

TOOLBASE™ TECHSPECS

Pre-manufactured Shear Wall Panels

(Narrow Wall Bracing Technologies)

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BENEFITS (+)/DRAWBACKS (-)

- + **ARCHITECTURAL FLEXIBILITY:** Provides high strength wall bracing in narrow wall sections. Allows more space for windows and doors.
- + **CODE ACCEPTANCE:** Most products in this category are not listed in building codes, but are approved for use in code evaluation reports.
- + **COMPATIBILITY:** Most narrow shear wall segments are designed to be simply inserted into otherwise conventional wood wall framing.
- + **DISASTER MITIGATION:** As an alternative to site-built shear wall panels, these products are commonly used in earthquake and high wind-prone areas to streamline the construction process.
- **DESIGN REQUIRED:** Unless the product is specifically recognized as a substitute for conventional wall bracing, a design professional may be required to specify the products for permitting purposes.
- **COST:** When eliminating or decreasing the size of window and door openings to make room for wider conventional bracing panels is not an option, narrow braced wall panels are cost effective. However, these panels generally cost more than conventional "field-built" shear walls or bracing methods.
- **ANCHORAGE:** Narrow, high-strength shear wall panels require strong anchors at the base to prevent the panel from uplifting or overturning (rocking). These anchorage forces often require a strengthened foundation and load path from the base of the panel to the foundation.

- **INSULATION:** Some shear wall panels have limited, or no, cavity space for conventional batt insulation. Therefore, other insulation products, such as spray applied insulation, may be required. To avoid thermal short-circuits in the wall panel, an insulating sheathing layer on the inside or outside of the panel may be advisable.

MAKING THE SWITCH

Shear wall panels are relatively easy to specify and install, but do require some pre-planning. Unless they are used as a direct substitute for conventional wall bracing recognized in the code, an engineer may be required to specify and approve the application. Also, most shear wall panels require that special anchorage devices be installed in a foundation capable of resisting the panel's anchorage forces. For panels that are not located directly above the foundation, framing connectors must be used to carry anchorage forces to the foundation. With proper specification and detailing on a given building plan, foundation and carpentry trades should be able to perform the installation with conventional tools and training.

INITIAL COST

Depending on the application, initial costs can be above or below conventional construction practices. However, where conventional construction (e.g., use of standard field-built shear walls or braced wall panels) does not provide adequate bracing capacity or cannot be used due to narrow-width wall segments between windows and doors, narrow shear wall panels are a cost-effective solution. The initial cost of these products can range from \$150 to

\$600 or more per panel depending on the size of the panel, the strength required, and local availability. However, because of the ease and convenience of specifying and installing these panels, engineering and labor costs are often minimized.

OPERATIONAL COST

Some shear wall panels provide inadequate cavity space for insulation and/or create thermal short-circuits through conductive wall framing materials (e.g., steel). Therefore, building operational (heating/cooling) costs may be slightly influenced, unless the panels are provided with additional insulation (e.g., spray-applied insulation and/or insulating sheathing).

CODE ACCEPTANCE

Shear wall panels are generally accepted under the "alternative means and methods" clause of building codes. Their use generally requires acceptance by the local building code official—usually based on evidence provided in a manufacturer's code evaluation report. While some code acceptance questions or limitations may occur, manufacturers generally provide technical support for this purpose.

RESULTS FROM THE FIELD

Shear wall panels have been in use for some time and have been approved by many jurisdictions for use. However, it is advisable to consult with manufacturer technical representatives for their implementation.

WARRANTY

Some manufacturers offer a conditional performance guarantee.

THE BASICS

Conventional wall bracing methods in the residential building code(s) have generally relied on the use of minimum four-foot wide bracing panels, using a variety of prescriptive bracing methods and materials. However, modern homes with increased size and more windows and doors often leave little space for conventional wall bracing methods—at least on some wall lines.

