

**2006 IRC
Recommended Action for IRC Section R602.10.5
Continuous Structural Panel Sheathing (Wall Bracing)**

For

The State of Minnesota who has Adopted the 2006 IRC

Applicability

This recommendation is presented since the 2006 International Residential Code (IRC) has been adopted without modifying Section R602.10.5 Continuous Structural Panel Sheathing. It is intended to address an uncorrected error in both the IRC 2003 and 2006 editions.

Issue

Many jurisdictions are beginning to adopt the 2006 International Residential Code (IRC), which includes language modified from the 2000 and 2003 IRC in Section R602.10.5 Continuous Structural Panel Sheathing that is confusing and creates a serious error when interpreted incorrectly.

The reason that this is an issue is because the two codes:

- Inappropriately restrict the ability to use various wall bracing options and materials for wall construction in homes per IRC Section R602.10;
- Make it more costly and difficult for builders to voluntarily offer “above-code” energy efficient homes such as Energy Star;
- Make it more costly and difficult for builders to participate in voluntary green building programs that are growing in interest.
- Prevent “free market” competition within the construction materials market by retaining exclusionary and technically unjustified language in Section R602.10.5 of the 2006 IRC.

The following is language from and a link to a National Association of Home Builders (NAHB) article on its proposal to resolve this identical issue:

- **Refine continuously-sheathed braced wall panel requirements.** NAHB is seeking to drop current ICC requirements for all walls to be fully sheathed with wood structural panels because they are inconsistent with IRC 2000 language and with the technical basis for IRC bracing provisions.

Wall-bracing requirements are confusing to many builders, NAHB code experts note, and the new language is meant to clarify what needs to be done.

- www.nbnnews.com/NBN/issues/2006-04-03/Front+Page/4.html

This concern does not affect construction in areas outside the prescriptive wind or seismic zones of the IRC. Recommended corrective action, background information, and technical justification follows.

Recommended Corrective Action

Suggested action for the State of Minnesota

Since the IRC 2006 has been adopted without addressing this specific issue it is recommended Minnesota correct this issue as they adopt the 2006 IRC, amending the 2006 language as follows:

Current 2006 IRC Language

R602.10.5 Continuous structural panel sheathing. When continuous wood structural panel sheathing is provided in accordance with Method 3 of R602.10.3 on all sheathable areas of all exterior walls, and interior braced wall lines, where required, including areas above and below openings, braced wall panel lengths shall be in accordance with Table R602.10.5. Wood structural panel sheathing shall be installed at corners in accordance with Figure R602.10.5. The bracing amounts in Table R602.10.1 for Method 3 shall be permitted to be multiplied by a factor of 0.9 for walls with a maximum opening height that does not exceed 85 percent of the wall height or a factor of 0.8 for walls with a maximum opening height that does not exceed 67 percent of the wall height.

Revise note 'c' of Table R602.10.5 as follows:

- c. Walls on either or both sides of openings in garages attached to fully sheathed dwellings shall be permitted to be built in accordance with Section R602.10.6.2 and Figure R602.10.6.2 except that a single bottom plate shall be permitted and two anchor bolts shall be placed at 1/3 points. In addition, tie-down devices shall not be required and the vertical wall segment shall have a maximum 6:1 height-to-width ratio (with height being measured from top of header to the bottom of the sill plate). This option shall be permitted for the first story of two-story applications in Seismic Design Categories A through C.

Suggested Revision to the 2006 IRC Language

R602.10.5 Continuous structural panel sheathing. When continuous wood structural panel sheathing is provided in accordance with Method 3 of R602.10.3 ~~on all sheathable areas of all exterior walls, and interior braced wall lines, where required,~~ including areas above and below openings, braced wall panel lengths shall be in accordance with Table R602.10.5. Wood structural panel sheathing shall be installed at corners in accordance with Figure R602.10.5. The bracing amounts in Table R602.10.1 for Method 3 shall be permitted to be multiplied by a factor of 0.9 for walls with a maximum opening height that does not exceed 85 percent of the wall height or a factor of 0.8 for walls with a maximum opening height that does not exceed 67 percent of the wall height.

