Batten&Cradle
Flooring Systems

SPECIFIERS GUIDE

VERSION 3 OCT 2016

GREEN STAMP
BUILDING LIVING SOLUTIONS

B&C SYSTEMS
INTERNATIONAL LTD

CONTENTS

ABOUT US

Batten and Cradle offer a range of products and services to assist you in reaching your design objectives.

This manual provides information about Batten and Cradle's Acoustiflor and Dekcradle products and acoustic systems for residential and non residential applications.

This manual is intended to assist designers in selecting suitable Batten and Cradle products, and to help choose a system which meets their performance requirements.

Designers should be familiar with relevant building code requirements and should read this manual to ascertain the extent of the partnership required between themselves and their acoustic engineer in delivering an effective acoustic system.

Please ensure that the information in this document is appropriate for the application you are planning and that you undertake specific design and detailing for areas that fall outside the scope of this manual.

When specifying Batten and Cradle products, ensure you have the current manual. If you are not sure you do, or you need more information please contact us or visit our website.

www.battenandcradle.co.nz

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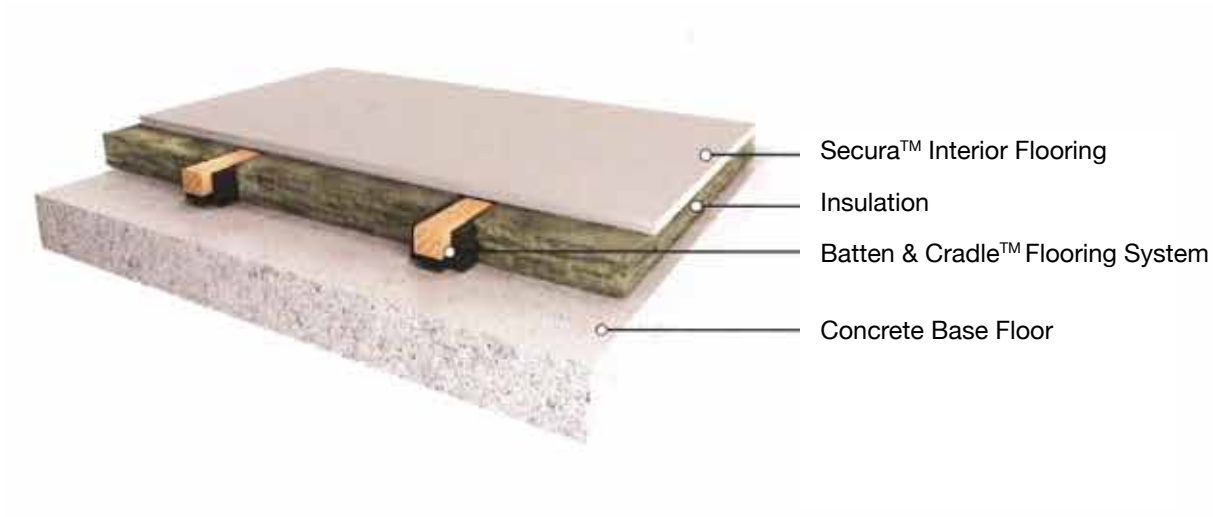

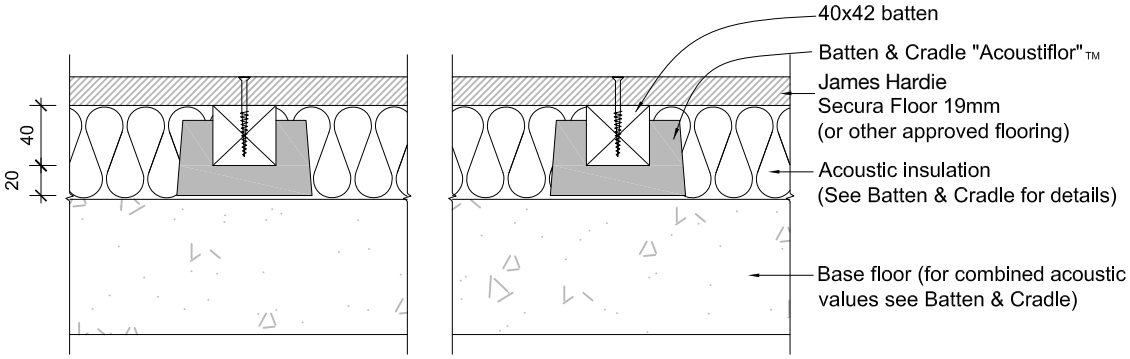

Note:

- Batten & Cradle "Acoustiflor"™
- Acoustic Insulation
- James Hardie Secura Floor 19mm (or other approved flooring)

Standard steel battens available - 30mm / 40mm / 55mm / 75mm
Other sizes available on request

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The following table details the expected impact performance of floor system B as described in Section 2.0 with various celling and floor slab combinations, including whether cavity insulation is installed.
As per Marshall Day June 2013 report on James Hadie Secura Floor.

5.0 OPINION: BATTEN AND CRADLE – BARE FLOOR – WITH CAVITY INFILL

The following table details the expected impact performance of floor system B as described in Section 2with various ceiling and floor slab combinations, including whether ceiling cavity insulation is installed:

Table 2: Batten and Cradle – Bare Floor – With cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		120 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)
No plasterboard ceiling	N/A	IIC 57	53 (+0) dB	IIC 64	46 (+1) dB	IIC 65	45 (+0) dB	IIC 62	48 (+0) dB	IIC 58	52 (+0) dB
1 x 10 mm plasterboard	No	IIC 54	53 (+1) dB	IIC 59	45(+3) dB	IIC 60	44 (+3) dB	IIC 58	48 (+1) dB	IIC 55	52 (+1) dB
	Yes	IIC 63	42 (+2) dB	IIC 66	37(+4) dB	IIC 67	36 (+4) dB	IIC 67	39 (+2) dB	IIC 64	41 (+2) dB
1 x 13 mm plasterboard	No	IIC 58	48 (+2) dB	IIC 63	40 (+3) dB	IIC 64	40 (+3) dB	IIC 62	43 (+2) dB	IIC 59	47 (+2) dB
	Yes	IIC 74	34 (+1) dB	IIC 77	28(+2) dB	IIC 78	27 (+2) dB	IIC 78	30 (+1) dB	IIC 75	33 (+1) dB
2 x 13 mm plasterboard	No	IIC 62	43 (+3) dB	IIC 67	36(+4) dB	IIC 68	35 (+4) dB	IIC 65	39 (+2) dB	IIC 63	42 (+3) dB
	Yes	IIC 78	32 (+0) dB	IIC 81	26(+1) dB	IIC 82	24 (+2) dB	IIC 82	28 (+0) dB	IIC 79	31 (+0) dB

Notes: 1. The $L'_{nT,w}$ $(+C_1)$ has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

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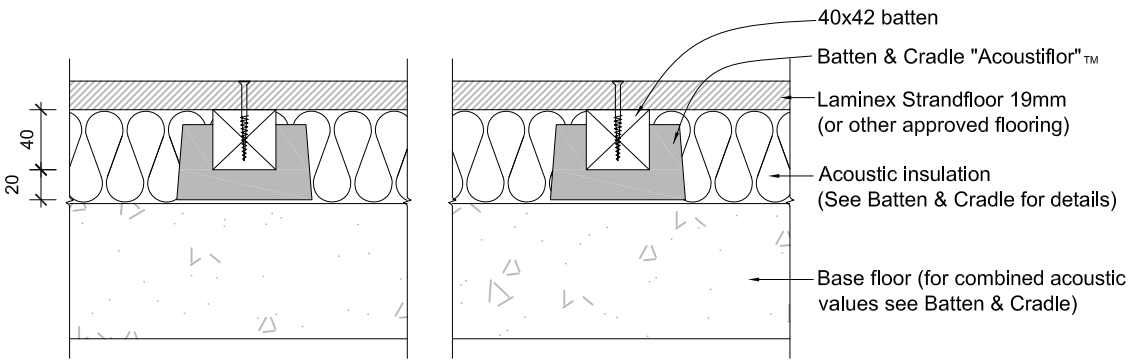
LAMINEX STRAND INTERIOR FLOOR



Note:

- Batten & Cradle "Acoustiflor"™
- Acoustic Insulation
- Laminex Strandfloor 19mm (or other approved flooring)

Standard wooden battens available - 30mm / 40mm / 90mm / 130mm
Other sizes available on request

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The following table details the expected impact performance of floor system B as described in Section 2.0 with various celling and floor slab combinations, including whether cavity insulation is installed. As per Marshall Day June 2010 report on Laminex Strand Floor.

Table 2: Batten and Cradle – Bare Floor – With cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		135 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)
No plasterboard ceiling	N/A	IIC 49	57 (+2) dB	IIC 55	51 (+2) dB	IIC 56	50 (+1) dB	IIC 54	52 (+2) dB	IIC 49	57 (+2) dB
1 x 10 mm plasterboard	No	IIC 42	58 (+5) dB	IIC 50	50 (+5) dB	IIC 51	49 (+5) dB	IIC 49	50 (+6) dB	IIC 42	58 (+5) dB
	Yes	IIC 50	48 (+7) dB	IIC 56	43 (+6) dB	IIC 56	41 (+8) dB	IIC 55	44 (+6) dB	IIC 50	48 (+7) dB
1 x 13 mm plasterboard	No	IIC 46	53 (+6) dB	IIC 54	45 (+6) dB	IIC 55	44 (+7) dB	IIC 53	46 (+6) dB	IIC 46	53 (+6) dB
	Yes	IIC 62	38 (+6) dB	IIC 68	31 (+6) dB	IIC 69	30 (+6) dB	IIC 67	33 (+5) dB	IIC 62	38 (+6) dB
2 x 13 mm plasterboard	No	IIC 50	49 (+6) dB	IIC 58	40 (+7) dB	IIC 59	40 (+7) dB	IIC 57	42 (+7) dB	IIC 50	49 (+6) dB
	Yes	IIC 65	35 (+5) dB	IIC 73	28 (+5) dB	IIC 74	27 (+5) dB	IIC 72	29 (+5) dB	IIC 65	35 (+5) dB

Notes:
1. The $L'_{nT,w}$ ($+C_1$) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

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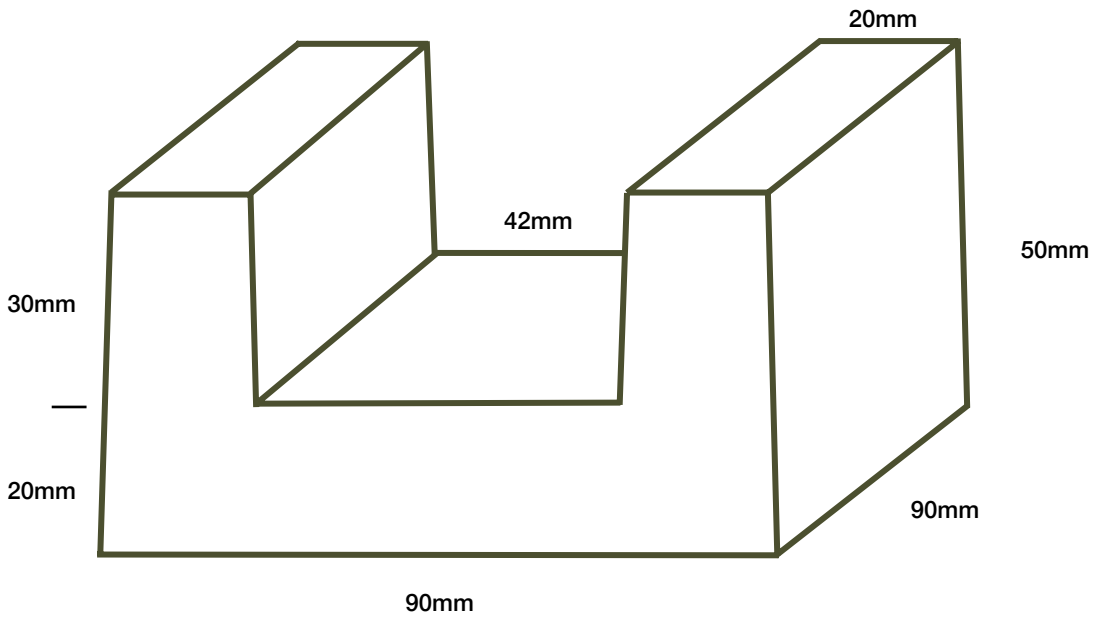
ACOUSTIC CRADLE



- Designed for the installed solution criteria using 42 x 42mm timber or steel. Other sizes available on request.
- Meeting structural code for use as flooring bearers, and for use of intermediary walls, if our specific battens are used.
- This cradle can be used for other than an Acoustic Solution if height of the sides appeals.
- Black in colour to ensure it is designated as normally installed solution cradle.

