Some Recent Findings on Field Impact Insulation (part 1)

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Not Refereed

Introduction

We recently carried out a number of Field Impact Insulation tests on apartment buildings in the Bay of Plenty. Impact Insulation typically relates to transmission of "footfall" noise between apartments, for example, noise from a person walking on a "hard" kitchen floor which is heard in the apartment directly below.

The minimum impact insulation requirement as per Clause G6 of the Building Code is FIIC 50 on site (Field Impact Insulation Class). That is, FIIC 50 or greater on site is a "pass" and FIIC 49 or less on site is a "fail".

The rating of FIIC 50 is the legal minimum, but higher ratings are recommended, especially for middle to high quality developments where owners/occupants have higher expectations of acoustical amenity.

We take this opportunity to report on two aspects of some recent measurements:

- Re-test Repeatability.
- The typical effect of Mapei Mapefonic (an acoustic underlay)

For those readers not familiar with building acoustic issues, footfall noise is often reduced by installing an acoustic underlay beneath areas with "hard" flooring (such as ceramic tiles, timber etc).

There is not usually any issue with transmission of impact noise when "soft" floor coverings such as carpet is used on top of concrete floors (typically easily complies with minimum legal requirement of FIIC 50). The test for impact insulation uses a standardised tapping machine (series of hammers drop onto the floor from a fixed height) and the noise level is measured in the apartment below. Since the level in the apartment below would depend on the volume of the room and how much absorption was present at the time of the test, the measured levels are "normalised". This procedure adjusts the measured values to that which would have been obtained if the receiving room had 10 m2 of absorption units.

Re-test Repeatability

We carried out an initial round of tests at a building under construction, on a range of sample installations. In general, this was a 1 m2 sample of ceramic tiles laid on top of an acoustic underlay, on top of the concrete floor/ceiling assembly.

Different acoustic underlays were installed (in patches) to determine the underlay to be used throughout the rest of the project. The final decision is left up to the builder/ developer based on the cost/benefit of the particular underlay.

Two weeks later, we carried out a second round of tests at the same site on some different samples. However, for general interest, while we were at the site we took the opportunity to re-measure the bare floor slab, and also one of the sample installations (with Mapei

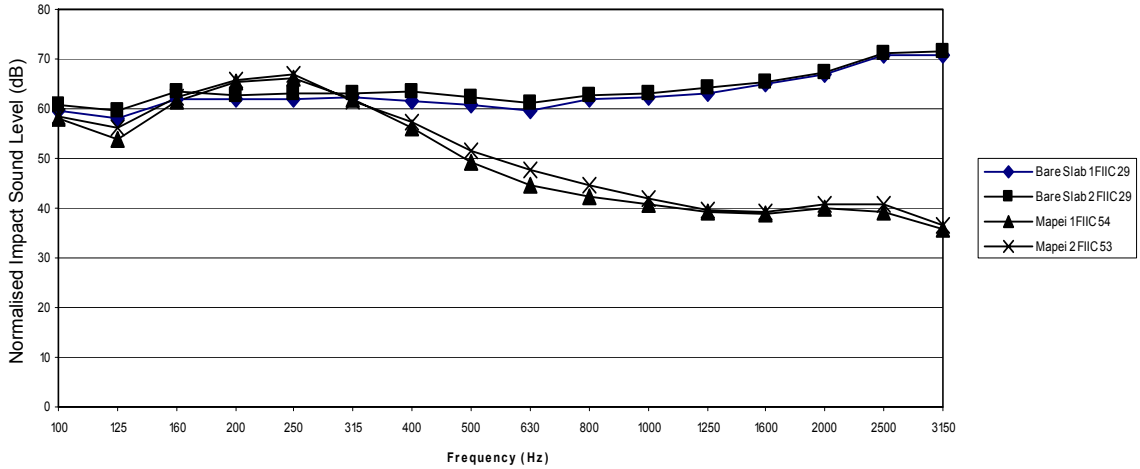

Figure 1: Field Impact Test Repeatability

Mapefonic underlay) to determine what may be described as "re-test repeatability".

In this case, we carried out the same test for impact insulation, under similar environmental conditions, with same or similar test equipment and methodology.

The results of the two rounds of tests are shown in figure 1.

Figure 1 shows rather good agreement between the first round, and the second round of testing carried out two weeks later, with approximately 0-2 dB variation across the frequency range.

The Field Impact Insulation Class rating was FIIC 29 for both tests on the bare slab, and one FIIC point difference for the installation with Mapei Mapefonic underlay (FIIC 54 versus FIIC 53).

Generally, we were surprised at the good agreement, especially in view of the large number of individual measurements associated with each test (eg. room volume, impact noise level and reverberation time).

Effect of Mapei Mapefonic

The above graph provides an indication as to the "improvement" in impact noise transmission provided by Mapei Mapefonic underlay beneath ceramic tiles (ie. "improvement" in terms of reduction in impact noise levels in the apartment below).

The improvement provided by Mapei Mapefonic on this project, as well as other projects, has been determined and averaged to help predict the likely effect of Mapei Mapefonic at other projects (eg. at design stage).

