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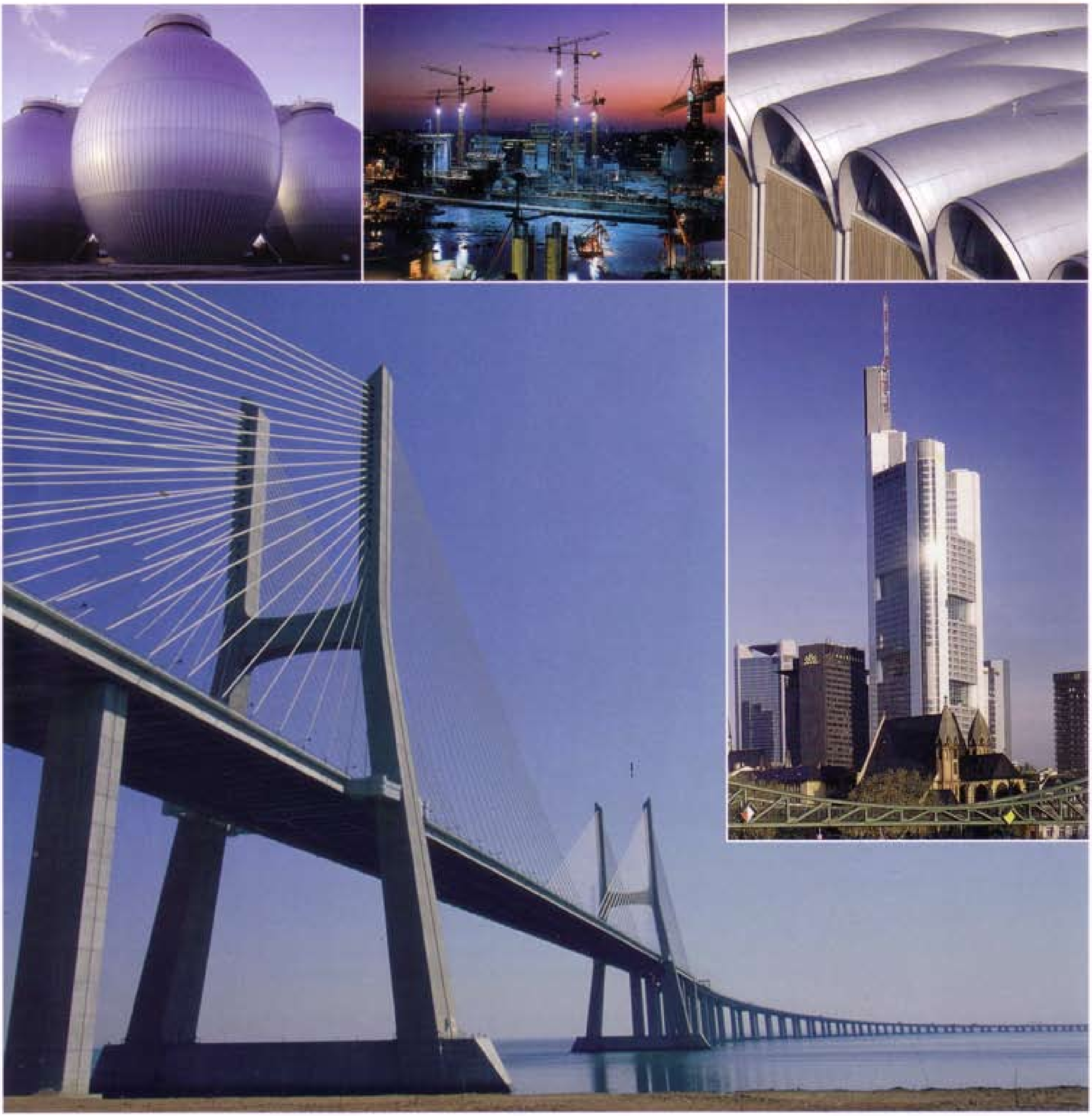

Reduction of impact sound transmission from precast stairs

Ever since precast stairs were first used in a building, the transmission of impact sound (stepsound) has been a problem. There is little incentive to address the problem of stepsound in the UK and in most cases it is ignored for a variety of reasons.

