

Sturdi-Wall Design Manual

for

*SW46, SW66, SW63, SW64, SW60,
SW83, SW84, and SW80 Models*



timbertech

ENGINEERING

Project Number ME086-05

by

Brent Leatherman, P.E.
Timber Tech Engineering, Inc
E-Mail: bl@timbertecheng.com

January 30, 2007

Table of Contents

1. Design Overview	Page 2
2. Sturdi-Wall Descriptions	Page 2
3. Steel Bracket Design.....	Page 2
4. Concrete Anchors	Page 2
5. Wood Connection.....	Page 3
6. Sturdi-Wall Bracket Design Chart.....	Page 3
7. Summary and Conclusion.....	Page 5



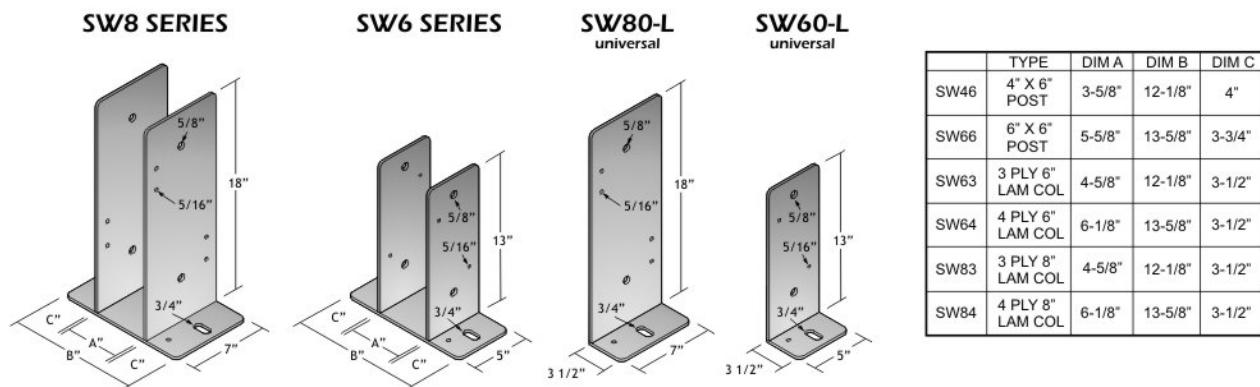
1. Design Overview

The Sturdi-Wall base brackets are designed to connect wood columns to a concrete foundation in a typical post frame building application. This manual contains drawings and descriptions for each of the Sturdi-Wall models, a chart showing allowable shear and uplift for Sturdi-Wall base brackets, descriptions of several methods for attachment to concrete, and discussion of design assumptions.

2. Sturdi-Wall Descriptions

Dimensions for the SW46, SW66, SW63, SW64, SW60, and SW80 are given in Figure 2.1. The brackets are constructed with 1/4" ASTM A36 steel and 1/4" fillet wells. Each assembly has a powder coat finish. The SW46 is to be used with a 4x6 wood post, SW66 with a 6x6 wood post, SW63 with a 3-ply 2x6 mechanically laminated column, SW64 with a 4-ply 2x6 laminated column, SW83 with a 3-ply 2x8 laminated column, and SW84 with a 4-ply 2x8 laminated column. Glued laminated columns are acceptable; however, the pocket dimensions need to be custom ordered to provide a snug fit. The single brackets (SW60, SW80) shall be used as pairs and fastened using the same connectors as the fully assembled brackets.

Figure 2.1



3. Steel Bracket Design

The forces applied from the building columns to Sturdi-Wall brackets are a vertical uplift force, a downward gravity force, and a horizontal shear force. The wood columns should have direct bearing on the bottom to transfer axial loads directly into the concrete foundation. The Sturdi-Wall brackets are assumed to have no moment capacity. The building must be designed to resist lateral loads through diaphragm action or other bracing means. All mechanical fasteners are to be installed as per the manufacturer's recommendations and this design manual. The brackets consist of 1/4" ASTM A36 steel with 5/8" diameter holes for the bolts in the vertical leg, and 3/4" x 1 1/2" slotted holes for concrete anchors in the base. The brackets also have 5/16" diameter holes for screws.

