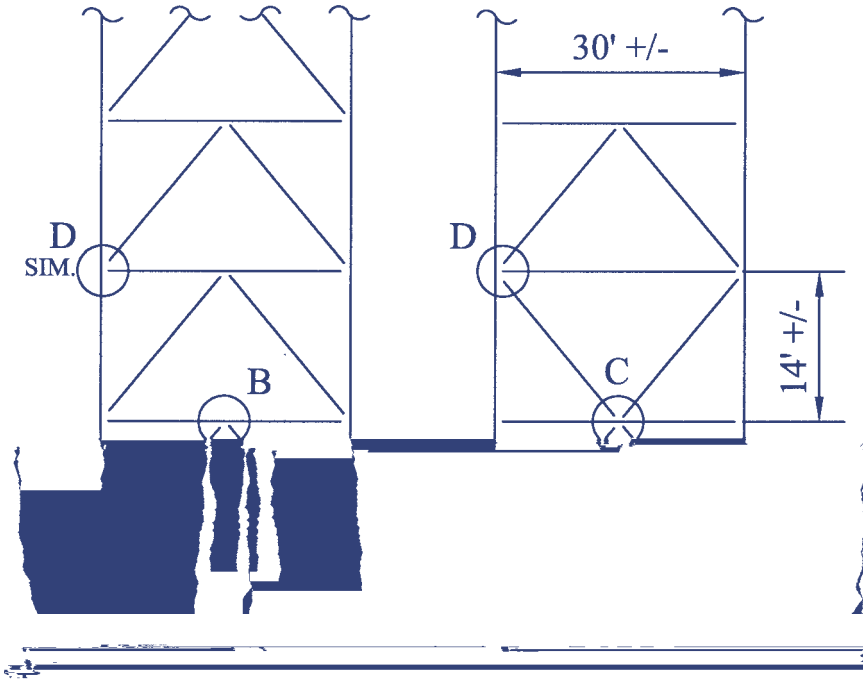
CHEVRON BRACING IN LOW-RISE BUILDINGS

Roberta Marstellar, Keith Mueller, Jason Ericksen and Christopher Hewitt

Estimating member sizes for chevron bracing in low-rise steel-framed construction is easier than ever with this handy design aid.



Schematic of typical chevron brace configurations. The details circled are highlighted in later figures in this article.

Chevron braces are a common configuration for providing lateral-load resistance in steel-framed buildings. This handy chart will help you quickly estimate the brace size and connection material required for a given force in chevron bracing designed to resist lateral forces due to gravity, wind and low-seismic loads.[1] These rules of thumb don't cover all situations, but they will provide a reasonable starting point for the preliminary brace and connection design or cost estimating.

Estimated brace sizes, gusset plate thicknesses, and required number of bolts or size and length of the welds are tabulated for a practical range of *unfactored* brace forces (tensile and compressive). The bolts and welds indicated are for the connection of the brace to the gusset plate. A 3" center-to-center bolt spacing and a $1^1/_2$" edge distance were assumed in the connection design. Suggested details for the various connections involved in chevron bracing are also included for each of the bracing types: HSS, W-shapes, WT-shapes and double angles.

The connection(s) of the gusset plate to the beam and / or column are not addressed in the table. Also, drift control issues must be considered separately.

The minimum length of the welds for the connection of the HSS to the gusset is 1.3 times the diameter of the round HSS or 1.3 times the side of the square HSS. Rectangular HSS are not included. This minimum length allows the welds to be designed with a shear lag coefficient $U = 1$ in the HSS.[2] A smaller weld length may be acceptable, provided the effects of shear lag are considered.

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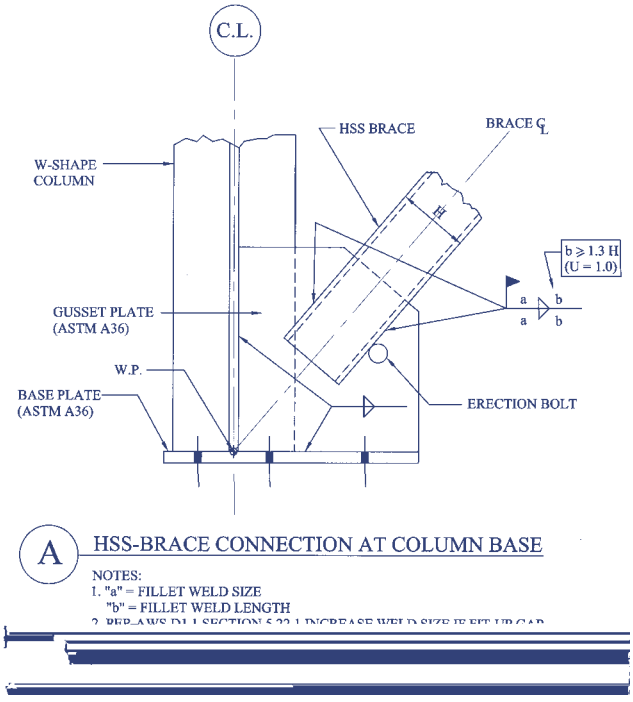
Shear Transfer in Low Rise Buildings (up to 18 stories) to Concrete or Masonry Shear Walls

