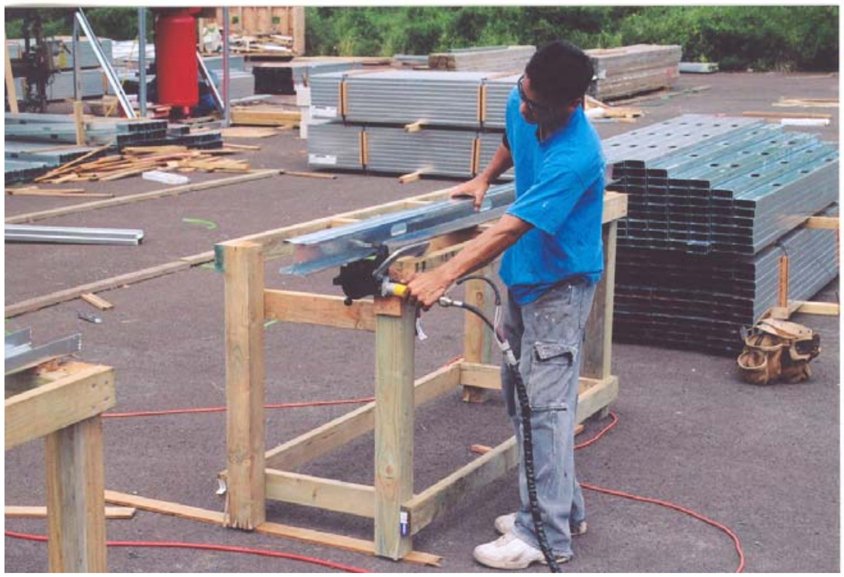
INTEGRATING PATH TECHNOLOGIES INTO MILITARY FAMILY HOUSING



Status Report on Technical Assistance at Radford Terrace, Pearl Harbor

Prepared for

Partnership for Advancing Technology in Housing

by

Newport Partners LLC

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Introduction and Objectives

The overall objective of the Partnership for Advancing Technology in Housing (PATH) military project is to develop a strategy for PATH to integrate innovative technologies into military family housing. Activities include working with military personnel, developers and contractors and others involved in the construction and operation of military family housing. The outcomes of the project will include a strategic plan for PATH to integrate technologies into military homes and topical reports on issues, requirements, and considerations surrounding the use of various technologies. Technical support will be provided throughout the project to educate the military and contractors about PATH technologies and to assist them in the evaluation and integration of new technologies into the design and production of their homes. This report addresses the activities to date on a project being constructed in a community known as Radford Terrace under a privatized housing project near Pearl Harbor.

Under the privatization approach to building military family housing, the private sector construction and management team, in this case Hawaii Military Communities (HMC), will build and maintain the properties over a long-term lease period. HMC has retained Hunt Building Corporation of El Paso, Texas to construct the homes. The first stage of construction will include about 750 homes. Another 1000 homes are planned for award in 2006, but will not begin construction for another three years.

Site Location and Description of Homes

The new homes will be built in an existing community called Radford Terrace, located near the Honolulu International Airport. The homes are a mix of single-family detached and attached homes. Hunt has been involved in previous home construction at the same site and is familiar with the needs of the community.

The site contains existing homes that are occupied by military families. Construction is staged so that a group of older homes can be demolished and new homes built in their place. However, the demolition can not get too far ahead of the construction since the contractor needs to maintain enough homes to meet the military’s demand. To accommodate space restrictions, much of the framing is panelized at an off-site facility.

The homes are built on a slab-on-grade foundation. A typical home under construction is shown in Figure 1. The walls are cold-formed steel c-sections, the floors are open-web wood trusses, and the roofs are wood trusses.

Figure 1 - Hybrid steel-wood home at Radford Terrace.

Target technologies and approach

At the start of PATH's involvement in a project, a team conducts a review of a typical home plan to identify potential technologies for evaluation and adoption. In this case, Hunt had been involved in a previous PATH project to conduct a preliminary evaluation of the use of clinching for steel framing, as opposed to the current practice of using screws. Under the previous project, the research team determined that clinching is probably best used on specialty items that are made up off-line and then placed in the wall assembly as the walls are framed. These include multiple stud members as shown in Figure 2 that are used at windows, doors, corners, and point loads.

Figure 2 – Multiple members built off-line and placed on main panel table.

Based on input from the first PATH clinching project, the manufacturer of the tool – Attexor, Inc. of Springfield, MA, - developed a newer version of the clinching tool to address the feedback from Hunt and others. During this second project, the team worked with the modified tool to move clinching closer to production of the homes. The approach included the following activities:

1. Work with the framing contractor, Dietrich Residential Construction, to determine the best use of clinching for their projects.
2. Assist the contractor to identify the benefits of the approach.
3. Assist in optimizing the design of the table and equipment.
4. Coordinate with the manufacturer on the tool use and set-up.
5. Work with the structural designer to obtain approval for use of clinching in appropriate applications.

