SOUND INSULATION STANDARDS IN THE UK: A DECADE OF CHANGE.

Roderick Mackenzie[1], R. Sean Smith[1], Chris Steel[1] and Richard Mackenzie[1]
[1]Building Performance Centre, Institute for Sustainable Construction, Edinburgh Napier University, 42 Colinton Road, Edinburgh, United Kingdom, EH10 5BT, ro.mackenzie@napier.ac.uk

1. INTRODUCTION

The last decade has seen a great deal of change in residential sound insulation standards across the UK. Diversification in the measurement criteria and intensification of testing requirements have coincided with changes to the design of separating and internal wall and floor partitions and increasing standardization in design. This paper outlines the causes and consequences of these changes.

2. Regulation changes in England and Wales

2.1 Approved Document Part E (ADE, 2003)

Prior to the release of ADE 2003 of the building regulations in England and Wales, an airborne D_{nTw} and impact L'_{nTw} criteria was used across the UK. Minimum airborne mean partition performance levels for a new-build site were 52 dB for floors and 53 dB for walls (with individual minimums 48 dB and 49 dB respectively), and mean impact level of 61 dB (65 dB individually). The requirement to test generally lay at the discretion of the local authority, and acoustic test compliance rates were generally poor. The new ADE 2003 document opted for a change in criteria to $D_{nT,w} + C_{tr}$, primarily to account for low-frequencies given a primary cause of complaint in attached dwellings was bass music. At this time, 11 European countries used $D_{nT,w}$ or R_w, whilst 2 countries (Sweden and France) used C correction and no country used C_{tr} for party walls or floors (this is still the case today). The C_{tr} correction weights heavily against poor performances in the 100 Hz to 315 Hz range, and particularly against lightweight frame partitions. Its introduction was subject to much debate within the UK acoustics community.

It was also put forward in the draft document, and later confirmed in the full ADE, that 10% of attached dwellings of any partition type on a site should be subject to Pre-completion Testing (PCT) for sound insulation. Whilst initial government estimates put the cost to the house building industry of this increased site test regime at £3m per annum, independent estimates put the cost at closer to £15m, with the government figure revised in late 2003 to £17.3m. There were also serious concerns over the supply of qualified acoustic testers and equipment. As such the industry lobbied hard to be allowed to use standardized partition designs, repeatably and reproducibly achieving results in excess of ADE targets. The government agreed providing the industry could set-up a robustly designed system of approval, certification and monitoring of such partitions within 9 months.

2.2 Robust Details (RD, 2003)

This would require a complete review of current methods of partition design with new constructions to be researched, developed and tested to achieve significantly higher levels of sound insulation. The project was called the "Robust Standard Details" (RSD) project and this contract was awarded to Edinburgh Napier University.

It was decided that any RD partition must be capable of consistently exceeding ADE performance standards by a mean 5 dB and minimum 3 dB. They must also be deemed to be practical to construct on site and reasonably tolerant to workmanship. To use the RD option to avoid PCT, the 'Person carrying out the work' must register each plot, build in accordance with the relevant RD specification, and give registration document to the building control body before work starts.

The RSD project commenced in September 2002 and was to be completed 9 months later for submission by the house building industry to the government. The scale of the *design and test* element to the project was a world first. As each new wall and floor design would require at least 30 tests, spread over 4 different construction sites, using at least 2 different developers and 3 different testing companies. Over 60 house builders took part in the project covering 175 testing sites. Successful RD partition designs were entered into the new RD handbook along with tables outlining which wall could be used with which floor. This booklet is produced by RDL, an independent body overseeing the approval and monitoring of the RD scheme. 2% of RD registrations are subject to random inspection per year.

The process of gaining RD status remains the same today, with over 30 RD wall designs and over 20 RD floor designs incorporating masonry block work, concrete, timber frame and steel designs. Typical performance levels are 7 dB better than ADE 2003. Since 2003, the RD project scheme is used by 410 local authority building control departments, all major warranty providers and 70% of all new attached homes per annum (over 500,000 new homes since 2004). The government had initially estimated in 2001 that it would take 10 years to bring compliance levels to 95% under the original proposed Part E process. The RD scheme produced a system resulting in compliance levels of 97% within one year of the new RD scheme's operation. In successive years (2006-2009) compliance levels have continued between 97% and 98%. There has been a 4-fold decrease in noise complaints as a direct result of the RD scheme. In 2010, Edinburgh Napier University work on the RD project was awarded the Queen's Anniversary Prize for services to improving quality of life in the UK.

