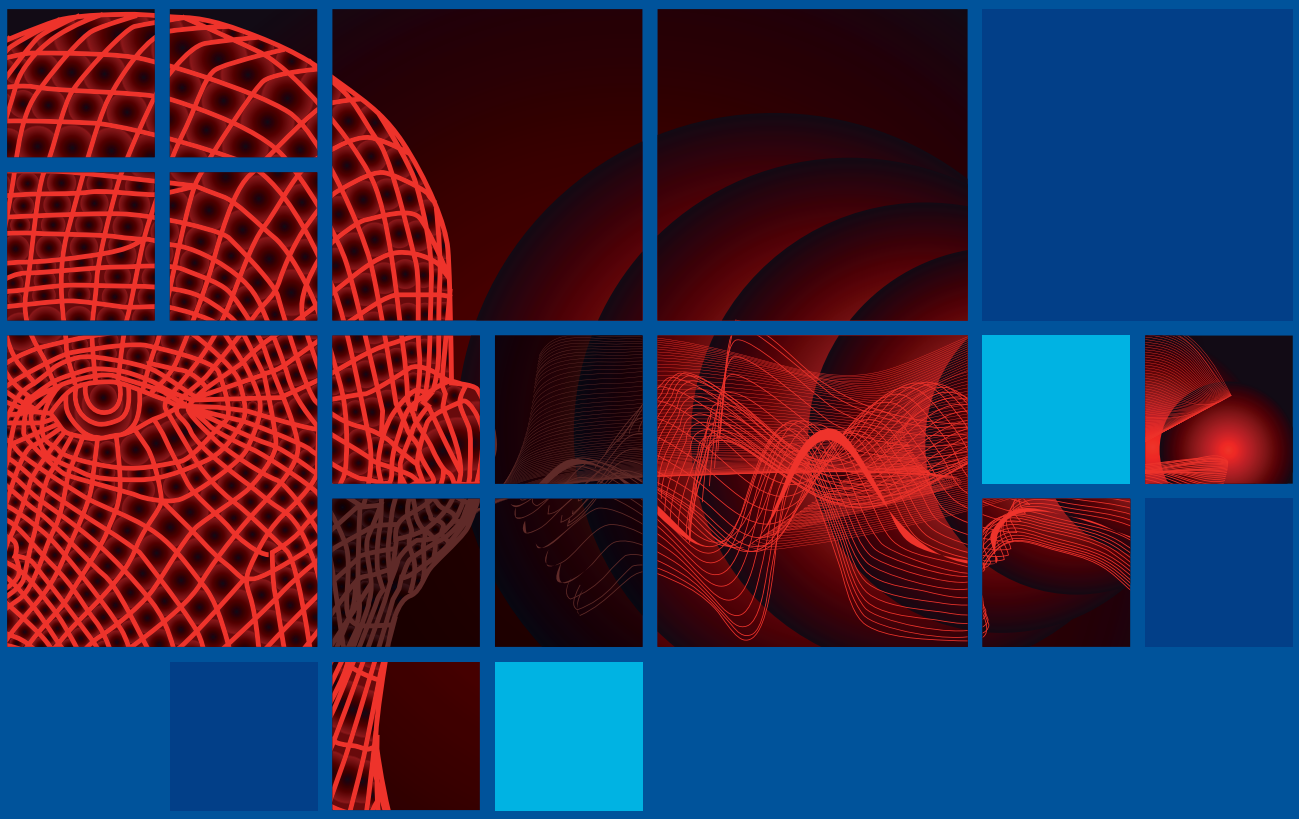
Sound progress

A review of homeowner feedback on noise in new homes



Primary research

NHBC Foundation
Housing research & guidance

F 56

NHBC Foundation
NHBC House
Davy Avenue
Knowlhill
Milton Keynes
MK5 8FP
Tel: 0844 633 1000
Email: info@nhbcfoundation.org
Web: www.nhbcfoundation.org


Follow us on Twitter @nhbcfoundation

Acknowledgments

This research was carried out by Peter Turner (NHBC).

The final report was prepared by Phil Rogers (NHBC) and Clive Turner (NHBC Foundation).

The NHBC Foundation is grateful to Dave Baker OBE, Chief Executive, Robust Details, for providing comments and insights in the development of this report.

