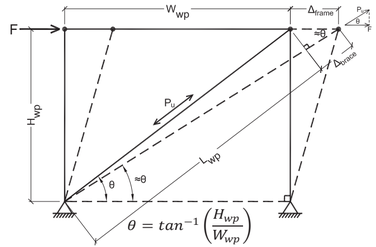
Brace Stiffness Calculations



EQ# Brace Force

❶ $$P_u = {F}/{cos\theta} = F\left(\frac{L_{wp}}{W_{wp}}\right)$$

Brace Elongation & Stiffness (Elastic)

❷ $$\Delta_{brace} = \frac{P_u\ L_{wp}}{A_{sc}\ KF\ E} = {P_u}/{K_{eff}} \Longrightarrow$$

❸ $$K_{eff} = {P_u}/{\Delta_{brace}} \Longrightarrow K_{eff} = \frac{KF\ A_{sc}\ E}{L_{wp}}$$

Frame Deflection (Elastic)

$$\Delta_{frame} = \frac{\Delta_{brace}}{cos\theta} \overset{\text{sub from ❷}}{\Longrightarrow} \Delta_{frame} = \frac{P_u}{K_{eff}\ cos\theta} \overset{\text{sub from ❶}}{\Longrightarrow}$$

❹ $$\Delta_{frame} = \frac{F}{K_{eff}\ cos^2\theta} \overset{\text{sub from ❸}}{\Longrightarrow} \Delta_{frame} = \frac{F\ L_{wp}}{A_{sc}\ KF\ E\ cos^2\theta}$$

Alternate Forms (Elastic)

$$\Delta_{frame} = \frac{2\Phi({F_y}/{E})\ H_{wp}}{KF\ sin2\theta}$$

$$Story\ Drift = \frac{\Delta_{frame}}{H_{wp}} = \frac{2\Phi({F_y}/{E})}{KF\ sin2\theta}$$

For LRFD design, use = 0.9 in addition to any factor of safety resulting from the ratio of the required A_{sc} to the provided A_{sc}.

Frame Stiffness

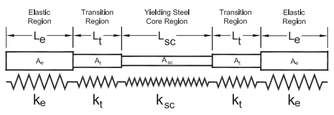
The effective horizontal stiffness can be summarized by the following statement:

$$\Delta_{frame} = {F}/{K_{frame}} \Longrightarrow$$

$$K_{frame} = {F}/{\Delta_{frame}} \overset{\text{sub from ❹}}{\Longrightarrow}$$

$$K_{frame} = K_{eff}\ cos^2\theta$$

Stiffness Determination of a Composite Element



$$K_{sc\_wp} = \frac{A_{sc}\ E}{L_{wp}}$$ Axial stiffness of yielding core projected from workpoint to workpoint

$$K_{eff} = \frac{1}{\sum_{i=0}^{n}\frac{1}{k_i}}$$ Effective (Actual) stiffness of composite element

$$KF = \frac{K_{eff}}{K_{sc\_wp}}$$ Axial Stiffness Adjustment Factor supplied by CoreBrace

$$K_{eff} = \frac{A_{sc}\ (KF \cdot E)}{L_{wp}}$$ Effective stiffness of BRB for use in deflection analysis

Rigid Assumption

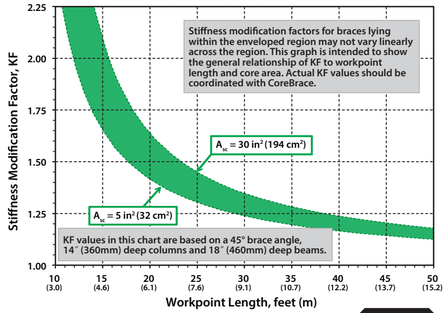
If k_e and k_t are assumed rigid, the above equation for KF simplifies to:

$$KF \cong \frac{L_{wp}}{L_{sc}} = \frac{1}{0.6} = 1.67 \Longrightarrow$$

$$K_{eff} \cong 1.67K_{sc\_wp}$$

This assumption can result in significant error as the ratio of L_{wp}/L_{sc} increases and can underestimate elastic deformations. However, since the elastic deformations of non-yielding regions calculated with non-rigid assumptions are amplified by Cd to calculate their inelastic deformations (which over-predicts these deformations , the rigid assumption may more accurately predict the total inelastic deformations of the element.