4. Concrete Anchors

This manual includes recommendations for anchor "L" bolts, epoxy anchors, expansion anchors, and screw anchors for the steel to concrete connection.

4.1 Anchor "L" Bolts

The anchor “L” bolts are to be typical ASTM A307 grade C right angle bend cast in place anchor bolts. These are set in wet concrete and must be placed within the tolerance of the slotted hole in the bottom of the bracket.

4.2 Epoxy Anchors

Epoxy or adhesive anchors provide the maximum amount of uplift resistance; however, they must be installed in a properly sized hole and within a set temperature range in order to be effective.

4.3 Expansion Anchors

Expansion anchors transfer forces to the concrete by means of an expansion sleeve or wedge which presses out against the sides of the hole as the top nut is tightened. Since the expansion forces are transferred to the concrete base material, these anchors have a greater minimum distance to the concrete edge than the other anchors.

4.4 Screw Anchors

Screw anchors have a hex head and a threaded shaft which can be installed with an impact wrench or conventional hand socket. There are no expansion forces transferred to the concrete base material so they can be installed closer to the edge than traditional expansion anchors.

5. Wood Connection

The wood to steel connection is made with (2) ½ “ diameter A307 (grade 2) bolts in double shear and ¼” x 3” strong drive screws (SDS) by Simpson Strong Tie or equal in single shear installed from each side. Typically, one screw is installed from each side of the bracket at each bolt except the SW8 series has 2 screws on each side at each bolt. Screws help prevent stress concentration around the bolt which would cause splitting of the wood members. The wood to steel connection was analyzed as per the National Design Specification for Wood Construction 2001 edition by the American Forest and Paper Association using Southern Yellow Pine wood columns. No wet service reductions have been made since the wood portion is not in contact with the soil or concrete and it is assumed to be used in an enclosed building. If the brackets are to be used in an environment where the moisture content of the wood in service will exceed 19% for an extended period of time, pressure treated wood and galvanized or stainless steel bolts should be used, and a wet service factor of 0.7 applied to the Wood Steel Connection numbers in Table 6.1. In addition, a barrier membrane should be applied between the pressure treated wood post and the Sturdi-Wall bracket to provide corrosion protection. Consult your local supplier for a suitable barrier. The design of the wood post above and the concrete foundation below the Sturdi-Wall bracket, as well as, lateral bracing of the supporting structure are the responsibility of others.

6. Sturdi-Wall Bracket Design Chart

Table 6.1 shows the allowable shear and uplift for the wood to steel connection and the steel to concrete connection using the fasteners described above. The allowable loads for the wood to steel connection have been increased by 60% for wind or seismic loading, reduce where other loads govern. The allowable loads for the concrete connection may be increased by 33.3% for wind or seismic loading where permitted by code. The steel to concrete design numbers are based on a minimum concrete compressive strength ($f'c$) of 3000 psi. The screw anchor design numbers are based on the Powers “Wedge-Bolt” Specification and Design Manual. The installation of anchors in concrete shall adhere to the “critical anchor dimensions in concrete” chart. This chart shows the minimum distance to the concrete edge, the minimum embedment depth into concrete, and the minimum center to center dimension for each of the anchor types. The minimum distance to the concrete edge is given as 4” for

the SW6 series and 5" for the SW8 series. These dimensions assume that the concrete edge is aligned with 2x girts installed flat wise against the outside of the posts. The 5/8" expansion anchors cannot be used for the SW6 series brackets because the 4" edge distance is inadequate. The minimum center to center dimensions are based on the physical location of the holes in each bracket type. The minimum embedment depth into concrete should be measured from the bracket to concrete interface.