Typical examples include garage front walls, especially on narrow lot configurations, and great room window walls. In these situations where greater bracing strength is needed and little wall space is available for conventional four-foot brace panels, narrow high-strength shear panels are an increasingly favored alternative solution. This example is illustrated in Figure 1. As illustrated, shear wall panels offer a cost-competitive alternative solution to meet the building code’s wall bracing requirements while affording the greatest architectural flexibility in maximizing window and door sizes and amounts in a given building or wall line. Several proprietary pre-fabricated products and generic (commodity) field-built methods are available for use.

Typically, pre-manufactured shear wall panels come in a variety of standard sizes up to 20 feet in height and as narrow as 12 inches wide (across the face of the panel). Custom sizes are also available. Materials used to fabricate these panels may include wood, engineered wood, and steel components. The allowable shear strength of shear wall panels varies widely depending on the height, width, and construction of the panel. Strengths of 1,200 pounds for a 16-inch-wide panel to 5,000 pounds for a 24-inch wide panel are representative, though manufacturer data should be consulted to obtain specific information. While pre-manufactured shear wall panels come in a variety of sizes, standard sizes are usually available and allow the panels simply to be inserted into a typical wood-frame or steel-frame wall assembly, provided manufacturer-specific installation recommendations and details are followed.

Two approaches are commonly used to specify pre-manufactured shear wall panels for a building plan or wall line. The first approach simply makes use of “substitution” rules for conventional brace panels required by the conventional residential building code (e.g., IRC). In this approach, where a four-foot conventional braced wall panel is required by code, a shear wall panel as narrow as 12 inches may be substituted to provide the same effective bracing strength as a four-foot panel. Thus, a braced wall line can be constructed with one-fourth the amount (length) of bracing panels required by conventional bracing methods, yet, the wall is at least as strong and stiff. This approach falls under the “alternative

means and methods” clause of the building code and, therefore, requires the approval of the local building official. For this purpose, manufacturers generally support their products with third-party code evaluation reports. This approach is the most economical use of the shear wall panel(s) because, depending on local code acceptance and conditions of use, the cost of an engineered design is avoided. The builder will need to follow appropriate installation and anchorage guidelines provided by the manufacturer. Because this may affect other portions of the building (e.g., foundation reinforcement and size), it is important to do more than just select a shear wall panel and stick it in the wall where needed. This concern with increased anchorage forces for narrow shear wall panels is illustrated in Figure 2.

The second approach involves the use of pre-manufactured shear wall panels as an alternative to code-recognized engineering

guidelines, which limit “field-built” engineered shear wall segments to a maximum height-to-width ratio of about 3.5:1 or 2:1, depending on conditions. Thus, pre-manufactured shear wall panels can provide narrower wall bracing segments than permitted in the code’s design rules that an engineer must follow. When an engineer uses narrow, high-strength shear wall panels, the manufacturer’s product data is consulted to select an appropriate size and number of panels to resist the wind or seismic forces acting on the building as a whole or on a specific wall line (as determined by the engineer). Because the panels require stringent anchoring details, the engineer may need to evaluate the load path from the panel to the foundation and strengthen framing, connections, and even the foundation as necessary. However, the engineer does not need to design the panel itself because it has already been pre-engineered with approved strength values.

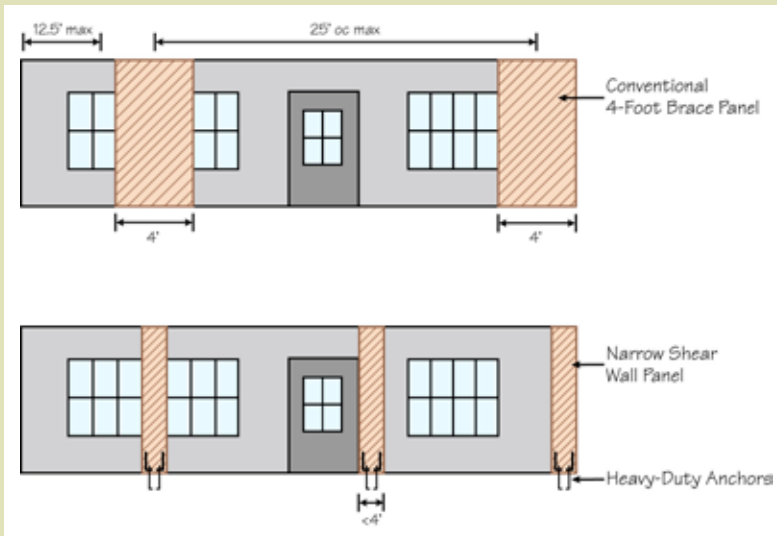


Figure 1 – Illustration of conventional 4-foot-wide braced wall panel (top) and narrow shear wall panel applications (bottom).