NF 56
Published by IHS BRE Press on behalf of the NHBC Foundation
April 2014
ISBN 978-1-84806-373-0

Sound progress

A review of homeowner feedback on noise in new homes

Contents

The NHBC Foundation

The **NHBC Foundation**, established in 2006, provides high quality research and practical guidance to support the house-building industry as it addresses the challenges of delivering 21st century new homes. To date we have published over 50 reports on a wide variety of topics, including the sustainability agenda, homeowner issues and risk management.

The NHBC Foundation is also involved in a programme of positive engagement with the Government, academics and other key stakeholders, focusing on current and pressing issues relevant to house building.

To find out more about the NHBC Foundation, please visit **www.nhbcfoundation.org.** If you have feedback or suggestions for new areas of research, please contact **info@nhbcfoundation.org**.

NHBC is the standard-setting body and leading warranty and insurance provider for new homes in the UK, providing risk management services to the house-building and wider construction industry. All profits are reinvested in research and work to improve the construction standard of new homes for the benefit of homeowners. NHBC is independent of the Government and builders. To find out more about NHBC, please visit **www.nhbc.co.uk**.

Foreword

The 2003 edition of Approved Document E was launched against a backdrop of growing concern over noise transmission between adjoining homes. To address this problem, AD E 2003 introduced new performance targets for airborne and impact sound resistance for separating walls and floors. It also set out a requirement for pre-completion testing that would need to be applied to 10% of all new homes. In 2004 the Robust Details scheme became available as a Government-approved alternative to pre-completion testing. Developed with the support of the industry, Robust Details are a series of high-performance construction details that, if adopted, enable separating floors and walls to meet or exceed the AD E performance standard. Since 2004 the Robust Details scheme has been increasingly used by designers and house builders as part of their housing solutions. Compliance testing shows that Robust Details are effective in delivering the performance standards set down by AD E 2003 and this has generated confidence in their use.

For the wider industry, with its increasing focus on the consumer, the key question is whether the introduction of the AD E 2003 standards, supported by the Robust Details scheme, has delivered better-performing homes in practice. To examine this question NHBC and the NHBC Foundation, have investigated and reviewed the pattern of noise problems reported by occupiers of new homes registered with NHBC since 2004. The findings from that work, summarised in this report, are very encouraging. For transmitted noise we can see a picture of gradual improvement in performance for new attached homes, from 2004, coinciding with the adoption of AD E 2003 and the availability of Robust Details. While, in this case, the true cause and effect relationship between regulatory intervention and improved performance is complex, the good outcome observed does give reassurance that close collaboration between Government, industry and academia can be effective in addressing critical challenges.

Rod MacEachrane
NHBC Director (retired)

Introduction

Background

During the latter part of the 20th century, noise transmitted between homes was a growing concern for homeowners and social landlords, and the subject of complaints to local government environmental health officers. In extreme cases, there were health implications for occupants subjected to noise nuisance. By the 1990s the issue had gained a high profile and a political dimension.

While many of these noise problems were associated with apartments and conversions of existing buildings to multiple-residential occupancy, some new build houses were also failing to prevent sound transmission at intrusive levels. Despite progressive tightening of the acoustic performance requirements in successive versions of Building Regulations (England and Wales) Approved Document E (AD E) *Resistance to the passage of sound*[1], noise transmission between homes remained a persistent problem. In response, in 2002, the Government proposed that a system of pre-completion sound testing be introduced for some types of home as a means of complying with the soon to be published AD E 2003. During the subsequent period of consultation with the industry an alternative option to pre-completion testing, Robust Details, was proposed and rapidly developed. The use of Robust Details, originally a set of 13 construction details which met more stringent acoustic performance standards, was formally accepted by Government in mid-2004 as an alternative method of complying with AD E 2003.

The portfolio of Robust Details has been steadily expanded over the years and the number of house-building plots registered with the scheme has increased rapidly. By 2010 (the last build year assessed in this research) over 58,000 homes[2] per annum were being built with Robust Details – over 70% of all attached homes under construction at that time. With Robust Details, compliance levels to AD E exceeded 99.4% in 2010[2], giving a high degree of confidence in the approach itself, and reassurance to designers and house builders that future occupants should not be troubled by noise transmitted from adjoining homes.