2.3 Code for Sustainable Homes (CSH, 2006)

The Code for Sustainable Homes (CSH) was introduced to promote low-carbon and sustainable new building design. In Section 7: Health and Well-being, aspirational targets were set for sound insulation where 1, 3, and 4 credits would be awarded to attached homes whose partitions repeatedly exceeded the requirements of ADE 2003 by 3, 5, and 8 dB respectively. The CSH's overall target points are due to increase every few years throughout the next decade, making acoustic points more valuable.

3. Regulation changes in Scotland

3.1 Section 5 Noise (2010)

Historically Scotland had had amongst the highest sound insulation standards in Europe. However by 2010, they had fallen behind the progress made in England and other countries in Europe. The required levels for residential sound insulation had not changed since 1987 (with guidance on construction only being partially amended in 2001). Thus in the 2010 edition of the Scottish Building Standards Authorities' (SBSA) Technical Handbook 2010, Section 5: Noise was completely rewritten.

Firstly the scope of the standard was widened to include all residential buildings, including hotels and halls of residence. Secondly, the 2010 edition set forth a significant increase in the sound insulation performance of separating walls and separating floors in attached housing. Whilst maintaining the $D_{nT,w}$ criteria, rather than adopting $D_{nT,w} + C_{tr}$, minimum airborne sound levels were increased from a mean result of 53 dB and / 52 dB walls and floors respectively, to a minimum of 56 dB. Similarly impact was set at a maximum 56dB and not a mean of 61 dB (L'_{nTw}). This has resulted in an effective increase of 8 dB in on-site design specification criteria to achieve such targets when compared with previous standards. Thirdly, a robust post-completion testing regime was implemented and is effective from May 2011 (apartments) and October 2011 (attached houses). One of the most striking illustrations of the change in required performance levels can been seen from how these example constructions have changed in Figure 1.

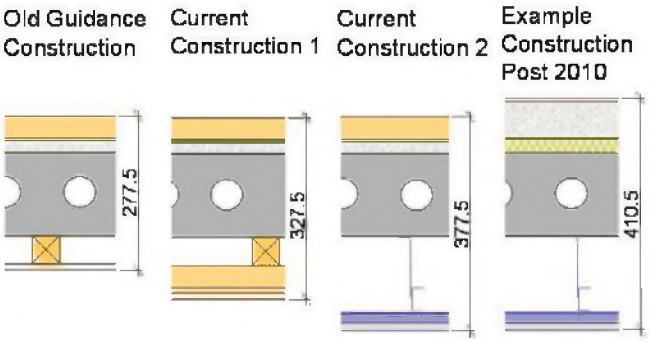

Figure 1 Changes in Precast concrete floor design

This represents a 48% increase in pre-cast concrete floor depths, whilst solid block work walls increase in thickness by 30% and unsheathed timber frame walls by 15%.

3.2 Section 7 Sustainability (Scotland 2011)

Comparable to the CSH in England and Wales, the new Section 7: Sustainability of the SBSA Technical Handbook set out further aspirational targets for sound insulation. As a result Silver and Gold standards are awarded to homes which improve by 2 dB and 4 dB respectively on Section 5's airborne and impact performances for separating and internal partitions (Bronze level).

4. CONCLUSIONS

The change in UK sound insulation standards in the past decade has been like no other before it. However, a net result of all these changes has been a 4-fold reduction in noise complaints in England and may also likely occur in Scotland. The standardization of residential partition design under the RD scheme and new Scottish example constructions means home builders who were just barely achieving the previous standards (which were intended as a minimum) or indeed failing compliance testing, now regularly exceed the targets as has been seen in RD compliance rates. Standards now set for separating floors and walls are relatively high compared with the rest of the UK and much of Europe (The median sound insulation levels achieved, as a result of the project, which are designed and tested, have placed England and Wales 2nd top in the international league table of airborne sound insulation).

Perhaps the most contentious issue involving UK sound regulations in the last decade has been the $+C_{tr}$ question. Scotland never adopted the $+C_{tr}$ adaptation term being used in England and Wales. This presents a problem for designers and house builders who operate UK wide.

It has been found that to develop a widespread increase in sound insulation standards in a short time across the entire house building industry requires the development of robust details, site checklists and random site testing monitoring collectively.

Looking to the future the work of COST Action TU0901 reviewing the potential for harmonized criteria across Europe has the potential to assist designers, product manufacturers and developers and reduce potential barriers to trade.