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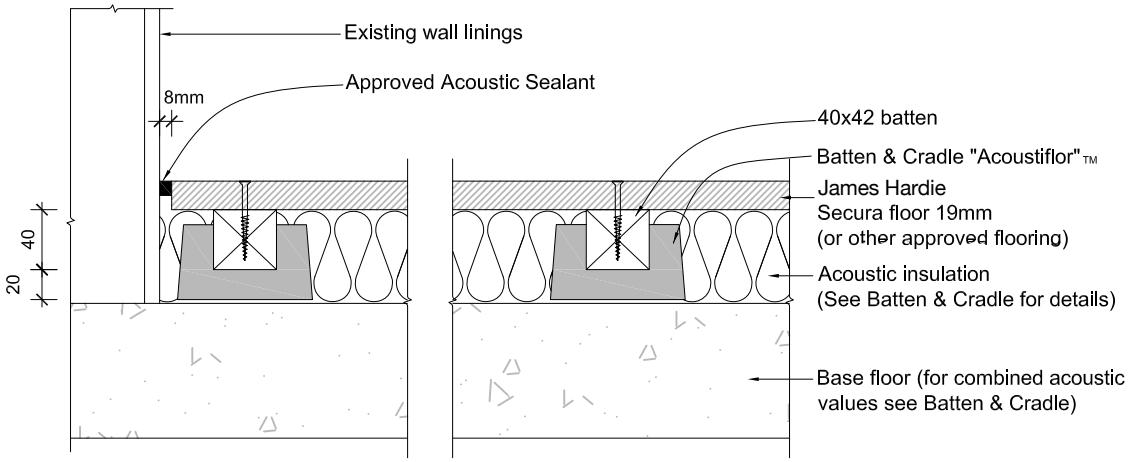
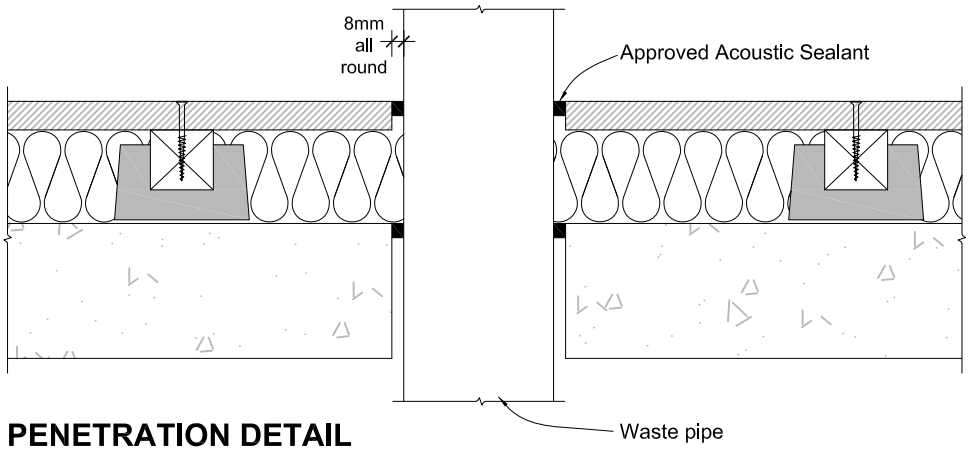


EDGE DETAIL



PENETRATION DETAIL

Note:
All penetrations must be approved by a Registered Acoustic Engineer, to either eliminate, mitigate or manage acoustic layout that could lead to a degradation of the acoustic ability of the system

Any service penetration and detailing must be pre-approved by Batten and Cradle.

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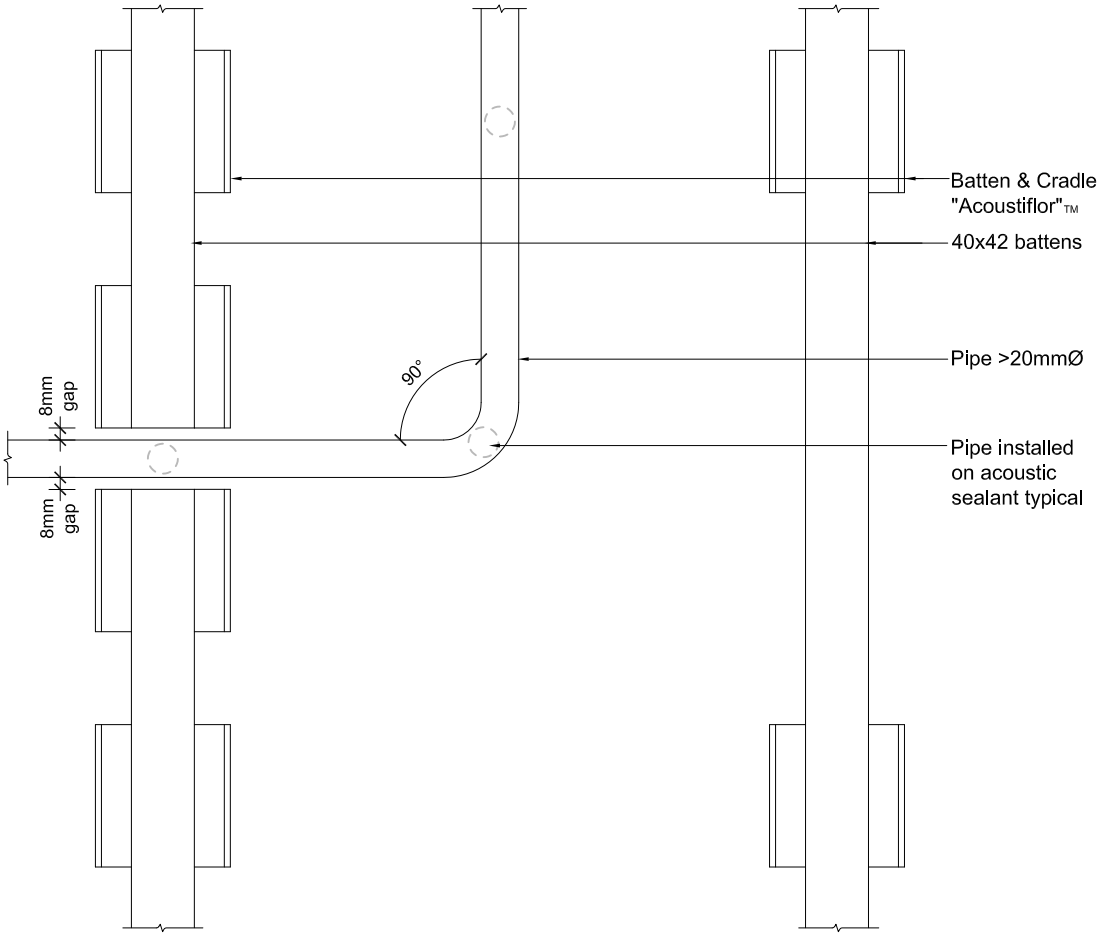

PIPE >20mmØ - PLAN VIEW

Note:
Representative Example of Structural Detail
Please refer to Batten & Cradle "Acoustiflor"™ Technical Department for any further options needed

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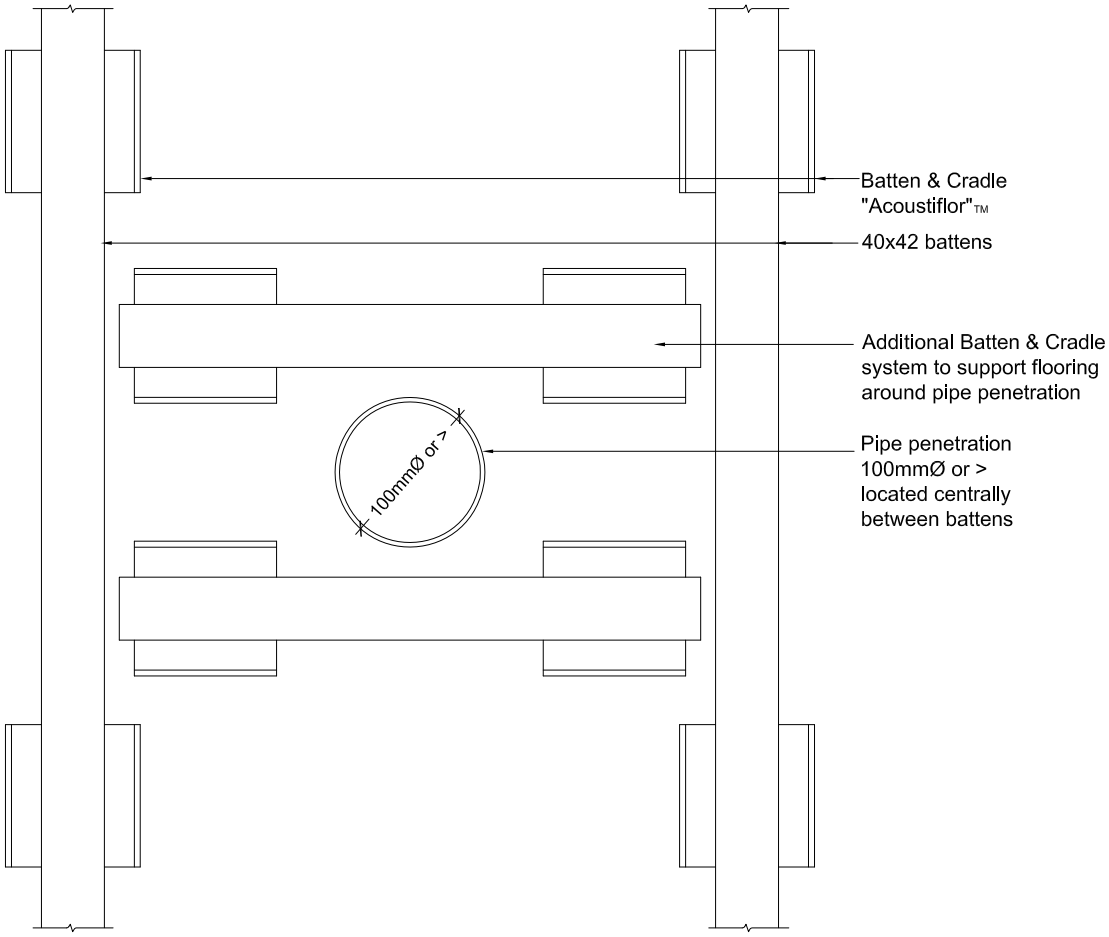

