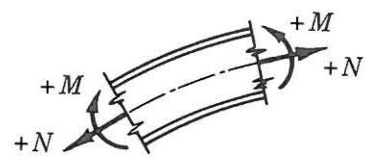
Values in light face type governed by vertical load.

Values in bold face type governed by combined vertical plus horizontal load. Tabulated moments and forces have been reduced 25 per cent in accordance with Sect. 1.5.6 of AISC Specification.



ARCH DESIGN DATA

TABLE 14 $h/L = 1/4$



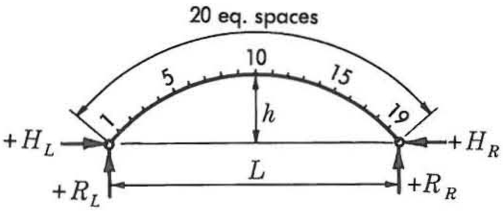
	Dead Ⓑ Load		Wind Ⓒ Load		Max $+M_L$ and Concurrent N, H, & R Due to Critical Live Load					Max $-M_L$ and Concurrent N, H, & R Due to Critical Live Load				
Point Ⓐ on Arch	$\frac{M_D}{W_D L^2}$	$\frac{N_D}{W_D L}$	$\frac{M_W}{W_W L^2}$	$\frac{N_W}{W_W L}$	$\frac{M_L}{W_L L^2}$	$\frac{N_L}{W_L L}$	$\frac{H}{W_L L}$ Ⓓ	$\frac{R_L}{W_L L}$	$\frac{R_R}{W_L L}$	$\frac{M_L}{W_L L^2}$	$\frac{N_L}{W_L L}$	$\frac{H}{W_L L}$ Ⓓ	$\frac{R_L}{W_L L}$	$\frac{R_R}{W_L L}$
1	−.00377	−.667	.01012	.449	.00420	−.205	.086	.236	.037	−.00798	−.462	.396	.264	.463
2	−.00548	−.641	.01665	.460	.00809	−.221	.119	.275	.054	−.01357	−.420	.363	.226	.446
3	−.00557	−.612	.01954	.464	.01143	−.187	.119	.275	.054	−.01701	−.425	.363	.226	.446
4	−.00451	−.583	.01875	.463	.01390	−.208	.157	.311	.074	−.01840	−.376	.325	.189	.426
5	−.00272	−.556	.01431	.456	.01529	−.181	.157	.311	.074	−.01802	−.375	.325	.189	.426
6	−.00064	−.531	.00842	.447	.01566	−.210	.198	.344	.098	−.01630	−.321	.284	.156	.402
7	.00139	−.510	.00332	.438	.01478	−.244	.241	.375	.125	−.01339	−.266	.241	.125	.375
8	.00306	−.495	−.00094	.432	.01290	−.282	.284	.402	.156	−.00984	−.213	.198	.344	.098
9	.00415	−.485	−.00433	.426	.01031	−.322	.325	.426	.189	−.00619	−.163	.157	.311	.074
10	.00452	−.482	−.00682	.422	.01026	−.244	.243	.172	.172	−.00574	−.238	.238	.338	.338
11	.00415	−.485	−.00838	.420	.01031	−.322	.325	.426	.189	−.00619	−.163	.157	.311	.074
12	.00306	−.495	−.00901	.419	.01290	−.282	.284	.402	.156	−.00984	−.213	.198	.344	.098
13	.00139	−.510	−.00870	.419	.01478	−.244	.241	.375	.125	−.01339	−.266	.241	.125	.375
14	−.00064	−.531	−.00744	.421	.01566	−.210	.198	.344	.098	−.01630	−.321	.284	.156	.402
15	−.00272	−.556	−.00526	.425	.01529	−.181	.157	.311	.074	−.01802	−.375	.325	.189	.426
16	−.00451	−.583	−.00292	.428	.01390	−.208	.157	.311	.074	−.01840	−.376	.325	.189	.426
17	−.00557	−.612	−.001210	.431	.01143	−.187	.119	.275	.054	−.01701	−.425	.363	.226	.446
18	−.00548	−.641	−.00013	.433	.00809	−.221	.119	.275	.054	−.01357	−.420	.363	.226	.446
19	−.00377	−.667	.00030	.434	.00420	−.205	.086	.236	.037	−.00798	−.462	.396	.264	.463

Ⓐ Location on arch (points equally spaced along curve)

Ⓑ $H_L/W_D L = H_R/W_D L = 0.482$
$R_L/W_D L = R_R/W_D L = 0.500$

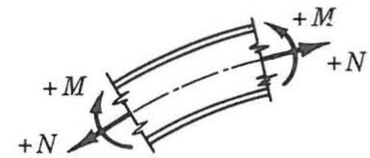
Ⓒ $H_L/W_W L = -0.424$
$H_R/W_W L = -0.268$
$R_L/W_W L = -0.223$
$R_R/W_W L = -0.341$

