FACTS | Foam Plastic Applications for Better Building

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"Right-Sized" Wall Bracing & Foam Plastic Insulating Sheathing (FPIS)

INTRODUCTION

Wall bracing provides necessary structural integrity to a home or building during an extreme wind or seismic event. But, wall bracing is not a one-size-fits-all proposition. Too little wall bracing decreases the safety of the structure. On the other hand, too much wall bracing wastes resources and adds unnecessary cost. To achieve an affordable, safe, and energy efficient home, one must "right-size" wall bracing together with other important design considerations for overall value (cost and performance).

Foam plastic insulating sheathing (FPIS) is not a wall bracing material. It is, however, a multi-functional exterior wall sheathing with many benefits and capabilities including thermal performance as continuous insulation, moisture resistance, and other building science benefits. When teamed-up with a "right-sized" wall bracing approach, FPIS can be used as the sole exterior sheathing behind cladding or as "over-sheathing" placed over exterior structural sheathing or panel bracing material. In both cases, the FPIS serves to protect the wall structure against costly and damaging effects of water, vapor, and thermal bridging. (See Wall Calculators for more details.)

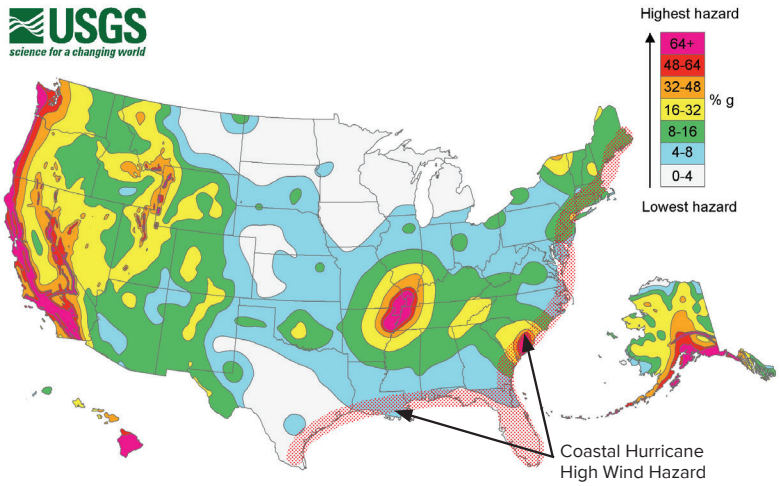

Figure 1. Map for Wind and Earthquake Hazards in U.S.

Source: NIST Earthquake Risk Reduction in Buildings and Infrastructure Program

In high wind and seismic hazard regions and particularly for larger custom or luxury homes, it is necessary to use stronger bracing methods with little flexibility in how to achieve acceptable wall bracing. However, in lower wind and seismic hazard regions covering most of the U.S. (see Figure 1) opportunities exist to "right-size" wall bracing to maximize overall wall value with FPIS as shown in the following case studies.[1]

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CASE STUDY 1: Basic Affordable Home

For a simple and affordable house plan of 1 or 1-½ stories (see Figure 2), an optimal wall construction for structural and energy performance may include:

- Gypsum wall board on the interior side of exterior walls (installed as wall bracing per code).
- Wood let-in or metal angle or X-braces applied to surface of studs (as needed per code to supplement gypsum bracing or to serve as temporary bracing during construction).
- 2x4 (R13) or 2x6 (R20) framing and cavity insulation as required by the building and energy codes.
- R5 to R10 rigid FPIS continuous insulation (ci) on the exterior side of the wall studs.
- Other components (siding, water-resistive barrier, vapor retarder, etc.) as required by code.

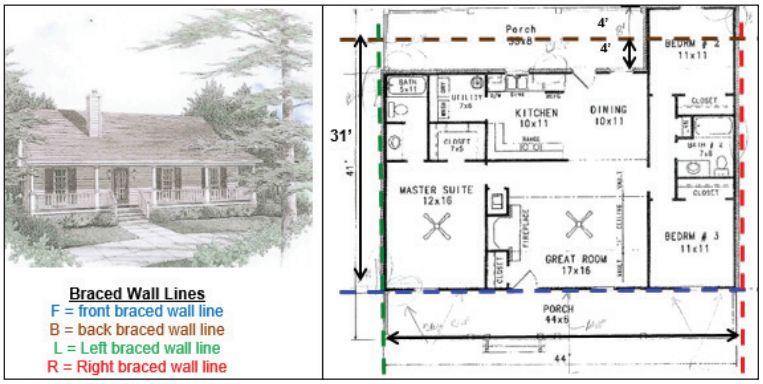

Figure 2. Example plan for a basic affordable home.

Source: IRC Wall Bracing Code Compliance Guide for Builders, Designers, and Plan Reviewers

For more information, visit continuousinsulation.org

[1] These case studies are based on optimizing compliance with the International Residential Code (IRC) and the International Energy Conservation Code (IECC).