Approximate Stiffness Modification Factor



For design assistance please contact CoreBrace:

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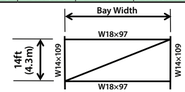
9/2016

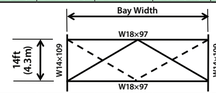
Approximate Stiffness Modification Factors, KF[1,2,7]

Sizes shown are representative of typical BRB sizes. Information on intermediate and larger sizes is available upon request.

STORY HEIGHT: 14ft (4.3m)

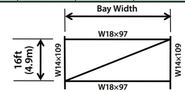
F_{ysc} = 38 ksi (262 MPa)		Bay Width, ft (m)									
A_{sc}[3] in² (cm²)	P_{y_axial}[4] kip (kN)	15 (4.6)	20 (6.1)	25 (7.6)	30 (9.1)	35 (10.7)	30 (9.1)	35 (10.7)	40 (12.2)	45 (13.7)	50 (15.2)
		SINGLE DIAGONAL					CHEVRON/V				
2.0 (13)	68 (306)	1.38	1.35	1.32	1.31	1.29	1.38	1.36	1.35	1.33	1.32
3.0 (19)	103 (448)	1.39	1.35	1.33	1.31	1.30	1.39	1.37	1.35	1.34	1.33
4.0 (26)	137 (613)	1.37	1.34	1.32	1.30	1.29	1.37	1.35	1.34	1.33	1.32
5.0 (32)	171 (754)	1.39	1.36	1.33	1.32	1.30	1.39	1.37	1.36	1.34	1.33
6.0 (39)	205 (919)	1.43	1.40	1.37	1.35	1.33	1.43	1.41	1.40	1.38	1.37
7.0 (45)	239 (1060)	1.41	1.38	1.35	1.33	1.32	1.41	1.40	1.38	1.37	1.35
8.0 (52)	274 (1225)	1.44	1.40	1.38	1.35	1.34	1.44	1.42	1.40	1.39	1.38
9.0 (58)	308 (1367)	1.43	1.39	1.36	1.34	1.33	1.43	1.41	1.39	1.38	1.36
10.0 (65)	342 (1532)	1.45	1.41	1.38	1.36	1.34	1.45	1.43	1.41	1.39	1.38
11.0 (71)	376 (1673)	1.51	1.46	1.43	1.40	1.38	1.51	1.49	1.46	1.44	1.43
12.0 (77)	410 (1814)	1.47	1.43	1.40	1.37	1.35	1.47	1.45	1.43	1.41	1.40
14.0 (90)	479 (2121)	1.45	1.41	1.38	1.36	1.34	1.45	1.43	1.41	1.39	1.38
16.0 (103)	547 (2427)	1.51	1.46	1.43	1.40	1.38	1.51	1.49	1.46	1.44	1.43
18.0 (116)	616 (2733)	1.52	1.47	1.44	1.41	1.39	1.52	1.50	1.47	1.45	1.44
20.0 (129)	684 (3040)	1.58	1.52	1.47	1.44	1.42	1.58	1.55	1.52	1.49	1.47
22.0 (142)	752 (3346)	1.56	1.50	1.46	1.43	1.41	1.56	1.53	1.50	1.48	1.46
24.0 (155)	821 (3652)	1.54	1.49	1.45	1.42	1.40	1.54	1.52	1.49	1.47	1.45
26.0 (168)	889 (3959)	1.61	1.55	1.50	1.47	1.44	1.61	1.58	1.55	1.52	1.50
28.0 (181)	958 (4265)	1.63	1.56	1.51	1.48	1.45	1.63	1.59	1.56	1.53	1.51
30.0 (194)	1026 (4571)	1.64	1.57	1.52	1.48	1.45	1.64	1.60	1.57	1.54	1.52
Workpoint Length, ft (m)		20.5 (6.3)	24.4 (7.4)	28.7 (8.7)	33.1 (10.1)	37.7 (11.5)	20.5 (6.3)	22.4 (6.8)	24.4 (7.4)	26.5 (8.1)	28.7 (8.7)

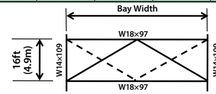




STORY HEIGHT: 16ft (4.9m)