Table 6.1 Allowable Shear and Uplift for Sturdi-Wall Base Brackets

All Loads in Pounds	Wood to Steel Connection		Steel to Concrete Connection							
			5/8" Anchor "L" Bolts		5/8" Epoxy Anchor		Expansion Anchor		5/8" Screw Anchor	
Model	Shear (160)	Uplift (160)	Shear (100)	Uplift (100)	Shear (100)	Uplift (100)	Shear (100)	Uplift (100)	Shear (100)	Uplift (100)
SW46	5700	7520	6180	7050	6180	7850	2940 (a)	3650 (a)	3492	5913
SW66	5700	7520	6650	7050	6650	8450	2940 (a)	3650 (a)	3492	5913
SW63	5700	7520	6450	7050	6450	8200	2940 (a)	3650 (a)	3492	5913
SW64	5700	7520	6650	7050	6650	8450	2940 (a)	3650 (a)	3492	5913
SW83	8200	10020	8220	8225	8220	9100	4685 (b)	5130 (b)	4607	6570
SW84	8200	10020	8475	8225	8475	9400	4685 (b)	5130 (b)	4607	6570
SW60 (pair)	5700	7520	6180	7050	6180	7850	2940 (a)	3650 (a)	3492	5913
SW80 (pair)	8200	10020	8220	8225	8220	9100	4685 (b)	5130 (b)	4607	6570

(a) 1/2" Expansion Anchor

(b) 5/8" Expansion Anchor

Notes:

- 1) This chart is for Sturdi-Wall brackets used in a post frame building application to connect wood columns to a concrete foundation.
- 2) The forces applied from posts to brackets are a vertical uplift force, and a horizontal shear force. Loads shown are unfactored.
- 3) Wood to steel design numbers calculated as per the 2001 NDS using Southern Yellow Pine columns, dry service conditions.
- 4) The allowable loads in wood have been increased by 60% for wind or seismic loading, reduce where other loads govern.
- 5) The allowable concrete loads may be increased by 33.3% for short term loading where permitted by Code.
- 6) Steel to concrete design numbers based on a minimum concrete compressive strength f'_c of 3000 psi.
- 7) Anchor "L" bolts to be ASTM A307 grade C right angle bend typical.
- 8) Epoxy anchors to be Hilti HY 150 adhesive anchor system using standard HAS Rods, or approved equal.
- 9) Expansion anchors to be Hilti Kwik Bolt II, or approved equal.
- 10) Screw Anchors to be Powers "Wedge-Bolt" self-threading large diameter tapcon or approved equal.
- 11) Install all fasteners as per the manufacturer's recommendations and these notes.
- 12) SW60 and SW80 shall be used as pairs and fastened like the other brackets.
- 13) Bending moment capacity of all Sturdi-Wall brackets assumed to be zero.
- 14) Final bracket design should include a complete building analysis by a Design Professional.
- 15) Installation of anchors in concrete shall adhere to the following chart:

Critical Anchor Dimensions in Concrete						
Anchor Type	SW46, SW63, SW64, SW66, SW60			SW83, SW84, SW80		
	I (in)	II (in)	III (in)	I (in)	II (in)	III (in)
5/8" Anchor "L" Bolts	4	8	8.375	5	8	9.375
5/8" Epoxy Anchor	4	5	8.375	5	5	9.375
1/2" Expansion Anchors	4	3.5	8.375	5	3.5	9.375
5/8" Expansion Anchors	-	-	-	5	4	9.375
5/8" Screw Anchor	4	4.5	8.375	5	4.5	9.375
Notes:	I = Min. distance to concrete edge II = Min. embedment depth into concrete III = Min. Center to Center Dimension					

The Sturdi-Wall design manual can be downloaded via our website: www.sturdiwall.com

7. Summary and Conclusion

Sturdi-Wall base brackets are designed to be used in a post frame building application to connect wood columns to a concrete foundation. This can be done in a wet set or a drill set application depending on the type of concrete anchor that is used. The Sturdi-Wall base brackets do not transfer bending moment from the column into the foundation. Therefore, it is critical that the supported structure be designed to resist lateral loads through diaphragm action or other bracing means.