A Presentation to the IBCI Building Control Conference, 2016

Sound and the Building Regulations
BUILDING REGULATIONS 2014

From Part E of the Second Schedule to the Building Regulations (1997 to 2014):

“E1 Each wall and floor separating a dwelling from –
(a) another dwelling or dwellings,
(b) other parts of the same building,
(c) adjoining buildings,
shall be designed and constructed in such a way so as to provide reasonable resistance to sound.

E2 The common internal part of a building which provides direct access to a dwelling shall be design and constructed so as to limit reverberation in the common part to a reasonable level.”
Application of Part E

• Amended Part E was published in December 2014.
• “Guidance set out in TGD E Sound (2014) applies to works, or buildings in which a material change of use takes place, where the works or the change of use commence or takes place, as the case may be on or after 1 July 2015.”
• Design assessment and testing in accordance with the new Regulations is already under way.
“In general for dwellings, the performance required by Regulation E1 should be satisfied by achieving the sound insulation performance levels as specified in Table 1…”

NEW GUIDANCE
Acceptable Constructions

• **Section 3:** Separating walls and associated flanking construction details
• **Section 4:** Separating floors and associated flanking construction details

Where the relevant walls and floors are designed and constructed using acceptable constructions, and performance is demonstrated through testing, this will indicate *prima facie* compliance with Regulation E1.
Example

3.4 Wall Type 2 (WT2) - Solid masonry with dry lining

3.4.1 General

3.4.1.1 The resistance to airborne sound depends mainly on the mass of the core mass (dense block), the absorption of the mineral wool and the isolation (de-coupling) of the dry lining.

3.4.2 Wall specification

3.4.2.1 Wall Type 2 construction (with different lining options) is described in Diagram 8.

3.4.3 Key junctions and flanking details

3.4.3.1 Details of key junctions in the construction of WT2 and details to limit flanking transmission are described in Diagrams 9 to 11.

Diagram 8: WT2 Solid masonry with dry lining – Specification

Specification

The minimum mass of the wall (including linings) should be 150 kg/m². Use blocks that are laid full wall width (i.e. 215 mm wide blocks laid on flat using single course stretcher bond only (no double coursing).

Wall lining options

The block wall faces should be lined with a mineral wool quilt of:

- 13 mm mineral wool roll with a density of 30 kg/m³, or
- 25 mm mineral wool quilt with a density of 15 kg/m³.

The wall linings should consist of a gypsum plasterboard with a mass per unit area of 10 kg/m². Fixed to:

- 45 mm x 45 mm timber battens spaced at 400 mm centres (max), or
- 45 mm (min) wide metal frame spaced at 400 mm centres (max) and secured to wall by brackets.

Example

215 mm solid dense block laid on flat (density 1800 kg/m³)
112.5 mm coursing (single course stretch bond)
25 mm mineral wool quilt (min. density 10 kg/m³) both sides
45 mm x 45 mm timber battens at 400 mm centres both sides
secured to wall through wall - such that the quilt is compressed and isolates timber batten from core wall

<table>
<thead>
<tr>
<th>Key Points to Watch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. DO NOT use double coursing only.</td>
</tr>
<tr>
<td>2. Fill all the joints between the blocks with mortar.</td>
</tr>
<tr>
<td>3. Ensure there is a good seal between the flanking wall and the separating wall with full contact.</td>
</tr>
<tr>
<td>4. Ensure the separating wall linings are taken up to the external face of the flanging wall.</td>
</tr>
<tr>
<td>5. Do NOT chase the masonry wall for sockets, so the reclaimed voids may be used for the purposes.</td>
</tr>
<tr>
<td>6. Liming to the flanking wall (inner leaf) may be a paper base or insulating cement (paper base bond or self).</td>
</tr>
</tbody>
</table>

Materials:

- Thermal insulation omitted for clarity.
- Cavity stops are specified for the purposes of minimising flanking sound transmission along the cavity. Cavity stops may also be required to act as a cavity barrier for the purposes of compliance with Part B - Fire Safety, see 11.6.3.
Wall Type 1 - Solid masonry/concrete with plaster finish
Wall Type 2 - Solid masonry with dry lining
Wall Type 3 - Cavity masonry wall with plaster finish

