Installation of SDWC Structural Screw for Retrofit of Existing **Double Wall Houses**

**Double Top Plate to Truss, Stud to Double Top Plate & Stud to Bottom Plate**

Partners – University of Hawaii Sea Grant

Simpson Strong-Tie
Background

- There are many double wall homes without hurricane clips or a continuous load path that can be strengthened, not to the level of a new house under newer codes, but stronger than before.

- In the past, it has been difficult to retrofit double wall houses. Unlike single wall houses where the intersection of the rafter and wall are readily exposed, the intersection of these components in a double wall house is hidden by siding (the 2nd wall). The SDWC structural screw is driven through the siding to reach the target structural components.

- The SDWC can be used for new homes (examples on Oahu exist for houses approved by the building department, inspectors and project structural engineer) as well as a retrofit of older homes as shown in this demonstration example.

- You may be able to perform the work yourself, but first seek the advice of a licensed structural engineer and architect (especially familiar with your house). This is a relatively straightforward retrofit given the proper guidance. The structural engineer can cover certain aspects of the continuous load path while the architect is especially versed with the envelope of your house (e.g., siding, house wrap, spacing).
Purpose

A. To strengthen existing roof (truss) to wall (double top plate) connections for existing homes in the situation where:
1. No hurricane clips since not required (double wall houses generally built on or before 1988 on O‘ahu, 1990 on Maui and Kaua‘i, and 1994 on Hawai‘i).
2. Poor Installation – with nails missing
3. Hurricane clips – every other rafter – older 1990’s building codes
4. Proper installation of clips with less capacity (H2.5s or H3s) – building codes in 1990’s to mid – 2000’s, depending on location and wind zone.

B. To continue the load path downward to the greatest extent possible in the situation where:
1. Houses were built with hurricane clips but not a complete load path (e.g., houses generally built between 1989 & 1995 on O‘ahu, between 1991 and 1995 on Maui, between 1991 and 1993 on Kaua‘i and built before 1994 on Hawai‘i County.)
Continuous load path with associated connectors.

Structural screw orientations that serve the same function.
Building Codes today require clips with more load – e.g., H10A Hurricane Clip with 8 nails on top tab and 9 on bottom.
Older building codes could use the H2.5 or H3. In addition, here, not a perfect installation. Hurricane clip with 4 nails on top tab and only 2 on the bottom ties the truss and double top plate.

Even with a hurricane clip, it is possible to fortify this connection with SDWC, See slide 17.
About the SDWC

From Simpson 2017-2018 Wood Construction Connectors Catalogue Page 321 - Configuration C – with two structural screws – one from inside, one from outside, the uplift load is 905 in DF/SP and 850 in SPF/HF. Optimal angle is 22.5 degrees. On page 319 footnote 4, it says screws are shown installed on the interior of walls. Installations on the exterior are acceptable if rafter overhangs a minimum of 3.5 inches. This is how it will be used in a retrofit application.

Configuration C: Install through Top Plate into Truss/Rafter

Both screws installed at a 16°-30° angle, offset ½" from the opposite edges of truss/rafter. Use metal installation guide included in screw kits for optimal 22.5° installation.
Many Applications for SDWC Used with Single Screw
Many Applications for SDWC Used with Single Screw (cont.)

Typical Roof-to-Wall Connection

Optional Roof-to-Wall Connection
Many Applications for SDWC Used with Single Screw (cont.) – 

Note: From the Fastening System Catalogue (page 351), the installation of a single SDWC is at 22.5 degrees maximum to tie the double top plate to the truss.
For top plate to truss connection, this is desired orientation. SDWC at bottom corner of double top plate goes into the truss at 22.5 degrees.
To obtain proper orientation, take a multi-tool and cut rectangular hole below the intersection of the truss and wall. This hole can be easily repatched (save cutout). After retrofit work is done, repair waterproof building wrap with silicone and patch cutout with cement filler to match cement Hardie siding. Sand and paint.

Bottom of Double Top Plate is 1.5 inches below trim.
Cut 23 degree angle template with multi-tool for proper orientation. Align hole with bottom corner of double top plate. But also must account for thickness of Hardie Siding and overlap of siding (see last 3 slides)
Pre-drill holes twice to prevent wandering. First with a small short bit, second a longer, wider bit. Pre-drilling may not be necessary in softer materials like wood, but to drill at an angle in hard fiber cement siding it is necessary.
Pre-drilling insures easy installation with little chance for wandering. Screw easily wanders if its drilled at an angle, versus perpendicular.
Double Checking in Attic – SDWC purposely missing truss

22.7 Degrees!!
Structural screw purposely misses truss to show can go from top plate to truss. Can fortify the hurricane clip or take place when missing or not perfectly installed.
Drilling Procedures Used – This may vary with your location and tools.

1.5 inch 3/32 bit to get hole started in difficult to drill Hardie siding and confirm location of top plate or stud in various applications.

