

Wood Pre-fabricated Shear Panels for Lateral Force Resistance

By Renee Strand, P.E.

To limit damage of wood-framed light commercial buildings, multi-family structures and homes against lateral forces from earthquakes and high wind, the *International Building Code (IBC)* and *International Residential Code (IRC)* allow several bracing methods. These include shear walls and braced wall panels built on-site, and pre-fabricated shear panels as allowed under the alternative materials section of the code. From an engineering standpoint, these are all workable solutions – depending on the specific wall design and building characteristics.

However, pre-fabricated shear panels offer a number of advantages to consider, such as consistent and predictable performance to satisfy code requirements, and the ability to accommodate high loads in narrow wall segments and other applications. For wood-framed structures, wood pre-fabricated shear panels also help simplify work for building crews when compared to steel panels.

Structural Applications

Because many modern building designs call for numerous window and door openings along a wall line, the required length of site-built shear wall segments or braced wall panels may be too wide to meet the architect's desired aesthetic. For engineered designs, the code-established height (h) to width (b) ratios are 3.5 to 1 for wind-controlled design loads and 2 to 1 for seismic-controlled design loads (with an exception for 3.5 to 1 for seismic if the allowable shear load is multiplied by 2b/h). For prescriptive design, even though the height-to-width ratios can be increased beyond 3.5 to 1 under certain rules, the required brace wall length may still be limited by the architectural design.

Pre-fabricated shear panels are tested to industry standards, and can thus exceed code limits on height-to-width. This allows for accommodating high loads in narrow wall segments. For example, a 24-inch wide by 8-foot tall wood pre-fabricated shear panel can have an allowable shear load of 4,435 lbs based on seismic controlled designs or 4,880 lbs based on wind controlled designs.

Some pre-fabricated shear panels can also be used as part of a single- or double-portal frame system installed on a concrete foundation. Code-evaluated portal frames have been tested as an assembly consisting of 1 or 2 panels with a header spanning the opening and connected to the panel(s) with a moment-resistive connection. Load capacities vary by manufacturer and for steel versus wood shear panels but, as an example, an 18-inch wide by 9-foot tall wood shear panel in a single-portal system can have an allowable seismic shear load of 1,905 lbs and an allowable wind shear load of 2,090 lbs. The same size panel in a double-portal system can have an allowable seismic load of 3,810 lbs and an allowable wind load of 4,180 lbs.

Pre-fabricated shear panels have also been tested and used successfully in tall walls up to 20 feet high and in two-story structures to meet the latest code requirements. Refer to ICC-ES ESR-2652, April 1, 2010, for details on one such product. The code evaluation report justifies using the panel as a shear wall in Type V construction, wood-framed buildings and as a one-to-one replacement for braced wall panels specified in IBC Section 2308.9.3 and IRC Section R602.10.

Because they come in a variety of sizes (heights ranging from 7 to 20 feet and widths ranging from 12 to 48 inches), wood pre-fabricated shear panels provide design flexibility for a variety of wall sizes and loading conditions. As these details vary by product, it is important to confirm specific capabilities in the manufacturer's literature.

Ease of Construction

Beyond structural considerations, specifying wood pre-fabricated shear panels can help streamline construction. Although ensuring a stable, code-compliant structure is the top design concern, taking into account the challenges building crews face on the jobsite can help reduce labor time and costs.

Due to the extensive list of components for site-built shear walls or braces (e.g., studs, plates, sheathing, anchor bolts, hold-downs, nails, etc.), site-built shear walls and braced wall panels can be difficult and



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time-consuming to build. If contractors do not follow design details closely, there is also a risk of red tag delays due to mistakes such as over-driven nails, incorrect nail spacing, nails that miss framing members, misplaced hold-downs and over-bent straps, to name a few.

Wood pre-fabricated shear panels are easier to install than site-built options since they come in one-piece units and have simple brackets for attachment to the building's foundation (additional fasteners are required at the top). Because of their consistency and pre-attached hold-down components, pre-fabricated shear panels also typically can pass inspection easier than site-built shear walls and braced wall panels.

While engineers often specify steel shear panels given a general familiarity with them, such panels can be more difficult to use on-site than wood pre-fabricated shear panels for contractors working on wood-framed buildings. Steel panels require additional framing materials to attach finish products, and the ability to modify the panels in the field is limited. Wood pre-fabricated shear panels, on the other hand, can be nailed, making them easier for contractors to attach exterior siding and interior wallboard. Crews can also trim some wood panels in height, which allows modifications to fit uneven foundations and varying wall heights. In addition, wood pre-fabricated shear panels can be drilled to accommodate wiring or plumbing. It is important to follow the manufacturer's guidelines for field trimming or drilling.

For more information, contact a shear panel manufacturer. They can provide details on product sizes, applications, allowable loads, and code compliance. ■

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