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**Design Solutions for Minimizing Flanking of Sound in Wood Buildings**

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<b>Project Leader:</b>	Jim Mehaffey, Building Systems Department, Fire Research Group, Ottawa Laboratory		
<b>Program Area:</b>	Building Systems	<b>Start Date:</b>	April 2006
<b>Program Goal:</b>	BTT	<b>Completion Date:</b>	March 2009*
<b>Project No.:</b>	5324	<b>Date of Last Update:</b>	May 09, 2007
<b>Project Liaison(s):</b>	Rodney McPhee, Canadian Wood Council; Paul Newman, COFI/Canada Wood; Sylvain Labbé, Quebec Wood Export Bureau		

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\*See Status below.

**Long Term Goals / Strategies**

- Focus on members' customers and product end-use performance by identifying design solutions which minimize the flanking transmission of sound in wood-frame houses and "small" buildings complying with requirements in the National Building Code of Canada (NBCC).
- Increase value of research through alliances with the National Research Council of Canada (NRC) and the other government and industry partners in this collaborative project.

**Key Objective**

- Consolidating our existing knowledge about minimizing flanking transmission of noise in wood structures into a web-based electronic design guide with smart system that is easily accessible and useable by builders, architects, engineers and building officials, and that could be easily referenced in Canadian building codes.

**Key Actions and Deliverables**

Deliverables	Expected Delivery Date
A web-based electronic design guide with smart system that consolidates the knowledge gained through the collaborative NRC-industry and NRC-CMHC research projects and presents it in a form that is easily accessible and useable	September 2008
Supplemental information on the acoustical performance of panelised toppings, and wood I-joists from different manufacturers.	March 2009*

\* Revised November 2006

**Status**

In March 2005, after nearly ten years of research on flanking noise transmission in wood-frame construction, the collaborative research project involving NRC and various industry partners came to an end with the publication of *Guide for Sound Insulation in Wood Frame Construction – Part 1: Controlling Flanking at the Wall-Floor Junction* by J.D. Quirt, T.R.T. Nightingale and R.E. Halliwell. Subsequently, Canada Mortgage and Housing Corporation (CMHC) established an agreement with NRC to supplement the information developed through the collaborative NRC-industry research project with additional information on the flanking of sound involving directly attached gypsum board on the ceilings of row housing and on the corridor walls in row and apartment buildings. While two of the partners in the collaborative NRC-industry research project, Marriott Hotels and Owens Corning, are using information in the *Guide* for design and construction of hotels and for marketing their products, the *Guide* is not readily available and is not a practical tool for use by architects, engineers, builders and regulatory officials. It is a compendium of constructions which pose varying degrees of flanking problems and offer varying levels of sound insulation. This project proposes to consolidate

the knowledge gained through the collaborative NRC-industry and NRC-CMHC research projects and present it in a form that is easily accessible and useable – a web-based electronic design guide with smart system. In addition, there is a small experimental component which will expand the number of toppings, especially panelised toppings, and investigate the range in results that might be expected by use of wood I-joists from different manufacturers. Again, there will be a number of funding partners working on this; however, because it deals exclusively with wood construction, Forintek's participation is essential. It had been anticipated that this would be a collaborative research project with a total value of \$260k, split among three industry partners (CMHC, Forintek, and United States Gypsum Company) and NRC.

After much negotiation, NRC was finally in a position in November 2006 to forward an Agreement for R&D Collaboration to those who had expressed interest in participating. It is now estimated that the cost of conducting experiments and creating the electronic design guide is \$270k. NRC has proposed that the industry portion of the costs be divided among five industry sectors each represented by an organisation as follows:

- Dimensional and panel wood products: Forintek Canada Corp.
- Engineered structural wood products: Trus Joist and/or Forintek Canada Corp.
- Gypsum board products: USG Corp. and/or Gypsum Association
- Fibrous insulation and interlayers: Owens Corning
- Builders/housing industry: CMHC and/or Marriott International

### Partners

Canadian Wood Council

### Rationale and Potential Impact

Increasingly, the Provinces of Ontario, Quebec and British Columbia are moving to limit noise transmission in multi-family dwellings. Canada Wood faces ever growing challenges to their efforts to market wood construction and the wood products used in construction of those buildings in Japan, Korea and China because of excessive noise transmission in wood structures. While costly, design solutions which meet regulations in those countries for fire performance have been developed. However, government officials and the public continue to perceive that wood structures are too noisy and that design solutions are too impractical to construct. This project will go a long way in overcoming those perceptions.