4.5 inch 5/32 bit to insure angle is 22.5 degrees by modifying the angle and size of hole.
Part 2 – Stud to Double Top Plate

1. Effort to continue the load path down for existing double wall houses.
2. By tying truss to top plate and top plate to stud, dead load of house is added as uplift resistance.
3. In prior application, the bottom of the double top plate has already been found (See slide 12).
Stud to Top Plate Connection

A good stud finder will work through Hardie siding. For double wall houses in Hawaii, the lower nail in the Hardie Siding is usually in the stud, so it’s a direct hint of the location. Also drill with a fine bit to find center of stud. Studs are typically 16 inches apart. Sometimes they are 24. Confirm in the field and with a licensed architect or engineer.
The location of the drill point for the stud-double top plate connection will be about 3 inches lower than the double top plate to truss connection. The bottom of the double top plate is 1.5 inches below the trim for this house.

Accounting for the thickness of the 5/16 inch (.31 in.) Hardie Siding and using trigonometry with the 22 degree drill angle, the drill point for the double top plate-truss connection is 2.6 inches below the trim (1.5 in. plus 1.1 in.) for this house, and 6.0 inches below the trim for the stud-double plate connection.

In this house the stud and truss do not align but are offset.
Exposed Siding showing bottom of double top plate

Double Top Plate to Truss

Stud to Double Top Plate
Check the Attic

This SDWC purposely misses truss to show relationship of SDWC with top plate and truss given the installation methodology.

This SDWC purposely overdriven to show relationship of stud and the top plate connection.
Ideal installation – once bottom of double top plate found, mark and drill 1 inch really 1.1) inches below to account for Hardie siding thickness of .31 inches. For this house (1.5 inches below trim plus 1 inch)

Drill screw completely past siding to target bottom lower corner of double top plate, Pre-drill to insure 22 angle. Pre-drilling may not be needed if drilling into softer siding, but needed for strong Hardie siding.

Hardie Siding from debris pile in Rockport Texas, brought to Hawaii.
Part 3 – Stud to Bottom Plate

1. Effort to continue the load path down for existing double wall houses.

2. By stud to double top plate the load path is completed provided the bottom plate is anchored to the foundation. Check with builder, licensed architect or engineer.
Weather resistant barrier wrap has been removed.
4.5” SDWC from Stud to Sill Plate

Repair weather proof barrier with silicone. Patch cutout with cement filler for Hardie siding.
Summary

• Significant application in Hawaiʻi for double wall houses without hurricane clips or a complete continuous load path.

• Houses with no hurricane clips – Generally houses built on or before 1988 on Oʻahu, on or before 1990 on Maui and Kauaʻi and on or before 1994 on Hawaiʻi

• Houses with no continuous load path. Generally houses built on or before 1993 on Kauaʻi, on or before 1994 on Hawaiʻi, and on or before 1995 on Maui and Oʻahu
Target orientation of screw, see slide 11.

\[ Y = \frac{0.31 \text{ inches}}{\text{Tangent 22}^\circ} \]

\[ Y = \frac{0.31 \text{ inches}}{0.404} = 0.79 \]

Preliminary for Top Plate to Truss

But also must account that Hardie siding is not flush but overlapped against lower piece. See next 2 slides

This distance would work if Hardie Siding is flush with wall, but is not.
Double Top Plate to Truss

1) \( \tan \theta = \frac{0.31}{7.75} \) – siding is 5/16 (.31 inches) and plank is 9.25 inches high with 1.50 overlap

2) Angle is 2.29 degrees

3) At drill location 3.79 inches down – space is
   \[ \tan 2.29 \ degrees = x/3.79 \ so \ x = 0.15 \ inches \]

4) Need to drill through .15 inches + .31 inches = .46 inches

5) Need to drill at 22.5 degree angle – \( \tan 22.5 = \frac{0.46}{y} \) so \( y = \frac{0.46}{\tan 22} = 1.1 \ inches \) lower then base of top plate.

Stud to Double Top Plate

At 7.1 inches down space is \( \tan 2.29 \ degrees = x/7.1 \) so \( x = 0.28 \) inches plus .31 inches = .59 inches

Need to drill at 22.5 angle – \( \tan 22.5 = \frac{0.59}{y} \) so \( y = \frac{0.59}{\tan 22.5} = 1.42 \ inches \) below
5/16 or .31 inch siding

Stud to Bottom Plate

1) \(\tan \theta = \frac{.25}{7.75}\) – plank is 9.25 inches high with 1.5 overlap (coinciding with 1.5 inch bottom plate)

2) Angle is 1.84 degrees

3) At drill location 5.25 inches down \((9.25 - 1.5 - 2.5 = 5.25”\)

\[\tan 1.84^\circ = \frac{x}{5.25}\]  
so \(x = .17\) inches

4) Need to drill through .17 inches + .31 inches = .48 inches

5) Need to drill at 22 degree angle – \(\tan 22 = \frac{.48}{y}\) so \(y = \frac{.48}{\tan 22} = 1.18\) inches higher

6) Drill 2.5 + 1.18 inches above top of bottom plate or **3.68 inches**.

Starter is .25” by 1.5”

Target

2.5”

Simpson Strong-Tie connectors catalogue

Hardie Install Guide

Stud-to-Bottom Plate Connection Over Concrete/Masonry Foundation (This application requires SDWC15450)