PIPE PENETRATION >100mmØ LOCATED CENTRALLY - PLAN VIEW

Note:
Representative Example of Structural Detail
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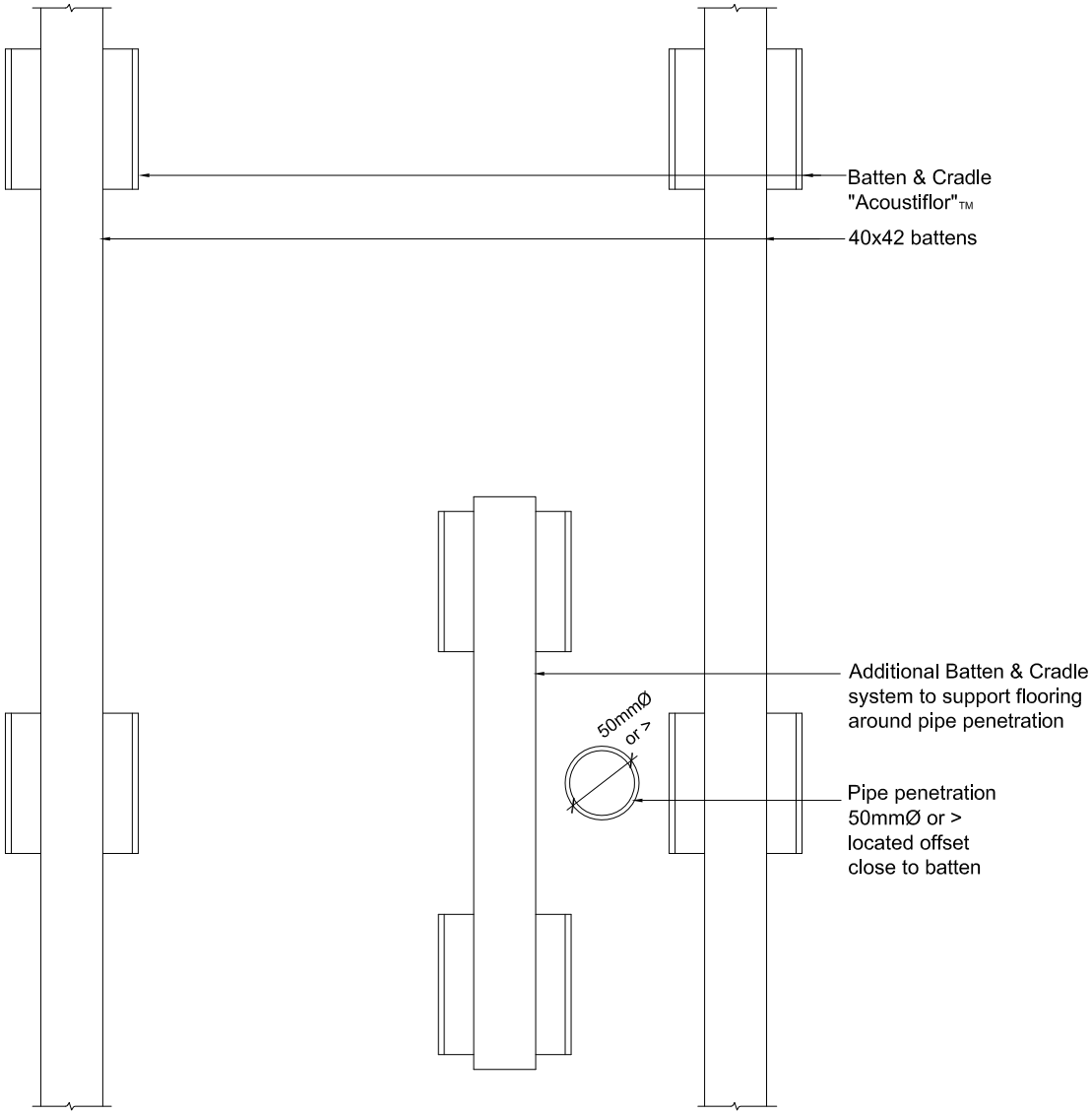

PIPE PENETRATION >50mmØ LOCATED OFFSET NEAR BATTEN - PLAN VIEW

Note:
Representative Example of Structural Detail
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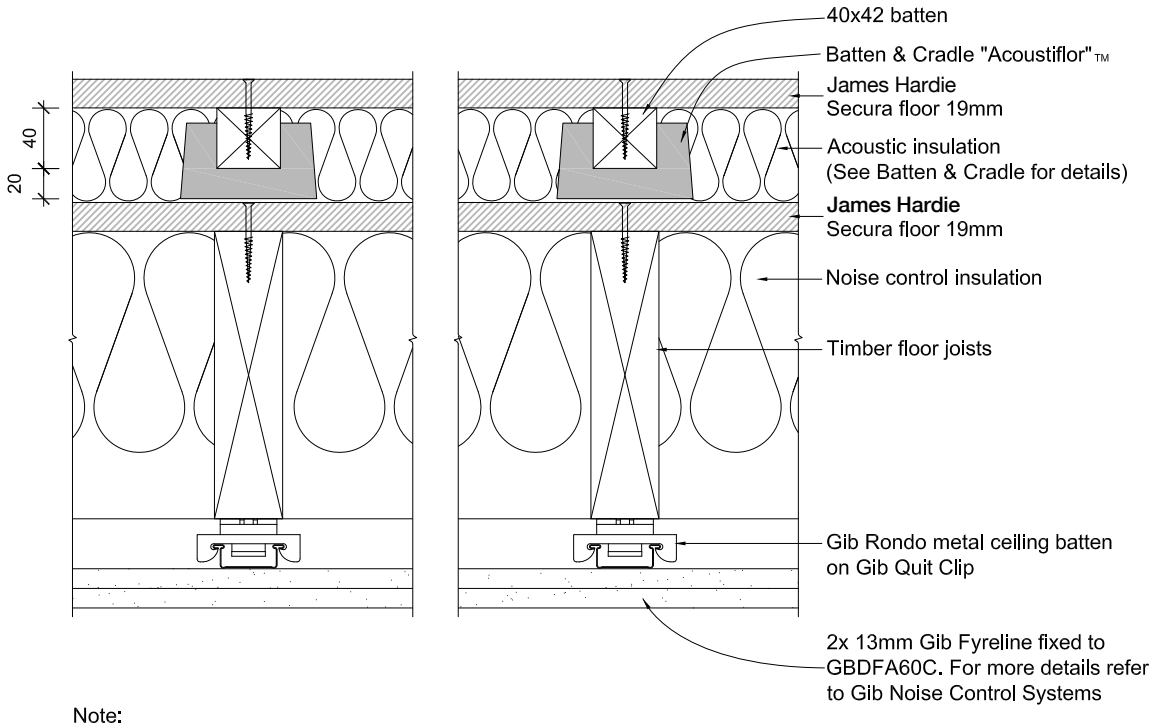
James Hardie
SECURA INTERIOR FLOOR
Floor and Acoustic System FRR60



Note:

- James Hardie Secura Floor / Ceiling System FRR 60/60/60 (STC 68 IIC 55)
- Floor Joists - 200mm 450mm c/c
- 2 x layers of 13mm Gib Fyreline / Noiseline fixed with Gib Quiet Clip and Rondo metal batten to GBDFA60C. For more details refer to Gib Noise Control Systems
- Acoustic Insulation
- James Hardie Secura Floor 19mm
- Batten & Cradle "Acoustiflor"™
- Acoustic Insulation
- James Hardie Secura Floor 19mm

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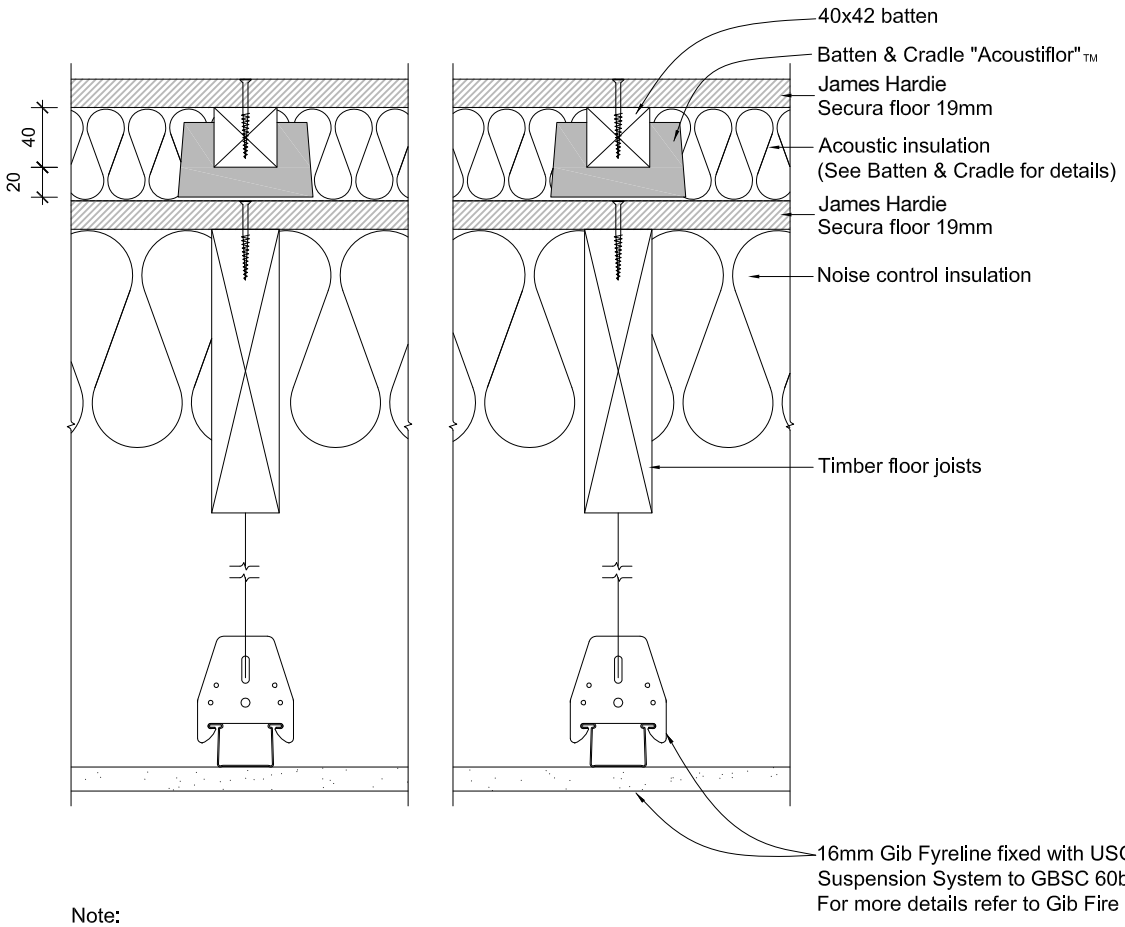
James Hardie
SECURA INTERIOR FLOOR
Floor Fire Protection Detail