Revise note 'c' of Table R602.10.5 as follows:

- c. Walls on either or both sides of openings in garages ~~attached to fully sheathed dwellings~~ shall be permitted to be built in accordance with Section R602.10.6.2 and Figure R602.10.6.2 except that a single bottom plate shall be permitted and two anchor bolts shall be placed at 1/3 points. In addition, tie-down devices shall not be required and the vertical wall segment shall have a maximum 6:1 height-to-width ratio (with height being measured from top of header to the

bottom of the sill plate). This option shall be permitted for the first story of two-story applications in Seismic Design Categories A through C.

Background and Technical Justification

The recommended corrective action returns Section R602.10.5 to its intended purpose, as originally developed and adopted in the 2000 IRC based on research funded by NAHB, the U.S. Department of Housing and Urban Development (HUD), and the Texas Association of Builders. Revised language adopted in the 2006 IRC for Section R602.10.5 creates a mandatory, and thus exclusionary, use of wood structural panels by requiring that “all exterior walls” and also interior braced walls be continuously sheathed with wood structural panels. This exclusionary use must occur even when only one wall may require use of this bracing method (e.g., a garage opening wall or street-facing wall with many openings requiring narrower than 48-inch-wide braced wall panels). The current language effectively excludes the use of other code-compliant wall bracing methods and sheathing products on all other walls of such buildings.

It is imperative to understand that the available research (including the original research on the continuous sheathed method by NAHB and HUD) and general experience in use of other wall bracing methods does not justify this exclusionary language in the code.

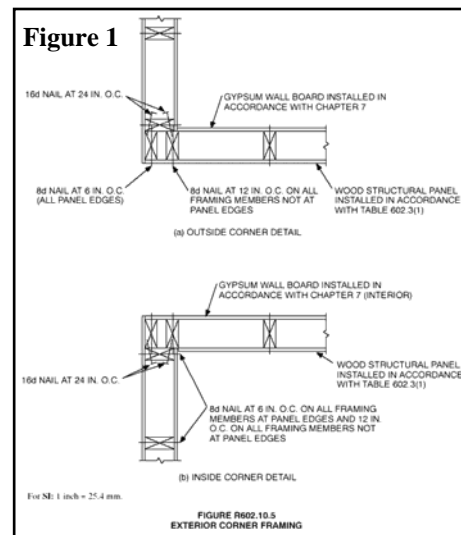
Four specific points that justify this conclusion:

- 1) General experience and at least one whole building test clearly show that different bracing methods can be used along with continuously sheathed walls on a given building (see Reference #1).
- 2) The basis of code evaluation requirements for wall bracing methods and requirement for equivalent minimum performance of various bracing methods is found in two locations:
 - a. In Section R104.11 of the 2006 IRC:
R104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code. Compliance with the specific performance-based provisions of the *International Codes* in lieu of specific requirements of this code shall also be permitted as an alternate.
 - b. And also in AC 269 acceptance criteria (see Reference #2):
1.1 Purpose: The purpose of this criteria is to establish requirements for racking shear evaluation of proprietary sheathing materials used as braced wall panels that are to be recognized in an ICC Evaluation Service, Inc. (ICC-ES),