Ⓓ $H_L/W_L L = H_R/W_L L$



ARCH DESIGN DATA

TABLE 15 $h/L = 1/3$



	Dead Load (B)		Wind Load (C)		Max $+M_L$ and Concurrent N, H, & R Due to Critical Live Load					Max $-M_L$ and Concurrent N, H, & R Due to Critical Live Load				
Point (A) on Arch	$\frac{M_D}{W_D L^2}$	$\frac{N_D}{W_D L}$	$\frac{M_W}{W_W L^2}$	$\frac{N_W}{W_W L}$	$\frac{M_L}{W_L L^2}$	$\frac{N_L}{W_L L}$	$\frac{H}{W_L L}$ (D)	$\frac{R_L}{W_L L}$	$\frac{R_R}{W_L L}$	$\frac{M_L}{W_L L^2}$	$\frac{N_L}{W_L L}$	$\frac{H}{W_L L}$ (D)	$\frac{R_L}{W_L L}$	$\frac{R_R}{W_L L}$
1	−.00650	−.583	.01452	.425	.00265	−.196	.055	.222	.032	−.00915	−.387	.295	.278	.468
2	−.00961	−.560	.02396	.442	.00579	−.162	.055	.222	.032	−.01540	−.398	.295	.278	.468
3	−.00994	−.530	.02820	.450	.00902	−.173	.080	.264	.049	−.01897	−.357	.270	.236	.451
4	−.00819	−.495	.02717	.448	.01185	−.184	.109	.304	.070	−.02004	−.311	.241	.196	.430
5	−.00508	−.458	.02090	.437	.01425	−.149	.109	.304	.070	−.01933	−.309	.241	.196	.430
6	−.00134	−.424	.01250	.421	.01562	−.165	.141	.341	.095	−.01696	−.258	.209	.159	.405
7	.00235	−.393	.00514	.408	.01581	−.186	.175	.375	.125	−.01346	−.208	.175	.125	.375
8	.00542	−.370	−.00107	.396	.01489	−.211	.209	.405	.159	−.00947	−.160	.141	.095	.341
9	.00744	−.355	−.00606	.387	.01302	−.239	.241	.430	.196	−.00561	−.117	.109	.070	.304
10	.00813	−.350	−.00976	.380	.01278	−.190	.190	.187	.187	−.00463	−.160	.160	.313	.313
11	.00744	−.355	−.01211	.376	.01302	−.239	.241	.430	.196	−.00561	−.117	.109	.070	.304
12	.00542	−.370	−.01308	.374	.01489	−.211	.209	.405	.159	−.00947	−.160	.141	.095	.341
13	.00235	−.393	−.01265	.375	.01581	−.186	.175	.375	.125	−.01346	−.208	.175	.125	.375
14	−.00134	−.424	−.01084	.378	.01562	−.165	.141	.341	.095	−.01696	−.258	.209	.159	.405
15	−.00508	−.458	−.00767	.384	.01425	−.149	.109	.304	.070	−.01933	−.309	.241	.196	.430
16	−.00819	−.495	−.00426	.390	.01185	−.184	.109	.304	.070	−.02004	−.311	.241	.196	.430
17	−.00994	−.530	−.00175	.395	.00902	−.173	.080	.264	.049	−.01897	−.357	.270	.236	.451
18	−.00961	−.560	−.00016	.398	.00579	−.162	.055	.222	.032	−.01540	−.399	.295	.278	.468
19	−.00650	−.583	.00048	.399	.00265	−.196	.055	.222	.032	−.00915	−.387	.295	.278	.468

(A) Location on arch (points equally spaced along curve)

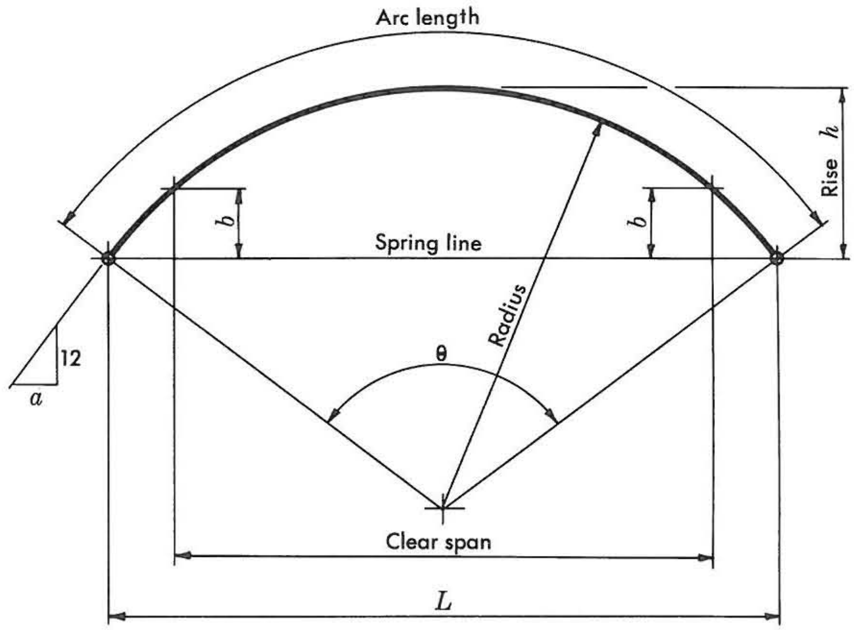
(B) $H_L/W_D L = H_R/W_D L = 0.350$
$R_L/W_D L = R_R/W_D L = 0.500$

(C) $H_L/W_W L = -0.394$
$H_R/W_W L = -0.165$
$R_L/W_W L = -0.265$
$R_R/W_W L = -0.363$

(D) $H_L/W_L L = H_R/W_L L$

APPENDIX

Geometric Properties of a Circular Arc



	$h/L = 1/4$	$h/L = 1/3$
Radius	$5L/8$	$13L/24$
Arc length	$1.1592L$	$1.2740L$
Angle θ	$106°16'0''$	$134°45'30''$
Bevel a	9	5
Clear span	$\sqrt{L^2 - 3Lb - 4b^2}$	$\sqrt{L^2 - \frac{5Lb}{3} - 4b^2}$

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