Dense aggregate concrete block

13 mm (min) plaster (each room face)

75 mm (min)
Wall Type 4 - Timber framed wall with absorbent material
Floor Type 1 - Resilient material bonded to concrete

- Includes a suspended ceiling below the concrete base.
Floor Type 2 - Floating layer on concrete base

• Includes a suspended ceiling below the concrete base.
Floor Type 3 - Floating layer on timber base

- Includes a suspended ceiling below the timber base.
Testing

• Mandatory pre-completion testing by a competent person.
• Tests to be performed on a representative sample of dwellings, total number dictated by the total number of units and the construction type.
• “Other” construction types require more tests, unless they are Assessed Sound Details.
“Sets of Tests”

• Each “set of tests” comprises a given number airborne and, in the case of floors, impact tests.

• In houses, bungalows: 2 no. airborne tests on walls.

• In apartments, duplexes: 2 no. airborne tests on walls, 2 no. airborne tests on floors, 2 no. impact tests on floors.
## Frequency of Testing

### TGD Constructions

<table>
<thead>
<tr>
<th>Table 3A</th>
<th>Minimum frequency of testing per group or sub-group type (Par. 2.2.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of attached dwellings</td>
<td>‘Sets of tests’ required</td>
</tr>
<tr>
<td>4 or less</td>
<td>At least 1</td>
</tr>
<tr>
<td>Greater than 4 but less than or equal to 20</td>
<td>At least 2</td>
</tr>
<tr>
<td>Greater than 20 but less than or equal to 40</td>
<td>At least 2 + 10% x No. of attached dwellings greater than 20</td>
</tr>
<tr>
<td>Greater than 40 but less than or equal to 100</td>
<td>At least 4 + 5% x No. of attached dwellings greater than 40</td>
</tr>
<tr>
<td>More than 100</td>
<td>At least 7 + 5% x No. of attached dwellings greater than 100</td>
</tr>
</tbody>
</table>

### Other Constructions

<table>
<thead>
<tr>
<th>Table 3B</th>
<th>Other constructions - minimum frequency of testing per group or sub-group type (Par. 2.4.1.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of attached dwellings</td>
<td>‘Sets of tests’ required</td>
</tr>
<tr>
<td>Up to 8</td>
<td>At least 1 for each sep. element (up to 4)</td>
</tr>
<tr>
<td>Greater than 8 but less than or equal to 20</td>
<td>At least 6</td>
</tr>
<tr>
<td>Greater than 20 but less than or equal to 40</td>
<td>At least 6 + 10% x No. of attached dwellings greater than 20</td>
</tr>
<tr>
<td>Greater than 40 but less than or equal to 100</td>
<td>At least 8 + 5% x No. of attached dwellings greater than 40</td>
</tr>
<tr>
<td>More than 100</td>
<td>At least 11 + 5% x No. of attached dwellings greater than 100</td>
</tr>
</tbody>
</table>
Assessed Sound Details (ASD’s)

- An assessment/certification process for constructions not listed in TGD E.
- Calls for 30 no. individual *in-situ* tests, maximum 16 no. per site, conducted by at least two different test bodies.
- Competency of tester stressed again.
- Report to be assessed by an independent approved body, e.g. NSAI.
- **Advantage:** reduced testing frequency per Table 3A.
Procedure for Testing and Reporting

• “Sound insulation testing should be conducted by a competent person…”

• Testing to be conducted in accordance with I.S. EN ISO 16283-1, 3382-2 & 140-7, and rated per the I.S. EN ISO 717 series.

• Restrict tests to living rooms and bedrooms, where possible (use kitchens and dining room only where necessary).

• Rooms should have a volume of at least 25m³.
Procedure for Testing and Reporting (cont.)