Note:

- Floor Joists - 200mm 450mm c/c
- 1 x layers of 16mm Gib Fyreline fixed with USG Drywall Grid Suspension System to GBSC 60b. For more details refer to Gib Fire Rated Systems
- Acoustic Insulation
- James Hardie Secura Floor 19mm
- Batten & Cradle "Acoustiflor"™
- Acoustic Insulation
- James Hardie Secura Floor 19mm

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ESTIMATED SOUND TRANSMISSION LOSS

TABLE 1: ESTIMATED SOUND TRANSMISSION LOSS (WOODEN BATTENS)					
Partition	Description	STC	Rw	IIC	L_{nTw}
	James Hardie Secura flooring on Batten and Cradle™ system on Secura flooring fixed to timber, LVL or Posi-STRUT joists with 2 x 13mm Gib Fyreline ceiling with 75mm approved Process Fibre Insulation	68	68	55	48
	James Hardie Secura flooring on Batten and Cradle™ system on Secura flooring fixed to timber, LVL or Posi-STRUT joists with 1x 16mm Gib Fyreline ceiling with Batts	65	64	53	50

TABLE 2: ESTIMATED SOUND TRANSMISSION LOSS (STEEL BATTENS)					
Partition	Description	STC	Rw	IIC	L_{nTw}
	Secura flooring on Batten and Cradle™ system on Secura flooring fixed to timber, LVL or Posi-STRUT joists with 2 x 13mm Gib Fyreline ceiling with 75mm Pink Batts Silencer blanket in cavity	>68	>68	59	45
	Secura flooring on Batten and Cradle™ system on Secura flooring fixed to timber, LVL or Posi-STRUT joists with 1x 16mm Gib Fyreline ceiling with75mm Pink Batts Silencer blanket in cavity	>68	>68	60	47

For other options using James Hardie products, please contact Batten and Cradle Technical Manager, Peter Huston 0274 521 831.

For further information refer to the test result section for the full report.

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James Hardie
SECURA® INTERIOR FLOOR
FRR60 ACOUSTIC SYSTEM

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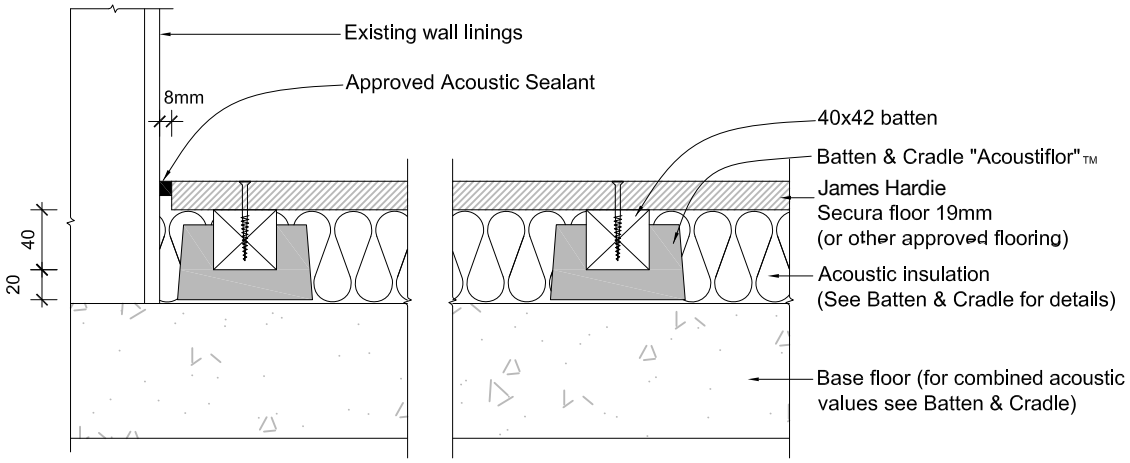
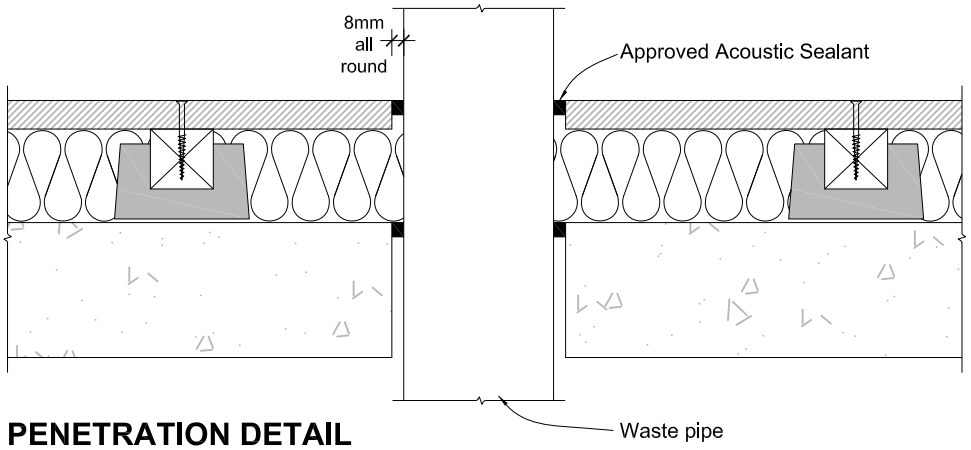


EDGE DETAIL



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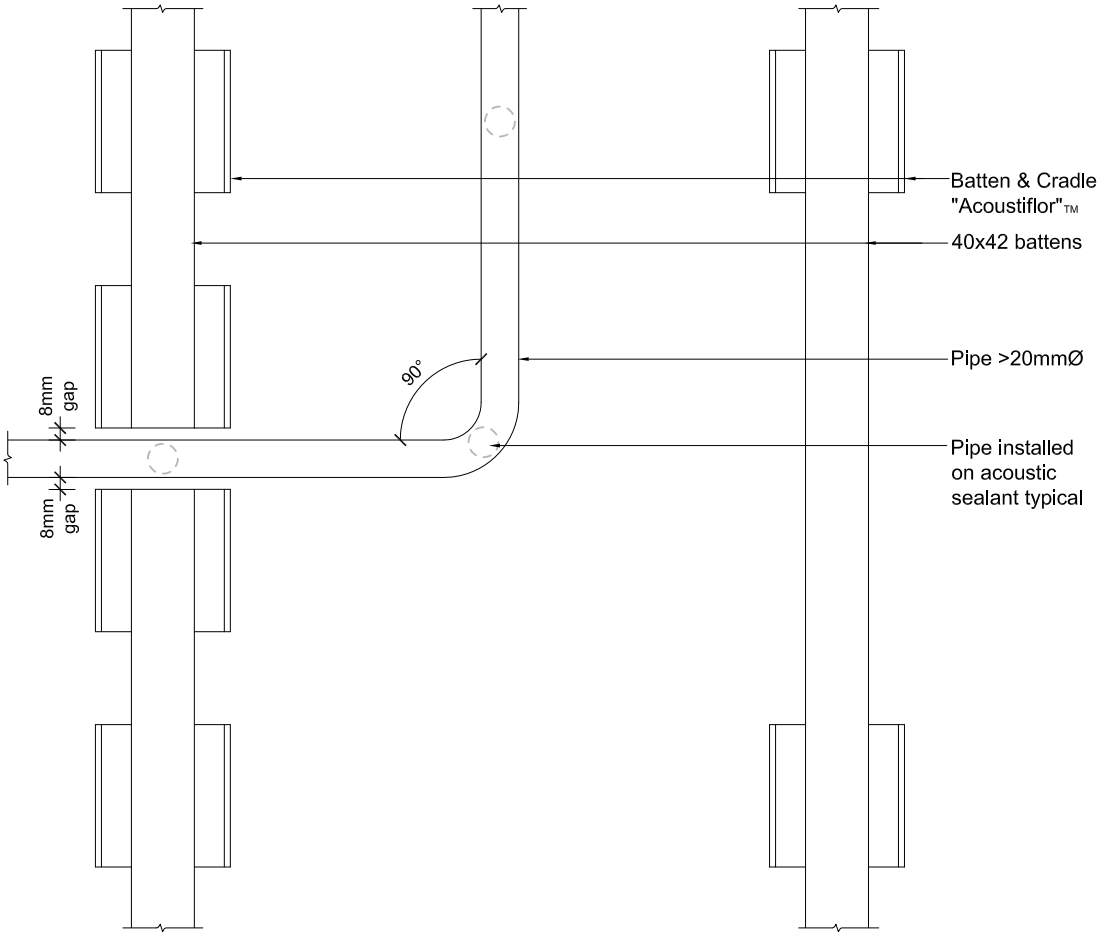

PIPE >20mmØ - PLAN VIEW

Note:
Representative Example of Structural Detail
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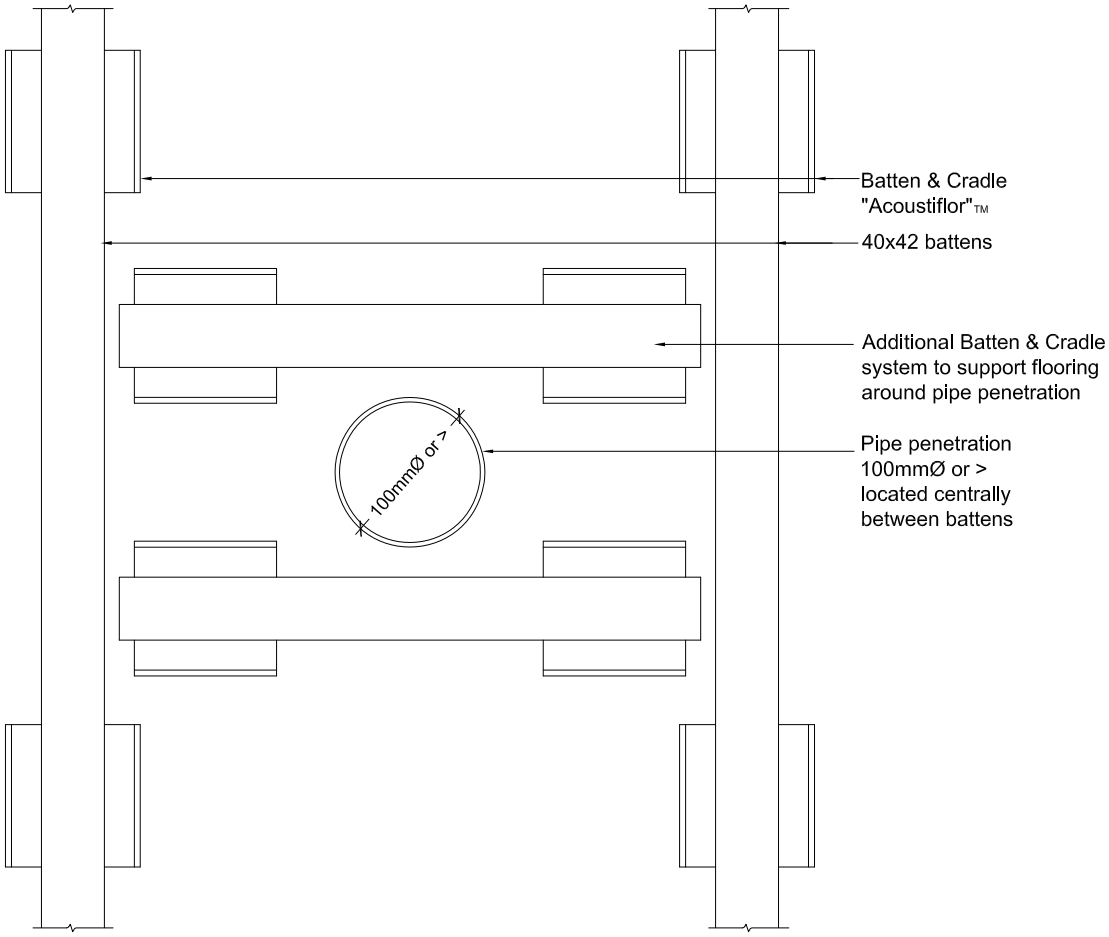

