FIELD FLOOR IMPACT
SOUND ISOLATION

46 OAKDENE DRIVE
15th September 2015

For

BUILD IT ECO
Unit 8 / 49 Prindiville Drive
WANGARA WA 6065
1. **INTRODUCTION**
Gabriels Environmental Design Pty Ltd were engaged by BuilditEco - Innovative Building Solutions, to measure the field impact isolation performance of the light weight floor construction at 46 Oakdene Drive, Madeley. The testing was performed on Wednesday morning, 9th September, 2015.

2. **IMPACT ISOLATION RATING SYSTEMS**
Floor impact noise is rated in terms of the noise levels received in the room directly below the floor being impacted. **The International Standard ISO 717-2** rates the resultant noise level produced in the room under the floor in terms of the $L'_{nT,w}$. The lower the $L'_{nT,w}$ the lower the noise level of impact heard within the room.

As the reverberation time in the room can vary in a room depending of the level of soft furnishings, the International Standard allows for the 'standardisation' to a 0.5 second reverberation time in all frequencies. In practice it is found that most furnished rooms have a 0.5 second reverberation time irrespective of volume. This is an appropriate reporting measure, which to some extent, takes out the variance of room volume and absorption in the receiving rooms. The Impact Sound insulation determined by the measurements is therefore reported as the "Weighted Standardised Impact Sound Pressure Level ($L'_{nT,w}$)."

The Building Code of Australia (BCA) establishes a criteria for impact noise transmission in apartment buildings in terms of the $L_{nT} + C_i$ of not greater than 62 dB. $C_i$ is an adaptation term based on the unweighted linear impact sound level. There is an anomaly in the BCA in that the adaptation term $C_i$ rates very favourably for bare concrete floors. The Standards Australia Committee AV4 has recommended to the Australian Building Codes Board that the $C_i$ correction factor be dropped in future editions, however we recommend that in the interim the BCA criteria be taken as $L'_{nT,w}$ not greater than 62 dB.

3. **TEST SET-UP AND PROCEDURE**

3.1 **Test Method**
The testing was based on the requirements of:
- ISO 140-7 – Acoustics – Measurement of sound insulation in building and of building elements; Part 7: Field measurement of impact sound insulation of floors.

3.2 **Building**
The building tested was a residential house with a newly constructed second storey. The two areas tested were from the main upstairs living / bedroom area to the living / dining room downstairs, as well as the alternate floor type in the bathroom upstairs down to the bedroom below.

3.3 **Source Room**
With the first flooring system tested, two test positions were located in the living area and another two positions were located in the Master Bedroom. The total area was a rectangular shaped room with internal wall cladding yet to be installed.
The bathroom area upstairs was a smaller rectangular shape, also without the internal wall cladding installed.

3.4 Floor Tested
The floor tested was the lightweight construction without any final floor finish installed. The floor in the living area was constructed of a composite Supafloor panel system, consisting of 10mm high strength Supaboard on top of a 34mm EPS core, with an under layer of 6mm standard grade Supaboard.

The floor in the bathroom area was constructed from panels of 18mm Supaboard flooring.

Both floors were glued and screwed to timber joists below. The air gap between floor and ceiling was 300mm with fibreglass insulation installed in the cavity space. The ceiling was constructed of 10mm flush plasterboard.

3.5 Noise Source
A Norwegian Electronics NOR211 Tapping Machine was used to generate impact noise. The Tapping machine was checked and adjusted to ensure the 40mm drop height for the hammers of the tapping machine to the floor was maintained and that the machine was level.

The tapping machine was set up at four positions in the living / master bedroom area. Two test positions were undertaken in the bathroom area.

Each test position was oriented at 45 degrees to the walls (i.e. diagonally across each test location). The source was rotated through 90 degrees for each of the test locations.

3.6 Receiving Rooms
The receiver room below the living / master bedroom test was the open plane living / dining / kitchen area. This room was approximately 6.0m x 9.4m x 2.4m.

