



*Building Operational  
Performance Framework  
Scoping Study on Impact  
Sound Transmission  
– Final Report*

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# Building Operational Performance Framework Scoping Study on Impact Sound Transmission – Final Report

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# Executive Summary

- 1 This report considers what work is needed to prepare guidance for builders and designers to help control transmission of sound from impacts in adjacent dwellings. The types of impact sound considered do not include footfalls on floors heard below, as this problem is addressed by the current Building Regulations.
- 2 We have started from the types of impact sound found to most often cause complaint and information from a literature search on assessment and control of these impact sounds. This basis is detailed in the interim report.
- 3 We have selected those that we consider a priority for further study and preparation of guidance. A programme of testing is proposed to gather further information. Following this a guidance document would be prepared.
- 4 A cost estimate is given for this work.

# Introduction

- 5     The current Building Regulations 2000 as amended, have requirements for impact sound insulation of separating floors between dwellings and rooms for residential purpose. However, over the years house-builders, landlords and others have regularly received complaints from householders about other structure-borne sound disturbing them. These sounds usually originate in the next dwelling or common areas within the same building.
- 6     The sources of noise complained of vary, for example, from people operating light switches to stair lifts for the elderly. Some structure-borne sounds, such as stair lifts, are clearly a function of the source and its installation, much more than the design of residential buildings. It does not seem practicable to frame regulations about how buildings in general must be constructed to pre-empt such problems.
- 7     The transmission of various impact sounds can be exacerbated by a building design, for example, hard work surfaces supported directly on a solid separating wall. Therefore, there is some scope for reducing the disturbance due to impact sounds through the regulation of building construction and design.
- 8     The purpose of this study is to draw up proposals for research leading to the production of a guidance document on controlling impact sounds in dwellings. The research would identify and test both design and remedial measures to control noise nuisance from impact sounds. The impact sounds considered are those not already addressed in the current Building Regulations.

# Methodology

- 9 The first part of the study was to find out what sort of impact sounds are causing residents to complain. Information was obtained by
  - a) Interviewing representatives from outside organisations such as Housing Associations
  - b) Drawing on the experience of staff within FM Nectar gained from past consultancy work
  - c) Reviewing published literature.
- 10 The results of this survey allowed us to rank order the complaints about various sorts of impact sound and take account of the seriousness of the complaints. We were not able to infer whether such complaints are more likely in timber framed or masonry constructions. Details were given in the interim report.
- 11 The second part of the study was a literature review to find out what guidance has been published on:
  - a) Construction measures to control impact sounds, particularly the transmission of impact sounds through buildings.
  - b) Measurement and test procedures relevant to this type of impact sound.
- 12 A few publications give advice on controlling impact sound. These were summarised in the interim report.
- 13 Although this advice covers all the types of impact sound relevant to this report, it is not comprehensive. It concentrates on controlling noise at source by either:
  - a) Changing or relocating the source, such as using solid-state light switches or not supporting stairs on a separating wall.
  - b) Cushioning the impact, such as putting resilient strips on door stops.
  - c) Isolating the source from the structure immediately around it, such as supporting kitchen cupboards using screws or bolts, isolated with neoprene sleeves and washers.

This advice will be brought together as the basis for a guidance document. If possible the advice should be made more comprehensive. This will require some research testing to be done. It is proposed to do this investigation in the laboratory.

- 14 There is little information on how the design and construction of the building itself can contribute to reducing the transmission of impact sound. In the main, this type of guidance is restricted to noise from internal door slams and footfalls on stairs. The



mounting of kitchen units on an additional plasterboard lining to timber or metal framed separating walls is included in the Robust Details.<sup>1</sup>

- 15 Although not published yet, DEFRA are producing a guidance document for householders on reducing noise they transmit to their neighbours. This will include advice on impact sound, but will be aimed at householders themselves using simple methods to control sound at source in existing buildings. DEFRA have also commissioned a report on good practice in the installation of laminate floors. This will address a number of issues related to impact sounds.
- 16 The programme of work proposed in this report will not duplicate these studies by DEFRA. It is intended that the guidance produced should complement what they may be expected to publish without much overlap.
- 17 None of the literature reviewed seems to offer a way forward in developing national standards for procedures and equipment for measurements of impacts on walls. Such test standards arise from sustained international effort over a number of years and build on established preliminary work. There is no evidence in the literature that any such preliminary work has reached a stage where ODPM's resources would be effectively directed to research into developing new standards. Therefore, the development of test procedures and apparatus for investigating impact sound through walls is not included in the proposed programme of work.
- 18 It is necessary that any guidance on the control of impact sound transmission through buildings does not conflict with other advice in the Building Regulations, for example, thermal insulation requirements in Part L. Before the guidance document is finalised it will be reviewed against other parts of the Regulations.