Purpose and scope of this research

The main aim of this NHBC Foundation research was to uncover any trends in occupant feedback of noise problems following the introduction of AD E 2003, and to test if, in practice, occupants were benefiting from the technical improvements encouraged by its introduction. The study therefore focuses particularly on noise transmission through party walls and party floors of attached homes (the AD E E1 noise category) which the Robust Details scheme was set up to address.

For evidence, the study draws on the feedback provided by occupants of new homes between 2004 and 2010. Under the terms of the NHBC Buildmark warranty, builders are liable to put right any defect or damage in the first 2 years after completion of the home, and it is this 2-year period which this research relates to. Contacts from homeowners made to NHBC relating to noise have been analysed and classified according to the type of noise and its source.

Noise between dwellings is only one sub-set of noise problems that are recognised by occupants. Other noise problems reported to NHBC include those generated by the fabric and services of the home itself, and noise transmitted between rooms. Contacts from homeowners to NHBC relating to these other sources of noise have also been reviewed in this report, which is also widened to cover feedback on detached homes.

Methodology

This study involved the analysis and classification of contacts to NHBC made by homeowners raising concerns related to noise during the first 2 years after occupation. The study period was from 2004 (the first full year following the introduction of AD E 2003) to 2010 (the last year for which a full set of data was available). The feedback was from homes in England and Wales.

Homeowner contacts have been classified into the following noise categories:

- AD E E1 – airborne and impact noise transmitted from an adjoining home
- AD E E2 – airborne and impact noise transmitted within a home
- AD E E3 – reverberation of sound in communal areas of buildings
- Creaking floors
- Creaking stairs
- Water pipes and WCs
- Boilers and radiators
- Extract fans.

Some homeowner contacts were received on a few other miscellaneous issues, including noise from weather, vibration and doors. However, these occurred in extremely low numbers and for this reason have not been included in this report.

It is to be noted that the annual output of new homes across England and Wales varied considerably during the study period and the proportion of detached to attached homes also changed over time (Figure 1). For this reason homeowner contacts are expressed as a number per 1000 homes registered with NHBC.

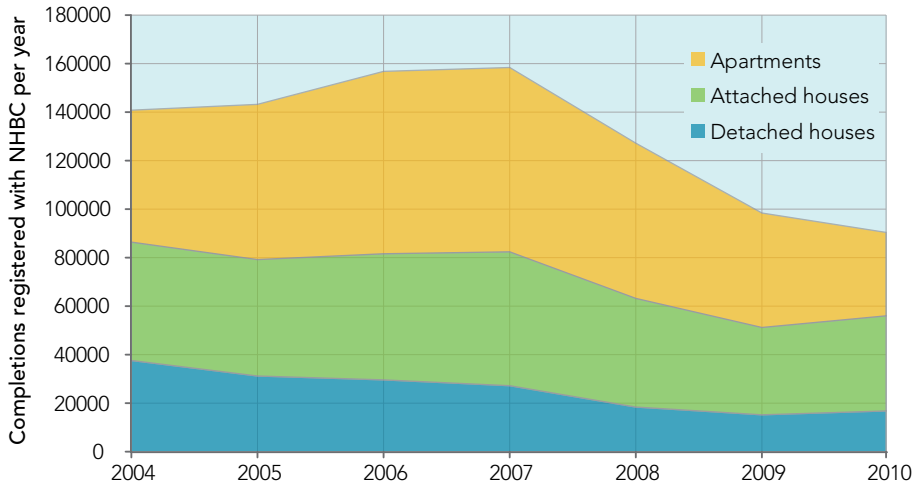


Figure 1 Numbers of new home completions registered with NHBC in England and Wales (2004 to 2010)

During the study, two categories of noise contacts predominated (E1 noise for attached homes and creaking floors for detached houses). These categories are given more detailed consideration in this report. For comparison, contacts on the secondary sources of noise are also included. These were recorded at very low levels, often well below a value of 1 contact for every 1000 homes. While each contact should be individually investigated, such low levels of concern would probably not indicate a systemic noise problem or signal the need for a change in regulation or good practice. Increasingly careful observation should be given as the level of concern for a particular noise problem rises above 1 in a 1000 homes, particularly if there are any indications of an upward trend.

Findings for attached homes

Results from this study indicate that for new attached homes (terraced and semi-detached houses and apartments) first occupied between 2004 and 2010, there has been a progressive decline in the noise-related homeowner contacts to NHBC (Figure 2). The majority of these contacts (Figure 3) are in the 'E1' category: noise transmission from adjoining homes.