Cliff Billington, J&P Building Systems

If stairs are used only as a means of escape, then there is generally no traffic and thus no noise. If certain areas do prove to be a problem, then a resilient covering will improve matters somewhat. However, this is not a cheap solution, it does not always lend itself to the precast configuration and it needs to be maintained against wear and tear. Surveys in Holland put 'normal' walking on stairs ahead of 'heavy' walking on floors as far as nuisance value is concerned. Yet while there are many ways of dealing with floor stepsound, there are relatively few published solutions for stairs.

Over recent years, the Building Regulations have recognised the problem and applied some limits on it. The 2004 revision to Part E[1], Tables 1a and 1b, give a maximum value of 62dB for impact sound for new-build premises. To put this figure into perspective, a value of 63dB is classed as 'well audible'. A rigidly connected in-situ staircase typically transmits between 55–66dB, thus frequently 'failing' to comply.

The British Regulations are currently far more lax than those on the continent. Most of Europe broadly complies with EN ISO 717-2[2] when considering impact sound. For example, Norway allows 53dB as does Finland. The German Standard DIN 4109 also gives a figure of 53dB. On the assumption that what is current in Europe will soon be applicable in the UK, there is a very good case to be made for 'future-proofing' precast stairs now, so as to avoid them becoming 'substandard' later on.

Traditionally, stairs, or more commonly landings, were normally supported either by a steel support angle fixed to the stairwell wall or a concrete ledge. Nowadays it is common to use a proprietary cast-in insert as these are visually preferable. Whichever method is used, the aim is to incorporate a resilient layer between the landing and the support, and there are various ways of achieving this, with differing degrees of success.

The basic start point for concrete stairs, with or without ceramic tiles, may be taken as 66dB. Taking this and applying various measures as listed below and in Figures 1–6, gives the following:

Covering

The use of a resilient/soft top covering on the landing can reduce levels by 10–15dB compared with ceramic tiles. However, this is only for high-frequency sounds. Tests show no appreciable reduction for low frequencies, thus simply applying a resilient finish does not always give compliance with Building Regulations.

An interesting point regarding the cast-in inserts is that, due to their limited contact area, the test values, even without any rubber bearings or the like, showed transmission values reduced from 59 to 46dB. In other words, they would satisfy the current European requirements without further measures and are comfortably within UK requirements.

If measures have been taken to isolate the landing from the supporting structure, then it is important not to compromise this by creating other points of contact. For example, the gap between the landing and the stairwell wall should not be filled with grout or plaster. Norwegian tests at SINTEF, a large independent research organisation in Scandinavia, checked the effect of creating a bridge between landing and wall. Steel wedges placed between landing and wall increased sound transmission by 5–7dB, and similar losses of efficiency occur with any bridging of the gap. To avoid sound travel, only materials and sealants

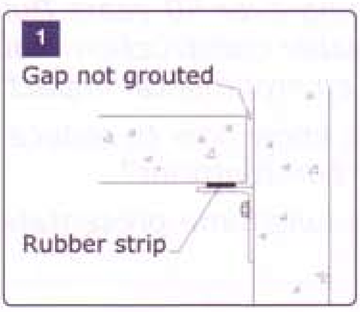

Figure 1: Simple bearing strip – a 12mm-thick, continuous strip bearing can give a reduction of the order of 17dB.

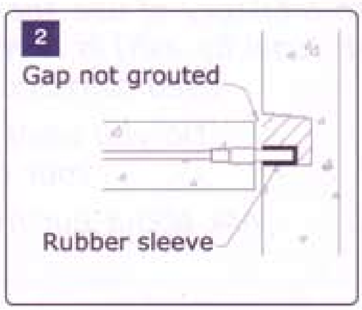

Figure 2: Screw-in bearing – this type of screw-in support on a resilient sleeve bearing can give a reduction of 16–19dB.