PIPE PENETRATION >100mmØ LOCATED CENTRALLY - PLAN VIEW

Note:
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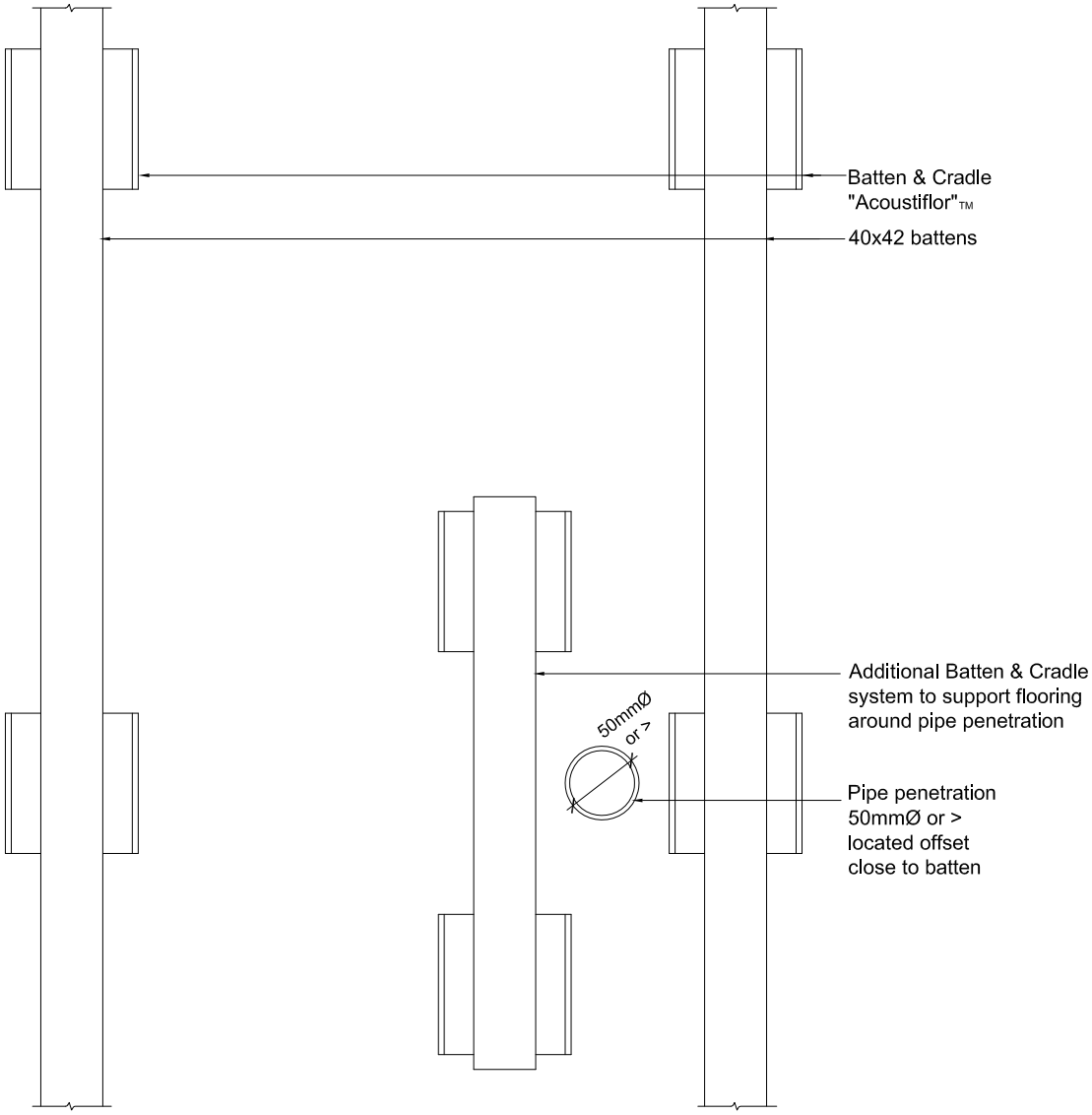

PIPE PENETRATION >50mmØ LOCATED OFFSET NEAR BATTEN - PLAN VIEW

Note:
Representative Example of Structural Detail
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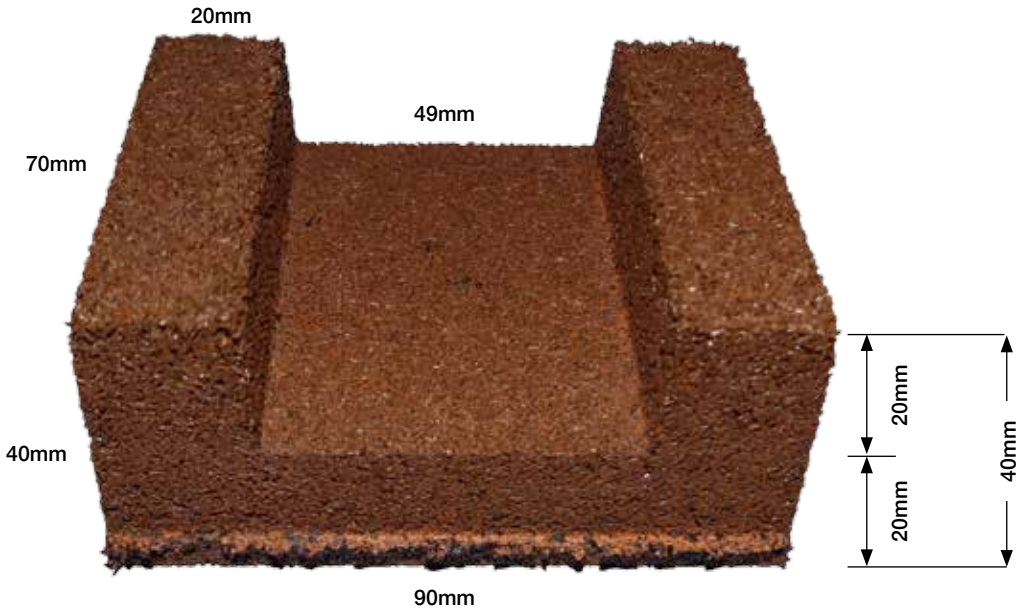
DekCradle™



- Manufactured from reclaimed rubber and or recycled rubber.
- Bonded using blocked resin formulation to help prevent any reaction with membranes
- 25 year warranty (see website for full details)
- Cradle sits directly on membrane with no adhesive or fastener required between cradle and the membrane
- Designed to take P&G H3.2 timber for external use.
- P&G 50mm thick timber is recommended, achieving a tolerance of 1mm either side in the Cradle.
- Sawn 50mm timber can be used and tightly fitted inside the cradle.
- Dekcradle™ can be used for both internal and external applications.
- Brown in colour to ensure product identification.

Note

DekCradle has been designed primary for external use. DekCradle has limited acoustic properties and should be only used for it's intended purpose.

To purchase DekCradle, refer to our website, www.battenandcradle.co.nz

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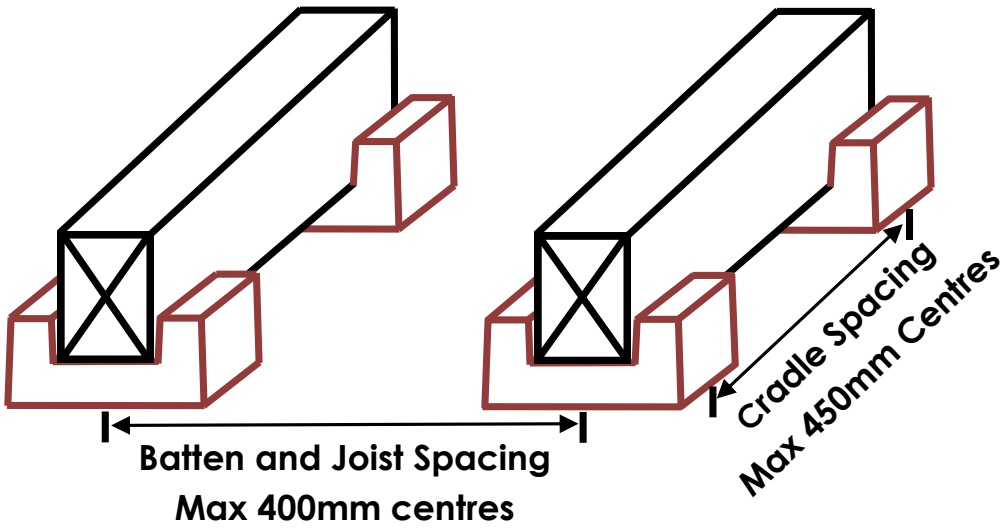
DekCradle™

Basic Specifications

- Construction should always conform to accepted building practices and NZS 3604, and this must always be checked, if in doubt.
- Batten or joists should be a minimum of 50mm wide and 40mm high. Most use 100 x 50 MSG No1 KD for internal use.
- If used outside, minimum treatment of H3.2 CCA.
- Cradles maximum spacing of 450mm centres, and are not glued or fastened to membrane.
- Battens maximum spacing of 400mm centres.
- Fastenings of deck or other overlay materials are to be as per manufacturers specifications.



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DekCradle™

Easy to install

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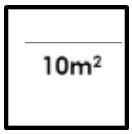
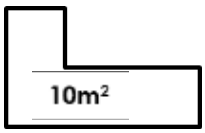
How Many DekCradles Do I Need For My Deck?

We recommend 7-10 cradles per m2 for your deck. This is subject to shape of floor area and layout of the cradles.**



Square shaped area may use: Approximately **7 cradles** per m^2.



Other deck shapes with the same square metres but more edges, may use: Approximately **10-12 cradles** per m^2.

* Edging requires support to a minimum of 100 mm.