- Test in completed but unfurnished rooms.
- Doors and windows should be closed.
- Fitted units, cupboards etc. should be open and empty.
- Place the sound source in the larger room in a pair.
- Up to two individual tests may be conducted on any given separating wall or floor.
Testing - Demonstration

Sound insulation tests are performed between adjacent rooms in order to establish the sound insulation performance of the separating construction.

There are three key components to each test:
• Generation and measurement of source level;
• Measurement of receiver level; and
• Reverberation time measurement.
Testing - Instrumentation

The following are required:

- Sound level meter & calibrator;
- Sound source;
- Amplifier;
- Transmitter; and
- Tapping machine (impact tests only).
Testing - Airborne

Outline test procedure:
1. Place the sound source in the larger room;
2. Measure the source noise level;
3. Measure the receiver noise level;
4. Measure the background noise level in the room;
5. Move the sound source and repeat steps 2/3/4; and
6. Measure the reverberation time in the receiving room.
Testing - Impact

Outline test procedure:
1. Place the tapping machine on the floor to be tested;
2. Measure the receiver noise level;
3. Repeat steps 1/2 three times;
4. Measure the background noise level in the room; and
5. Measure the reverberation time in the receiving room.
SOUND INSULATION TEST
COVER SHEET

CLIENT:
PROJECT:
CONTRACT NO:
SITRI SITE REF:

SITE ADDRESS:

DATE:
TIME:

ENGINEER(S):

TEST TYPES:
- Airborne (Wall)
- Airborne (Floor)
- Impact

SI KIT:
- Kit A
- Kit B
- Kit C

CHANGES TO STANDARD KIT:

CALIBRATOR:
- Type
- S/N
- In Calibration? Yes □ No □

FIELD CALIBRATION:
- Date
- Before
- After
- Time
- Drift
- Accepted? Yes □ No □

DATA FILE PATH:

CHECK LISTS:
- Airborne Tests
  - SLM □ Amplifier □ Cables □ Transmitter □
  - Speaker □ Tripod □ Calibrator □
- Impact Tests
  - SLM □ Tapping Machine □ Power Source □
  - Calibration Pegs □ Hardwood Base □
- Other Items
  - Extension Cable □ Safety Signs □ Spare Batteries □
  - PPE □ Site Drawings □ Transformer □
  - Measuring Tape/Laser □ Standards □

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SOUND INSULATION TEST
PROCEDURE NOTES

Airborne Sound Insulation Measurements

Sound Source:
- Erect warning signs.
- Check all drivers operational.
- Place in larger room.
- Minimum of two sound source positions.
- If rooms staggered and source room >50m², both positions should be in the part of the source room closest to the common partition.
- Each position should be:
  - At least 1.4m apart on separate room planes at least 0.7m apart;
  - At least 1m from the partition under test;
  - At least 0.5m from any other room boundary.
- No more than 6dB decay from 1m in front of sound source to 0.5m in front of common partition, otherwise move source closer.
- The measured Lₘ spectrum should satisfy the “8dB rule” or take corrective action.

Measurements (Source & Receiver):
- 5 mic positions with 6s measurement at each per source location (both L₁ & L₂).
- If the room >50m², increase to 10 mic positions with 6s measurement at each.
- Each position should be:
  - At least 0.7m apart on different room planes;
  - At least 0.5m from any room boundary; and
  - At least 1m from the sound source.
- In receiving room, exclude those parts where the sound pressure level is 6dB or more below the level in the part of the room closest to the common partition.

Background:
- 5 mic positions with 6s measurement at each after each L₂ measurement.
- Background noise levels should be at least 6dB (preferably more than 10dB) below the measured level in each band.

Impact Sound Insulation Measurements
- Tapping machine: check drop height and level on flat surface.
- If carpeted floors, remove carpet if possible.
- If required place hardboard on carpet and test (note this procedure if performed).
- If floor finishes are different, divide tests into subgroups.
- Minimum of 4 tapping machine positions, each at 45° to supports.
- 2 mic positions with 6s measurement at each per tapping machine position.
- 0.7m between measurement positions and at least 0.5m from room boundaries.
- Measure background as above after all receiver measurements complete.