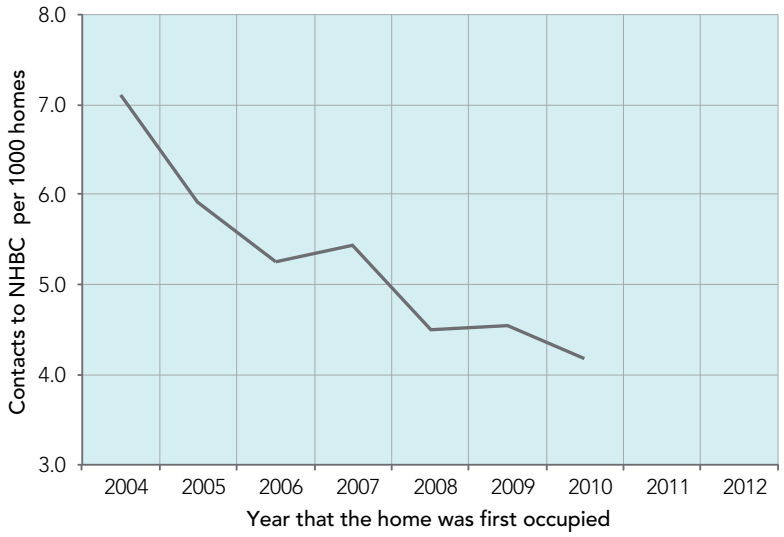


Figure 2 Attached homes. Homeowner contacts to NHBC for all noise categories (for homes first occupied between 2004 and 2010)

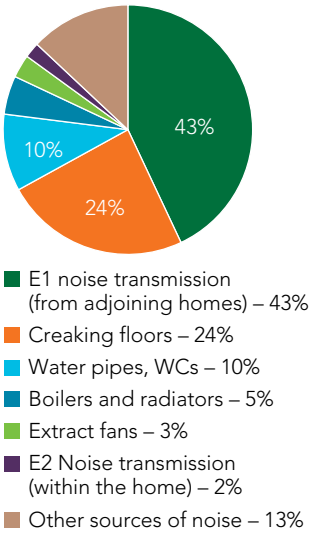


Figure 3 Attached homes. Distribution of main types of noise contacts to NHBC (for houses first occupied between 2005 and 2010)

The E1 noise category merits closer examination because minimising this noise problem for occupants was a priority for the revised guidance in AD E 2003 and for the Robust Details scheme introduced in 2004. From Figure 4 it can be seen that E1 noise contacts reduced significantly over the study period, and largely accounted for the overall reduction in noise contacts shown in Figure 2. Figure 5 shows the patterns of contacts related to other sources of noise. These were all at very low levels across the study period.

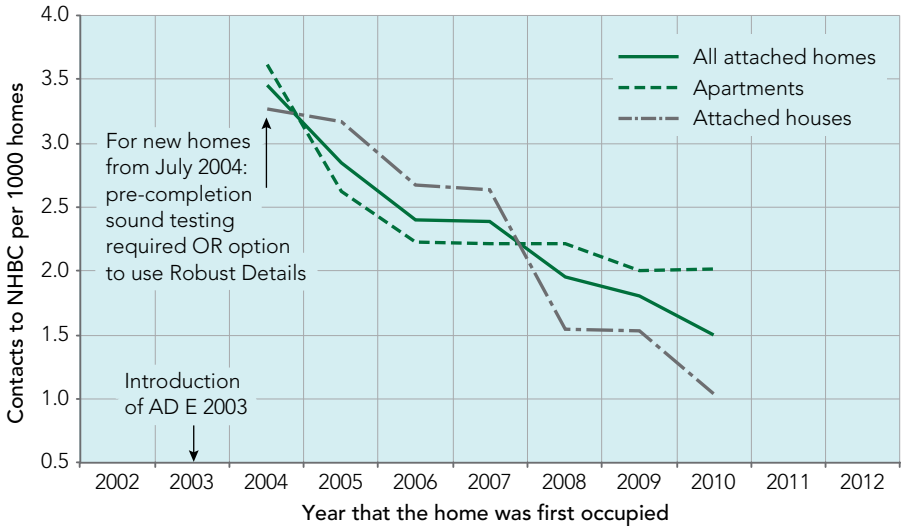


Figure 4 Attached homes. Homeowner contacts to NHBC on noise from adjoining properties – E1 noise (for homes first occupied between 2004 and 2010)

