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### **Tool for predicting transmission of air-borne and structure-borne sound in buildings**

Quirt, J. D.; Dickinson, J. K.

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*Institute for  
Research in  
Construction*

# ***Tool for predicting transmission of air-borne and structure-borne sound in buildings***

David Quirt and John Dickinson



National Research  
Council Canada

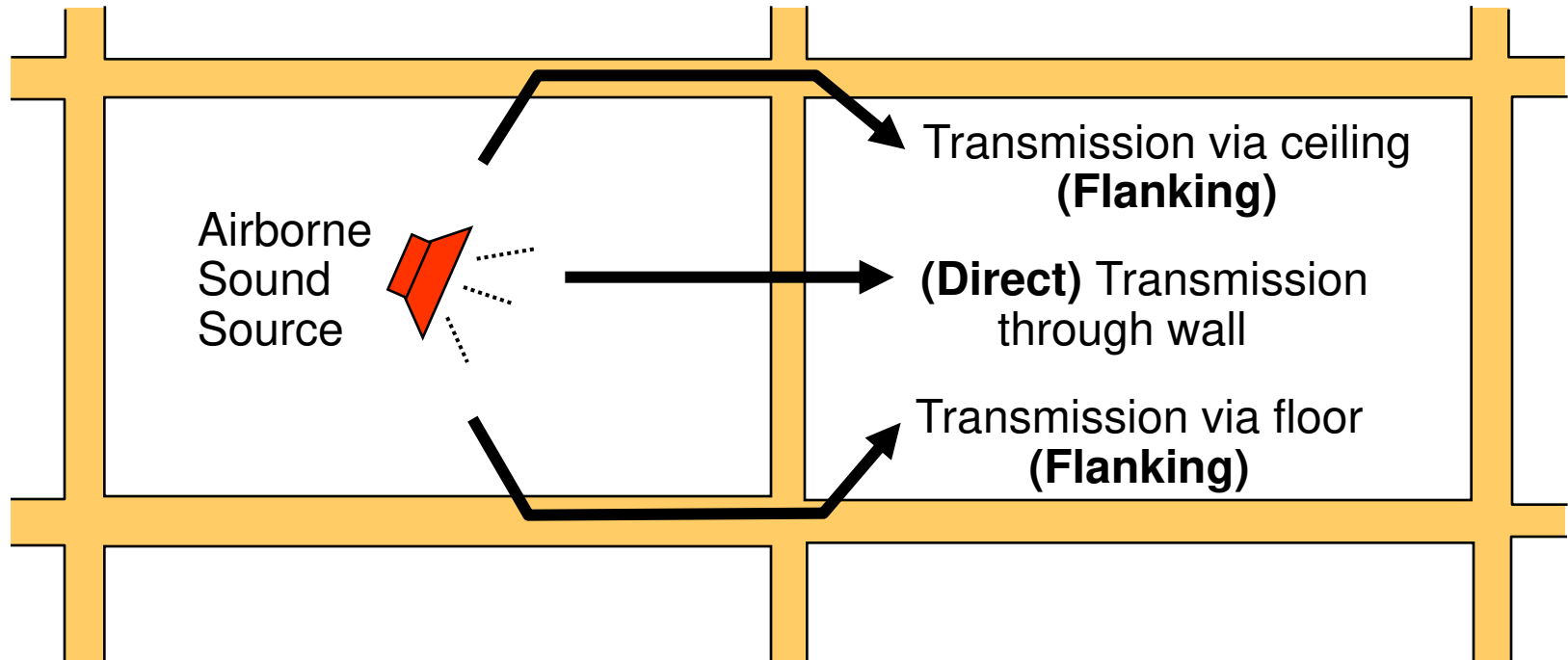
Conseil national  
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**Canada** 

## Focus of this talk ...

- Sound transmission between adjacent spaces within a building (*mainly multi-family wood-framed buildings*)
- Focus on sound from airborne sources coming from neighboring occupancy (*similar issues for impact sound due to footsteps*)
- Goal is to provide an effective tool to support design
- Report on work in progress