F_{ysc} = 38 ksi (262 MPa)		Bay Width, ft (m)									
A_{sc}[3] in² (cm²)	P_{y_axial}[4] kip (kN)	15 (4.6)	20 (6.1)	25 (7.6)	30 (9.1)	35 (10.7)	30 (9.1)	35 (10.7)	40 (12.2)	45 (13.7)	50 (15.2)
		SINGLE DIAGONAL					CHEVRON/V				
2.0 (13)	68 (306)	1.33	1.30	1.28	1.27	1.26	1.33	1.31	1.30	1.29	1.28
3.0 (19)	103 (448)	1.33	1.31	1.29	1.27	1.26	1.33	1.32	1.31	1.30	1.29
4.0 (26)	137 (613)	1.32	1.30	1.28	1.26	1.25	1.32	1.31	1.30	1.29	1.28
5.0 (32)	171 (754)	1.33	1.31	1.29	1.28	1.27	1.33	1.32	1.31	1.30	1.29
6.0 (39)	205 (919)	1.37	1.34	1.32	1.30	1.29	1.37	1.36	1.34	1.33	1.32
7.0 (45)	239 (1060)	1.36	1.33	1.31	1.29	1.28	1.36	1.34	1.33	1.32	1.31
8.0 (52)	274 (1225)	1.38	1.35	1.33	1.31	1.30	1.38	1.36	1.35	1.34	1.33
9.0 (58)	308 (1367)	1.37	1.34	1.32	1.30	1.29	1.37	1.35	1.34	1.33	1.32
10.0 (65)	342 (1532)	1.38	1.35	1.33	1.31	1.30	1.38	1.37	1.35	1.34	1.33
11.0 (71)	376 (1673)	1.44	1.40	1.37	1.35	1.33	1.44	1.42	1.40	1.39	1.37
12.0 (77)	410 (1814)	1.40	1.37	1.34	1.33	1.31	1.40	1.39	1.37	1.36	1.34
14.0 (90)	479 (2121)	1.38	1.35	1.33	1.31	1.30	1.38	1.37	1.35	1.34	1.33
16.0 (103)	547 (2427)	1.44	1.40	1.37	1.35	1.33	1.44	1.42	1.40	1.38	1.37
18.0 (116)	616 (2733)	1.45	1.41	1.38	1.36	1.34	1.45	1.43	1.41	1.39	1.38
20.0 (129)	684 (3040)	1.49	1.45	1.41	1.39	1.36	1.49	1.47	1.45	1.43	1.41
22.0 (142)	752 (3346)	1.48	1.43	1.40	1.38	1.36	1.48	1.45	1.43	1.42	1.40
24.0 (155)	821 (3652)	1.46	1.42	1.39	1.37	1.35	1.46	1.44	1.42	1.41	1.39
26.0 (168)	889 (3959)	1.52	1.47	1.43	1.41	1.38	1.52	1.49	1.47	1.45	1.43
28.0 (181)	958 (4265)	1.53	1.48	1.44	1.41	1.39	1.53	1.51	1.48	1.46	1.44
30.0 (194)	1026 (4571)	1.54	1.49	1.45	1.42	1.40	1.54	1.51	1.49	1.47	1.45
Workpoint Length, ft (m)		21.9 (6.7)	25.6 (7.8)	29.7 (9.0)	34.0 (10.4)	38.5 (11.7)	21.9 (6.7)	23.7 (7.2)	25.6 (7.8)	27.6 (8.4)	29.7 (9.0)





NOTES:

1. $KF = K_{eff} / K_{sc\_wp}$ where K_{eff} is the actual WP to WP stiffness of the installed brace and K_{sc_wp} is the stiffness of the indicated core area if it occurred from WP to WP. The indicated KF factors are expected "base value" (minimums). These can be adjusted upwards somewhat, but doing so can affect overstrength factors and may have undesirable effects. Coordinate with CoreBrace.
2. Indicated KF factors are approx values for the indicated frame geometry and beam/column sizes. Different beam and/or column sizes will result in different KF values.
3. Indicated core area is minimum cross sectional area of yielding portion of BRB core.
4. P_{y_axial} is the design yield strength of the BRB equal to: $\alpha F_y A_{sc}$ based on the lower-bound of the yield stress range. Typ yield stress range = 42 ksi ± 4 ksi (290MPa ± 28MPa)
5. Where a KF is not given in the table, the brace orientation may result in an unacceptable level of strain. Contact CoreBrace for project specific details.
6. The area of the "Connection Region" (WP to Tip of gusset) is taken to be on average 5× stiffer than the "End Region" of the brace, which results in a semi-rigid offset.
7. Values given are intended for schematic design only. Contact CoreBrace for project specific information.
8. Brace sizes and Stiffness Modification Factors in addition to those shown are available upon request.
9. This table was created by considering core strain at 2% story drift minimum as required by AISC 341-10. For other story drifts, values may be different.