**We are conservative in our recommendation figures. Cradles required varies from 7-8 cradles per m^2 in large open areas, and up to 10 cradles per m^2 where situations call for more.

Based on this information, table below has been calculated based on 10 cradles per m^2. (Subject to shape of deck)

DekCradles Per Square Metre

Square Metre Job

Number of Cradles (Recommended)	10	20	30	40	50	60	70	80	90	10
										1000
									900	
								800		
							700			
						600				
					500					
				400						
			300							
		200								
	100									

DekCradles are available at selected building merchants nationwide. Phone our office to find your nearest supplier. (Cradles are supplied in strips of 13 per strip.) Subject to Volume.

DekCradle

To purchase DekCradle, refer to our website, www.battenandcradle.co.nz

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Batten&Cradle
Flooring Systems

DekCradle™

Deck Timber Support

Protects roofing membrane - safely lay on top of trafficable waterproof membranes

Made of recycled rubber

Sits on the membrane surface with no need for glue

Easy to use

Keeps joists and timber out of surface water

Lower noise transmission to lower levels

ARDEX Australia Pty Ltd
20 Powers Road
Seven Hills NSW 2147
Tel: (02) 9851 9199
Fax: (02) 9674 5621
Email: techinfo@ardexaustralia.com
Internet: www.ardex.com

ARDEX New Zealand Ltd
32 Lane St, Woolston
Christchurch, New Zealand
Tel: (03) 373 6900
Fax: (03) 384 9779
Internet: www.ardex.co.nz

DekCradle™
Deck Timber Support

PRODUCT DESCRIPTION

The DekCradle™ is a support for deck timber over waterproofing membranes and complies with NZ Building Code, Clause E2/AS1 7.3.1.2. Designed to elevate a deck from the waterproofing membrane, DekCradles allow a floating deck to be installed with no risk of damaging the membrane below.

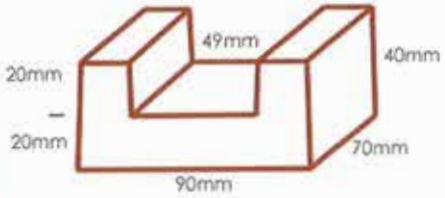
The DekCradle™ sits directly on the membrane. No glue, adhesive or fasteners of any kind are necessary between the DekCradle™ and the membrane.

Made from recycled rubber the DekCradle™ does not contain solvents and is a fully blocked resin formulation to guard against reaction with all membranes.

The DekCradle™ was designed to take 50mm thick H3.2 timber for external use.

The dimensions of 100mm x 50mm nominal give a 47mm finish allowing 1mm either side inside the cradle. This allows the timber bearers to be removed for trimming without disturbing the cradle position.

The DekCradle™ can be used both internally and as per its specific design for exterior use.

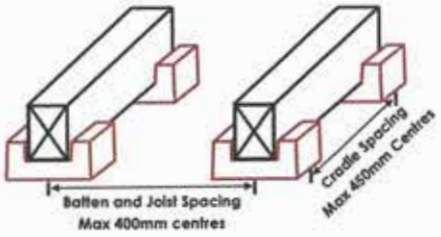


BASIC SPECIFICATIONS

Construction should always conform to accepted building practices and NZS 3604 - this must always be checked, if in doubt.

Batten or joists should be a minimum of 50mm wide and 40mm high. Most use 100mm x 50mm MSG No1 KD for internal use.
If used outside, minimum treatment of H3.2 CCA is recommended. The spacing between the centres of two cradles should not exceed 450mm (see drawing). The cradles are not glued or fastened to the membrane.
The battens maximum spacing is 400mm (again from the centre of one cradle to the centre of the next).

Fastenings of deck or other overlay materials are to be as per manufacturers specifications.



INSTALLATION

- The site must be clean and free of waste.
- Most builders will use a laser level to verify level placement.
- Plan the layout of your cradles to meet the spacing of no more than 450mm centres in length, and no greater than 400mm centres in width.
- Ensure a cradle is placed no greater than 50mm from an outside extremity, to ensure load support is covered around external edges.
- Cradles must be laid parallel.
- Joists may need to be ripped to make up for variations in floor height or for fall of deck surface.
- If floor surface is not level, use timber or ply H3 treated shims, or wedges within the DekCradle™ to place under the joists, from either end of the cradle.
- Connect the shim, with a dob of timber approved glue, to the joist, not the DekCradle.
- The shim cannot be packed up higher than 10mm.
- Do not shim between floor surface and the bottom of DekCradle™. Place all joists in the DekCradle, and check for level. The extreme between timber and side of cradle is planned.
- Install your decking or chosen surface following the appropriate building practice and product specifications. Please check before installation for the appropriate fastenings specifations.
- All fastenings of your top surface material must be connected to only the joist, not the DekCradle™ as per manufacturers instruction.

ARDEX Australia Pty Ltd
Technical Services Toll Free: 1800 224 070

NSW	Ph (02) 9851 9100	Fax (02) 9838 7970
QLD	Ph (07) 3817 6000	Fax (07) 3881 3188
VIC/TAS	Ph (03) 9308 9255	Fax (03) 9308 9332
SA	Ph (08) 8268 2511	Fax (08) 8345 3207
WA	Ph (08) 9256 8600	Fax (08) 9455 1227

ARDEX New Zealand Ltd
Technical Services Toll Free: 0800 227 339

Auckland	Ph (09) 636 0005	Fax (09) 2967 689
Wellington	Ph (04) 5685 949	Fax (04) 5686 376
Christchurch	Ph (03) 373 6900	Fax (03) 3849 779

May 201

SYSTEMARDEX
PREMIUM PERFORMANCE

Engineered solutions
for tiling, flooring and
waterproofing projects

ACCESSORIES

For use with ARDEX Butynol, EPDM, TPO, Undertile and Bituminous Torch On Waterproofing Membranes

ACCESSORIES

ADDITIONAL ITEMS

10522 Rubber Roller

For detailing sheet membranes

800007 Probe

For checking welds on TPO membranes

10918 Brass Roller

For detailing sheet membranes

9000007 Triac PID

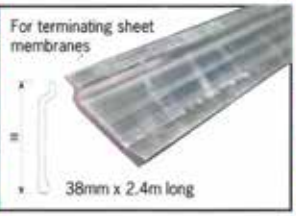
Digital micro processor temperature control

10465 Long Handle Roller

For detailing sheet membranes

10801 Pressure Bar

For terminating sheet membranes



38mm x 2.4m long

22154 Plunger Can

Convenient solvent dispenser

8000007 Unroof E

Hot air welding machine

13264 Green Right Mix Bucket

20 litre mixing bucket

11030 Water Gauging Bucket

73201 30L Mixing Bucket

8000007 Versicell

Drainage system for ARDEX Living Roof Systems. Available on indent order.

19492 Deck Cradle

8000007 Triac S

Manual temperature Control

AcoustiFlor™

August 2014

Batten and Cradle Living Standards' Product is stable and will achieve the acoustic standards recorded in laboratory tests as set out in the Product literature where it is properly installed. However, acoustic performance for each installation is site specific and the level of acoustic performance achieved will require the customer's own acoustic engineer's assessment of all factors affecting acoustic performance. The customers own acoustic engineer must set the level of acoustic performance to be expected. Batten and Cradle warrants that for a period of 15 years its Product will not rust, rot, corrode, crack, deform (under normal 1.5kPa live loads), suffer damage from termite attacks, leach, contaminate or combust to the extent published in Batten and Cradle Product literature current at the time of installation. Batten and Cradle warrants that for the period of 5 years from date of purchase that its Product will be free from defects due to the manufacturing process and raw materials. Nothing in this document shall exclude or modify any rights a customer may have under the Consumer Guarantees Act or otherwise which cannot be excluded or modified at law. This warranty is strictly subject to the following conditions:

Conditions of Warranty:

This warranty is strictly subject to the following conditions:

1. Batten and Cradle will not be liable for breach of warranty unless the claimant provides proof of purchase and makes a written claim within 30 days after the defect would have become reasonably apparent or, if the defect was reasonably apparent prior to installation, then the claim must be made prior to installation;
2. this warranty is not transferable;
3. the Product must be installed and maintained strictly in accordance with the relevant Batten and Cradle literature current at the time of installation and must be installed in conjunction with the components or products specified in the literature. Further, all other products, including coating and jointing systems, applied to or used in conjunction with the Product must be applied or installed and maintained strictly in accordance with the relevant manufacturer's instructions and good trade practice;
4. the project in which the Product is installed must be designed and constructed in strict compliance with all relevant provisions of the current New Zealand Building Code (NZBC), regulations and standards;
5. the claimant's sole remedy for breach of warranty is (at Batten and Cradle's option) that Batten and Cradle will either supply replacement Product, rectify the affected Product or pay for the cost of the replacement or rectification of the affected Product;
6. Batten and Cradle will not be liable for any loss or damages (whether direct or indirect) including property damage or personal injury, consequential loss, economic loss or loss of profits, arising in contract or negligence or howsoever arising. Without limiting the foregoing Batten and Cradle will not be liable for any claims, damages or defects arising from or in any way attributable to poor workmanship, poor design or detailing, settlement or structural movement and/or movement of materials to which the Product is attached or adjoins, incorrect design of the structure, act of God including but not limited to earthquakes, cyclones, floods or other severe weather conditions or unusual climatic conditions, efflorescence or performance of paint/coatings applied to the Product, normal wear and tear, growth of mould, mildew, fungus, bacteria, or any organism on any Product surface or Product (whether on the exposed or unexposed surfaces);
7. all warranties, conditions, liabilities and obligations other than those specified in this warranty are excluded to the fullest extent allowed by law;
8. if making a claim under this warranty involves recoating of other materials then there may be slight colour differences due to the effects of weathering and variations in materials over time. Batten and Cradle is not liable for any such colour variations.

Defined Terms used in this document:

"AcoustiFlor" is the protected trade name for Batten and Cradle Flooring Systems Limited and use of this trade name within this document means Batten and Cradle Flooring Systems Limited. "Batten and Cradle" has the same meaning.

"Product" means the AcoustiFlor™ AC20 (black) moulded rubber cradle.