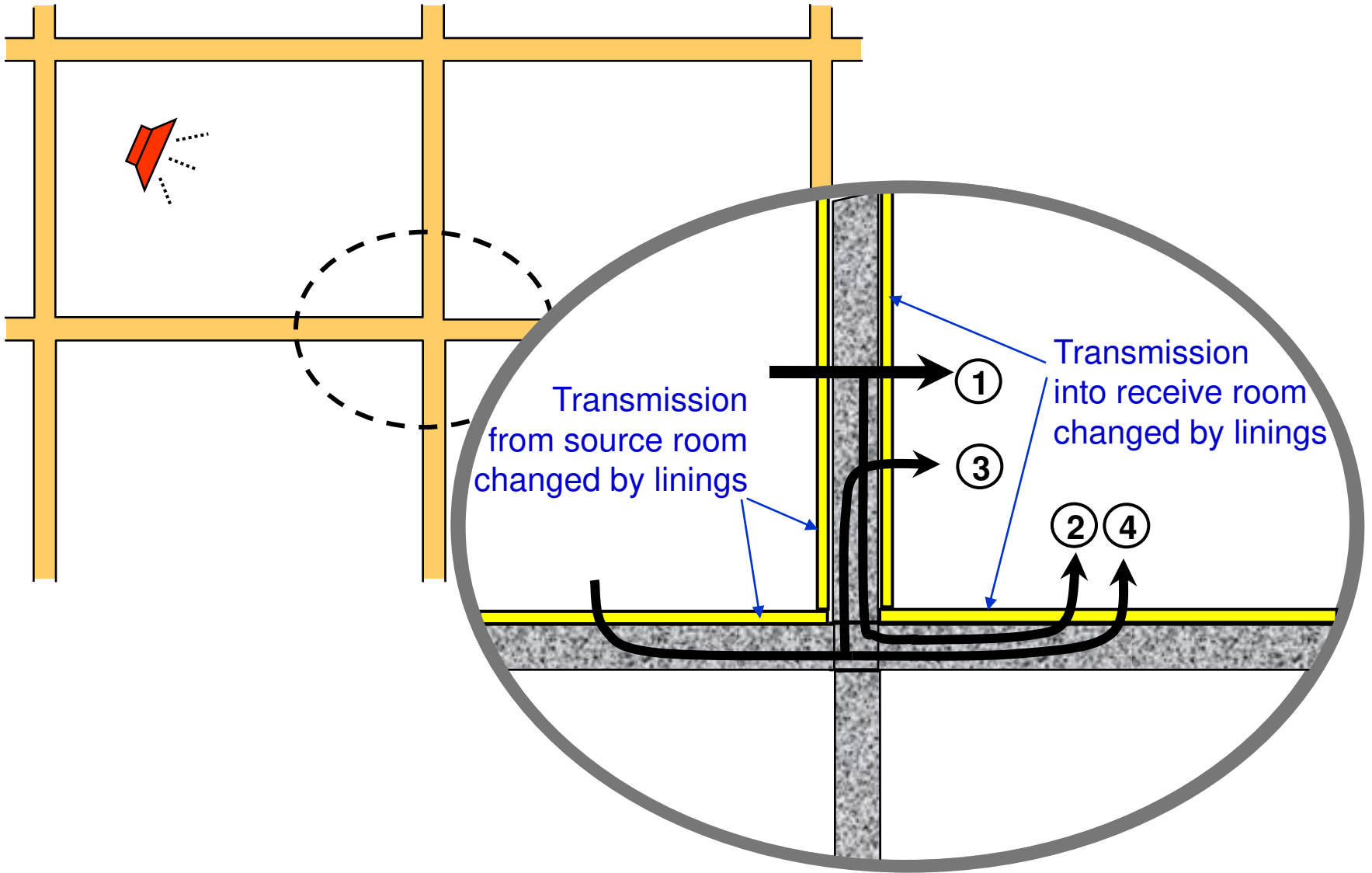
# Describing System Performance



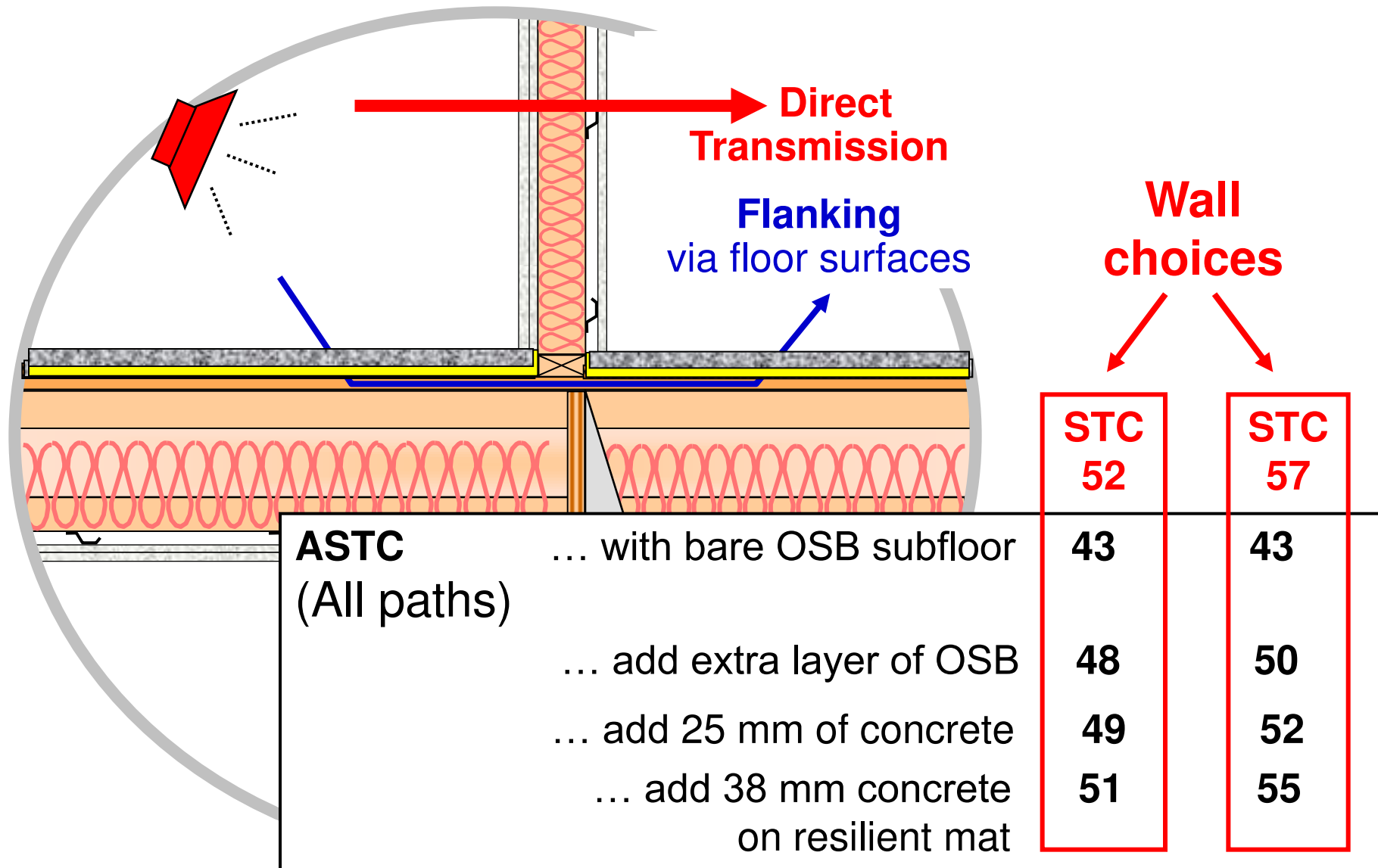
⇒ ***Apparent Sound Transmission Class (ASTC)***

includes all transmission paths between 2 rooms

⇒ defined in ASTM E336 standard in 2005



# Just the Wall and Floor... Balancing



# Putting it Together – the Design Process

For side-by-side units, 4 sets of paths matter:

