Development and Performance Monitoring of Sound Insulation using Robust Details Approach

Could during-construction inspection for thermal & energy apply an RD approach?

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Overview

• How did the RD approach work from the start?
  – What was the catalyst or drivers for change?

• Key ingredients of the RD system
  – Entry Assessment: Entry to RD Design Handbook
  – Registration and Monitoring “CIRCULAR” pathway
  – Types of Details & Build Information
  – The Journey
  – Monitoring & Inspection - Traffic Light System

• Standards Committee processes
• Updating handbook and notifications
• IMPACT of using RD approach for sound insulation
What was the catalyst for change?

BEFORE 2001

**SOUND INSULATION Compliance rates (pass rates)**

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
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<tbody>
<tr>
<td>Walls</td>
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<tr>
<td>Floors</td>
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**Attached Houses and Apartments - Before 2001**

- High levels of noise complaints
- Lack of standardised process
- Construction monitoring for sound insulation very low
- Fail Rates: Walls (40%) Floors (60%)
<table>
<thead>
<tr>
<th>Government:</th>
<th>House Building Industry:</th>
<th>Edinburgh Napier University:</th>
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<tbody>
<tr>
<td>Wanted to improve sound insulation standards &amp; performance</td>
<td>Keen to improve AND wanted no materials industry to be unfairly treated – AIM: standardised approach across industry</td>
<td>Had UK’s largest design database for site sound insulation (real buildings) + knowledge of best performing walls &amp; floors</td>
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<tr>
<td>Site sound insulation testing was going to be mandatory to check workmanship &amp; build</td>
<td>Not enough site testers &amp; wanted to avoid housing completion delays and reduce proportion of testing</td>
<td>Had knowledge of robustness required and changes needed to design &amp; build via sample testing</td>
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<td>Wanted to track influence of new regulations &amp; monitor industry</td>
<td>Preferred to build better than minimum regulations (de-risk) and have a design handbook which supported generic and innovative designs</td>
<td>Could design the NEW RD Handbook &amp; provide coding system to track each construction (both generic and innovative)</td>
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Getting started

- Compulsory sound testing on sites forced Housebuilders to ask “is there a better way” to ensure we build correctly from the start.

- If we build better than the regulations….and repeatedly meet the targets… “do we need as much testing?”

- Target aim of RSD = improve performance, workmanship and repeatability (each site) & reproducibility (different sites)

- Industry asked Government – “can we try a Robust Detail approach?”

- Government gave industry 12 months to provide data on such a route! (July 2002)

Robust Standard Details project started

.....

.....Deadline June 2003!!

- Industry invested £1 million R&D
- 5 Working groups formed
- 119 committee members representing housebuilding supply and product supply chain
- Napier project managed and designed first set of details
- Each construction “Type” to be tested 30 times (max 8 per site)
- 9 months to complete project

Stakeholders
- Multi stakeholder engagement
- Industry, Warranty, Insurance, Building Control Authorities and Government

**Deadline by Month 3:**
- All trial sites identified
- Napier team could instruct all changes required to acoustic build process
- Industry provided 72 live construction sites
- 1,400 new homes developed put forward
- 15 acoustic companies subcontracted to assess sites
- Some double visited “2nd different tester”
- Min 3 different testers per Robust Detail “Type”

RSD Sites
- Steel
- Timber
- Block
Key RD system ingredients

- Standardised robust construction details
- Target enhanced designs +5dB better than regulations
- Whole industry approach (raising skills, designs and knowledge)
- Registrations of wall and floors to be built on site
- Key junction details explained
- Checklists – which are functional!
- RD Site Inspectors - Traffic light system
- Liaison to local building control authorities
- Updating of handbook (allowing generic and proprietary named product solutions)
Standardised constructions: pre-assessed

3 stage process for entry to handbook

**STAGE A**
8 tests + robustness assessment

**STAGE B**
22* tests + robustness assessment

**STAGE C**
Publication in Handbook

*A reduced number of stage B test sets would be required for new flanking conditions to existing robust details, and might also be acceptable in the case of some new components of existing robust details*
Registration and tracking: National database

- Plot Registration
  - Performance Monitoring
    - Undertaken by 30 RD Inspectors. Site inspection and sample testing data is reviewed by the RD Standards Committee – meets every 3 months.

- Publication in Handbook
  - Y
  - Assessments
    - N
    - Withdraw or Amend design (possibly)

- Approval?
  - Y
  - Applications for new robust details
    - Stages A, B and C
Construction technologies for tomorrow’s communities

Key junction details

RD Design Handbook (EXAMPLE)

Separating Floor – Timber I-Joists

E-FT-1

- Timber I-Joists
- Use with timber frame walls only

Floating floor
- See section 6 for suitable floating floor treatment

Floor decking
- 15mm thick (min)

Joists
- 240mm (min) timber

Absorbent material

Ceiling treatment CT1
- Two layers of gypsum-based board of 19mm (nominal 13.5 kg/m²) fixed screws, and 12.5mm (nominal 8 kg with 42 mm screws

Ceiling treatment CT2
- Two layers of gypsum-based board of 15mm (nominal 12.5 kg/m²) fixed screws and second layer of 15mm based board (nominal 12.5 kg/m²) fixed 42mm screws

CEILING BOARD FIXINGS MUST PENETRATE OR TOUCH JOISTS

- 16mm (min) metal resilient ceiling b at right angles to the joists at 400mm (bars must achieve a minimum lab performance of nd, Rw=Ctr=17dB + nd, Lw=16dB) – see Appendix E

Checklist (to be completed by site manager/supervisor)