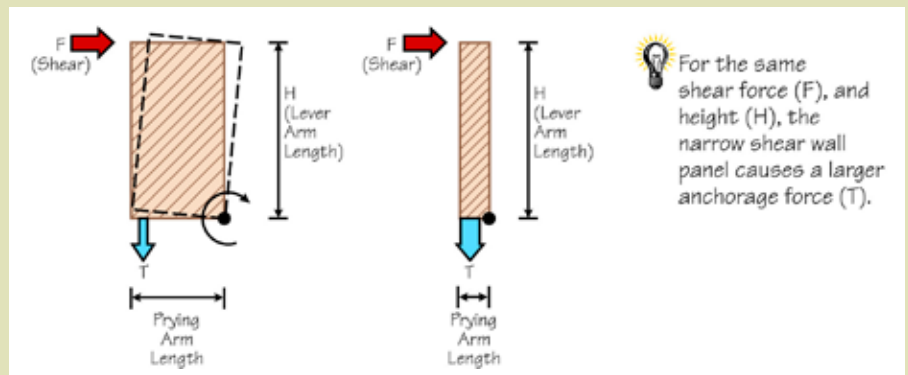


Figure 2 – Illustration of increased anchorage forces for narrow shear wall panels.

APPLICATION TIP

Pre-manufactured shear wall panels are most effective when wall segments that measure between one and four feet in width are required to be used as wall bracing to meet code-required wall bracing amounts. For larger wall segments, a conventional (non-proprietary) braced wall panel or engineered shear wall is usually more cost-effective. When wall segments that are less than 12 inches in width must be used as bracing, it is generally advisable to consider a steel moment frame system or other suitable engineered solutions.

RESULTS FROM THE FIELD

Currently, there is very little independent (third-party) field evaluation information on the various pre-manufactured shear wall panel products. However, various builders have been using these products for some time, especially in higher wind regions of the country. Until this type of information becomes more widely available, it is advisable to consult with manufacturer's technical representatives as well as users of the product. As with any alternative building practice, there are always "tricks of the trade" that help to ensure success and minimize the mistakes often made by first-time users. Refer to the "Food for Thought" and "Tech Check" sections below for some generic recommendations for successful implementation.

FOOD FOR THOUGHT

This section provides some things to think about before switching to this building technology – make sure it's the right choice for you.

- Use narrow, high-strength, pre-manufactured shear wall panels only where conventional solutions are not possible (e.g., walls with narrow wall segments between window and door openings).
- Using pre-manufactured shear wall panels can allow other portions of walls to be sheathed with non-structural products such as foam sheathing, to meet energy code or enhance energy efficiency.
- Where possible, and to avoid engineering costs, use products that provide prescriptive rules for substituting narrow shear wall panels for conventional four-foot-wide bracing panels.
- Become familiar with the options available with each product to address difficult bracing conditions. This knowledge will aid in making informed building planning and architectural decisions, that otherwise could have significant engineering or construction cost impacts.
- Consider ways that shear wall panels can be used for retrofit or remodeling applications, especially when adding windows and doors and removing conventional bracing from an existing building.

TECH CHECK

Below is a checklist of steps to follow in order to implement this technology in each of your projects.

- Check local availability, prices, and lead-time before specifying a particular pre-manufactured shear wall panel product.
- Check for local building official acceptance of a specific shear wall panel product prior to use.
- Follow manufacturer details for anchorage and connections of the panels and ensure that this information is consistent with conditions shown on the building construction plans.
- Include manufacturer-specific construction details on the building plans.
- Ensure field personnel (concrete and framing trades) are familiar with installation requirements and tolerances.
- Verify proper installation of anchorage devices prior to casting concrete and verify proper installation of panels in walls prior to close-in.