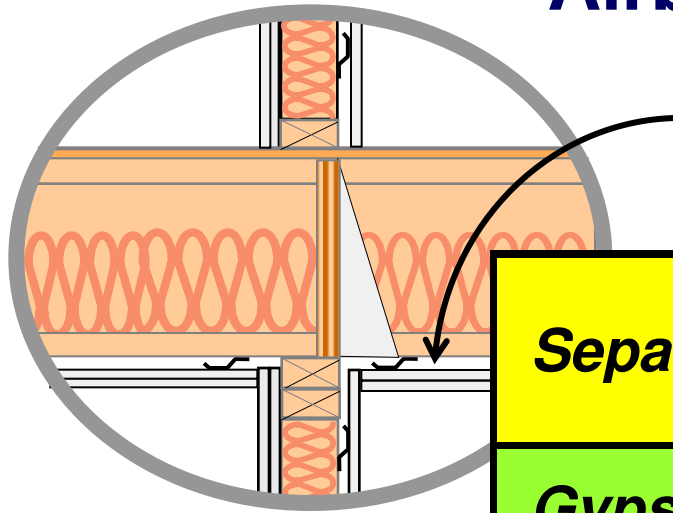
- Direct (through separating wall) 

First priority
-------------------
- Floor-floor flanking path
- Side wall flanking path 

May limit ASTC
-------------------
- Ceiling-ceiling flanking path



# Airborne Sound to Unit Beside



Ceiling gypsum board on resilient channels  
(so that path is controlled)

<b><i>Separating wall:</i></b>	Basic Wall (STC 52)	Better Wall (STC 57)	
<b><i>Gypsum board on side walls:</i></b>	Direct or resilient	Direct resilient	
<b><i>Floor Topping:</i></b>	(Apparent-STC)		
Basic OSB subfloor	43	43	43
Second layer of 19-mm OSB	48	50	50
•	•	•	•
•	•	•	•
38 mm gypsum concrete + resilient mat on subfloor	51 →	53 →	55



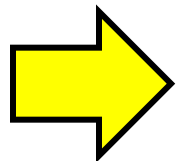
## Tables are limiting ...

- For the side-by-side case, each table applies to one specific set of wall, floor and junction details
  - Need many tables
  - Must compare between tables to assess variants on wall or junction or floor
  - Each table gives only a few choices for each part of assembly (concrete topping, flooring ...)
- Tables approach does not highlight dominant paths (direct or flanking) to focus improvement

# To support the design process

Design tool should have key features:

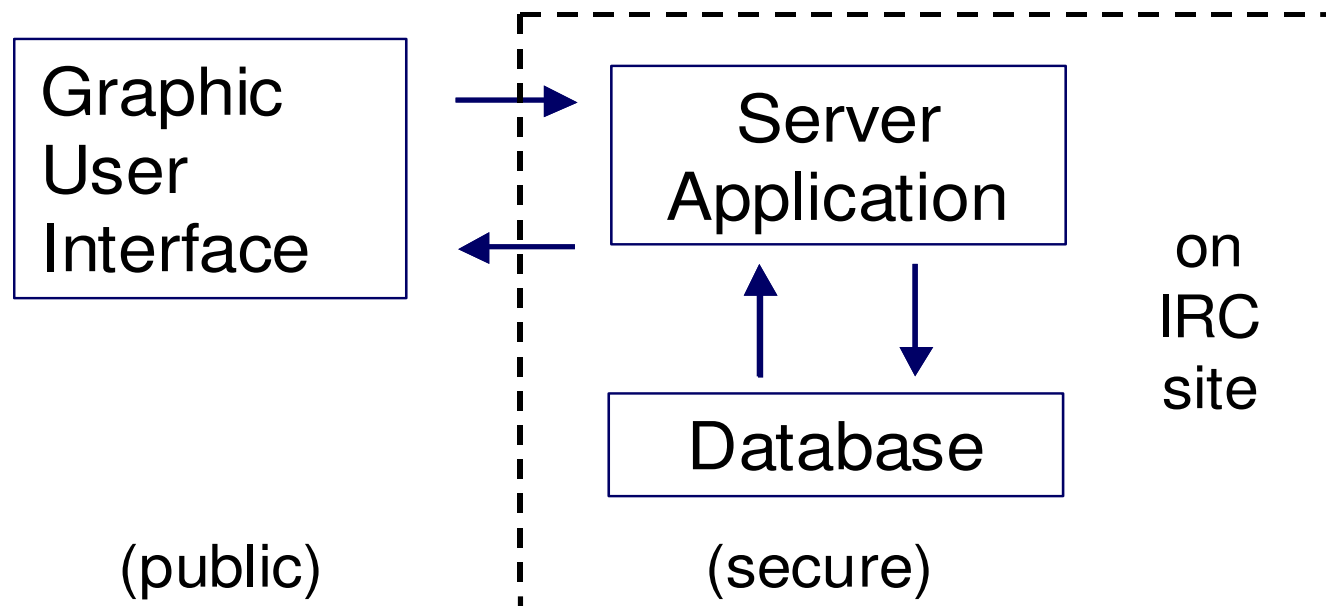
- Give system performance (ASTC)
- Show dominant paths (focus on weak parts and avoid wasted improvement of adequate parts)
- Permit easy selection of construction options
- Handle data for many choices  
(for example for all the layers of floor surfaces)