Approximate Stiffness Modification Factors, KF[1,2,7] (cont'd)

Sizes shown are representative of typical BRB sizes. Information on intermediate and larger sizes is available upon request.

STORY HEIGHT: 18ft (5.5m)

F_{ysc} = 38 ksi (262 MPa)		Bay Width, ft (m)									
A_{sc}[3] in² (cm²)	P_{y_axial}[4] kip (kN)	15 (4.6)	20 (6.1)	25 (7.6)	30 (9.1)	35 (10.7)	30 (9.1)	35 (10.7)	40 (12.2)	45 (13.7)	50 (15.2)
		SINGLE DIAGONAL					CHEVRON/V				
2.0 (13)	68 (306)	1.30	1.27	1.25	1.24	1.23	1.30	1.28	1.27	1.26	1.25
3.0 (19)	103 (448)	1.30	1.27	1.26	1.24	1.23	1.30	1.28	1.27	1.27	1.26
4.0 (26)	137 (613)	1.29	1.26	1.25	1.24	1.23	1.29	1.27	1.26	1.25	1.25
5.0 (32)	171 (754)	1.31	1.28	1.26	1.25	1.24	1.31	1.28	1.28	1.27	1.26
6.0 (39)	205 (919)	1.30	1.30	1.29	1.27	1.26	1.30	1.32	1.30	1.29	1.29
7.0 (45)	239 (1060)	1.33	1.29	1.27	1.26	1.25	1.33	1.30	1.29	1.28	1.27
8.0 (52)	274 (1225)	1.35	1.31	1.29	1.28	1.26	1.35	1.32	1.31	1.30	1.29
9.0 (58)	308 (1367)	1.33	1.30	1.28	1.27	1.26	1.33	1.31	1.30	1.29	1.28
10.0 (65)	342 (1532)	1.35	1.31	1.29	1.28	1.26	1.35	1.32	1.31	1.30	1.29
11.0 (71)	376 (1673)	1.40	1.35	1.33	1.31	1.29	1.40	1.37	1.35	1.34	1.33
12.0 (77)	410 (1814)	1.37	1.33	1.31	1.29	1.28	1.37	1.34	1.33	1.32	1.31
14.0 (90)	479 (2121)	1.35	1.31	1.29	1.28	1.27	1.35	1.32	1.31	1.30	1.29
16.0 (103)	547 (2427)	1.40	1.35	1.33	1.31	1.30	1.40	1.37	1.35	1.34	1.33
18.0 (116)	616 (2733)	1.41	1.36	1.34	1.32	1.30	1.41	1.38	1.36	1.35	1.34
20.0 (129)	684 (3040)	1.45	1.39	1.37	1.34	1.32	1.45	1.41	1.39	1.38	1.37
22.0 (142)	752 (3346)	1.44	1.38	1.35	1.33	1.32	1.44	1.40	1.38	1.37	1.35
24.0 (155)	821 (3652)	1.43	1.37	1.35	1.33	1.31	1.43	1.39	1.37	1.36	1.35
26.0 (168)	889 (3959)	1.48	1.41	1.38	1.36	1.34	1.48	1.43	1.41	1.40	1.38
28.0 (181)	958 (4265)	1.49	1.42	1.39	1.37	1.35	1.49	1.44	1.42	1.41	1.39
30.0 (194)	1026 (4571)	1.50	1.43	1.40	1.37	1.35	1.50	1.45	1.43	1.41	1.40
Workpoint Length, ft (m)		23.4 (7.1)	26.9 (8.2)	30.8 (9.4)	35.0 (10.7)	39.4 (12.0)	23.4 (7.1)	25.1 (7.7)	26.9 (8.2)	28.8 (8.8)	30.8 (9.4)

STORY HEIGHT: 20ft (6.1m)