<table>
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<tr>
<th>Ref. Item</th>
<th>Site manager/ supervisor</th>
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<tbody>
<tr>
<td>1.</td>
<td>Are timber I-Joists at least 240mm deep?</td>
</tr>
<tr>
<td>2.</td>
<td>Has quilt (min 100mm thick) been fitted between the joints?</td>
</tr>
<tr>
<td>3.</td>
<td>Are resilient ceiling bars fitted at right angles to the joints?</td>
</tr>
<tr>
<td>4.</td>
<td>Has ceiling system been fitted in accordance with the manufacturer’s instructions?</td>
</tr>
<tr>
<td>5.</td>
<td>Has floating floor treatment been fitted in accordance with the manufacturer’s instructions?</td>
</tr>
<tr>
<td>6.</td>
<td>Has quilt been fitted between the floor battens?</td>
</tr>
<tr>
<td>7.</td>
<td>Is ceiling treatment CT1 or CT2 fixed to the resilient bars with correct screws?</td>
</tr>
<tr>
<td>8.</td>
<td>Are all joints sealed with tape or caulked with sealant?</td>
</tr>
<tr>
<td>9.</td>
<td>Are vertical service pipes wrapped in quilt and boxed in with two layers of gypsum-based board combined nominal mass per unit area of 16 kg/m²?</td>
</tr>
<tr>
<td>10.</td>
<td>Have all resilient flanking strips been fitted?</td>
</tr>
<tr>
<td>11.</td>
<td>Is separating floor satisfactorily complete?</td>
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</tbody>
</table>

Notes (include details of any corrective action)

Site manager/ supervisor signature: ______________________________
## Using Robust Details

### The Journey

<table>
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<tr>
<th><strong>THE BUILDER</strong></th>
<th><strong>Robust Details Ltd (RDL)</strong></th>
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<tbody>
<tr>
<td><strong>Step 1</strong> – Select the RD from the handbook for the design of the building</td>
<td><strong>Step 1</strong> – RDL places you in the national database</td>
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<tr>
<td><strong>Step 2</strong> – Register the site with RDL (stating RDs you are using)</td>
<td><strong>Step 2</strong> – RDL issues every 3 months to local area RD inspectors the list of construction sites and RDs being registered</td>
</tr>
<tr>
<td><strong>Step 3</strong> – Provide your RD registration document to the local authority building control dept (before you build)</td>
<td><strong>Step 3</strong> – RD Inspectors may visit site (no warning) to visually check and sample test registered homes</td>
</tr>
<tr>
<td><strong>Step 4</strong> – Build in accordance with the RD Designs</td>
<td><strong>Step 4</strong> – RD Inspectors submit site inspection and test reports data to RD Standards Committee</td>
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The Robust Detail Inspectorate

- 30 RD Acoustic Inspectors
- Regionally located
- Inspect without prior notice
- “As built under the microscope”

RD Population - sampling requirements
Samples 1% visual inspection
Samples 2% site sound testing

2006-2016 (National RD Database)
- Visual Inspections 6,570
- Sample site tests 17,468
Traffic Light System – used by RD Inspectors

1. **Green** – ALL OK – built in accordance with RD

2. **Amber** – Deviations – builder has 28 days to correct

3. **RED** – Major deviations found or builder not corrected – local authority is informed – site or Homes registered no longer are RD compliant - so compulsory testing must now be done to check if homes meet building regulations

- Typically 8-10% may be amber
- Less than 1-2% are red
- *RD Inspector completes a standardised Report for each visit*
- *This helps with data capture*
- *Visits by RD Inspectors during build stage have been very powerful for knowledge transfer, educating site personnel and improving build*
England, Wales, Scotland – Robust Details

1. Stronger emphasis on what is to be built! Do it correctly.

2. Site pays £33 registration fee per home.

3. Register and build in accordance with construction specifications

4. Site manager **MUST** give access to RD Inspector

**BENEFITS & IMPACTS of RD approach so far:**
- 4 fold **decrease** in noise complaints
- 12-17,000 car journeys removed each year (versus only mandatory testing)
- Significant upskilling of sector has been enhanced
- Current noise complaints less than 0.01%
- Ratio of 1 in 5,000 homes to 1:10,000 homes
IMPACT of using RD approach for sound insulation

✍️ By 2017 over 1 million homes built using robust details

✍️ Regulation compliance rates went from:
- 40% floors and 60% walls (before Robust Details)
- ....to **97% within 3 years (with Robust Details)**
- Now at 99% (2016)

✍️ Winner in 2009 of the Queens Anniversary Prize for positive impact to **innovation, sustainable housing and quality of life**

✍️ First RD Design Handbook had 13 walls and floors

✍️ Now (2016) has over **60 walls and floor construction** systems

✍️ Allowing over **500 combinations of walls/floors for apartments**

✍️ RD Handbook now in **4th Edition** – free to download

RD Standards Committee……..continues

Has Acoustic Experts and representatives from Housebuilders, Warranty, Insurance, Building Control (government members can attend to monitor)

- **Meets every 3 months** to review New RD construction applications for entry to Handbook
- Reviews **quarterly reports** from RD Inspectors
- Has the ability to **amend and increase the robustness** of a RD construction
- Has the ability to **withdraw an RD** if not performing well
- **Encourages innovation** and provides route to market for new construction systems
- **Tracks trends via national database** of activities, construction methods, performance, data mining, trends,
- Can increase % of Testing or Inspection for specific robust details if concerned about any aspect
Useful links

About the RSD project “Development of Robust Details”


RD Website

www.robustdetails.com

Many research papers and analysis has been developed using RD database

Recent journal paper below (example):

https://www.researchgate.net/publication/308296175_Translation_between_existing_and_proposed_harmonized_airborne_sound_insulation_descriptors_A_statistical_approach_based_on_in-situ_measurements
Questions?

End of Presentation
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