Main findings for attached homes first occupied between 2004 and 2010

- From 2004, attached homes built in successive years, generated progressively fewer homeowner contacts related to noise problems. For attached homes first occupied in 2004, about 7 households per 1000 contacted NHBC about a noise problem. For homes first occupied in 2010, the level was down to about 4 for every 1000 households.
- The reduction in homeowner contacts is found to be largely attributable to fewer concerns over transmission of noise from adjoining homes (the AD E E1 noise category). E1 contacts from 2010 homes (data from houses and apartments combined) were less than half those recorded for those first occupied in 2004 (Figure 4).
- For attached ***houses*** the ongoing downward trend in E1 contacts is particularly pronounced (Figure 4). For houses first occupied in 2010, only about 1 in a 1000 households registered an 'E1' concern.
- The start of the downward trend in E1 contacts coincides with new regulatory guidance in AD E 2003 and the associated launch of the Robust Details scheme in 2004. This improvement trend should be interpreted alongside the transitional arrangements for adoption of the regulatory requirements and guidance, which allows the previous AD to be used, provided plans were agreed before the introduction of the revised edition. In practice there can be a considerable lag, of some years, before all projects are finally aligned.
- For ***apartments***, the improvement trend with E1 contacts is less pronounced (Figure 4) perhaps reflecting the greater technical challenges associated with minimising sound transmission in this housing type. The contacts received suggest that a high proportion of the noise problems were associated with party floors, rather than party walls.
- After E1 noise, creaking floors were the next most common cause of homeowner contact across the period of investigation, but for this and other sources of noise (examples shown in Figure 5) the overall level of concerns registered by homeowners was very low.

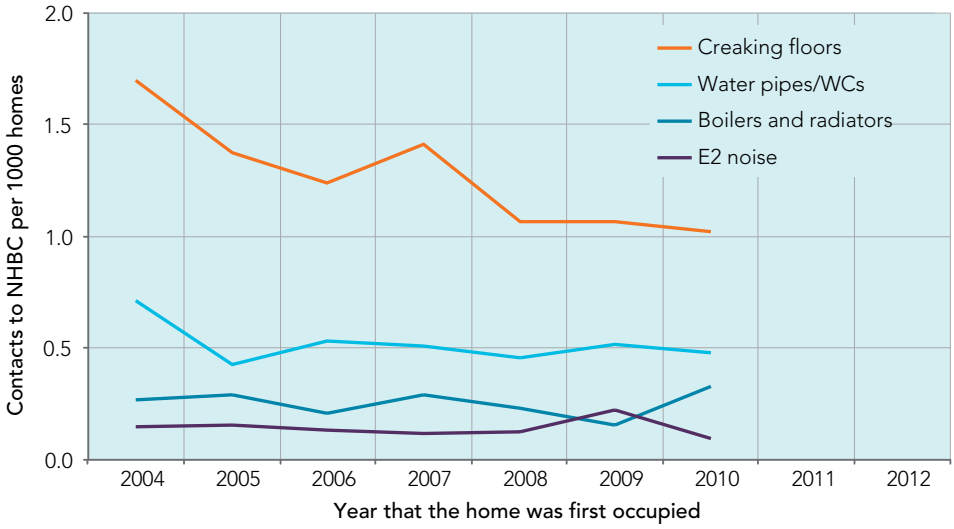


Figure 5 Attached homes. Homeowner contacts to NHBC on other noise categories (for homes first occupied from 2004 to 2010)

Findings for detached homes

Owners of detached homes were typically twice as likely to contact NHBC about noise, than those living in attached homes (Figure 6). Of the homeowner contacts received, the most common (48%) related to creaking floors (Figure 7). By definition none fall in the E1 noise category (noise transmission from adjoining homes).

In this study, contacts relating to creaking floors could be up to five times higher from owners of detached, compared to attached homes (Figure 8). Contacts relating to other sources of noise (Figure 9) were also more common from detached homeowners, typically at levels between 3 and 4 times those for attached homes.