evaluation report under the 2006 *International Building Code*® (IBC), the 2006 *International Residential Code*® (IRC), and the 1997 *Uniform Building Code*™ (UBC). Bases of recognition are IBC Section 104.1.1, IRC Section R104.11, and UBC Section 104.2.8. Applicable code sections are IBC Sections 2211.2 (Type I shear walls), 2303.1.4 (Wood structural panels), 2304.6 (Wall sheathing), 2306.4 (Shear walls), 2305 (General Design Requirements for Lateral-Force-Resisting Systems), 2308.3.2 (Braced wall panel connections), 2308.9.3 (Bracing), and 2505 (Shear Wall Construction); IRC Sections R602.10 (Wall bracing), R602.11.1 (Wall anchorage), R603.7 (Structural sheathing), and R604 (Wood Structural Panels; and UBC Sections 2219 (General), 2303 (standards of quality), 2310 (exterior wall coverings), 2315 (wood shear walls and diaphragms), 2319.2 (wood structural panel diaphragms), 2315 (Wood shear walls and diaphragms), 2320.11.3 (Bracing), and 2513 (Shear resisting construction with wood frame), and Table 23-II-B-1 (Nailing Schedule), as applicable. The reason for the development of this criteria is to allow evaluation of proprietary sheathing materials for racking resistance, since the proprietary sheathing materials are not listed for use as shear wall sheathing under Section 2306.4 of the IBC, or Section R602.10.3 of the IRC, or Sections 2315.3.3 and 2319.2 of the UBC. This criteria may also be used to evaluate code-complying sheathing materials that require racking shear testing to determine design values for installations not described in the code.

For this reason, conventional bracing methods in the IRC or proprietary methods that also meet minimum requirements should not be excluded when continuous sheathing may be required on one or more braced wall lines of a given building.

- 3) The analysis of IRC bracing requirements for R602.10.5 continuous sheathing (resulting in adjustments to bracing amounts in Table R602.10.1 for Method 3 bracing) are based on testing and analysis of individual wall lines that are fully sheathed with only short corner returns with sheathing (e.g., 2') (see References #3 through #7). Therefore, the only requirement is for a minimum 2-foot corner return that is sheathed at the ends of a continuous sheathed braced wall line per Figure R602.10.5. The technical data does not require that the whole building be fully sheathed and, in fact, specifically demonstrates that such action is not justified.



- 4) The IRC has always allowed different bracing methods to be used on a given building and has not excluded this practice that has been used successfully in the past. In fact, the IRC has language that explicitly permits this type of strategy to be employed in the substitution of alternated braced wall panels on a panel-by-panel basis (see

IRC 2006 Section R602.10.6.1 which has existed in the code since the IRC 2000 edition and also in precursor model codes).

In addition, a more extensive re-write and technical correction of Section R602.10.5 was accepted per code proposal RB209 in the current ICC code development cycle and is now pending final action in May 2007 (www.iccsafe.org/cs/codes/2006-07cycle/). This pending IRC 2009 correction was the joint effort of the ICC Ad Hoc Committee on IRC Wall Bracing (<http://www.iccsafe.org/cs/cc/ahc-wb/>), NAHB, Virginia Building Officials, the Foam Sheathing Coalition, and others. The recommended corrective action is consistent with current direction for the IRC 2009 and is consistent with similar amendments or interim corrections that have been already made or are in progress in a number of states including Ohio, Georgia, Indiana, North Carolina, Pennsylvania, and Virginia.

The IRC 2006 code proposal that added the text to Section R602.10.5 and is proposed for deletion in this proposal did not properly consider the above factors and research. The reason submitted with that past ICC code change proposal is as follows:

The concept behind the method is that the sheathing above and below openings (window and doors) and on adjacent walls at corners prevents rotation (overturning) of braced wall panels under lateral loading. However, the wording of this section does not make it clear that all parts of the walls have to be sheathed for this method to work as intended.

Without these clarifications, it is possible that this method could be used on one wall only, with the rest of the walls using the conventional braced wall panel method. If this were done, there may not be sheathing on adjacent walls to prevent overturning of the braced wall panels in the continuously sheathed wall.