Reverberation Time Measurements
- Minimum of 2 loudspeaker locations in room corners, at least 2m apart.
- 3 measurement positions per loudspeaker location with 1 decay at each position (i.e. 6 decays in total).
- Measurement positions at least 2m apart and at least 1m from any room boundary.

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# Sound Insulation Test Record Sheet

**Contract No:**

**Site Site Ref:**

**Page:**

**Measurement Procedure:**
- I.S. EN ISO 16283 – 1 2014
- I.S. EN ISO 140 – 7 1998
- I.S. EN ISO 3382 – 2 2008
- Other (details below)

### Source Room
- **Name:**
- **Length (m):**
- **Width (m):**
- **Height (m):**
- **Volume (m³):**

### Receiver Room
- **Name:**
- **Length (m):**
- **Width (m):**
- **Height (m):**
- **Volume (m³):**

### Airborne (Wall)
- **File Name:**
- **Result:**
  - L₁ Source Spectrum Check (“8dB Rule”)?
  - Yes □ No □
  - L₁ Background Level 10dB Below?
  - Yes □ No □
  - No. of L₁ No. of L₂ No. of B₁ No. of T₁

### Airborne (Floor)
- **File Name:**
- **Result:**
  - L₁ Source Spectrum Check (“8dB Rule”)?
  - Yes □ No □
  - L₁ Background Level 10dB Below?
  - Yes □ No □
  - No. of L₁ No. of L₂ No. of B₁ No. of T₁

### Impact (Floor)
- **File Name:**
- **Result:**
  - L₂ Background Level 10dB Below?
  - Yes □ No □
  - No. of L₂ No. of B₂ No. of T₂

### Notes
- Notes:

### Sketch
- Sketch:

### Calibration Check
- **Time:**
- **Drift:**
  - (discard if > 0.5dB)
Testing - Analysis

• May be performed by the sound level meter itself (can be unreliable).
• Can undertake post-measurement analysis on a pc using proprietary software.
• Alternatively, use bespoke spreadsheets (probably the most robust approach).
**Standardized level difference according to I.S. EN ISO 16283-1**

Field measurements of airborne sound insulation between rooms in accordance with TGD E in Ireland

**Client:** SITUN

**Source Room:** Large Office

**Receive Room:** Small Office

**Description:** Party wall between offices at AWN

**Construction:** 215mm masonry laid on flat

<table>
<thead>
<tr>
<th>Frequency [Hz]</th>
<th>1/3 octave [dB]</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>32.5</td>
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<tr>
<td>63</td>
<td>36.5</td>
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<td>80</td>
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<td>47.6</td>
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<td>500</td>
<td>50.4</td>
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<td>630</td>
<td>51.4</td>
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<tr>
<td>800</td>
<td>50.2</td>
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<tr>
<td>1000</td>
<td>47.0</td>
</tr>
<tr>
<td>1250</td>
<td>48.9</td>
</tr>
<tr>
<td>1600</td>
<td>50.6</td>
</tr>
</tbody>
</table>

**Source Room Volume:** 172 m³

**Receive Room Volume:** 69 m³

**Common Area:** 16 m²

**Diagram:**
- Frequency range according to the curve of shifted reference values (ISO 717-1)
- Correct Scale: 15 mm per octave horizontally, 20 mm per decade vertically

**Evaluation:** Based on field measurement results obtained in one-third-octave bands by an engineering method.

**Rating according to ISO 717-1:**

\[ D_{st}(f) = 46 - 3 \text{ dB} \]

**Tester:** Chris Dilworth

**No. of Test Report:** xxx/1

**Date:** 04/02/2016

**Signature:**
In the Event of a Failure

• A set of tests has deemed to have failed if any individual value does not reach the stipulated levels of sound insulation performance.

• Action required:
  – Remediate the failed constructions until the performance is satisfactory;
  – Apply the same measures to (or test) other constructions completed prior to the failure, and;
  – Increase the frequency of testing.
How can we ensure good sound insulation?

