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WHAT CONFIDENCE CAN WE HAVE FOR BUILDING CONVERSIONS UNDER ADE2003?

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TESTING VERSUS PREDICTION

Times change, and so do Building Regulations. Under ADE1992, emphasis was on constructions, with sound insulation values forming a desired outcome. Under ADE2003 this has been turned on its head, with the sound insulation values being the basis of the regulations, and all construction advice being suggested means of meeting the criteria. To this end, and rightly so, sound insulation testing is the sole means of demonstrating compliance with ADE2003.

There is much debate over the ability to accurately predict the acoustic performance of robust details for new-build developments. How repeatable a detail can be, bearing in mind site constraints and the unknown factor of workmanship, is a subject in itself. However, working with buildings that already exist, that are in varying states of decay, having been built at various times throughout history and by an unknown number and quality of builders, is so full of uncertainty and surprises that prediction of acoustic behaviour can often be a fruitless exercise. Even seemingly identical constructions, built within years of each other and using similar methods, can yield widely variable results.

How then can we provide Clients with a construction solution that uses the existing building fabric in the most cost effective way, whilst giving confidence that stringent requirements under ADE2003 can be met? Standards for conversions under ADE2003 are generally much higher than under ADE1992. The Spectrum Adaptation Terms can be greatest when used to rate existing buildings, frequently being in excess of -15 dB. This can result in constructions that would have yielded a good pass under ADE1992 new-build standards only scraping a pass, or even failing, under ADE2003 conversion standards.

The easy solution would be to over-specify and over-engineer solutions, but we have a duty of care to our Clients to ensure the best solution is obtained at the best cost. Emphasis should also be on the practicality of solutions; many of the best performing solutions are entirely impracticable to reproduce en mass on site. Building Control will also require the confidence that a solution will meet ADE2003, before it is installed on site.

THE ON SITE APPROACH

So, how can we obtain this confidence. The key is the realisation and admittance that no two buildings perform the same. There often seems little correlation between prediction using traditional methods and actual performance, irrespective of building age and type. Clients have to be made aware that Acoustics, especially when dealing with building conversions, is not an exact science. The only way to obtain this confidence is to do what ADE2003 requires, and carry out testing; this is the sole means of demonstrating compliance with ADE2003, but also of finding out what factors come into play with respect to flanking and structural transmission. Older buildings will also have added complications due to composite (and sometimes patchwork) constructions, and use of different types of mortar. It is not unusual to find assorted debris, rubble and even straw within a Listed floor.

But how can you carry out a test in a building which is in a state of disrepair? What use will the tests be, if all they show is how the existing floor or walls perform prior to conversion? For this to be a meaningful exercise, the Client needs to invest a moderate amount of money in exploratory construction work, and either one or two specialist manufacturers need to be involved. In order to

create a realistic, representative test, an area of floor or wall needs to be isolated, and different build-ups of remedial systems installed and tested in turn. When undertaking such an exercise, the following needs to be considered:

- Two rooms need to be constructed, one either side of the party element
- Rooms should be different sizes, with the largest being used as the source
- Site constraints should be included within the test chambers, e.g. flanking walls, structural members etc.
- Walls of test chambers should ideally be isolated from the building structure, and be sufficiently robust to minimise flanking noise

Providing the installers are sufficiently competent, it should be possible to carry out up to 7 or 8 tests in one day. Each configuration will be dependant on the performance of the last test, and will guide the direction the testing takes. However, test results do not always follow logic or the obvious laws of physics, and as many options as possible should be explored.

EXAMPLES OF SUCCESSFUL MOCK-UP TESTING

Example 1 - Conversion of Grade 2 Listed building and attached 1970s office block, Birmingham
The first area to be investigated was the 1970s building, having a nominal 250 mm in-situ concrete slab, representing the greatest floor area. Criteria were for an impact-resistant flooring, providing a 50 mm clear services zone. Two manufacturers were approached to participate in tests, being asked to install as many configurations as possible in one day in a test chamber. This promoted competition between manufacturers which, in turn, gave a competitive cost to the Client. The exercise also gave a good impression of how well each manufacturer handled fitters and deliveries. The successful manufacturer was then awarded the contract, and carried out a similar mock-up exercise for the two other floor constructions within the 100,000 ft2 development.