F_{ysc} = 38 ksi (262 MPa)		Bay Width, ft (m)									
A_{sc}[3] in² (cm²)	P_{y_axial}[4] kip (kN)	15 (4.6)	20 (6.1)	25 (7.6)	30 (9.1)	35 (10.7)	30 (9.1)	35 (10.7)	40 (12.2)	45 (13.7)	50 (15.2)
		SINGLE DIAGONAL					CHEVRON/V				
2.0 (13)	68 (306)	1.28	1.24	1.23	1.22	1.21	1.28	1.25	1.24	1.23	1.23
3.0 (19)	103 (448)	1.29	1.25	1.23	1.22	1.21	1.29	1.26	1.25	1.24	1.23
4.0 (26)	137 (613)	1.28	1.24	1.22	1.21	1.20	1.28	1.25	1.24	1.23	1.22
5.0 (32)	171 (754)	1.29	1.25	1.23	1.22	1.21	1.29	1.26	1.25	1.24	1.23
6.0 (39)	205 (919)	1.33	1.27	1.26	1.24	1.23	1.33	1.29	1.27	1.27	1.26
7.0 (45)	239 (1060)	1.31	1.26	1.25	1.24	1.23	1.31	1.27	1.26	1.25	1.25
8.0 (52)	274 (1225)	1.34	1.28	1.26	1.25	1.24	1.34	1.29	1.28	1.27	1.26
9.0 (58)	308 (1367)	1.32	1.27	1.25	1.24	1.23	1.32	1.28	1.27	1.26	1.25
10.0 (65)	342 (1532)	1.34	1.28	1.26	1.25	1.24	1.34	1.30	1.28	1.27	1.26
11.0 (71)	376 (1673)	1.39	1.32	1.30	1.28	1.27	1.39	1.34	1.32	1.31	1.30
12.0 (77)	410 (1814)	1.36	1.29	1.28	1.26	1.25	1.36	1.31	1.29	1.28	1.28
14.0 (90)	479 (2121)	1.34	1.28	1.26	1.25	1.24	1.34	1.29	1.28	1.27	1.26
16.0 (103)	547 (2427)	1.39	1.32	1.30	1.28	1.27	1.39	1.33	1.32	1.31	1.30
18.0 (116)	616 (2733)	1.39	1.32	1.30	1.29	1.27	1.39	1.34	1.32	1.31	1.30
20.0 (129)	684 (3040)	1.43	1.35	1.33	1.31	1.29	1.43	1.37	1.35	1.34	1.33
22.0 (142)	752 (3346)	1.42	1.34	1.32	1.30	1.29	1.42	1.36	1.34	1.33	1.32
24.0 (155)	821 (3652)	1.41	1.33	1.31	1.29	1.28	1.41	1.35	1.33	1.32	1.31
26.0 (168)	889 (3959)	1.46	1.37	1.34	1.32	1.31	1.46	1.39	1.37	1.36	1.34
28.0 (181)	958 (4265)	1.47	1.38	1.35	1.33	1.31	1.47	1.40	1.38	1.36	1.35
30.0 (194)	1026 (4571)	1.48	1.38	1.36	1.33	1.32	1.48	1.41	1.38	1.37	1.36
Workpoint Length, ft (m)		25.0 (7.6)	28.3 (8.6)	32.0 (9.8)	36.1 (11.0)	40.3 (12.3)	25.0 (7.6)	26.6 (8.1)	28.3 (8.6)	30.1 (9.2)	32.0 (9.8)

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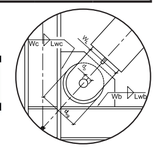


PINNED COREBRACE BRB TABLES

PINNED COREBRACE BRB TABLES

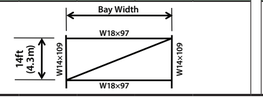
Approximate Casing Sizes[1,8] in (mm)

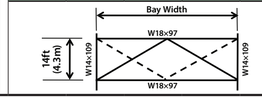
Sizes shown are representative of typical BRB sizes. Information on intermediate and larger sizes is available upon request.

STORY HEIGHT: 14ft (4.3m)

F_{ysc} = 38 ksi (262 MPa)		Bay Width, ft (m)									
A_{sc}[3] in^2 (cm^2)	P_{y_axial}[4] kip (kN)	15 (4.6)	20 (6.1)	25 (7.6)	30 (9.1)	35 (10.7)	30 (9.1)	35 (10.7)	40 (12.2)	45 (13.7)	50 (15.2)
		SINGLE DIAGONAL					CHEVRON/V				
2.0 (13)	68 (306)	t7 (t178)	t7 (t178)	t7 (t178)	t8 (t203)	t8 (t203)	t7 (t178)	t7 (t178)	t7 (t178)	t7 (t178)	t7 (t178)
3.0 (19)	103 (448)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)
4.0 (26)	137 (613)	t8 (t203)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t8 (t203)	t8 (t203)	t8 (t203)	t10 (t254)	t10 (t254)
5.0 (32)	171 (754)	t8 (t203)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t8 (t203)	t8 (t203)	t8 (t203)	t10 (t254)	t10 (t254)
6.0 (39)	205 (919)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
7.0 (45)	239 (1060)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
8.0 (52)	274 (1225)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
9.0 (58)	308 (1367)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
10.0 (65)	342 (1532)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
11.0 (71)	376 (1673)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
12.0 (77)	410 (1814)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
14.0 (90)	479 (2121)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
16.0 (103)	547 (2427)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)
18.0 (116)	616 (2733)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)
20.0 (129)	684 (3040)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
22.0 (142)	752 (3346)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
24.0 (155)	821 (3652)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
26.0 (168)	889 (3959)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
28.0 (181)	958 (4265)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
30.0 (194)	1026 (4571)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
Workpoint Length, ft (m)		20.5 (6.3)	24.4 (7.4)	28.7 (8.7)	33.1 (10.1)	37.7 (11.5)	20.5 (6.3)	22.4 (6.8)	24.4 (7.4)	26.5 (8.1)	28.7 (8.7)