The flush plasterboard ceiling had several penetrations of mechanical air diffusers (with only flexible ductwork behind) and small spot type downlights. It should be noted that there was a small amount of flanking noise audible in the receiver room through un-sealed light fixtures and that the mechanical diffusers created a weakness in the total system construction. This was most evident in the small bedroom with a centrally located air diffuser. The bedroom was approximately 4.0m x 3.0m x 2.4m.

All windows and doors were closed during testing such that flanking noise through all other paths was well controlled.

3.7 Noise Level Measurements
Noise level measurements were taken with a NATA calibrated Brüel & Kjær 2270 Sound Level Meter (certificate can be supplied if requested). The meter was field calibrated prior to and after measurements with no significant drift noted.

One third octave band sound pressure level measurements (L\text{Aeq}) were taken as a general sweep of the area below the tapping machine, with the source at the approximate centre of the sweep area. Measurements were not taken closer than 1.0 metre to perimeter walls.

Background noise levels were measured in the receiving room. Where the impact sound levels are within 10 dB of the background noise levels, a correction for background noise must be made in accordance with ISO 140-7. This was not required for any of the tests undertaken.
3.8 Absorption in the Receiving Room

The absorption in the receiving room was determined from the Reverberation Times (RT). The RT's were measured in 1/3 octave bands from an impulse noise source using the B&K 2270. Three different positions around the room were measured.

4. RESULTS

4.1 Results of Measurements

The results of the measurements are set out in Table 1.

<table>
<thead>
<tr>
<th>Test</th>
<th>Details</th>
<th>$L_{nTw}$</th>
<th>$C_1$</th>
<th>BCA Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Living Area - 50mm Supafloor Composite Panel</td>
<td>59 dB</td>
<td>0 dB</td>
<td>✓</td>
</tr>
<tr>
<td>02</td>
<td>Bathroom Area - 18mm Supaboard Panel</td>
<td>67 dB</td>
<td>-6 dB</td>
<td>✗</td>
</tr>
</tbody>
</table>

The relevant Field Impact Sound Insulation Data Sheets are attached to and form part of this report. If reproduced, the report should be reproduced in full.

5. CONCLUSION

Based on the results from the on-site measurements and calculations, the floor tested in the main living area meets the current Building Code of Australia Criteria. As indicated above, the floor surface in the bathroom area has a noticeably different result with an $L_{nTw}$ above the BCA criteria.

Although difficult to directly compare the results as these are tested in different rooms, it is our assumption that this increase in noise level is due to a few factors such as the EPS foam interlayer in the structure, floor material strength, connection to adjoining structure, distance between load bearing walls, alignment of walls, ceiling and ceiling suspension system, ceiling insulation etc. Unlike airborne noise transmission, structure borne noise transmission in buildings cannot be accurately predicted. It is therefore important to note, that the results of field tests in one building cannot be assumed to be achieved in another building.

If you have any queries regarding this information please call the undersigned on 9474 5966.

Regards,

Michael Ferguson
B.IntArch  M.A.A.S.

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ATTACHMENTS
- APPENDIX A  - Background Information on Impact Isolation Tests
- APPENDIX B  - Testing Data Sheets (x2)
APPENDIX A

BACKGROUND INFORMATION ON IMPACT ISOLATION TESTS

A1. Criteria
The Building Code of Australia has established a criteria of a maximum $L_{ntw} + C_I$ of 62 dB. As the $C_I$ is an anomaly, it is recommended that $L_{ntw}$ of 62 is taken as the criteria.

The BCA establishes minimum performance standards. The Association of Australian Acoustic Consultants (AAAC) established performance in terms of a 6 star rating. The standards established in their document are:

- $L'_{ntw}$ 65 dB
- $L'_{ntw}$ 55 dB
- $L'_{ntw}$ 50 dB
- $L'_{ntw}$ 45 dB
- $L'_{ntw}$ 40 dB

It should be noted that carpet will generally achieve an $L_{ntw}$ below 40 dB.