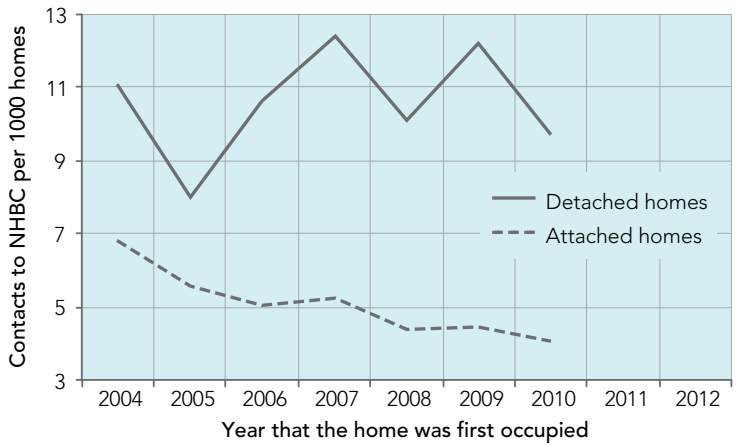


Figure 6 Detached homes. Homeowner contacts to NHBC on all noise categories (for homes first occupied between 2004 and 2010)

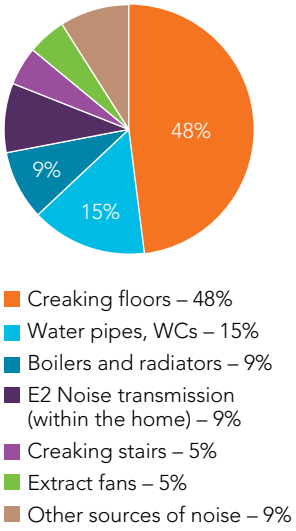


Figure 7 Detached homes. Distribution of main types of noise contacts to NHBC (for homes first occupied between 2005 and 2010)

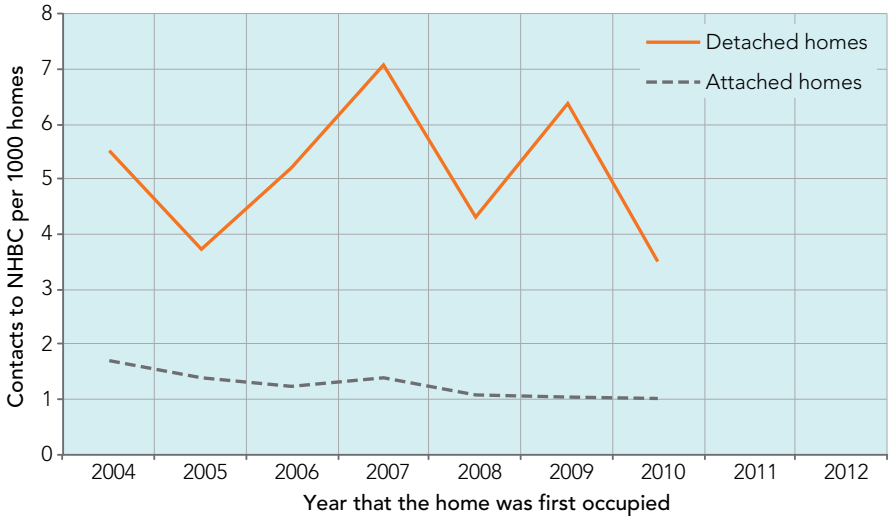


Figure 8 Detached homes. Homeowner contacts to NHBC on creaking floors (for homes first occupied between 2004 and 2010)

Main findings for detached homes first occupied between 2004 and 2010

- From 2004, owners of detached homes were much more likely to contact NHBC in relation to noise issues than those living in attached homes (Figure 6). The most recent data suggests that homeowners of detached homes were 58% more likely to raise a noise issue than owners of attached homes. During the period of this study, between 8 and 12 detached households per 1000 contacted NHBC about a noise problem.
- Overall contacts on noise from detached homes do not indicate an obvious trend (rise or fall) over time.
- For detached houses the most common contact related to creaking floors (Figure 7). On average about 1 in every 200 detached homes registered a concern about this type of noise though this figure varied considerably across the period of study (Figure 8). Significantly, people in detached homes were 3-5 times more likely to report creaking floors than people in attached homes.
- Contacts related to other noise types (Figure 9) were also noted to be at higher levels in detached homes, compared with attached homes, including:
  - Plumbing (pipes and WCs)
  - Boilers and radiators
  - Creaking stairs
  - E2 (Noise transmission within the home).