t = square tube
p = round pipe
(rectangular casings also available)

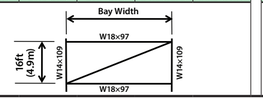


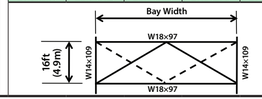


STORY HEIGHT: 16ft (4.9m)

F_{ysc} = 38 ksi (262 MPa)		Bay Width, ft (m)									
A_{sc}[3] in^2 (cm^2)	P_{y_axial}[4] kip (kN)	15 (4.6)	20 (6.1)	25 (7.6)	30 (9.1)	35 (10.7)	30 (9.1)	35 (10.7)	40 (12.2)	45 (13.7)	50 (15.2)
		SINGLE DIAGONAL					CHEVRON/V				
2.0 (13)	68 (306)	t7 (t178)	t7 (t178)	t7 (t178)	t8 (t203)	t8 (t203)	t7 (t178)	t7 (t178)	t7 (t178)	t7 (t178)	t7 (t178)
3.0 (19)	103 (448)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t10 (t254)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)
4.0 (26)	137 (613)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t8 (t203)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)
5.0 (32)	171 (754)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t8 (t203)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)
6.0 (39)	205 (919)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
7.0 (45)	239 (1060)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)
8.0 (52)	274 (1225)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)
9.0 (58)	308 (1367)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)
10.0 (65)	342 (1532)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
11.0 (71)	376 (1673)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
12.0 (77)	410 (1814)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
14.0 (90)	479 (2121)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t14 (t356)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
16.0 (103)	547 (2427)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)
18.0 (116)	616 (2733)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)
20.0 (129)	684 (3040)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
22.0 (142)	752 (3346)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
24.0 (155)	821 (3652)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
26.0 (168)	889 (3959)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
28.0 (181)	958 (4265)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
30.0 (194)	1026 (4571)	t16 (t406)	t16 (t406)	t16 (t406)	p20 (p508)	p20 (p508)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
Workpoint Length, ft (m)		21.9 (6.7)	25.6 (7.8)	29.7 (9.0)	34.0 (10.4)	38.5 (11.7)	21.9 (6.7)	23.7 (7.2)	25.6 (7.8)	27.6 (8.4)	29.7 (9.0)

t = square tube
p = round pipe
(rectangular casings also available)





NOTES:

1. CoreBrace BRB Casing Sizes are approx square minimums for the indicated frame geometry and beam/column sizes. Different beam/column sizes will affect brace length and casing size. More economical sizes or shapes may be used unless specifically required otherwise. Round or rectangular casings are also available.
2. Indicated core area is minimum cross sectional area of yielding portion of BRB core.
3. F_{y_axial} is the calculated yield force of the BRB equal to: $\sigma F_y A_{sc}$ based on the lower-bound of the yield stress range. Typ yield stress range = 42 ksi ±4 ksi (290 MPa ±28MPa).
4. Where casing size is controlled by fit up, alternate core configurations (width × thickness) may allow for reduced casing sizes, on a project specific basis. Contact CoreBrace for details.
5. Casing buckling checks include a FS of 1.3 accounting for code prescribed phi factors and casing initial out-of-straightness in addition to BRB overstrength (and length effects for WP ≥ 40' (10.2 m)). Where casing size is controlled by buckling, alternate casing configurations must maintain the same minimum moment of inertia about the critical axis. Contact CoreBrace for assistance with alternate configurations.
6. Brace and casing sizes other than those shown are available upon request.
7. This table was created by considering overstrength at 2% story drift as required by AISC 341-10. For other story drifts, values may be different.
8. Casing sizes in table are intended for schematic design only. Contact CoreBrace for project specific sizes.