End of warranty

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Batten&Cradle
Flooring Systems

DekCradle™

August 2014

Batten and Cradle Living Standards' Product is stable and will last a very long time! Batten and Cradle warrants that for a period of 15 years its Product will not rust, rot, corrode, crack, deform (under normal 1.5kPa live loads), suffer damage from termite attacks, leach, contaminate or combust to the extent published in Batten and Cradle Product literature current at the time of installation. Batten and Cradle warrants that for the period of 5 years from date of purchase that its Product will be free from defects due to the manufacturing process and raw materials. Nothing in this document shall exclude or modify any rights a customer may have under the Consumer Guarantees Act or otherwise which cannot be excluded or modified at law. This warranty is strictly subject to the following conditions:

Conditions of Warranty:

This warranty is strictly subject to the following conditions:

1. Batten and Cradle will not be liable for breach of warranty unless the claimant provides proof of purchase and makes a written claim within 30 days after the defect would have become reasonably apparent or, if the defect was reasonably apparent prior to installation, then the claim must be made prior to installation;
2. this warranty is not transferable;
3. the Product must be installed and maintained strictly in accordance with the relevant Batten and Cradle literature current at the time of installation and must be installed in conjunction with the components or products specified in the literature. Further, all other products, including coating and jointing systems, applied to or used in conjunction with the Product must be applied or installed and maintained strictly in accordance with the relevant manufacturer's instructions and good trade practice;
4. the project in which the Product is installed must be designed and constructed in strict compliance with all relevant provisions of the current New Zealand Building Code (NZBC), regulations and standards;
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6. Batten and Cradle will not be liable for any loss or damages (whether direct or indirect) including property damage or personal injury, consequential loss, economic loss or loss of profits, arising in contract or negligence or howsoever arising. Without limiting the foregoing Batten and Cradle will not be liable for any claims, damages or defects arising from or in any way attributable to poor workmanship, poor design or detailing, settlement or structural movement and/or movement of materials to which the Product is attached or adjoins, incorrect design of the structure, act of God including but not limited to earthquakes, cyclones, floods or other severe weather conditions or unusual climatic conditions, efflorescence or performance of paint/coatings applied to the Product, normal wear and tear, growth of mould, mildew, fungus, bacteria, or any organism on any Product surface or Product (whether on the exposed or unexposed surfaces);
7. all warranties, conditions, liabilities and obligations other than those specified in this warranty are excluded to the fullest extent allowed by law;
8. if making a claim under this warranty involves recoating of other materials then there may be slight colour differences due to the effects of weathering and variations in materials over time. Batten and Cradle is not liable for any such colour variations.

Defined Terms used in this document:

"DekCradle" is the protected trade name for Batten and Cradle Flooring Systems Limited and use of this trade name within this document means Batten and Cradle Flooring Systems Limited and "Batten and Cradle" has the same meaning.

"Product" means either or both: AcoustiFlor™ AC20 (black)
DekCradle™ DC20 (brown)

End of warranty

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Batten & Cradle Flooring Systems
Recommended Installation Manual for installers

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Batten&Cradle
Flooring Systems

Batten & Cradle Flooring Systems
Recommended Installation Manual for installers

Introduction

Batten & Cradle systems are dry floating floors which provide an easily levelled under structure for supporting composite flooring. Concrete ground level supported floors must have a damp proof membrane and screed complying with the appropriate Codes of Practice and Building Regulations.

Storage

All components should be kept inside, under cover and in dry conditions at all times. Materials should be stored in the environment in which they are to be fixed at least 48 hours prior to fixing. Do not place large quantities of material such as chipboard or plasterboard on top of laid flooring as this extreme loading can damage the resilient layers. If in doubt refer to manufacturers manual for recommendations.

Preparation

The building must be weather proof and all materials must have reached their recommended moisture content before commencing installation of the flooring system. All joints and air paths between concrete units and at perimeter walls must be carefully and thoroughly grouted for effective performance of acoustic floors. Components exposed to wet conditions such as ingress of rain or plumbing leaks should be discarded and replaced.

Dryness of Concrete and Timber

Excessive moisture from cast in situ slabs and screeds which have not dried out can have adverse effects on flooring materials and timber components. Therefore “it is reasonable to recommend that the concrete be considered dry when the relative humidity falls to 75% or less” (when tested by use of a hygrometer). Where the dryness of concrete cannot be guaranteed it is recommended that a vapour barrier is installed that complies with the appropriate code of practice and building regulations.

Services

The provision of access to services is most successful if the location of services are identified on as built drawings. Services should be kept at least 150mm away from walls to allow space for perimeter support Battens. Any service penetration and detailing must be pre-approved by Batten and Cradle.

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Design Recommendations

Partitions

Most lightweight timber or metal stud partitions may be constructed directly on the floating floor. Masonry: internal non load bearing Partitions should be erected from the sub-floor and not on top of the floating floor. All partitions must be approved by the designer prior to their installation locations.

Access Panels

Batten & Cradle Flooring Systems are ideal for providing partial access to services. Access panels should be square edged and supported along all edges by Support Battens. The panels should be screwed to the battens without bridging the resilient layer.

Areas of Heavy Loading

In areas where heavy loadings are anticipated, such as kitchens and bathrooms the Support Batten centres should be reduced to 300mm. In cases of extraordinary loading, advice should be sought from the designer, specifier or manufacturer.

Ceramic Tiles

As acoustic floors are designed to deflect vertically in order to reduce impact sound there are inherent risks in laying ceramic tiles on top of floating floors. However the risks can be significantly reduced by good detailing and the use of flexible adhesives. Ceramic tiles have been successfully laid on Batten Cradle System.

Support Batten and Cradle Centres

Support Battens and Cradles must be laid in accordance with centres specified.

Cradles and Support Battens

To ensure consistent levels throughout the building, commence in corridor areas proceeding to rooms. In each area work to a datum using packers and elevating blocks to overcome low areas or cambers. Ensure that each Cradle is sitting on a level, flat spot. Cradles should not rock or lie at an angle. Set out the Cradles and Support Battens around the perimeter of the room so that the Support Battens are approximately 50mm from perimeter walls. Then lay the remainder of Support Battens levelling with the packers as required. Where Support Battens meet, the Cradle should be positioned so that it equally supports both ends. When laying alternate rows of Support Battens, commence with a half-length so that the joints are staggered.

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Services

The 20mm Resilient Cradle Support will not always allow for services to run underneath the Support Batten. In this instance cut the Support Battens and place approximately 8mm either side of the pipe. Fully support the Battens with additional Cradles. Additional noggins may also be required to properly support the deck.

Do not notch Support Battens
If it is intended that services run under the Support Battens a deeper Resilient Cradle Support should be specified and adequate clearance provided beneath the Support Batten. In acoustic systems ensure that gaps where services come through the flooring are sealed to prevent airborne sound leakage.

Packing

In order to achieve a level floor, place the correct combination of packers within the shoulders of the Cradle plate to a maximum of 5mm from the top. If more packing is needed than what is achievable within the shoulders, a 100 x 100mm approved packer may be placed under the cradle. If two or more packers are used we recommend using a light adhesive between each packer.

Perimeters

Ensure that there is an expansion gap of at least 10mm between the edges of the flooring and at the perimeter walls. This gap must also be maintained at doorframes and filled with a flanking isolation strip or acoustic sealant.

Thresholds

A Support Batten on Cradles should be placed across the threshold for additional support. The flooring type should be configured so as to ensure no but joints are present.

Installation of flooring products

When laying flooring on top of the Batten and Cradle System, always refer to the manufacturers instruction on how to install their products.

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Batten & Cradle Flooring Systems
Recommended Installation Manual for installers

Additional Components - (Acoustic Systems Only)

Batten & Cradle Acoustic Insulation

If specified, lay acoustic insulation between the Cradles over the entire floor area. The edges of insulation should be turned up at the perimeter walls. The same method will apply if thermal insulation is being used on a ground floor application.

Batten & Cradle Flanking Strip

Insert the 3mm thick Flat shaped Acoustic Flanking Strip around the perimeter of the room on the 10mm gap between the flooring and the perimeter wall. When the skirting board is being fied to the wall lightly trap the Flanking Strip between the bottom of the skirting and the flooring panel and neatly trim off the excess. It is essential to isolate the skirting from the floor surface to prevent impact sound flanking transmission.

Figure 2 - The Batten and Cradle System

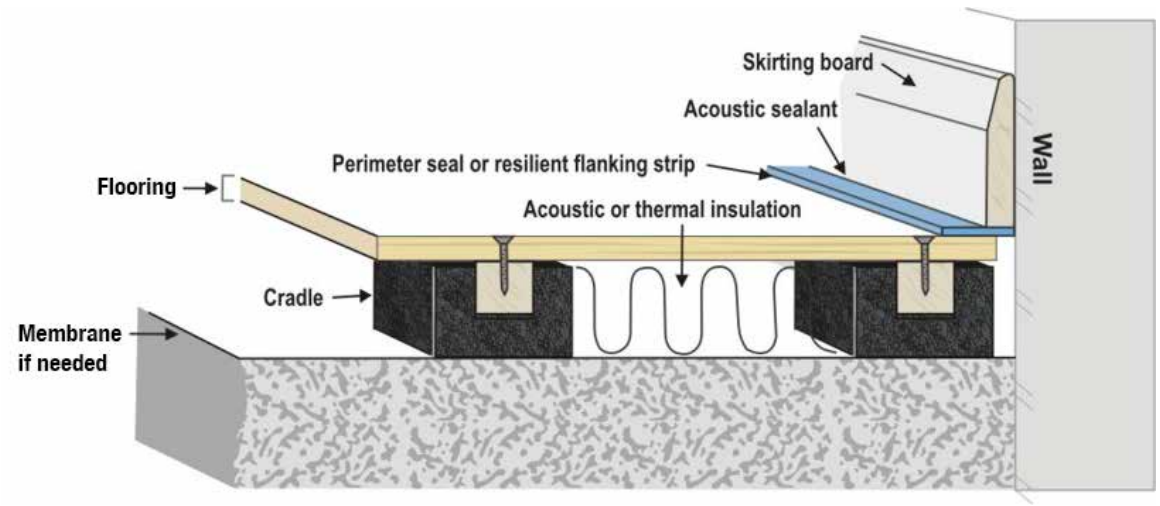

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Figure 3 - Fire and Acoustic Rated Secura™ flooring - Cradle with sound insulation

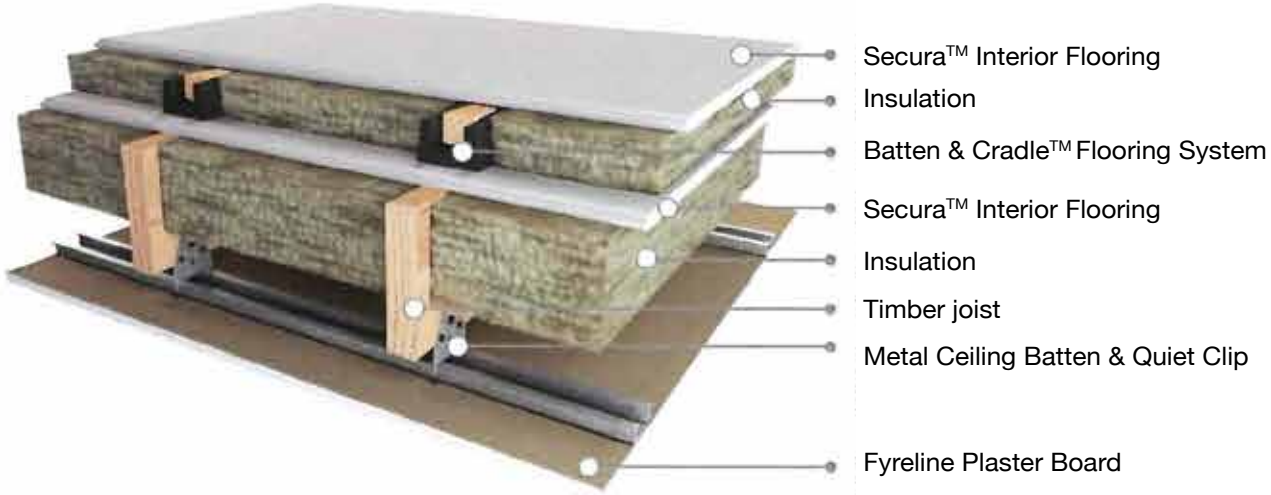
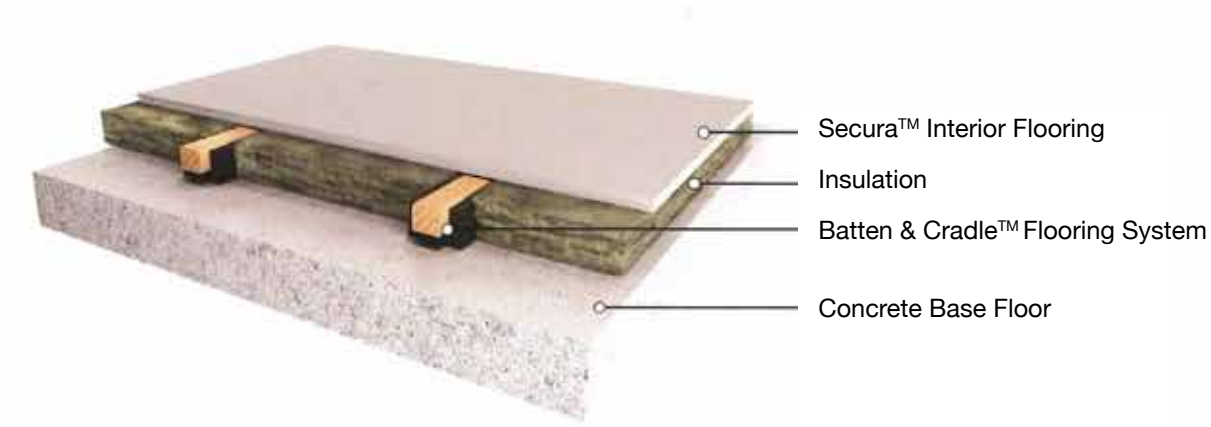


