

# Examining Footfall and Furniture Movement Noise in Schools

## Design & Technology Series #14



Fig. 1: Modular furniture in an Alberta classroom.

### Background and Testing

In two-story schools, structure-borne noise from activities happening above a classroom, such as furniture movement and walking, are common complaints and can disrupt the learning environment.

This is becoming a greater issue as 21<sup>st</sup> century learning increasingly relies on modular furniture, which may be moved multiple times per day to suit a variety of teaching styles.

To examine the role of different floor finishes on Footfall and Furniture-induced noise in schools, Alberta Infrastructure carried out a range of Apparent IIC (AIIC) tests at a two-story school in Alberta.

IIC, or Impact Insulation Class, is a rating used to measure the sound insulation performance of a floor or ceiling system, specifically in the context of impact noise. Impact noise refers to the noise generated by objects striking or impacting a surface, such as footsteps, dropped objects, or furniture being moved. Field tests were carried out as per ASTM E1007-13b Standard “*Test Method for Field Measurement of Tapping Machine Impact Sound Transmission through Floor-Ceiling Assemblies and Associated Support Structures*”, using a tapping machine (see Fig. 2).

Higher IIC ratings indicate better sound insulation performance, meaning that less impact noise is transmitted to the space below.

Further, furniture noise generated by dragging a typical student desk with metal glides, back and forth, across the test area for standard intervals, while recording sound levels in the classroom below. This was to simulate a common noise complaint reported by school staff.

The tested floor/ceiling assembly is very typical in Alberta schools:

- polished concrete finish
- 125 mm composite steel deck (87 mm concrete topping on 38 mm metal floor deck)
- suspended mineral fiber acoustic ceiling tile with open return air grille.

Tested floor finishes included the existing polished concrete, vinyl sheet and plank flooring, linoleum flooring, rubber flooring, as well as specialty foam-backed floors and underlays marketed specifically for noise reduction.

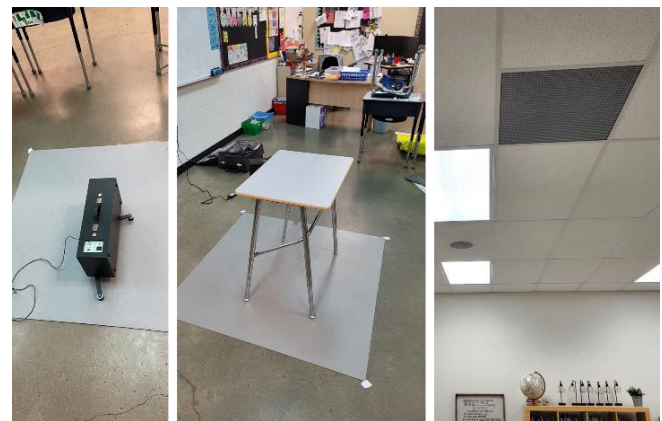


Fig. 2: Tapping Machine and Desk on flooring specimen. Ceiling in Classroom below.

### Findings

All tested flooring was found to exceed the minimum IIC 45 rating (AIIC 40), for floors located above core learning spaces outlined in ANSI/ASA S12.60-2010/Part 1.

However, no flooring sample met the minimum AIC ratings, IIC 70 (AIC 65), for high impact usage such as gymnasiums or dance studios located above core learning spaces. While not tested as part of this investigation, note that a similar assembly without a suspended T-bar ceiling can test as low as AIC 25, if the deck is fully exposed.

Differences in furniture movement noise of up to 30 dB, depending on the floor finish, were observed. Furniture noise was generally correlated with AIC (see Fig. 3). Polished concrete resulted in the most noise, and flooring samples with acoustic backing or with a separate acoustic underlay, attenuated furniture noise the most.

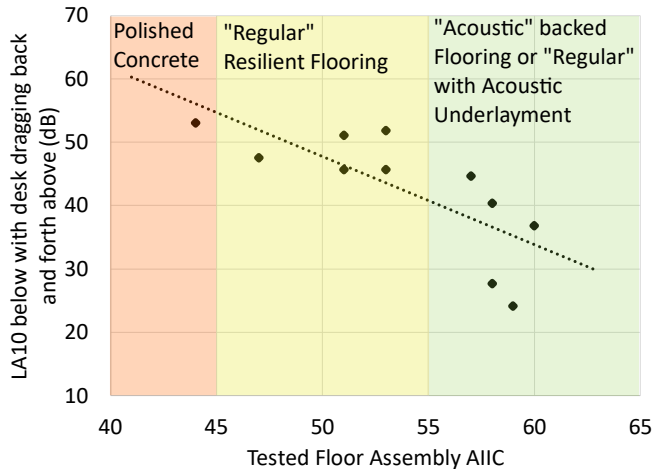


Fig. 3: Relationship between Measured Impact Insulation (AIC) and Furniture Dragging Noise below from tested Floor Assemblies.

## Recommendations

“Acoustic” floor finishes clearly provide measurable, significant reductions of impact and furniture noise. These include vinyl, linoleum, and rubber floors, either with integrated foam or felt backings, or combined with a separate foam or rubber underlayment. As moveable, modular furniture is becoming the standard in Alberta (see Fig. 1, 4 & 5), these floors should be considered for any new or renovated two-story school. However, higher cost as well as potentially lower durability and resistance to indentations (PSI rating) need to be carefully evaluated.

For typically used floors located above core learning spaces, as a minimum, “standard” resilient flooring should be used to reduce furniture and footfall noise, particularly when the floor/ceiling assembly does not include a suspended ceiling.

Also, furniture suppliers offer a variety of chair and table glides (e.g., felt, nylon, see Fig. 6) and can help specify the correct type to minimize noise for the chosen floor finish.

High impact uses, such as fitness rooms or dance studios located above core learning spaces, should receive specialty fitness flooring, a floating floor, or spring-hung drywall ceilings below to confidently control high levels of impact noise. These critical adjacencies should always be reviewed by an acoustical consultant.

Fig. 4 & 5: Modular Furniture in Alberta classrooms.



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Fig. 6 Examples of different furniture glides

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