

Section 3: Starting with Steel

In the mid 1990s, the U.S. military services began specifying cold-formed steel for family housing in Hawaii, with a specific focus on wall construction. The aggressive nature of the Formosan Termite was the primary reason for the shift to termite-resistant construction. Much of the private sector on Oahu has followed suit and is now using steel, treated wood, or a combination of the two. Steel has now become such a commonplace material in Hawaii that there are few significant buyer or market issues.

Builder issues

Hunt began using steel for housing in 1997, well before the start of Radford Terrace. They have used steel floor, wall, and roof framing in the past. At Radford Terrace, Hunt uses open web wood floor trusses instead of steel because openings in steel joists were too small to accommodate the size of the specified ducts. Roof framing members are wood trusses.

Hunt has used steel roof trusses in the past. For simple gable roofs, they prefer a steel panel roof system. However, some of their plans have complex roof lines with dormers, overhangs, ridges, and pop-outs to create some variety. Hunt discovered that as roofs get more complicated, steel loses its advantages over wood. Wood trusses that accommodate these design features can be built faster and at lower cost than steel roof systems. In the residential market, steel framed roof systems can cost 40% more than wood truss systems.

Hunt has tried a variety of approaches to steel framing ranging from traditional methods of subcontracting with multiple contractors for each of the individual trade activities to the current approach of using one company as the supplier, manufacturer and installer of framing materials. Along the way, they also tried a technology where they purchased an onsite roll forming system and rolled their own studs and track and built their own panels at the site. Each of these approaches carries different levels of capital investment.

Under the current approach, Hunt minimized their need for capital investment by using Worthington as a one-stop shop for a series of services that previously were provided by multiple suppliers or contractors. More specifically, by contracting out the panel fabrication and erection, Hunt limited the transition costs commonly associated with switching to steel framing. Thus, the major costs involved in using steel as compared to wood framing are incurred by Worthington on the Radford terrace project.

A disadvantage for steel identified by Hunt is that a steel design needs an engineer's and an architect's seal. Conversely, a wood home two stories and under requires an architect's seal but not the structural engineer's seal. This was attributed by the builder to the longer history of building with wood in Hawaii.

Framer issues

Worthington serves as the framer, panel manufacturer, and steel supplier. They also purchase all tools and miscellaneous supplies related to the steel framing and installation of windows. Since Worthington frames homes for builders other than Hunt, the cost of equipment related to the framing component can be spread out over a larger number of homes.

One of the most significant costs associated with using steel panels is related to the fabrication plant location. Labor and facilities related to fabrication are two other important factors for a builder or framer to consider. These issues were addressed by Worthington in the following sections.

Space for the fabrication plant – Limited space at the construction site required Worthington to set up a panel plant on an off-site parcel of land owned by Hunt. Hunt gets a reduced price for the panels under this arrangement, and Worthington minimizes their need to lease or purchase space for the fabrication plant.

The fabrication area takes up 10,000 square feet, material storage 14,000 square feet, and completed panel storage about one acre. A similar amount of space would be needed if the fabrication was conducted on-site. The builder indicates that they could squeeze the plant into about 1.25 acres if necessary.

Start-up equipment – Worthington uses two framing tables manufactured by TRIAD with double-sided dolly screw guns to eliminate the need to flip the panels to screw studs into tracks from both sides. The tables are located under a tent. Materials and supplies are stored nearby or in an existing building. The facilities fabrication footprint is rather small, with the bulk of the land reserved for storage.



Storage - The necessity for storage makes ample space (land) crucial. Depending on the construction schedule and shipping times, stockpiled panels can take up a vast amount of space. The fabrication plant needs to be ahead of the construction process or else fabrication will slow the construction schedule.

The biggest panels at Worthington's facility ranged between 20' and 22' in width and 10' to 12' tall. Each floor of a home was placed in one stack. Thus each floor required a 22' by 12' space.

Although some storage is required once the panels are delivered to the building site, this is only temporary. The production process allows for some stockpiling

at the home sites, but the panels are erected almost as soon as they are delivered.