In addition to the steel clinching, the plumbing and lighting systems are also being reviewed for efficiency improvements using innovative technologies. These include technologies that require only small changes to the construction, such as the use of AAVs at island sinks and to reduce roof penetrations, advanced lighting controls, compact fluorescent bulbs, and daylighting techniques. The evaluation of these technologies and how they might fit into the homes is at the early stages. Thus, this report focuses on the clinching of steel framing members.

Initial Site Visit

The site was visited in March 2005 to set up an initial clinching application and work on optimizing the design of the clinching setup. Newport Partners first visited the Radford Terrace site to meet with Hunt and verify on-site construction processes and materials. The Hunt supervisor arranged for a visit to the off-site framing facility and made appropriate introductions. The framing facility is located to the west of Pearl Harbor near Ewa. After observing the construction on-site and at the framing facility, the team confirmed the following:

1. The steel framing is used only in the walls and consists of 20 and 25 gauge members. The walls are framed on a table as shown in Figure 3. Ceramic coated screws, collated for automatic feed, are used. The framing crew typically builds the walls for sets of 12 homes at a time.

Figure 3 – Framing table at plant

2. The five-person crew typically spends about 1-1½ days building all of the back-to-back members for headers, double studs, and cripples for each set of 12 homes. Between 900 and 1000 pairs of these types of members are built for each set. The schedule calls for them to build two sets of 12 wall frames each month.
3. Two #10 screws are placed at 12" intervals along the back-to-back c-sections. This results in 18 screws in each eight-foot section. The members are stockpiled near the framing table. As the walls are framed, the members are readily available to set into their appropriate place on the framing table.
4. The panelization process is limited to the steel frames, with the exception of a single wood top plate over the top steel track. The sheathing, 15/32 plywood, is attached in the field. Double screwing of the sheathing to each stud is required where back-to-back members are located at tie downs.

<u>Engineering Approval</u>

Before valuable time and materials were invested into this project, the framing contractor wanted to make sure that the clinching connections were approved for use in the wall panels. The structural engineering firm for this project was Anderson-Peyton of Seattle. Based on an ICBO-ES report from Attexor, the project team prepared an evaluation letter for Andersen-Peyton to review and approve or modify as necessary. Anderson-Peyton determined that two clinches would be acceptable at 12 inches on center to substitute for the #10 screws on back-to-back sections for headers and other components. However, the approval was limited to the Radford Terrace homes and also required screwing of the plywood sheathing into both sets of double studs at locations of hold downs. Based on field observations, double fastening at these locations is already standard practice on the jobsite.

<u>Clinching Table Design and Operation</u>

Newport Partners and Attexor staff worked with the framing contractor's crew to design and build the table and set up for the clinching tool. The table consisted of two sections, each three feet tall and six feet long (See Figure 4). An 8-inch wide steel track member was placed on top of the table to act as a guide for the studs as they passed through the clinching tool. The tool was placed on top of a wood block and clamped to the table with the c-section facing upward.

Only one person was needed to operate the clinching tool for the back-to-back member connections. A bundle of studs was located next to the table. The operator would grab two studs at a time, line up the ends, slide the studs through the tool going right-to-left, and clinch every 12 inches. He would then flip the member, and run it back through the opposite end to get the second connection.