A more appropriate solution to the above concern would have been to clarify that the corner detail in Figure R602.10.5 (see Figure 1 above) requires a minimum 2-foot corner return panel at the ends of a continuously sheathed braced wall line. This would appropriately allow a transition to other bracing methods on other wall lines while also properly adhering to the research data that supports the continuous sheathed bracing method first introduced in the 2000 IRC.

In addition, a new footnote 'c' was added to Table R602.10.5 in the 2006 IRC that further propagates the exclusionary requirement that an entire building must be fully sheathed with wood structural panels even when only a garage opening may require use of a special framing practice to allow narrow braced wall panels (i.e., portal frame construction per IRC 2006 Section R602.10.6.2, but modified by footnote 'c' of Table R602.10.5 to exclude requirement for hold-down brackets). This requirement also is inconsistent with the original research data supporting this method that did not investigate whole building performance but rather tested individual braced wall lines (as has been done for all other bracing methods pre-existing in the IRC). Furthermore, the test data was based on equivalence to existing IRC bracing methods which lends further evidence that the test data should not be extrapolated or misrepresented to mean that an entire building must be fully sheathed when this bracing method is used only on a garage opening wall. Instead, it is clearly appropriate to use other code-compliant bracing methods on other portions of the building provided the corner framing detail of Figure R602.10.5 is used at the ends of the portal frame garage opening with a minimum 2-foot-wide panel at the corner on the abutting wall. Therefore, the present 2006 IRC language unfairly excludes use of other viable wall bracing methods in the IRC or proprietary bracing methods that have demonstrated equivalence to these code-compliant bracing methods.

Conclusion

The above **Recommended Corrective Action** fully restores the ability for builders to use all code-compliant bracing options in the code, gives appropriate flexibility in the design and construction of homes, removes confusing language and erratic enforcement from the code, and promotes fair market competition among various wall assembly and bracing products. As such, this allows designers and builders to use the best code-approved wall assemblies to achieve or exceed all objectives of the code for a given building including safety, affordability, energy efficiency, and other factors.

Technical References:

1. HUD, 2001. Whole Structure Testing and Analysis of a Light-Frame Wood Building. U.S. Department of Housing and Urban Development, Washington, DC.
2. ICC-ES. Acceptance Criteria for Racking Shear Evaluation of Proprietary Sheathing Materials Used as Braced Wall Panels (AC 269). ICC Evaluation Service, Inc. (www.icc-es.org)
3. HUD, 1997. Performance of Long Wood-Frame Shear Walls with Varying Opening and Base Restraint Configurations Including Anchor Bolts, Hold-downs, and Corner Framing. U.S. Department of Housing and Development, Washington, DC. (www.huduser.org)
4. HUD, 1998. The Performance of Perforated Shear Walls with Narrow Wall Segments, Reduced Base Restraint, and Alternative Framing Methods. U.S. Department of Housing and Urban Development, Washington, DC. (www.huduser.org)
5. HUD, 1999. Perforated Shear Walls with Conventional and Innovative Base Restraint Connections. U.S. Department of Housing and Urban Development, Washington, DC. (www.huduser.org)
6. HUD, 2001. Wood Shear Walls with Corners. U.S. Department of Housing and Urban Development, Washington, DC. (www.huduser.org)
7. HUD, 2003. Light-Frame Wood Shear Walls with Various Overturning Restraints. U.S. Department of Housing and Urban Development, Washington, DC. (www.huduser.org)
8. ICC Ad Hoc Committee on Wall Bracing (www.iccsafe.org/cs/cc/ahc-wb)
9. ICC 2006/2007 Code Change Cycle (www.iccsafe.org/cs/codes/2006-07cycle/)
10. National Association of Home Builders (NAHB) article regarding resolution of the 'all walls' issue, www.nbnnews.com/NBN/issues/2006-04-03/Front+Page/4.html

If you have any questions regarding the above technical references and justification presented in this report, please do not hesitate to contact Jay Crandell, P.E., ARES Consulting (410-867-9617, jcrandell@aresconsulting.biz).

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