- Base the design on construction types that have been shown to work well. Alternatively, conduct a robust theoretical assessment of the proposed base construction.
Prediction of Sound Insulation using Insul
Prediction of Sound Insulation using Bastian
Prediction of Sound Insulation with SONarchitect
Prediction of Sound Insulation with SONarchitect
Prediction of Sound Insulation with SONarchitect
How can we ensure good sound insulation?

• Base the design on construction types that have been shown to work well. Alternatively, conduct a robust theoretical assessment of the proposed base construction.
• Detail junctions carefully.
• Consider the potential for noise transfer via flanking paths.
Flanking Noise Transfer

Source: National Research Council Canada
How can we ensure good sound insulation?

- Base the design on construction types that have been shown to work well. Alternatively, conduct a robust theoretical assessment of the proposed base construction.
- Detail junctions carefully.
- Consider the potential for noise transfer via flanking paths.
- Inspect during construction.
- Conduct pre-completion testing.
- If necessary, make recourse to a variety of remedial noise control measures.
Reverberation Control

- **Method A**: Apply an absorber of a specified class to an area that is a function of the area of the floor (in entrance halls, corridors or hallways) or the combined area of stair treads, landings and top floor ceiling (in stairwells or stair enclosures).
- **Method B**: Apply an absorber of the required Class to an area derived by calculation (only in entrance halls, corridors or hallways).

**NEW GUIDANCE**
Class of Absorption
Method A

- **Entrance halls, corridors or hallways:** Apply an acoustically absorbent material to an area equal to or greater than the floor area. The material should be a Class C absorber or better, per I.S. EN ISO 11654:1997.

- **Stairwells or a stair enclosure:** Calculate the combined area of stair treads, landings and top floor ceiling area – cover an equivalent area with a Class D absorber or 50% of this area with a class C absorber or better.
Method B

- Takes into account the absorptive qualities of the basic schedule of finishes.
- Additional absorption is added as necessary.
- The requirement is based on the volume and usage of the space.
- Involves a relatively straightforward but potentially lengthy calculation.
- **Advantage:** typically results in a requirement for less absorption than Method A.
Method B Example

Method B results in the use of a Class D absorber instead of Class C per Method A.
The Need for a Certification Scheme

• Given the increased importance of sound insulation testing under the new Regulations, DECLG considered that a certification scheme should form part of the improved regime.

• This is referenced in TGD E: “Sound insulation tests carried out by a person certified by an independent third party to carry out this work offers a way of ensuring that such certification can be relied upon.”

• DECLG encouraged the industry to explore options that would support the availability of competent testers to meet the new regime requirements.

• This led to the current proposals for SITRI – the Sound Insulation Testing Register (Ireland).
• A Certification Scheme developed by the Association of Noise Consultants (ANC) and the Institute of Acoustics (IOA).

• A “not for profit” professional body in the form of a Company Limited by Guarantee, wholly owned by the ANC.

• Modelled on the existing ANC Certification Schemes operated in the UK.
• The Institute of Acoustics is the UK's professional body for those working in acoustics, noise and vibration. Formed in 1974, it has some 3000 members and an active Irish Branch.

• The Association of Noise Consultants is a trade association for acoustics, noise and vibration consultancy practices. The membership includes more than 115 companies representing nearly eight hundred consultants. The ANC operates a Registration Scheme for member companies undertaking sound insulation testing in the UK.
OVERVIEW

The aims of the Sound Insulation Testing Register (Ireland) are to:

• Ensure an adequate supply of suitably qualified and experienced sound insulation testers in order to meet the requirements of Technical Guidance Document E Sound;

• Maintain a database of competent testers in order that industry professionals (such as Assigned Certifiers and Building Control) can commission sound insulation tests with confidence; and

• Maintain a database of results from sound insulation tests conducted by its members.
THE APPLICATION PROCESS

- **Stage 1** – Expression of Interest
- **Stage 2** – Submit Application (with confirmation of proposed Route to Registration)
- **Stage 3** – Evaluation (Training, Review of Experience or Existing Accreditation from another jurisdiction)
- **Stage 4** – Registration Audit
- **Stage 5** – Enrolment on the Sound Insulation Testing Register (Ireland)
On successful completion of the Registration Audit, the applicant will be deemed fully competent to carry out sound insulation testing as a Registered Tester on the SITRI Scheme and will be listed on the Scheme Register.

