

Sections 4: Capital Requirements and Inventory

Capital requirements for the use of steel framing vary depending on the business model. Hunt has settled on an approach where they purchase panels from a third party. As the panel provider and framer, Worthington incurs the bulk of the capital costs and inventory costs. The one major exception is that the land for the panel plant is owned by Hunt as part of a land-sharing arrangement negotiated into the cost of the panels and framing package.

The business approach used at Radford Terrace has evolved over time, and some of the changes have impacted the inventory requirements. For example, Hunt used to purchase screws for the framer but has ended this arrangement. Requiring the framer to include the cost of screws in their bids gives the framer more incentive to reduce unnecessary use.

The sections below summarize the capital and working inventory requirements for the plant and framing at Radford Terrace. Except for the land, these items are all the responsibility of the framer. The emphasis is on components that are related to steel. Note that since this is a hybrid house with steel and wood components, the typical tools and fasteners used for wood framing would also be required on the jobsite. Also note that the items addressed in this section are based on production of approximately 28 homes per month.

The prices listed in this report are the prices in Hawaii with bulk purchase discounts. These will vary as market costs rise and fall. Mainland prices would likely be lower.

Tools

Following is a list of tools each crew used for panel fabrication and framing tasks. The first table covers the tools at the off-site fabrication plant. Note that the items in the table represent requirements at start up and for operation of the plant. Periodic replacement and some maintenance would be required

Panel Fabrication

Tool	Application	Average Cost	Quantity
Framing table (manufactured by TRIAD)	Framing wall panels	\$38,000	1
Automated Double Screw Gun	Screw studs to tracks on table	\$250 per gun	4
Chop Saw	Modify studs/track	\$200	2
Skill Saw	Modify studs/track	\$180	2
Hand Screw Gun	Attach studs to track, headers, gang studs, attach wood bucks for doors, sills and windows	\$100	4
Electric Shears	Modify studs/track	\$300	2



The following tables describe tools and equipment needed for each task associated with the even-flow process employed at Radford Terrace (i.e., on-site framing). Note that each task is associated with a specific crew that brings their own tools to the home they are working on at the time. Thus, except where noted, tools and equipment are not shared among the crews.

1st Story Wall Panels

Tool	Application	Average Cost	Quantity
Hand Screw Gun	Attaching panels and braces	\$100	4
Powder Actuated Nail Gun	Apply temporary anchoring	\$600	1
Skill Saw	Cut steel tracks	\$180	2
Gas Powered Electric Generator	Power tools	\$1,500	1

Anchoring of Panels to Slab

Tool	Application	Average Cost	Quantity
Hammer Drill (drill and screw bit)	Drill holes for bolts and screwing bolts	\$700	1
Gas Powered Air Compressor	Clean bolt holes	\$800	1
Gas Powered Electric Generator	Power for the drill	\$1,500	1



Floor Framing and Sheathing (Two Tasks)

Tool	Application	Average Cost	Quantity
Screw Gun	Attach brackets to beams	\$200	2
Nail Gun	Attach sheathing to floor joists and attach joists to wood plate	\$400	3
Gas Powered Air Compressor	Power nail gun	\$800	2
Gas Powered Generator	Power screw gun	\$1,500	2

2nd Story Wall Panels

Tool	Application	Average Cost	Quantity
Screw Gun	Attach sheathing (plywood) Attach panels to floor and other panels	\$200	3
Skill Saw	Cut steel tracks	\$180	2
Gas Powered Generator	Power screw gun and saw	\$1,500	1

Exterior Wall Sheathing

Tool	Application	Average Cost	Quantity
Screw Gun	Attach sheathing	\$200	2
Skill Saw	Cut wood	\$180	1
Router Saw	Cut out windows	\$350	1
Gas Powered Generator	Power screw gun and saw	\$1,500	1



Roof Tasks (Includes truss, soffit, fascia, and sheathing crews)

Tool	Application	Average Cost	Quantity
Nail Gun	Attaching trusses, soffit, fascia and decking	\$600	13
Skill Saw	Cut wood	\$180	4
Gas Powered Generator	Power saw gun	\$1,500	3
Gas Powered Air Compressor	Power nail gun	\$800	3

Note: The roof tasks were combined in this table since there was significant tool sharing by the separate crews.