# Programme of Work

## Priorities for Guidance Document

- 19 The first priority will be to bring together existing information and advice into a single guidance document suitable for builders and architects. The document will, as far as possible, include advice based on the investigations proposed here.
- 20 From our survey of complaints, we conclude that the main sources of disturbing impact sounds are:
  - a) Various types of doors being shut
  - b) Objects banged on worktops and hard surfaces
  - c) Operation of light switches and plugs put in or pulled out of electrical sockets
  - d) Creaking or scraping, particularly of timber floors.
- 21 We consider that an investigation of the effectiveness of isolating the noise of objects banged on worktops or other hard surfaces should be a priority.
- 22 A significant amount of work has already been done on the noise of doors being shut and advice exists. Some further work on isolating the frame might prove useful but it is not a high priority.
- 23 Sound from the operation of switches is more a question of the design of the switch. Quiet switches have been developed, but are not widely used. The sound of plugs being put in or taken out of sockets was a much less frequent complaint. Further investigation of this type of sound is not considered a priority.
- 24 Sound generated on timber floors is an issue being addressed by DEFRA and will not be considered further in this study.
- 25 Other sources which should be considered further are footfalls on staircases, and, although not necessarily impact sounds in the normal sense, plumbing/water sounds particularly from the use of WCs.
- 26 We consider that adequate information and advice exists about footfalls on stairs, but that additional investigation on reducing the structure-borne transmission of plumbing/water sounds by isolation would be worthwhile.
- 27 Published information found during our literature survey indicated that the operation of domestic appliances, particularly washing machines, was a significant cause of complaint. As in the case of plumbing/water sounds this is not strictly impact noise. However, the significant number of complaints suggests that it should be investigated further. This is not often a problem in buildings with timber floors and there is not likely to be much improvement achieved through changing the building structure. Therefore, it is not a high

priority. The approach that could be investigated is that of stiffening the floor, moving its natural frequency well above the running speed range of washing machines and tumble driers.

- 28 A study of impact sound transmission through building constructions could not be comprehensive without first developing measurement apparatus and procedures. In any case, we consider that it would not be a cost effective way to develop new practicable methods of controlling impact noise. However, we propose investigating the effectiveness of using resilient material between flank walls (internal or external walls) and separating walls. Unless impacts are directly on the separating wall, the sound often travels primarily through the junctions.

## Testing to be Done

### WORKTOPS AND KITCHEN UNITS

- 29 Measure impact sound transmission across and down a cavity masonry wall in a 'flanking' rig. The wall separates rooms at ground and first floor level with a concrete separating floor. The airborne sound insulation would be measured between rooms to confirm that this was not affecting subsequent structure-borne noise measurements.
- 30 A kitchen base unit, with worktop and cupboards would be located at first floor level, supported on the floor and fixed to the wall. A standard tapping machine on the worktop would be the source. Impact noise levels would be measured in the source room, the receiver room below and the receiver room opposite.
- 31 The reduction in impact noise would be measured for various ways of fixing and different resilient materials. First, tests would be done with the unit not touching the wall, to separate the structure-borne path through the floor.
  - a) Unit supported off base floor only
  - b) Unit supported off floor via resilient layer
  - c) Unit supported off floor via timber floated floor
  - d) Unit supported off floor via most effective resilient layer and fixed directly to wall
  - e) As d) but fixed to wall with resilient fixings or via an intermediate resiliently fixed board
- 32 Part of the programme would be to source and try suitable alternative resilient materials and fixing boards.
- 33 As an option, additional tests could be done on a cupboard unit supported only from the wall. However, we consider this less of a priority as worktop noise appears to be complained of more than cupboard doors. Also, some of the information obtained from the tests on the base unit would be relevant to high level cupboard units.

## **NOISE FROM WASTE WATER PIPEWORK**

- 34 Investigate the improvement obtained by using isolated clamps to support waste water pipes from a supporting wall. Continuously running water and 'flushes' will be used as the source of structure-borne noise generated in the pipe. Angled bends will be installed near the top of the pipework run, above where it is fixed to the wall.
- 35 The pipework will be boxed in as advised in ADE 2003, (boarding of 15 kg/m<sup>2</sup> and 25mm of mineral wool lagging).
- 36 Measurements will be done varying the following factors:
  - a) Baseline measurement without boxing
  - b) With standard boxing
  - c) With standard boxing and isolation clamps
  - d) With additional boxing
  - e) With additional boxing and isolation clamps
  - f) Different pipe material (metal and plastic)
  - g) Different wall constructions (masonry and timber studwork)

## **KITCHEN APPLIANCES**

- 37 Construct timber joist separating floor in laboratory aperture. Measure airborne and impact sound insulation. Measure sound transmission with a loaded washing machine running through a spin cycle. Measure sound level versus spin speed. Repeat the test with the machine on a section of the floor framed and with additional joists and noggins to stiffen the floor. Measure the deflection under static load of the centre of the framed section as a measure of stiffness.

## **ISOLATION OF STRUCTURE-BORNE NOISE**

- 38 Investigate how much benefit there is from putting resilient layers in junctions whilst still fixing through them. The junctions are those between a studwork partition and masonry/concrete separating wall/floor constructions. Although the fixing will prevent 'proper' full isolation, it does allow a simple practicable measure that may be worth considering if there is some benefit.
- 39 Construct a timber framed 'internal' wall on a separating floor at right angles to a cavity masonry separating wall. Measure the transmission of impact sound generated in the wall down and across the separating wall. Investigate the effect of putting a resilient layer around the perimeter of the partition, at the junction of the partition with the separating wall and the separating floor.
- 40 Do similar tests using a door/frame built into the timber framed 'internal' wall, using the impact of the door being shut as the source. Repeat with resilient material fixed between the door-frame and partitions.

## Cost Estimate

41 The estimated costs (excluding VAT) for the programmes of work are:

- |    |                       |        |
|----|-----------------------|--------|
| a) | Kitchen worktop noise | - £15k |
| b) | Waste water pipework  | - £15k |
| c) | Washing machine       | - £7k  |
| d) | Structure borne noise | - £8k  |

# References

- <sup>1</sup> Robust Details Limited. Robust Details Part E – Resistance to the Passage of Sound