A2. Performance of Impact Isolation Systems in the Field
The impact noise level of a floor covering plus acoustic underlay compared to the performance of the bare floor surface is a useful indicator of the reduction in impact noise provided by a particular acoustic underlay product. Over a number of tests, this may be able to provide an indicator of the expected performance. Of greater value is the field testing of various acoustic underlays on the same site; this provides good comparative performance between acoustic underlays.

A field test on a specific project is therefore the most reliable method of identifying the expected performance for a particular acoustic underlay in a particular building.

A3. Loudness Versus Decibels
The following Table is an approximation of human sensitivity to changes in sound pressure level. Although the ear registers change in sound pressure, it is transferred to the brain where it is recorded by its loudness. This makes hearing quite individualised. The perceived loudness is also dependant on the frequency content of the sound. The Table should be seen as a useful approximation to keep in perspective the impact of changes in sound level.

- 1 dB difference  Almost imperceptible
- 2 dB difference  Just perceptible
- 3 dB difference  Clearly noticeable
- 10 dB difference  Twice (or half) as loud

With floor impact isolation underlays, there is usually a discernible change in frequency response with a small change in the $L'_{ntw}$. 
FIELD IMPACT SOUND INSULATION
DATA SHEET

Project No: 15-012E
Meas. Date: 9-Sep-15

Project: Oakdene Drive
Client: BuilditEco
Tapping Machine: NE Nor 211

Task: Impact Testing - Bare Lightweight Flooring
No. of Source posn: 4
Details: Living to Living

Receiving Room Volume: 130 m³
Mic. posn: 4 sweeps
RT meas: 3

Description of Specimen:

Supafloor Panels
10mm High Strength Supaboard
34mm EPS Core
6mm Standard Grade Supaboard
300mm Air gap with fibreglass insulation
10mm Flush plasterboard ceiling (some ductwork / lighting penetrations)

Weighted Standardized Impact SPL

Results standardized to a RT of 0.5 seconds

<table>
<thead>
<tr>
<th>Centre Frequency (Hz)</th>
<th>Living to Living</th>
<th>Impact Ref Contour</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Living to Living</td>
<td>Deficiencies</td>
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<tr>
<td></td>
<td>dB</td>
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<tr>
<td>100</td>
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<td>63.6</td>
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<tr>
<td>160</td>
<td>63.3</td>
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<td>200</td>
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<tr>
<td>250</td>
<td>67.1</td>
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<td>55.0</td>
<td>57</td>
</tr>
<tr>
<td>1k</td>
<td>51.2</td>
<td>56</td>
</tr>
<tr>
<td>1.25k</td>
<td>48.2</td>
<td>53</td>
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<td>1.6k</td>
<td>47.8</td>
<td>50</td>
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<td>2k</td>
<td>48.1</td>
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<td>37.5</td>
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<tr>
<td>5k</td>
<td>29.9</td>
<td></td>
</tr>
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</table>

Total

L’nT,w 59
C₁ 0

30.0 35.0 40.0 45.0 50.0 55.0 60.0 65.0 70.0 75.0 80.0

1/3 Octave Band Centre frequency HZ

STANDARDIZED IMPACT SPL

Living to Living

Impact Ref Contour

Total L’nT,w 59 31.5
FIELD IMPACT SOUND INSULATION
DATA SHEET

Project No: 15-012E
Project: Oakdene Drive
Client: BuilditEco
Task: Impact Testing - Bare Lightweight Flooring
Details: Bathroom to Bedroom

Description of Specimen:

18mm Supaboard Panels
300mm Air gap with fibreglass insulation
10mm Flush plasterboard ceiling (some ductwork / lighting penetrations)

Weighted Standardized Impact SPL
L'nT,w 67
C_i -6

Bathroom to Bedroom

<table>
<thead>
<tr>
<th>Centre Frequency (Hz)</th>
<th>Bath. to Bedroom</th>
<th>Impact Ref Contour</th>
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<tbody>
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<td></td>
<td>dB</td>
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Total
L'nT,w 67 31.9