MAKING THE SWITCH

What is required to transition from your current building practices to using this technology?

Switching to pre-manufactured shear wall panels is easy. So easy in fact, that an entire building plan can be changed to use these types of wall panels without changing basic framing practices or techniques. More commonly, the panels are used in specific locations, such as a garage opening wall, a great room wall with many closely-spaced window openings, or a patio wall with many closely spaced sliding doors. The panels simply fit within segments of a conventionally-framed wall as needed. While the installation is relatively easy, some pre-planning is usually necessary. For example:

- The foundation should be detailed in accordance with manufacturer recommendations to properly anchor the panels.
- Framing connectors are usually required to attach the panel to surrounding wall framing.
- Some panels require use of specialty insulating products such as spray-applied insulation or insulating sheathing to comply with energy-efficiency requirements.

As mentioned, most of these products are not directly recognized in the building code because they are proprietary. Therefore, these products require the approval of a local code official. It is always a good idea to check with the local code department to ensure that they will accept alternative bracing methods. Also, some methods are included in the building code as field-built narrow wall bracing solutions. One example is the "portal-frame" bracing method commonly used to brace garage opening walls. Information on this method can be found in the IRC (2006 edition or later) and in popular bracing guides (see "Resources").

A typical installation of a pre-manufactured shear wall panel starts with using a manufacturer-supplied template to carefully position anchor bolts in the foundation wall or slab while it is being cast. Next, the panels are placed either before or after the wall framing as each story level is constructed. If shear panels are stacked (one above another), connectors are required between the panels—extending through the floor deck, to ensure that the panels act as a continuous unit. It is always a good idea to include appropriate construction details on the plans. Many manufacturers provide CAD details that can be used for this purpose. In addition, installation training materials are offered by some manufacturers.

DOLLARS AND SENSE

As mentioned, the cost of these products generally ranges from \$150 to \$600 for typical (stock) panels. For custom fabricated applications, higher costs should be expected. Because these products vary significantly in composition, and material costs may fluctuate, detailed costs should be determined on a case-by-case basis. Customers should contact the manufacturer or distributor directly.

DEFINITIONS

Braced Wall Panel

Refers to conventional wall bracing methods using the requirements given in the building code (e.g., 4-foot-wide structural sheathing panel, 45° 1x4 let-in brace, etc.).

Shear Wall

A general term referring to a wall, or segment of a wall, that has been designed in accordance with engineering provisions found in the building code. These can include various structural panel products or braces, with connection schedules and anchorage designed to give a desired level of bracing strength.

Pre-manufactured Shear Wall Panel

A pre-manufactured shear wall panel is a pre-fabricated assembly (including framing and anchorage devices), that provides for narrower segment widths and higher unit shear strengths than are otherwise permitted by the building code conventional wall bracing methods or engineering provisions. Their performance is usually determined by testing rather than engineering analysis.

Steel Moment Frame System

A framework of generally hot-rolled steel vertical and horizontal members that are specially designed and joined together to resist rotation and lateral in-plane forces without the presence of bracing members (X-braces).

RESOURCES

General information about pre-manufactured shear wall panels and their installation:

International Code Council

2006 IRC Wood Wall Bracing Provisions
500 New Jersey Ave, NW 6th floor
Washington, DC 20001-2070
(888) 422-7233

www.iccsafe.org

APA – The Engineered Wood Association

7011 South 19th St
Tacoma, WA 98466
(253) 565-6600

www.wallbracing.com

Hardy Frames, Inc.

789 S. Victoria Ave. Suite 200
Ventura, CA 93003
(805) 477-0793

www.hardyframe.com

iLevel by Weyerhaeuser

P.O. Box 9777
Federal Way, WA 98063-9777
(888) 453-358

www.ilevel.com

Shear Transfer Systems

9845 Santa Fe Ave. East
Hesperia, CA 92340-2563
(877) 743-2762

www.shearmax.com

Simpson Strong-Tie

4120 Dublin Blvd.
Dublin, CA 94568
(800) 999-5099

www.simpsonstrongwall.com



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