Overall, the Worthington plant sits on about 2 acres of land, including parking space for the employees. As mentioned above, the builder has fit similar operations on as little as 1.25 acres.

Labor - Labor concerns in Hawaii are similar to other areas of the United States in that there is always an ongoing struggle to find and retain construction workers. At Radford Terrace, labor issues were not necessarily complicated due to the use of steel.

Although there were some labor issues early in the process of transitioning from wood to steel on projects in Hawaii, very few staff members from either Worthington or Hunt were around when the transition began in the 1996-1997 timeframe. The few employees who were on staff at this time were unable to recall specific issues that arose during the transition.

No coordinated effort to train employees was required in the beginning stages at Radford Terrace, since the market had matured enough since the mid 1990s. Framers and sub-trades have come to realize that working with steel is a requirement in Hawaii, especially for military contracts. Further, labor in Hawaii is heavily influenced by labor unions who often supply qualified workers.

When Hunt began building steel homes the contracts were small and didn't draw much union interest. Now that Hunt is involved in large, multi-year projects, they have worked out an agreement with the local construction union. Hunt offers union wage rates and has an open shop policy, meaning workers can join the union if they want to, but all workers have to pay union dues regardless of their membership status.

There is some benefit from a wage standpoint to fabricating panels off site. The crews at the panel plant are not union members nor subject to union dues. Conversely, when panel fabrication occurs at the job site, employers are required to pay union wages because the employees fall under the negotiated union agreement.

Other trade contractor issues

In addition to the issues faced by the framer and builder when deciding to use steel framing, there are some issues that need to be addressed with other trade contractors.



The electrician for the Radford Terrace homes has found working with a hybrid frame that includes steel and wood can require extra effort to run wiring. Although steel wall panels have

standardized holes punched in the studs, they do not always line up with the wiring.

The electrician also needs to drill or cut track sections when wiring runs through the floor. In this situation, they need to switch drill bits depending on whether they are drilling through wood, steel, or a combination of the two materials. Besides having to switch drill bits, steel is perceived to be harder to drill than wood.

The plumber encounters similar problems as the electrician with drill bit changes. The plumber recommended a bi-metal drill bit to avoid time delays associated with changing drill bits. They also use a plasma cutter when cutting steel.

The drywall contractor also claims that working with steel takes longer than with wood because they have to use screws. Additionally screwing into heavy gauge steel is more difficult than wood, especially if it is overhead.

The housewrap contractor also raised some issues that need to be addressed in the early stages of the project. First, the housewrap task has to be integrated into the framer's work flow since the home needs to be wrapped before windows can be installed.

Second, the design of the shear system impacts the housewrap installation. For the homes at Radford Terrace, only shear walls are fully sheathed with plywood. If only a portion of the wall is classified as shear the entire wall is sheathed to prevent siding complications. Typically at least one wall is completely unsheathed. Wrapping a wall without sheathing presented a problem for the crew since it requires a double sided tape that will stick to the steel studs and house wrap. The housewrap crew at Radford Terrace uses ProTrim Constructions' blue Alum-A-Pole tape to adhere the wrap to the studs on walls without sheathing.



The siding installer also noted some differences in working with the homes at Radford Terrace compared to homes with wood framed walls. A fiber-cement product manufactured by James Hardi is the siding product for this project. The siding contractor indicated that he uses screws for fiber cement for wood and steel walls, but the use of screws could result in an upcharge by some contractors who don't commonly use screws with wood framed homes. With the siding at Radford Terrace, the manufacturer provides an innovative screw with wings that cut through the siding. The wings break-off as the screws hit and penetrate the steel studs.

The siding contractor would prefer every wall to be sheathed because they can screw into the side of the home anywhere they want. When a wall is not sheathed (as in the case with some of the walls at Radford Terrace) they need to

screw directly into a stud, which affects the length of the siding product. Locating a stud is usually not hard because you can see the studs through the housewrap.

Worthington straps the panels to facilitate cabinet installation. Cabinets are commonly installed with self drilling screws. Cabinet installers have grown accustomed to working with steel and cited no concerns with working with steel.