The Register is maintained on the Scheme website and will list all those persons deemed competent as Registered Testers for the purposes of sound insulation testing per TGD E.

It will be searchable by tester details, company name and location.
ONGOING SCHEME ACTIVITY

Members of the Scheme will be required to:

• Conduct sound insulation tests in accordance with the Scheme handbook and all applicable standards;
• Upload all sound insulation test results to the Scheme database, accessible via the website;
• Undergo an annual audit; and
• Undergo a witnessed test every three years.
The Scheme will maintain a database of results for all sound insulation tests conducted by members of the Register.

This will be accessible from the website using a unique identifier and password for each tester.

Building Control, Assigned Certifiers, Clients, Architects, etc. will be able to access the results for specific developments using a site identifier and password.

It will be possible to download summary reports with a complete listing of results from each site.
# CERTIFICATION OF PRE-COMPLETION SOUND INSULATION TESTING

**Task number:** 11  
**Password:** [redacted]  
**Registered organisation number:** 115  
**Task registration date:** 04/02/2016  
**Registered organisation name:** AWN Consulting  
**Client:** [redacted]  
**Registered organisation address:** The Tecpro Building, IDA Business and Technology Park, Dublin, D17 NX50  
**Site address:** [redacted]  
**Registered organisation e-mail:** stephan.amyd@awnoconsulting.com

<table>
<thead>
<tr>
<th>Test ID</th>
<th>Test Date</th>
<th>Source Room</th>
<th>Receiving Room</th>
<th>Project Type</th>
<th>Wall / Floor</th>
<th>Type</th>
<th>Target</th>
<th>Descriptor</th>
<th>Result</th>
<th>Pass / Fail</th>
<th>Retest Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>Wall</td>
<td>Airborne</td>
<td>≥ 53 dB</td>
<td>D\text{nt,w}</td>
<td>64 dB</td>
<td>✓</td>
<td>New test</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>Wall</td>
<td>Airborne</td>
<td>≥ 53 dB</td>
<td>D\text{nt,w}</td>
<td>63 dB</td>
<td>✓</td>
<td>New test</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>A</td>
<td>Wall</td>
<td>Airborne</td>
<td>≥ 53 dB</td>
<td>D\text{nt,w}</td>
<td>63 dB</td>
<td>✓</td>
<td>New test</td>
</tr>
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<td>≥ 53 dB</td>
<td>D\text{nt,w}</td>
<td>60 dB</td>
<td>✓</td>
<td>New test</td>
</tr>
</tbody>
</table>

- **A**: New Build
- **B**: Material Change of Use
- **C**: Protected Structure

- ✔️ Performance is at or better than the performance cited in The Building Regulations (Ireland) 2014, Technical Guidance Document E Sound
- ✗ Performance is worse than the performance cited in The Building Regulations (Ireland) 2014, Technical Guidance Document E Sound
- P Protected Structure - a dispensation or relaxation (or partial dispensation or relaxation) of the requirements has been granted by the local Building Control Authority

To check this certificate against the official online test log, please go to [http://www.soundtestingireland.com](http://www.soundtestingireland.com), follow the link to the VISIT website and input **TASK NUMBER 11** and **PASSWORD [redacted]**

This Certificate confirms that the tests described in the list above gave the results stated and were carried out by the named SITRI registered test organisation, at the stated property, on the stated date and that the named test organisation was a member of the SITRI Scheme at the time of the tests.
Likely Benefits?

The experience from England & Wales, which have similar requirements and operate a testing certification scheme:

• **Failure rate:** fell from 25% for walls and 40% for floors to 3% overall between 2003 and 2011;

• **Builders’ concerns:** were alleviated once it became clear that net costs had fallen;

• **Knowledge transfer:** increased consumer confidence;

• **Improved quality:** led to fewer complaints and improved health; and

• **Database:** more & better information for regulators.
Any Questions?
Thank you for your attention