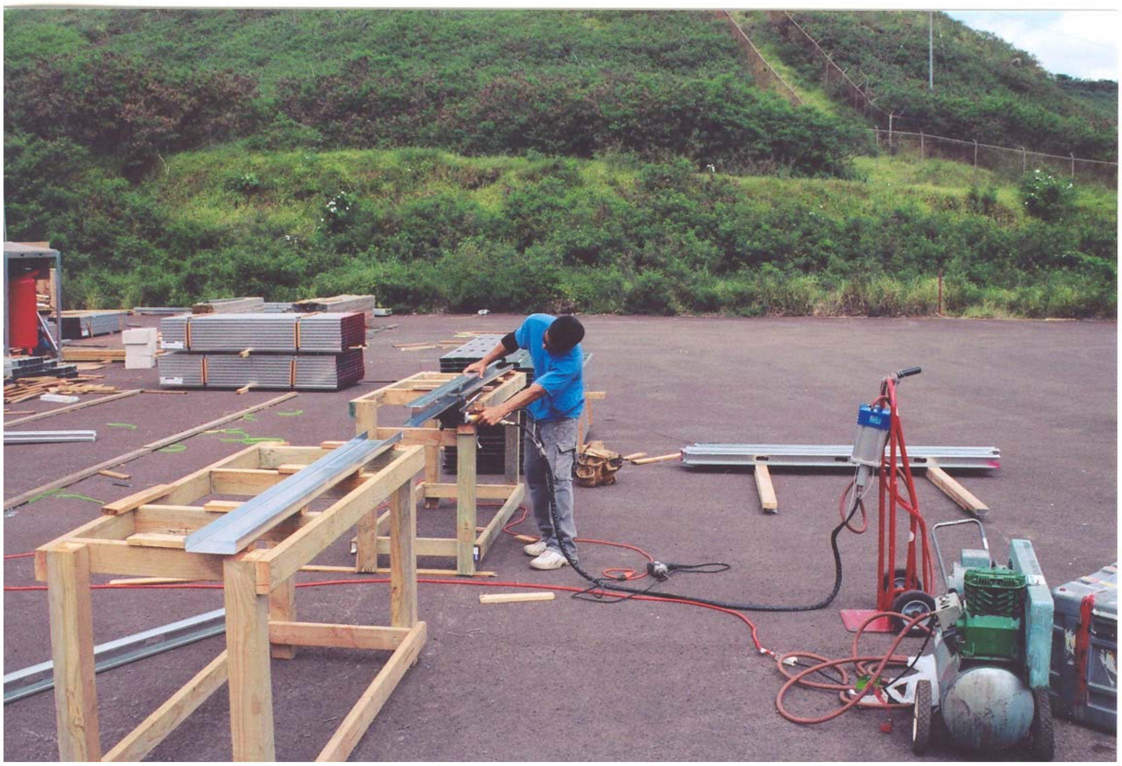

Figure 4 – Clinching table and set-up

A second option was tried whereby the operator would clinch one side of the pair moving right-to-left, then bring it back to the starting position, flip the assembly, and repeat the process to catch the opposite side of the assembly. This took more time and was more labor intensive than the first approach.

Once the operator was comfortable with the tool and had developed the method that worked best for him, he could consistently complete the entire process for each assembly, from grabbing the studs to placing the finished product in new bundles, in about 60 seconds.

<u>Feedback</u>

The operators were favorably impressed with the setup and clinching in general. They believed it would be quicker than using screws and much less wearing on them. One operator asked: "What happens if you mess up and need to undo a clinch?" This occurred once during the observation period on the first clinch of a back-to-back member. The operator popped the clinch apart using a screw driver. The only real threat of this happening would be during the first and maybe second clinch. After that, the initial clinches secure the studs together and reduces the chance of applying the clinch incorrectly.

Newport, Attexor, and the Dietrich representatives discussed the use of the tool and contributed suggestions for optimizing the process: These include:

- Use of a foot pedal. The hand-pressed trigger device seemed to get in the way as the operator was walking back and forth. Mounting the tool so that the c-section faced left or right vs. up or down would work well with a foot pedal. This would eliminate the need for the operator to bend over and check the spacing between each clinch. The operator would have clear sight to the stud holes and be better able to line up the clinches.
- Develop a setup with a double clinch. Two clinching frames could be used to optimize the process by applying the top and bottom clinch in a single pass and eliminate the need to flip the assembly.
- Mount the tool on an adjustable bracket to allow for easy calibration when different size studs are used (they use 4” and 6” sections).
- Develop a mobile clinching table. Dietrich has four panelization facilities on Oahu. They suggested that a portable setup would allow them to rotate the tool between the four sites to maximize the benefits of clinching. This would require them to modify their schedule of operations slightly to avoid downtime on the part of their crews. The clinching tool is only operated by one person. They could have one person rotate between the four plants doing nothing but clinching the back–to-back sections. If they do this on the final day of a rotation, it would save the plant from having to spend the next day or two screwing all their back-to-back sections. If the tool were to be rotated between the plants, the table would need to remain small and light for easy transportation. Another option would be to build stationary tables at each site so just the clinching tool would need to be mobile.
- Evaluate the set-up with the foot petal and/or double clinch over a period of several weeks.

<u>Costs and Potential Savings</u>

The clinching setup would cost the framing contractor between $8,000 and $14,000, depending on whether a single or double clinch set up is used and on other details such as the use of a trigger mechanism or foot pedal.

Ceramic-coated, #10 screws used at the site cost about 2.5 cents each. If the setup is used at four sites on 12 pairs of homes twice each month (assuming 950 pairs each set on average and 18 screws per pair), then the simple payback would be just under 2-1/2 months with the single clinch setup and about four months for the double clinch setup.

The payback estimated here is based only on the cost of screws and assumes no difference in labor costs, no wasted screws, and negligible maintenance costs for either the screws or clinches. The payback period would change significantly if the production of wall panels increases or decreases radically.

Next Steps

During the next several months, the focus of this project will be on optimizing the design of the clinching setup and building a portable table that can serve multiple sites. Newport Partners will coordinate these activities between the builder, framing contractor, and clinching tool manufacturer. We will also continue to refine the cost estimates based on the optimized setup and the higher production rates from the four combined sites so that others can make informed decisions on this technology.

The opportunity to continue working with this builder will be used to pursue the adoption of other PATH technologies in the areas of plumbing and lighting. Air Admittance Vents, daylighting techniques, compact fluorescents, and lighting controls are all under investigation for this site as it expands into future phases of construction.

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