Interior Walls

Tool	Application	Average Cost	Quantity
Screw Gun	Attach studs	\$200	2
Skill Saw	Cut Studs	\$180	1
Gas Powered Electric Generator	Power screw gun	\$1,500	1

The tools in the tables above are all supplied by Worthington in accordance with union rules. Workers purchase their own hammers, tape measures and other common tools. Before the union became involved, workers were responsible for providing their own screw guns and other tools.

The costs in the tables above are estimates that a builder or framer would encounter if purchasing all of the items. However, since Worthington buys large amounts of screws, nails, and tools, they often get screws guns and other tools for free or at a discounted rate from manufacturers.

Supplies

The following section lists the costs for supplies or materials needed on a monthly basis by the framer. Note that the items are specific to the steel components used in the homes. Typical items required to frame the wood components of the framing (i.e., lumber, trusses, plywood, nails, etc) are not addressed here.

Fabrication Plant Supplies

Item	Application	Average Cost
Screws	Attachment	\$6,075
2x4 and 2x6 Steel Tracks and Studs	Wall panel fabrication	\$120,000

Additional required materials include the top plates for walls (wood 2x4s or 2x6s). These are provided as needed by the builder as part of their lumber package purchase.

On-site Framing Activities

Item	Application	Average Cost per month
Screws	Attaching panels to other panels and attaching braces	\$7,425
Powder Actuated Nails	Temporary panel anchoring	\$1,200
Caulk	Attaching foam and decking material	\$1,200
Foam	Buffer between concrete and steel	\$1,000
Sealer/fabric between bottom track and slab	Protection between concrete and steel	\$2,000
Steel Braces	Brace wall panels	\$5,000
Epoxy and applicator	Secure anchor bolt	\$1,000
Anchor Bolts	Secure panels	\$1,800
Corner Braces	Use for high load areas	\$6,000
Bracket Strips	Connect first story wall sheathing to second story sheathing	\$300
Steel Studs and Tracks – Interior	Non-load bearing walls	\$14,000



Additional material includes treated plywood for exterior sheathing.

Inventory supplies are maintained by Worthington's supervisor, however this project has been operating for a few years and many of the crew members know the appropriate inventory levels for each item and help with inventory management.

Panels, trusses, joists and beams are delivered a few homes at a time and are stored until needed, preferably at their construction location. Plywood is purchased in bulk and stored on site.



Safety Equipment

Everyone on the job-site is required to wear a hard-hat. Ear and eye protective equipment is common, especially for those tasks involved in cutting. Protective

gloves were worn by some workers. Individuals who work off the ground are required, in most cases, to tie-off with approved equipment.

Machinery

At the panel fabrication facility there is one all-terrain forklift and at the job site there are two all-terrain forklifts. The job-site forklift operators are responsible for prepping workers by placing a stack of panels at their appropriate location, including on top of the first floor. Also, the forklift operators move trusses, joists and plywood around. At night, generators and compressors are loaded onto skids and elevated into the air to prevent theft.



Electric Trailer Generator

The fabrication plant crew uses one diesel electric generator which costs around \$15,000. At the construction site there is one diesel electric trailer generator supplied by Worthington that costs approximately \$25,000. The majority of the frame crews used their own generator when they are far from the central diesel generator. Other subcontractors are responsible for supplying their own power at the construction site.



Transportation

Flatbed trucks, owned by Worthington, are used to transport panels from the fabrication facility to the construction site, approximately fifteen miles. Worthington engages in many steel production activities. Thus, the transportation trucks are used for a wide variety of other business activities. Had they only been engaged in fabrication for Radford Terrace, renting the transportation trucks would be a viable option.