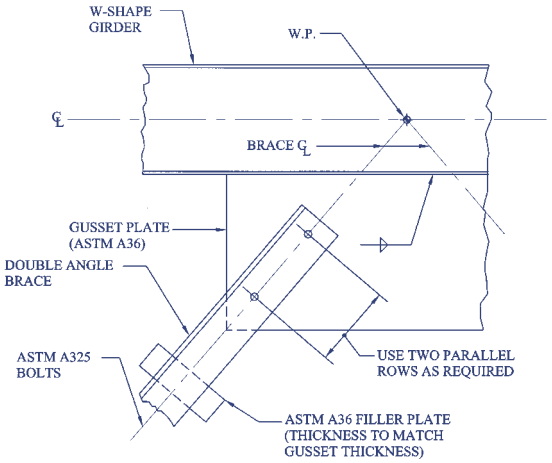
		30	50	75	100	150	200
		PL 3/8"	PL 3/8"	PL 1/2"	PL 1/2"	PL 3/4"	PL 3/4"
	Double Angles ASTM A36	2L5x5x5/16 (21 lb/ft)	2L6x6x3/8 (30 lb/ft)	2L6x6x3/8 (30 lb/ft)	2L6x6x1/2 (39 lb/ft)	2L8x8x1/2 (53 lb/ft)	2L8x8x1/2 (53 lb/ft)
	3/4" Bolts / row ASTM A325	3	4	6	6	6	8
	7/8" Bolts / row ASTM A325	3	4	4	6	5	6
	No. of Rows	1	1	1	1	2	2
		HSS 5.000x0.375 (18.5 lb/ft)	HSS 6.000x0.312 (19.0 lb/ft)	HSS 6.000x0.500 (29.4 lb/ft)	HSS 6.875x0.500 (34.1 lb/ft)	HSS 8.625x0.500 (43.4 lb/ft)	HSS 9.625x0.500 (48.8 lb/ft)
		HSS5x5x1/4 (16 lb/ft)	HSS6x6x1/4 (19 lb/ft)	HSS6x6x1/4 (19 lb/ft)	HSS7x7x1/4 (22 lb/ft)	HSS8x8x5/16 (32 lb/ft)	HSS8x8x3/8 (38 lb/ft)
Weld	**"a" (in) [See Details]**	3/16	3/16	1/4	1/4	5/16	5/16
Weld	**"b" (in) ** [See Details]**	7	8	8	9 (Round) 10 (Square)	12 (Round) 11 (Square)	13 (Round) 11 (Square)
		W6x20	W8x28	W8x31	W8x35	W8x48	W10x49
	Web Plates ASTM A36	(2) PL 3/8"	(2) PL 3/8"	(2) PL 3/8"	(2) PL 3/8"	(2) PL 3/8"	(2) PL 3/8"
	3/4" or 7/8" ASTM A325 Bolts	4 - Gusset 4 - Web	4 - Gusset 4 - Web	4 - Gusset 4 - Web	4 - Gusset 4 - Web	4 - Gusset 4 - Web	4 - Gusset 4 - Web
	Angles ASTM A36	4 L4x4x5/16	4 L4x4x5/16	4 L4x4x5/16	4 L4x4x5/16	4 L4x4x5/16	4 L4x4x5/16
	3/4" or 7/8" ASTM A325 Bolts	4 - Gusset 8 - Flange	4 - Gusset 8 - Flange	4 - Gusset 8 - Flange	4 - Gusset 8 - Flange	6 - Gusset 12 - Flange	8 - Gusset 16 - Flange
		WT6x13	WT6x25	WT6x43.5	WT7x45	WT8x38.5	WT13.5x73
	3/4" Bolts ASTM A325	4	4	4	6	6	8
	7/8" Bolts ASTM A325	4	4	4	6	6	8

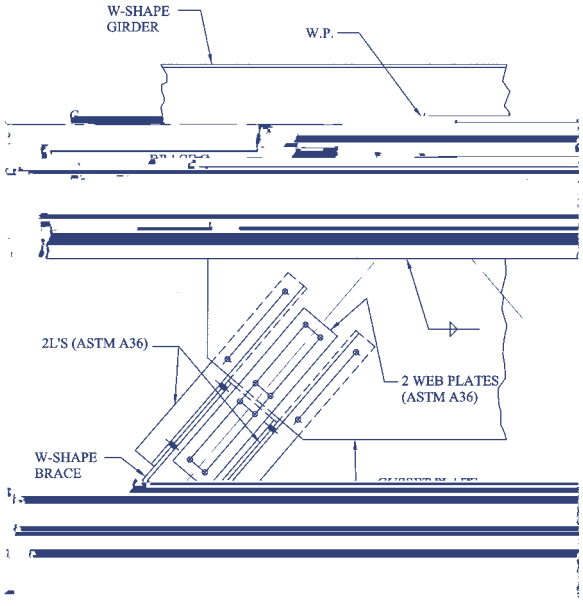
** Weld lengths are based on 1.3*H*, where *H* is the outside diameter of a round HSS or leg dimension of a square HSS.