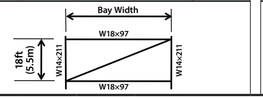
Approximate Casing Sizes[1,8] in (mm) (cont'd)

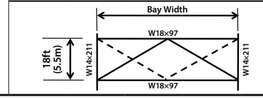
Sizes shown are representative of typical BRB sizes. Information on intermediate and larger sizes is available upon request.

STORY HEIGHT: 18ft (5.5m)

F_{ysc} = 38 ksi (262 MPa)		Bay Width, ft (m)									
A_{sc}[3] in^2 (cm^2)	P_{y_axial}[4] kip (kN)	15 (4.6)	20 (6.1)	25 (7.6)	30 (9.1)	35 (10.7)	30 (9.1)	35 (10.7)	40 (12.2)	45 (13.7)	50 (15.2)
		SINGLE DIAGONAL					CHEVRON/V				
2.0 (13)	68 (306)	t7 (t178)	t7 (t178)	t8 (t203)	t8 (t203)	t8 (t203)	t7 (t178)	t7 (t178)	t7 (t178)	t8 (t203)	t8 (t203)
3.0 (19)	103 (448)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t10 (t254)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)
4.0 (26)	137 (613)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
5.0 (32)	171 (754)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
6.0 (39)	205 (919)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
7.0 (45)	239 (1060)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
8.0 (52)	274 (1225)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)
9.0 (58)	308 (1367)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t12 (t305)
10.0 (65)	342 (1532)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
11.0 (71)	376 (1673)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
12.0 (77)	410 (1814)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t14 (t356)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
14.0 (90)	479 (2121)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t14 (t356)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
16.0 (103)	547 (2427)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)
18.0 (116)	616 (2733)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t16 (t406)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)
20.0 (129)	684 (3040)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
22.0 (142)	752 (3346)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
24.0 (155)	821 (3652)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
26.0 (168)	889 (3959)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
28.0 (181)	958 (4265)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
30.0 (194)	1026 (4571)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
Workpoint Length, ft (m)		23.4 (7.1)	26.9 (8.2)	30.8 (9.4)	35.0 (10.7)	39.4 (12.0)	23.4 (7.1)	25.1 (7.7)	26.9 (8.2)	28.8 (8.8)	30.8 (9.4)

t = square tube
p = round pipe
(rectangular casings also available)

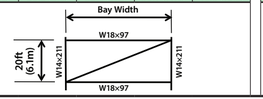


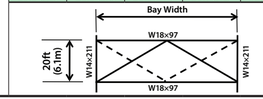


STORY HEIGHT: 20ft (6.1m)

F_{ysc} = 38 ksi (262 MPa)		Bay Width, ft (m)									
A_{sc}[3] in^2 (cm^2)	P_{y_axial}[4] kip (kN)	15 (4.6)	20 (6.1)	25 (7.6)	30 (9.1)	35 (10.7)	30 (9.1)	35 (10.7)	40 (12.2)	45 (13.7)	50 (15.2)
		SINGLE DIAGONAL					CHEVRON/V				
2.0 (13)	68 (306)	t7 (t178)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t7 (t178)	t7 (t178)	t8 (t203)	t8 (t203)	t8 (t203)
3.0 (19)	103 (448)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t10 (t254)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)	t8 (t203)
4.0 (26)	137 (613)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
5.0 (32)	171 (754)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t8 (t203)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
6.0 (39)	205 (919)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)
7.0 (45)	239 (1060)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)
8.0 (52)	274 (1225)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t10 (t254)	t10 (t254)	t12 (t305)
9.0 (58)	308 (1367)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t12 (t305)	t10 (t254)	t10 (t254)	t12 (t305)	t12 (t305)	t12 (t305)
10.0 (65)	342 (1532)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
11.0 (71)	376 (1673)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
12.0 (77)	410 (1814)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t14 (t356)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
14.0 (90)	479 (2121)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t14 (t356)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)	t12 (t305)
16.0 (103)	547 (2427)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)
18.0 (116)	616 (2733)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t16 (t406)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)	t14 (t356)
20.0 (129)	684 (3040)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
22.0 (142)	752 (3346)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
24.0 (155)	821 (3652)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
26.0 (168)	889 (3959)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
28.0 (181)	958 (4265)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
30.0 (194)	1026 (4571)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	p20 (p508)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)	t16 (t406)
Workpoint Length, ft (m)		25.0 (7.6)	28.3 (8.6)	32.0 (9.8)	36.1 (11.0)	40.3 (12.3)	25.0 (7.6)	26.6 (8.1)	28.3 (8.6)	30.1 (9.2)	32.0 (9.8)

t = square tube
p = round pipe
(rectangular casings also available)