Figure 2 is the calculated average reduction (negative log) provided by a number of sample installations of Mapei Mapefonic.

Figure 2 shows a clear trend of the effect of Mapei Mapefonic which typically causes impact sound pressure levels to increase slightly at 160-315 Hertz but provides significant reduction of impact sound pressure levels at mid to high frequencies.

Discussion of Results

Those of you familiar with Building Acoustics may wish to consider the following:

- Re-test repeatability. From a legal viewpoint, it may be prudent for us as acoustic consultants/certifiers to always quote likely repeatability error when presenting results of testing. Our simple repeatability test showed this is likely to be in the order of plus/minus 1 FIIC point.

  We note this agrees with a report by Warnock and Birta for NRC Canada1 which showed that out of 8 laboratory IIC tests, 4 tests achieved IIC 45 and the other 4 achieved IIC 46. This was

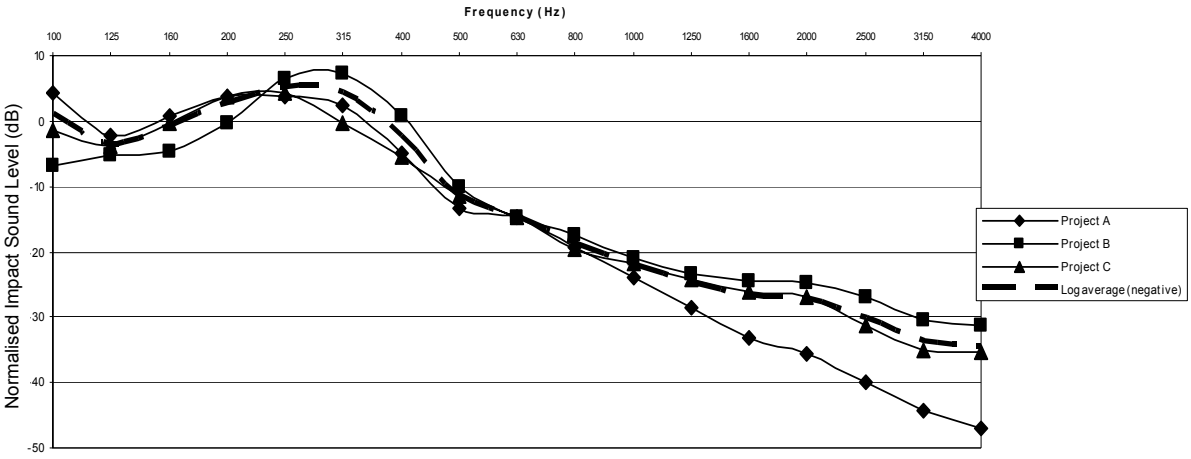

Figure 2: Effect of Mapei Mapefonic

carried out on a particular floor/ ceiling installation over a number of days, with nothing changed between tests. This was achieved in the laboratory under much more controlled conditions than in the field.

- Effect of Mapei Mapefonic. Note the results shown in the first graph – FIIC 29 for bare slab versus FIIC 53-54 with ceramic tiles and Mapei Mapefonic on top.

  Those of you "in the know" would probably say that FIIC 29 is "about right" for a bare slab with no ceiling suspended beneath. You may be surprised to learn that this result was in fact obtained with a plasterboard ceiling suspended below !

  On this project, there was a deep concrete beam supporting the concrete floor slab, which protruded down into the apartment directly below. Because of height issues, the suspended ceiling within this lower apartment was butted into the sides of the beam, and the beam plastered and painted. This beam is likely to be a significant "flanking path" for impact noise transmission, rendering the suspended ceiling ineffective. In our experience, Mapei Mapefonic is typically a solid performer, which achieves good results on site, as it does here (provided improvement of approximately 24 FIIC points). Other underlay products were also measured on site and lead to failures (below FIIC 50) or marginal results (FIIC 50-52) which we had to advise against as there was little or no safety factor.

Further Thoughts

These days, Territorial Authorities are becoming stricter in enforcing/ testing acoustical performance of finished buildings at Code Compliance stage. A new clause G6 of the Building Code may also introduce more stringent acoustical criteria. Results of recent field testing indicate there are a lot of acoustic underlays available on the NZ market, which, for whatever reason, perform poorly in the field. Impact Insulation is tricky to predict, and can be significantly affected by on-site factors. Acoustic consultants need to be careful in this environment, as potential for failure is high. Acoustics appears to be one of the few areas in the building industry where performance can be measured on site at the end of the day against fixed criteria.

Architectural drawings show important aspects of the building design, but do we need to carry out a thorough review of structural, mechanical and other drawing packages to help avoid problems occurring? Are these drawing packages available and, if so, sufficiently detailed for us to adequately review? Do we need to provide field inspections during installation ? Is the client (and building industry in general) prepared to pay for this? To help avoid what may be inevitable problems with structure, services etc compromising the on-site performance, should we only recommend top-performing acoustic underlay products like Mapei Mapefonic ?

We hope to provide another report in the near future, looking at some other on-site factors affecting field impact insulation performance.

References:

(1) NRC Canada. IRC Internal Report IR-811, July 2000

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