### Proposed Approach

The Acoustics Group at NRC was to establish a consortium of partners to fund and participate in the development of a web-based design guide on how to abate flanking noise transmission in wood-frame construction. The guide was to consolidate knowledge gained in earlier collaborative research ventures and to supplement that knowledge with data generated by testing several new designs involving innovative wood-based floor toppings. Forintek intended to be a major player in the consortium.

### Work Completed this Fiscal Year

In November, FPInnovations – Forintek Division signed a contract to participate in NRC's project entitled *Flanking Sound Transmission in Wood Frame Multi-Family Dwellings. Phase V: Consolidation for Electronic Design Guide*. Several other industries had already agreed to sign on so that Forintek's commitment to the project was sufficient for NRC to finally launch the work.

S. Craft and L. Richardson attended the first meeting of the Steering Committee for the project on January 30, 2008. Also in attendance were NRC scientists as well as two representatives from Owens Corning, a representative from Lauzon Floors (a manufacturer of pre-finished hardwood and engineered wood flooring products) and Claude Beaudet (a Québec-based builder of multi-family buildings).

Only FPInnovations and Owens Corning have signed-on as "industry" partners. US Gypsum Company (USG) was prepared to join but its funding has been frozen due to the precipitous drop in housing starts in the USA.



USG will participate if funding becomes available. Marriott International is also interested but with more than 600 wood-frame hotel construction projects underway, has no one available to participate in this project. They expect to join the Consortium when more human resources become available. Issues related to sound insulation have been assigned a low priority for CMHC so they will not participate in this project.

During the meeting, NRC was strongly urged to seek additional partners from the building construction, design, and architectural communities. NRC was also urged to seek participation by new-home warranty programs in British Columbia, Alberta and Ontario, and by the Québec home builders association and the Régie du bâtiment du Québec.

The deliverables from this project will include an electronic design guide that is readily accessible and usable by building designers, engineers, architects and building officials on possible sound-control options for multi-family residential structures (both side-by-side compartments in row houses and one-above-another and side-by-side compartments in apartment buildings). The contents and formats for the guide(s) will be determined by the Steering Committee. Guides will include AutoCAD files for all construction detail drawings thereby permitting easy inclusion of them in architectural plans.

There was general agreement that the floor construction would involve wood I-joist floor constructions. In the next six to nine months, NRC will conduct flanking transmission testing on floors constructed with wood I-joists oriented in various directions relative to the party-walls, OSB floor sheathing, and with wood rafts placed over a resilient interlayer (Owens Corning QuietZone<sup>®</sup> Acoustic floor mat). Various finish floor coverings including carpet, resilient vinyl flooring, manufactured (engineered) wood flooring, hardwood strip flooring and ceramic tile will be installed upon the rafts. The rafts will be constructed of OSB and plywood, in two layers oriented perpendicular to each other. Future testing may involve rafts constructed of USG's Durock<sup>®</sup> a lightweight panel product that is used as a substrate for ceramic tile application in "wet" areas, and/or Owens Corning QuietR<sup>®</sup> Duct Board, also over QuietZone<sup>®</sup> floor mats.

Work on developing the electronic design guide will commence immediately with the initial concept to be completed and distributed to the members for their review and feedback by early spring.

The Steering Committee will meet every six months. Interim technical reports will be delivered every twelve months. Summaries of progress will be delivered every six months (prior to each meeting of the Steering Committee). All reports are to be kept confidential as they are for internal use by Committee members and may contain errors and interpretations that may be found in error during subsequent testing.

The Final Technical Report will contain detailed drawings of the assemblies and measured data in both tabular and graphical form (both Apparent Sound Transmission Class [ASTC] and Field Impact Insulation Class [FIIC] ratings). The report will also include interpretations and discussions of dominant flanking paths, including their ranking; and discussions of the test results and the relation of those results to previous NRC findings. The report will emphasize practical solutions to minimize flanking.

All partners will have the right to create derivative technical and professional publications based upon this project; however no such publication may be released before approval of the final report, unless approved by the Steering Committee. All derivative publications must acknowledge (credit) the role of all the partners.

The next meeting of the Steering Committee will be on Thursday, July 24, 2008.

## **Publications**

None.