Example 2 – Conversion of a grain mill into apartments, Wolverhampton
The building itself was in a state of disrepair, with many of the floor boards rotten and windows broken. An area of flooring was identified where original boards would be retained, adjacent to the external wall, including structural members (steel columns and timber beams). Test chambers were constructed and 6 sets of tests were carried out. A solution was found that met with ADE2003 requirements, and test showed that there was only a 1 dB difference in performance between two configurations having a materials-only cost difference of £6 per m2. Testing gave the Client confidence to use the cheaper of the two solutions, and the resultant saving far out-weighed costs of testing.

Example 3 – Conversion of existing building into apartments with A3 use at ground floor, Birmingham
Due to the non-residential use at Ground Floor, Building Control required a DnT,w of 65 dB to the First Floor. The base construction was timber joists, square edge boards, with a lath-and-plaster ceiling. A number of tests were carried out to explore how this value could be achieved, resulting in a timber floating floor having a 300 mm air gap and large drop ceiling. The test also highlighted flanking walls that required treating. These early tests enabled a firm cost plan to be established, and gave the Client confidence to proceed with a difficult project.

Example 4 – 200 New build timber frame apartments, Birmingham
The timber frame formed part of shell and core works carried out by the main contractor, and was constructed over a mixed-use leisure development. Acoustic isolation between leisure and residential areas was designed by the shell contractor's Consultant. The timber frame was poorly constructed, with up to 40 mm variation in height across some apartments. A solution capable of levelling out the floor was therefore required, together with fireproofing to the timber floors and an acoustic ceiling. The floor system was fixed, and various ceiling configurations were tested, together with different types of insulation within the floor. Testing found that the least expensive, lightest ceiling boarding configuration provided the best result and met with project requirements.

This result showed that a standard plasterboard ceiling on resilient MF hangars provided a better standard of insulation in this instance than SoundBloc or Plank, and could not reasonably have been predicted at design stage.

CONFIDENCE IS POSSIBLE, AND USEFUL

Mock-up testing gives much-needed confidence that ADE2003 requirements can be achieved in the most challenging of buildings. Working with such buildings shows that prediction of performance using remedial measures is approximate, and what may have worked on one job may not work on another. Laboratory results and manufacturer's quoted 'improvement' figures should be used as a guide only. Testing gives the Client confidence in the following areas:

- A solution can be achieved, and fixed at the early stages of a project
- Cost certainty can be gained, providing the tests include flanking elements
- Tests give the Client the assurance that, if pre-completion testing shows a shortfall in performance, then this is due to installation (or possibly detailing), but not the fundamental design
- This regime of testing is in line with requirements under ADE2003 for demonstrating compliance

THINGS TO NOTE

When providing an acoustic solution to an existing building, the Consultant has a duty of care to identify risks and practicality issues surrounding specified remedial measures. The following items should therefore be considered:

- Does the acoustic solution provide requisite fire protection? Is this fire barrier penetrated by services? If so, perhaps a sacrificial acoustic ceiling should be implemented, with recessed fittings pattressed where practicable
- How appropriate is it to use gypsum products as a floor overlay solution? Although boards have a high mass, in the event of water leakage, boards may cause collapse
- Similarly, sand pugging between joists is a good mass solution, but in the event of water leakage, may put undue loading on the structure, and retain moisture that could cause ceilings to collapse
- How appropriate are overlay solutions on existing timber floor boards? As boards are generally uneven, many overlay solutions may crack or be bottomed out when laid on an uneven surface. Although solutions may not bottom out during testing, what happens when heavy furniture is added?