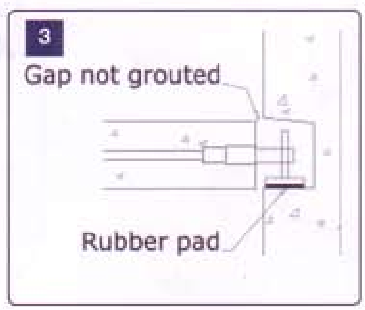

Figure 3: Screw-in bearing – this type of screw-in support with bearing pad may give a reduction of 20dB.

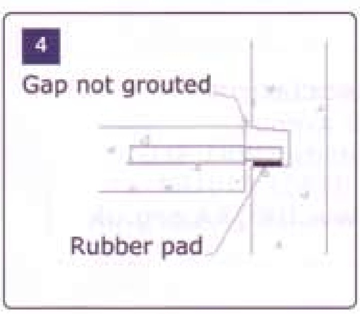

Figure 4: Cast-in support inserts on resilient pad – a cast-in insert on a bearing pad gives a reduction of 18dB.

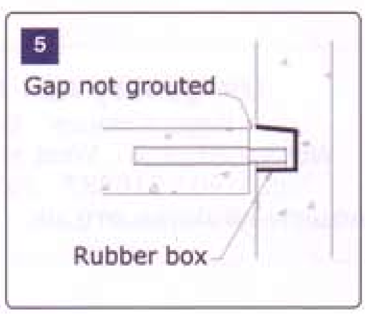

Figure 5: Cast-in support inserts in resilient box – a cast-in insert seated in a rubber box gives a reduction of 18dB.

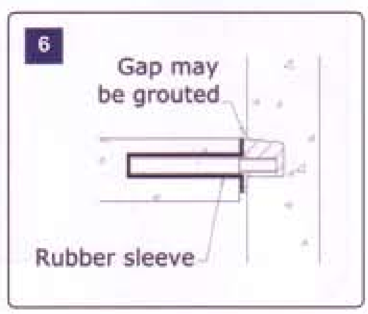

Figure 6: Cast-in support inserts in resilient sleeve – a cast-in insert with rubber 'sleeve' within the landing gives a reduction of 28–32dB.

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(Photos: S&P Building Systems Ltd.)

that cannot transmit sound vibration should be used.

There are several numerical results and values given above. However, it must be remembered that sound, and sound measurement, is not an exact science, particularly when tests are carried out in a real building rather than in a laboratory. For stepsound in particular, results can be affected by such factors as the quality and thickness of bearings, the number of supports, the stiffness of the stair construction itself, the effect of flanking transmissions through doors or other openings and the effect of 'sound bridges' between the landing/flight and walls. In addition, a single test, no matter what the result, is not an adequate indicator of performance. Many tests are needed before the required confidence level is achieved.

Concluding remarks

As the figures on the left show, there are fairly simple ways of getting well within the limits required. Although there is an initial cost element, this is low in terms of total cost, and European practice has shown that the added value gained from stairs that minimise nuisance more than offset the initial cost. In simple terms, a block of flats with sound cutting measures attracts a higher price than one without. There is also a human side that cannot easily be costed. A quieter environment is good news for everyone. In residential developments it leads to less tension between neighbours; in schools it helps create a better environment for teaching, with less distraction. In Europe, these matters are being taken seriously and tighter limits being imposed. Fortunately, and partly driven by legislation, the tools have now become available to comply with the limits. In the UK, the Regulations still allow noisy buildings to continue ... but for how much longer? ■

Figures 7–10: Photos of the test procedure showing sound generator and measurement.

References:

1. DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT. The Building Regulations 2000. *Approved Document E: Resistance to the passage of sound.* NBS, London, Amended 2004.
2. BRITISH STANDARDS INSTITUTION. BS EN ISO 717. *Acoustics. Rating of sound insulation in buildings and of building elements. Part 2 – Impact sound insulation.* BSI, London, 1997.