Two key benefits of the wall construction outlined in Case Study 1 are:

1. The wall bracing approach represents a traditional U.S. wall bracing practice. The value of the gypsum wall board is enhanced by installing it as wall bracing per code on the interior side of exterior walls. It can also be used for bracing of interior wall lines where required to achieve code compliance. Generally, this application only requires additional fastening beyond that required for installation as the interior finish material. Wood let-in or metal angle (X-braces) can be added for temporary bracing during construction and additional permanent bracing.
2. The use of FPIS installed on the exterior side of studs also serves multiple purposes including continuous insulation, siding backer, water-resistive barrier, air-barrier, and vapor control. Thus, it can eliminate the need for other material layers on the wall assembly to reduce cost while maintaining or enhancing required performance. FPIS also can be used to allow 2x4 wall construction instead of 2x6 wall construction for reduced framing cost and increased useable floor area while still satisfying energy code insulation requirements.

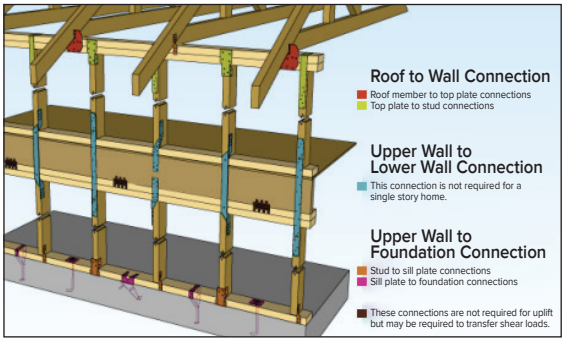

Figure 3. Continuous load path to resist wind uplift.

Source: Insurance Institute for Building & Home Safety as published in HUD Durability by Design, 2nd Edition, p. 131

NOTE: Where required by code and as shown in Figure 3, additional framing fasteners or connection hardware may be required to provide a sufficient wind-uplift load path from the roof, through the walls, and into the foundation—a concern that applies to all homes regardless of the bracing method used or exterior sheathing materials used. Experience has shown that wind-uplift is often a more significant safety concern than wall bracing. The exterior siding, such as vinyl siding, and FPIS material should also be specified for code-required wind resistance.

CASE STUDY 2: "Move-up" (Intermediate) Home

For an optimal design on intermediate sized homes like that shown in Figure 4, one must consider a multi-faceted bracing approach to achieve a "right-sized" solution. Thus, this plan may use a combination of bracing methods and materials as follows:

1. Exterior side walls and rear walls on both stories with relatively few window and door openings—same as Case Study 1 (gypsum wall board bracing with additional let-in or metal braces as needed).
2. Street facing exterior walls with relatively large amounts of openings—use continuous wood structural panel bracing.
3. Garage opening with narrow wall segments to either side—use a "portal frame" tying the wall and header framing and structural sheathing together as a rigid unit.
4. Select interior walls—use gypsum wall board bracing on one or both sides (e.g., the shared garage and house walls typically have gypsum wall board on both sides as do many interior walls).

The key benefits of investing in this design effort include optimized performance and cost savings that are especially relevant to house plans that may be used repeatedly.

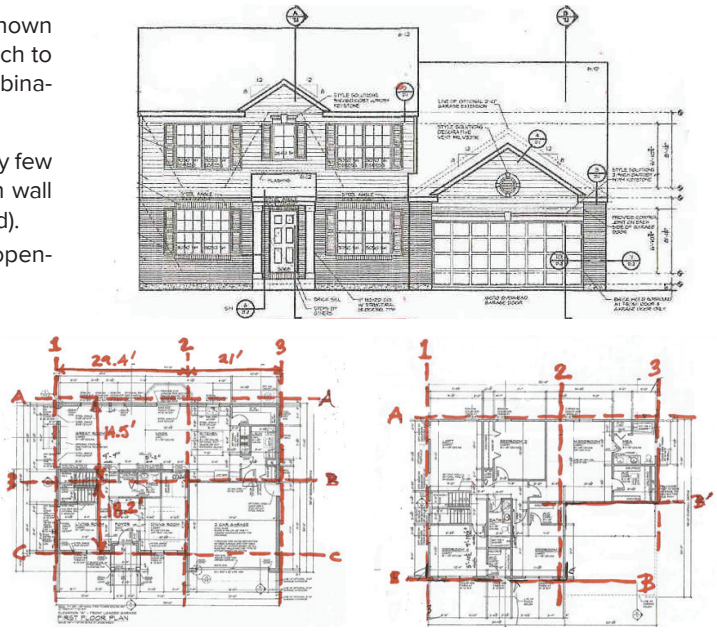

Figure 4. Example plan for a typical "move-up" home.

Source: IRC Wall Bracing Code Compliance Guide for Builders, Designers, and Plan Reviewers

CONCLUSION

There are many possibilities to "right-size" wall bracing for optimal wall designs that also make use of the many benefits and capabilities of FPIS. A building designer with detailed knowledge of wall bracing provisions in Section R602 of the International Residential Code can be a valuable resource in exploring those possibilities. For more information on how to optimize wall bracing using prescriptive or engineered wall bracing, refer to this IRC Wood Wall Bracing Calculator and this guide.