  For all these categories of noise, occupants of detached homes were 3 to 4 times more likely to make contact with NHBC than those living in attached homes.

  Contacts related to these noise categories showed no consistent trends across the timeframe of this study, though it is possible that in the more recent years, creaking from stairs is an emerging issue.

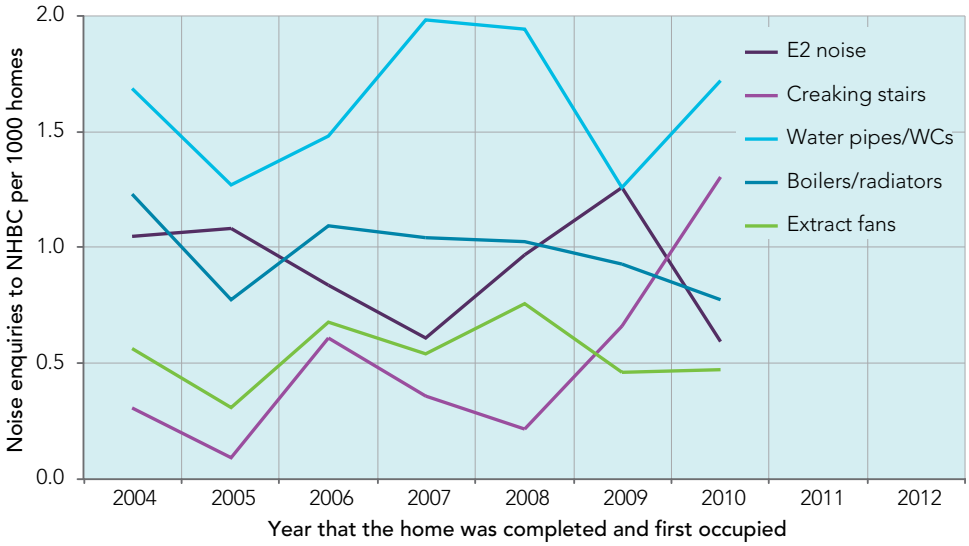


Figure 9 Detached homes. Homeowner contacts to NHBC on other sources of noise (for homes first occupied between 2004 and 2010)

Conclusions

Approved Document E 2003

The key ambition for AD E 2003 was to achieve a step change in the reduction of sound transmission between adjoining homes (Requirement E1) and sound transmission within homes (Requirement E2). Since they were introduced in 2004, Robust Details (see, for example, Figures 10 and 11) have been progressively adopted by house builders as an option for meeting AD E.

AD E E1

This report shows that since 2004, occupants of new-build attached homes are reporting fewer and fewer concerns over sound transmission from adjoining properties. The downward trend in E1 homeowner contacts is striking for attached houses, indicating that excellent progress has been made in achieving this principal policy objective of AD E 2003. For apartments, although good progress has been made, the reduction in homeowner contacts is less marked (particularly after 2006) than for attached houses. This is perhaps unsurprising, given that the additional E1 elements (floors and their junctions with adjoining flanking structures) represent a more complex and technically challenging set of acoustic issues.

AD E E2

Airborne and impact noise transmitted within a home (E2 noise) is only very rarely reported (less than 1 in 5000 homes) by occupiers of attached homes. Though occupiers of detached homes made contact more frequently about E2 noise, this is still a rare concern and seemingly adequately addressed by design and construction.

Figure 10 Minimising noise transmission (AD E E1) between new homes. The cavity sock provides fire protection and insulation against flanking sound transmission
Photograph courtesy Robust Details Ltd

Figure 11 Minimising noise transmission (AD E E1) between new homes. Separating wall and floor joist detailing to minimise sound transmission
Photograph courtesy Robust Details Ltd

AD E E3

With apartments, contacts for E3 noise issues (reverberation of sound in communal areas) are extremely rare, suggesting that current guidance and construction quality is satisfactory.

Other noise

As well as noise categories covered by AD E, there are three other notable sources of noise that appear significant to homeowners. For **creaking floors** (overall representing 34% of all noise contacts) site investigations tend to show that floor decking was not adequately fixed down and, once remedied, homeowners no longer experienced problems. For **water pipes and WCs**, noise problems were typically associated with lack of allowance for expansion or contraction movement, and contact with rigid brackets and linings: issues that would be eliminated by following existing good practice. For the third most common problem, noise from **boilers and radiators**, this could largely be eliminated by adjustments to the heating system.