Software system  
(user interface, database, calculation)

# Conceptual parts of the design software

- Application on IRC website
  - ⇒ User inputs specimen description
  - ⇒ GUI sends query to server
  - ⇒ Server returns values to GUI



# Interface Step 1 – Room & Framing

The screenshot displays the 'Flanking UI' interface. At the top, a menu bar includes 'File', 'Language', and 'Help'. Below it, a progress bar shows four steps: '1. Joist & Room Setup' (highlighted with a red circle), '2. Separating Elements', '3. Flanking & Junctions', and '4. Reports'. The main area is titled 'Step 1: Room Orientation and Junction Selection'. On the left, there are three sections: 'A: Room Orientation' with two 3D room orientation icons; 'B: Upper Joist Orientation' with 'Front to Back' and 'Left to Right' buttons; and 'C: Lower Joist Orientation' with 'Front to Back' and 'Left to Right' buttons. The center features a 3D perspective view of a room with joists. On the right, a 'Getting Started' panel contains a 'Welcome to Flanking UI' message, 'Sample Files' (with links for 'Vertical Room Example' and 'Horizontal Room Example'), and 'Recent Files' (listing three 'fileName.xml' files). The bottom status bar shows 'Loaded : Example-SWS.xml (2Kb)' on the left and 'April 29th Release' on the right.

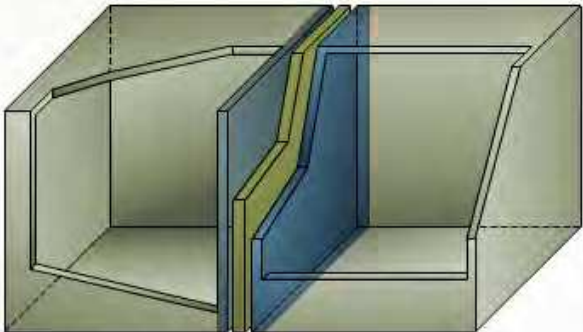
# Interface Step 2 – Separating assembly

File Language Help

1. Joist & Room Setup      **2. Separating Elements**      3. Flanking & Junctions      4. Reports

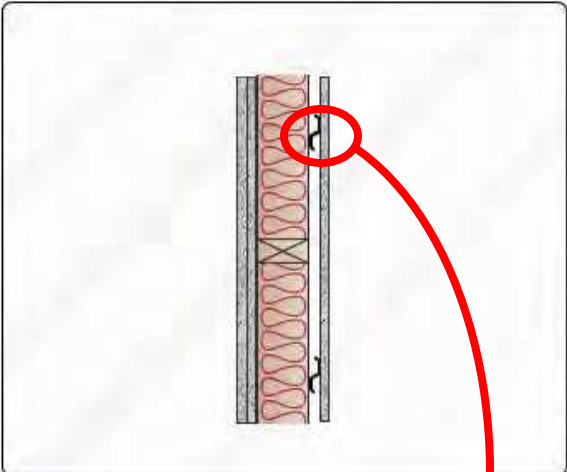
**Separating: Room Display**

STC Rating  
Separating Partition: 55



**Separating: Assembly View**

Continue



**Select Wall Cladding and Framing Elements**

- Double layer of 15.9 mm gypsum board
- Single Stud 38 x 89 mm 406 mm o.c. / 90 mm Unfaced thermal insulation
- Resilient Channel with 1 Layer gypsum