Permits are not needed to transport the panels. The panels are laid flat on the truck and the width is dictated by the height of the panel. Typically the panels are 9' to 10' in height. Stacks are usually between 5' and 6' high, consisting of ten to fourteen panels.

Panels can be carried by two people. Machinery is not needed to hoist or lift individual panels during the erection stage, even when the second story panels are sheathed.

Storage

Panels and other materials are stored in uncovered stacks at the job site and plant. Supplies and tools, on the other hand, need a protected storage location. Workers typically take their power tools home while supplies are stored in lock boxes on site. The lock boxes hold screws, nails and brackets that their respective tasks require. There are also freight containers on site to store supplies. Supplies are order to last a month and have approximately a three week delivery time.



Steel panel wall stacks are stored as close to their desired location as possible when they arrive at the construction site. Wood boxes are used to keep the panels off the ground and enable the forklift to easily get under the panels.

Construction Site Storage

There are typically two, 8 feet by 40 feet containers on-site for inventory storage. The roofers and erectors have their own storage box to store immediate supplies. Material inventory is also stored in stacks around the job site.

Fabrication Facility Storage

Inventory for panel fabrication predominately consists of screws, wood, steel studs and tracks, and completed panels. Panels are stored in stacks and, due to their size, take up the bulk of the land requirements. Steel studs and tracks arrive cut to length and are stacked near the fabrication tables in piles according to size and gauge. Wood, used for sill plates and door jams, is stored in a similar fashion. Screws are stored in an existing 14,000 square foot building.

All exterior sheathing is done at the construction site and accordingly there is no plywood or OSB inventory at the fabrication facility.

Waste Management

Hunt has noticed significant reductions in waste management fees when building with steel over wood. By using steel panels, a typical home construction job results in approximately one regular garbage can being filled. The majority of the waste consists of wall braces that have outlived their usefulness. Most steel

panel jobs avoid the purchase of a 40 yard or 20 yard dumpster that stick-built wood construction jobs need. Additionally, there are companies who will come and recycle scrap steel, further reducing job site waste. Hunt estimates that their system will reduce waste removal charges by \$500 to \$600 per month.

Security

Despite the construction site being located in a city environment, the security measures are remarkably low.



The site is surrounded by a fence with a screen attached. The screen is primarily intended to keep dust and dirt inside the construction site. The fence gate at the entrance to the construction site is closed during the night hours.

The fabrication facility is uniquely located in a ravine with a guarded entrance. Hunt also uses the fabrication area for other business activities not related to this project.

Panel Costs

A typical steel wall panel home has a one-time \$10,000 to \$15,000 design cost. This cost is spread across the number of homes using that design. A single panel, 8 feet in length and 9 feet in height, costs between \$45 and \$65 in material. A panel's maximum dimensions are 22 feet in length and 10 feet in height. Panel sizes and steel gauges vary depending on the layout.

Currently a steel home's design does need a PE stamp but there is indication that in the near future single-story steel homes will not require a PE stamp.

Fabrication at the plant requires a five man crew, including one layout person (supervisor) and four fabricators. The starting pay begins around \$15.00 per hour and peaks at \$49.00 per hour, including benefits. The pay scale changes if the panel fabrication is conducted at the construction site due to union dues.

The on-site framers operate under a salary schedule that was negotiated with the union. The starting salary is \$15.00 per hour and progresses up to \$52.00 per hour, with benefits. According to the union's journeyman track, apprentices receive a raise every six months for four years. After four years apprentices become journeyman with the \$52.00 wage rate. Radford Terrace is a multi-year project and many of the workers are at or very close to reaching the top of the pay scale.

Overall Costs

According to the framing contractor, they are framing a home, depending on complexity, from \$21 to \$24 per square foot. The homes when completed will cost the builder about \$200,000 not including land preparation. Forest City Military Communities owns the land and they hired another firm for land preparation and installing utilities. The homes would cost about 3% to 10% less to frame if treated wood was used. However this estimate doesn't take into account the reduction of waste material, recycling of scrap steel, reduction of termite treatment in the future and reductions in insurance costs.