

# ON THE DEGRADATION OF SOUND INSULATION BY FIRE STOPPING AT THE FLOOR/WALL JUNCTION IN WOOD FRAME MULTI-FAMILY DWELLINGS

T.R.T. Nightingale, R.E. Halliwell Institute for Research in Construction, National Research Council, Ottawa, Ontario, Canada

## Introduction

The National Building Code of Canada requires that fire stops be located in wood frame party walls at the floor/wall intersection. A recent study<sup>i</sup> at the Institute for Research in Construction has shown that fire stops can significantly degrade the apparent sound insulation between horizontally separated dwellings. This paper summarizes the results of the IRC project that systematically investigated the impact of the materials or techniques listed in the Code.

## Specimen Constructions

The study was structured to allow the comparison of the apparent sound insulation measured with a fire stop to a reference construction that did not have any fire stopping at the floor/wall intersection. Figures 1 and 2 show the Reference A and Case 4 specimens, respectively, each had 39x235 mm joists 400 mm o.c. supported by the party wall.

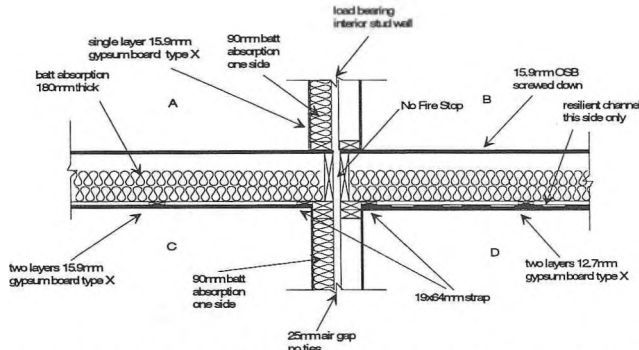


Figure 1: Sketch of Reference A construction which does have a fire rated A-C floor/ceiling assembly.

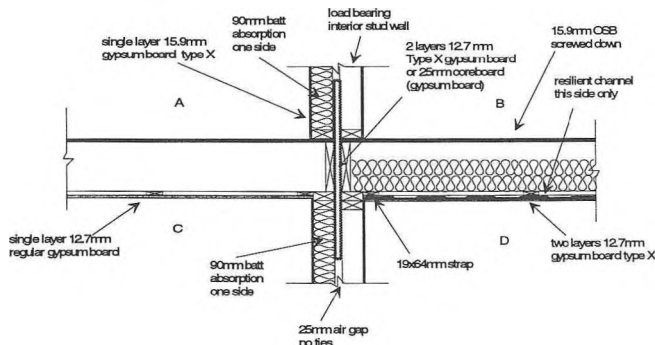


Figure 2: Sketch of the Case 4 construction showing the vertically oriented fire stop between the joist headers (typical of Cases 3, 4, and 5). Also shown is the non-fire rated A-C floor/ceiling assembly.

Figures 1 and 2 show the base A-B party wall. To establish the limiting sound insulation this wall was replaced by a superior wall that had an additional layer of gypsum board on both sides and an extra layer of cavity insulation.

**Case 2\*:** Add additional cavity absorption to the wall such that the width of the air space in the cavity does not exceed 25 mm (1995 NBC 9.10.15.2.2.a). With this condition met, an explicit fire stop is not required.

**Case 3\*, Case 4\*:** Gypsum board 25 mm thick\* installed vertically in the nominal 25 mm space between joist headers at the wall/floor joint.

**Case 5#:** Semi-rigid batt material<sup>ii</sup> installed vertically in the nominal 25 mm space between joist headers at the wall/floor joint.

**Case 6#:** 0.38 mm sheet steel\* (without profile) installed horizontally under the sole plates of the party wall.

**Case 7#:** 15.9 mm thick OSB\* continuous under the sole plates of the party wall.

**Case 11#:** 15.9 mm thick Plywood\* continuous under the sole plates of the party wall.

## Measured Results and Conclusions

Table 1 shows the measured apparent airborne sound insulation (direct path plus all flanking paths) between rooms A and B. From the table it is evident that a fire stop in the form of a continuous surface (Case 7 and 11) is the least desirable. With a continuous OSB sub-floor, the apparent sound insulation will not be greater than FSTC 52, regardless of the A-B party wall construction. The gypsum board between the joist headers (Case 3 and 4) and the sheet steel (Case 6) have a limiting sound insulation of FSTC 57. Although the connection is rigid it is made in such a manner that bending waves will not be transmitted, unlike the continuous sub-floor of Case 7. The most desirable cases are ones which do not create any structural connections (Cases 2 and 5), in particular Case 2 where an additional layer of insulation was added to the wall cavity such that an explicit fire stop was not required.

Case	Base AB Party Wall		Superior AB Party Wall		Limiting sound insulation of fire stop (FSTC)
	Measured apparent sound insulation (FSTC)	Change Re Reference A or B (FSTC)	Measured apparent sound insulation (FSTC)	Change Re Reference A or B (FSTC)	
Ref. A	51	-	-	-	-
2	56	+5	-	-	-
3	51	0	-	-	57
Ref. B	50	-	66	-	-
4	50	0	57	-9	57
5	52	+2	-	-	-
6	51	+1	57	-9	57
7	50	0	52	-14	52
11	-	-	51	-15	-

Table 1: Measured apparent sound insulation between rooms A and B.

<sup>i</sup> "Flanking transmission at joints in multi-family dwellings Phase I: Transmission via fire stops," T.R.T. Nightingale, R.E. Halliwell, Report A1042F, IRC-NRCC, October 1997.

\* A-C floor/ceiling fire rated as shown in Figure 1.

# A-C floor/ceiling not fire rated as shown in Figure 2.

\* This detail satisfies the NBCC criteria for fire stop location (9.10.15.2.1) and material (9.10.15.3.1).

<sup>ii</sup> This detail satisfies the criterion for fire stop location (9.10.15.2.1), but semi-rigid batt material is not listed (9.10.15.3.1) as an acceptable material. However, the fire resistance of semi-rigid materials were tested and found to comply with the intent of 9.10.15.3.g.