No Right Side Cladding Selection Made

- One layer of 15.9 mm gypsum board
- Resilient Channel with 1 Layer gypsum**
- Double layer of 15.9 mm gypsum board

Loaded | Example-SWS.xml (2Kb)

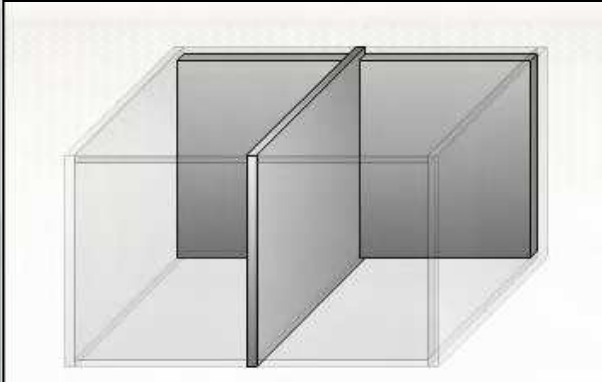


# Interface Step 3 – Flanking junctions

File Language Help

1. Joist & Room Setup 2. Separating Elements 3. Flanking & Junctions 4. Reports

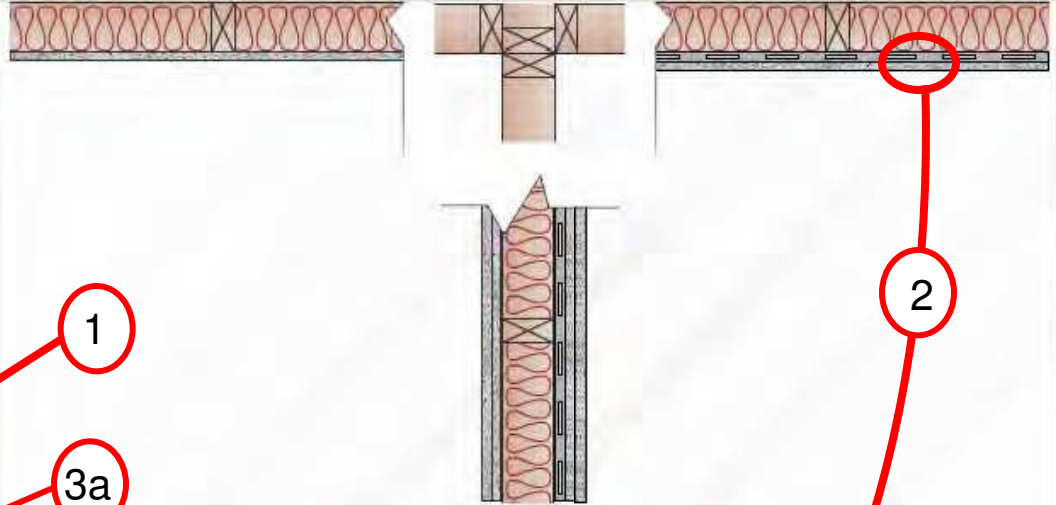
### Junction Selection



Separating Partition	Bottom	Top	Front	Back
Direct or Flanking - STC				
57	53	58	62	62
Direct or Flanking - IIC				
--	55 → ← 53	--	--	--

Overall Performance:  
**Apparent STC 51**  
**Apparent IIC 55**

### Back Flanking Assembly



1

2

3a

3b

Select Left Side Wall Elements  Junction Selection  Select Right Side Wall Elements

- Single Stud 38 x 89 mm 406 mm o.c./ 90 mm Unfaced thermal insulation
- Resilient Channel with 1 Layer gypsum

No Right Side Cladding Selection Made

- One layer of 15.9 mm gypsum board
- Resilient Channel with 1 Layer gypsum
- Double layer of 15.9 mm gypsum board

Loaded | Example-SWS.xml (2Kb) April 29th Release

# Summary

- A new software tool is nearing completion
- This talk provided a glimpse of the user interface and how it responds to our sense of designers' needs.
- The next stage will be Beta-testing  
*(We are seeking expressions of interest)*