For design assistance please contact CoreBrace:

5789 West Wells Park Road
West Jordan, UT 84081
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www.corebrace.com

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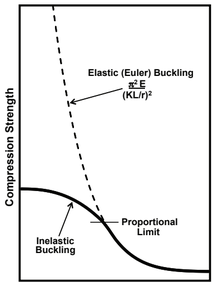
SUPERIOR SEISMIC PERFORMANCE

Pinned Brace and Casing Information



1st-Mode Euler Buckling

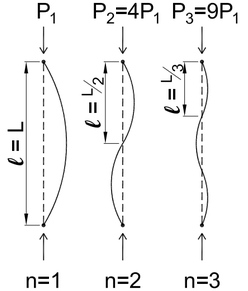
$$P_{cr} = \frac{\pi^2 EI}{(KL)^2} \qquad F_{cr} = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2}$$

nth-Mode Euler Buckling

$$P_{cr\_n} = \frac{\pi^2 EI}{(K\ell)^2} = \frac{\pi^2 EI}{\left(\frac{KL}{n}\right)^2} = n^2 \frac{\pi^2 EI}{(KL)^2} = n^2 P_{cr}$$

where $\ell = L/n$

$$P_{cr\_n} = n^2 P_{cr} \qquad F_{cr\_n} = n^2 F_{cr}$$



Casing Demands

$$I_{reqd} = \frac{FS_B P_u (KL_g)^2}{\pi^2 E}$$

FS_B = Factor of safety against buckling. Should include code-prescribed phi factor, factor to account for initial out-of-straightness, and any additional factors as deemed necessary.

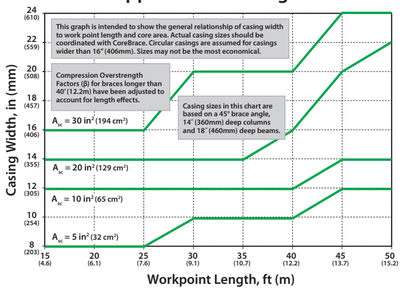
Adjusted Brace Strength Determination

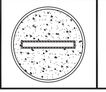
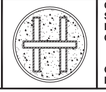
$$P_c = \beta\omega F_y A_{sc} \quad (compression)$$

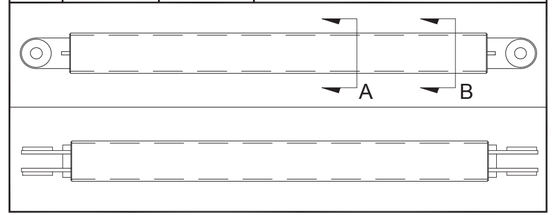
$$P_t = \omega F_y A_{sc} \quad (tension)$$

F_y of material used to fabricate brace yielding cores to be established based on coupon testing of individual plates. In such cases, R_y may be taken equal to 1.0 in the above equations. (See AISC 341)

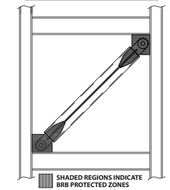
Approximate Casing Size



	SECT. A	SECT. B	MATERIAL SPECIFICATIONS
SQUARE CASING			CORE PL: A36 CONTROLLED YIELD STIFFENER PL: A36 (F_y = 249 MPa) LUG PL: A572 GR-50 (F_y = 345 MPa) CASING: A500 GR-B (F_y = 318 MPa) GUSSET/REPAD PL: A572 GR-50 (F_y = 345 MPa) PIN A193 GR-B (F_u = 930 MPa) MIN
ROUND CASING			CORE PL: A36 CONTROLLED YIELD STIFFENER PL: A36 (F_y = 249 MPa) LUG PL: A572 GR-50 (F_y = 345 MPa) CASING: ROUND HSS: A500 GR-B (F_y = 290 MPa) PIPE: A53 GR-B (F_y = 242 MPa) GUSSET PL: A572 GR-50 (F_y = 345 MPa) PIN: A193 GR-B (F_u = 930 MPa) MIN



BRB Protected Zones



Schematic BRB Behavior