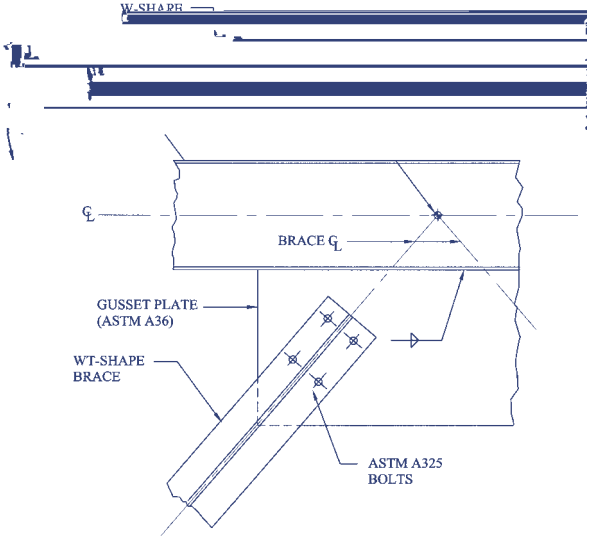


A HSS-BRACE CONNECTION AT COLUMN BASE

NOTES:
1. "a" = FILLET WELD SIZE
"b" = FILLET WELD LENGTH

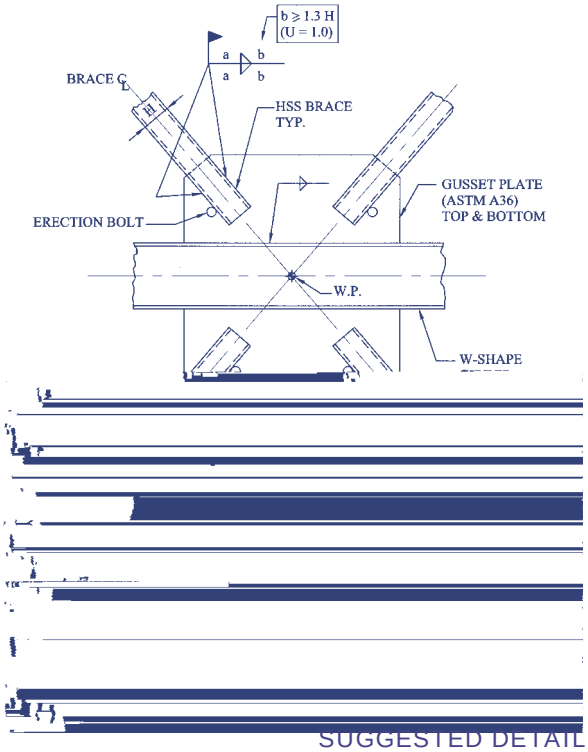


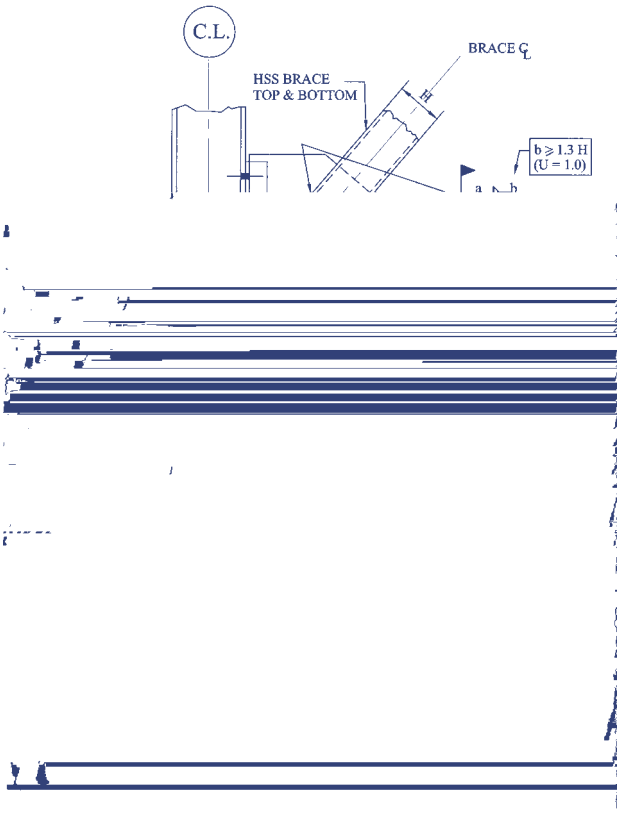




B3 WT-FLANGE CONNECTION AT MIDSPAN

SUGGESTED DETAILS FOR CHEVRON BRACING





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