These three noise sources accounted for the majority of contacts (as high as 72% in detached homes) and a key observation is that many would be avoidable by taking additional care on site and following accepted good practice.

References

1 Approved Document E 2003 (amended). Resistance to the passage of sound. Available from the Department for Communities and Local Government Planning Portal: www.planningportal.gov.uk/buildingregulations/approveddocuments.

2 Robust Details Annual Review 2010. Keeping sound where it belongs. Downloadable from: www.robustdetails.com/Support/Downloads.

NHBC Foundation recent publications

Cellulose Based Building Materials – Use, performance and risk

Interest and awareness about the embodied energy associated with the production, use and disposal of construction materials remains topical, resulting in traditional cellulose-based building materials such as thatch, cob, hemp and lime, or straw bales being re-examined as potential low impact building materials, products and systems.

This report provides a brief history of cellulose-based building materials, and reviews the current developments in their use. It looks at the use and performance of such materials, examining the potential benefits and associated risks – informing the debate and resulting in a better understanding about the use of low impact building materials. In addition, the report also provides examples of recent projects built in the UK. ***NF 55*** November 2013

Review of co-heating test methodologies

The co-heating test has been developed to assess the amount of heat that leaks through the thermal envelope of a building – the ground floor, walls, roofs and windows, etc. It is currently the only test available for assessing whole buildings and providing a measure of as-built performance. This report shows results from a programme of work designed to evaluate the reproducibility of the co-heating test. Tests were carried out on a single house by the seven separate test organisations which partnered on this project. Results varied considerably, suggesting that more work was needed to ensure that the test was an accurate predictor of as-build performance. The work considered some effects which may be contributing to the variation in test result and how these might be controlled. ***NF 54*** November 2013

Low- and zero-carbon technologies in new homes

Building on earlier research, this study by Reading University explores how occupants use the low carbon energy technologies incorporated in their homes. The work shows that occupants generally have a poor understanding of these technologies and, through poor or incorrect operation, may not be fully benefiting from them. It examines in particular the key role that sales staff could play in inspiring occupants in the effective use of these technologies. The report provides a detailed insight into the day-to-day marketing and use of homes with LZC technologies and includes an improvement cycle, which can inform marketing strategy. The work has significance in the run up to 2016, helping to address a potentially crucial aspect of underperformance-in-use of low carbon homes. ***NF 53*** August 2013

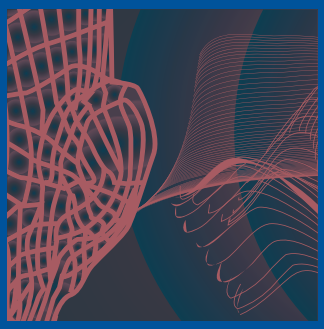
To see NHBC projects currently underway and likely publication dates, please visit **www.nhbcfoundation.org** and view the Research tab.

NHBC FOUNDATION
Housing research & guidance

Sound progress

A review of homeowner feedback on noise in new homes

In the 1990s noise transmission was a major cause of dissatisfaction for occupiers of attached homes. To address this problem, sound insulation standards were tightened in the 2003 edition of Approved Document E (AD E) and in 2004 the Robust Details scheme became available as a compliance route for designers and house builders. To understand the impact of these measures on the ground, this NHBC Foundation report examines feedback on noise from occupants of new homes built since 2004. For attached homes the work identifies an encouraging downward trend in the number of concerns on transmitted sound, suggesting that AD E and supporting guidance has progressively improved performance for the benefit of house buyers.



The NHBC Foundation, established in 2006, provides high quality research and practical guidance to support the house-building industry as it addresses the challenges of delivering 21st century new homes. To date the NHBC Foundation has published over 50 reports on a wide variety of topics, including the sustainability agenda, homeowner issues and risk management. Visit **www.nhbcfoundation.org** to find out more about the NHBC Foundation research programme.

NHBC FOUNDATION
Housing research & guidance

F 56

Published by IHS BRE Press on behalf of the NHBC Foundation
ISBN 978-1-84806-373-0