Figure 4 - Secura™ Acoustic Floor System over Base Floor - Cradle with sound insulation



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Sound reduction index, R, in accordance with ISO 10140-2
Laboratory measurements of airborne sound insulation of building elements

Description and identification of the test specimen and test arrangement: Date of test: 31-Mar-16

Airborne sound insulation of a floor system Client: Batten & Cradle

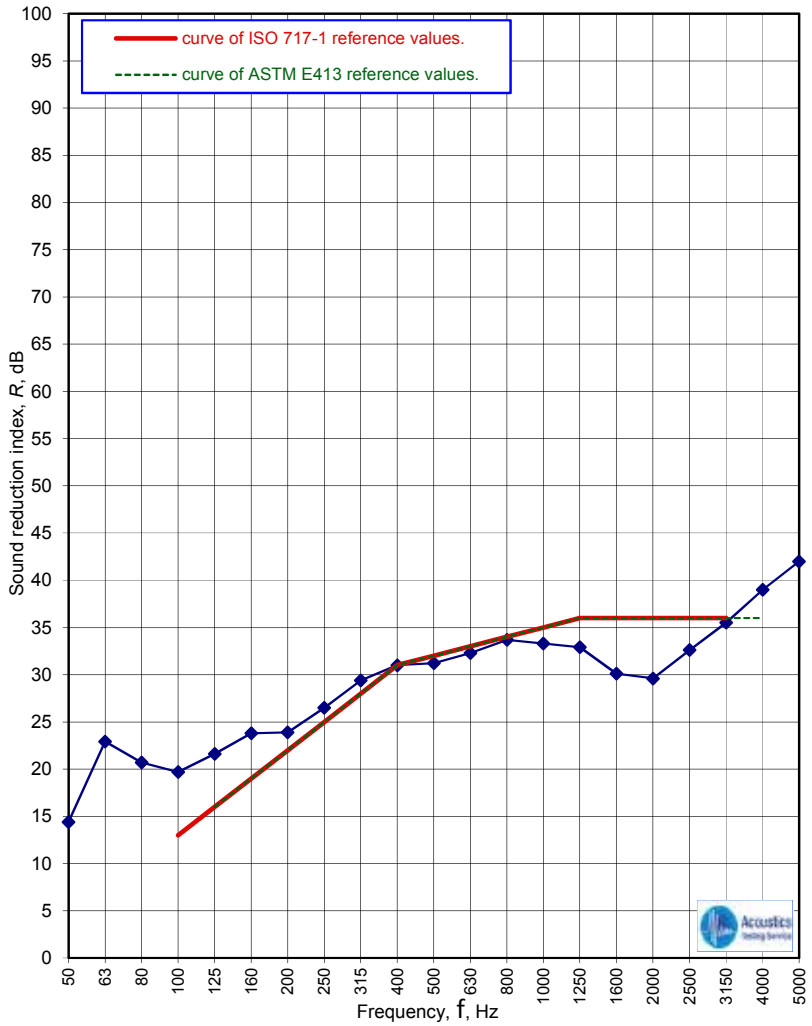
Test Floor Frame: 190mm x 45mm timber joists set at 450mm centres fixed in joist hangers to 190mm x 45mm perimeter joists.
Test Floor Linings: Source chamber side: 1 layer of 20mm *James Hardie Secura* tongue and groove flooring screwfixed at 600mm centres
Cavity Absorption: Nil
Test Floor Lining Joint Filler: *GIB Soundseal*
Test Floor Perimeter Sealant: *GIB Soundseal*

Source chamber: Chamber C, Receiving chamber: Chamber A . Test specimen installed by client. Curing time: 1hr
Computer files: T1612-1 Bare Hardie floor.CMG Emmited noise: T1612-1 Bare Hardie floor.CMG: ID.65 Received noise: T1612-1 Bare Hardie floor.CMG: ID.66 Reverberation time: T1612-1 Bare Hardie floor.CMG: ID.63

Area *S* of test specimen: 10.24 m^2
Mass per unit area: 0.00 kg/m^2
Air temp in the test rooms: 23 °C
Air humidity in test rooms: 60 %
Source room volume: 202 m^3
Receiving room volume: 153 m^3

Frequency *f* Hz	*R* One-third octave dB
50	14.4
63	22.9
80	20.7
100	**19.7**
125	**21.6**
160	**23.8**
200	**23.9**
250	**26.5**
315	**29.4**
400	**31.0**
500	**31.2**
630	**32.3**
800	**33.7**
1000	**33.3**
1250	**32.9**
1600	**30.1**
2000	**29.6**
2500	**32.6**
3150	**35.5**
4000	**39.0**
5000	42.0

Notes:1. #N/A = Value not available.
2. **Bold** values are used to calculate STC and R_w.
3. Words in ***Blue Italic*** in the description are manufacturers brand names.



Rating according to ISO 717: R_w $(C;C_{tr})$ = **32 (-1 ; -2) dB**

$C_{50\text{-}3150}$ = -1 dB $C_{tr,\ 50\text{-}3150}$ = -3 dB
$C_{50\text{-}5000}$ = 0 dB $C_{tr,\ 50\text{-}5000}$ = -3 dB
$C_{100\text{-}5000}$ = 0 dB $C_{tr,100\text{-}5000}$ = -2 dB

Rating according to ASTM E413 -87
Sound Transmission Class = 32 dB

No. of test report: **T1612-1** Name of test institute: University of Auckland Acoustics Testing Service.
Signature: **Informal Results** Date:

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Batten&Cradle
Flooring Systems

Normalized Impact sound pressure levels according to ISO 140-6
Laboratory measurements of impact sound insulation of floors

Date of test: 31-Mar-16

Description and identification of the test specimen and test arrangement: Client: Batten & Cradle

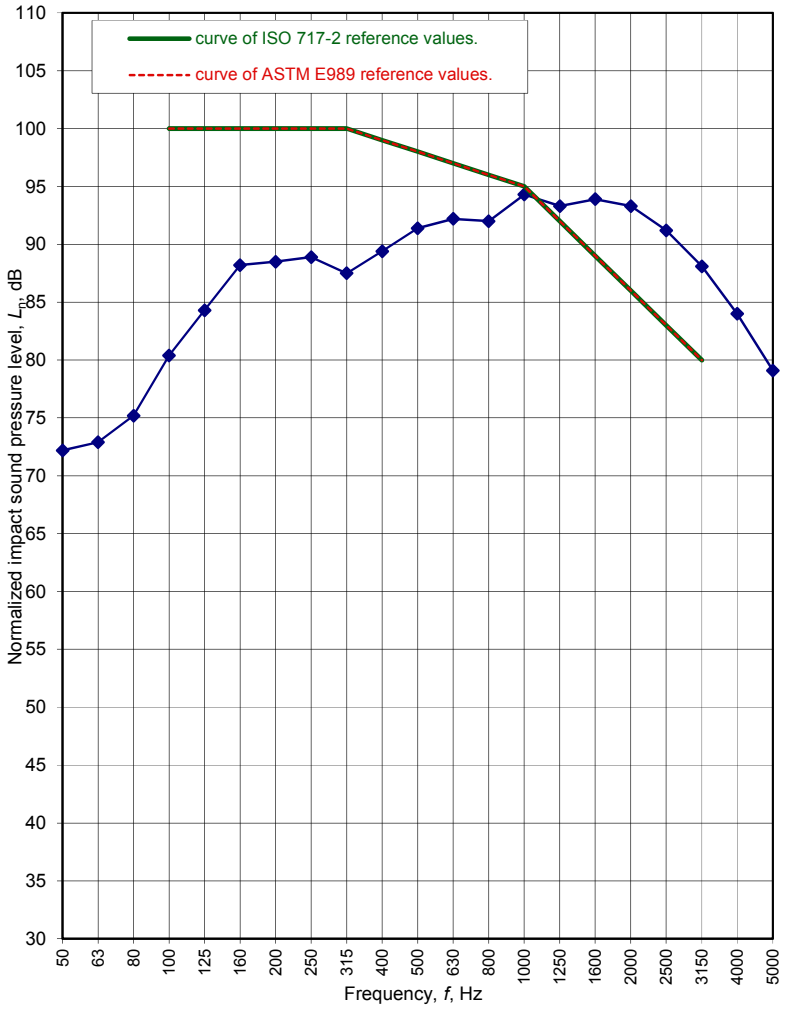
Test Floor Frame: 190mm x 45mm timber joists set at 450mm centres fixed in joist hangers to 190mm x 45mm perimeter joists.
Test Floor Linings: Source chamber side: 1 layer of 20mm *James Hardie Secura* tongue and groove flooring screwfixed at 600mm centres to the 140mm x 45mm timber joists
Cavity Absorption: Nil
Test Floor Lining Joint Filler: *GIB Soundseal*
Test Wall Perimeter Sealant: *GIB Soundseal*

Source chamber: Chamber A. Receiving chamber: Chamber B. Test specimen installed by the client. Curing time was:
Computer Files:

Area *S* of specimen floor: 10.24 m^2
Mass per unit area: 0 Kg/m^2
Air temp in the test rooms: 23 °C
Air humidity in test rooms: 60 %
Receiving room volume: 153 m^3

Frequency *f* Hz	L_n One-third octave dB
50	< 72.2
63	72.9
80	75.2
100	**80.4**
125	**84.3**
160	**88.2**
200	**88.5**
250	**88.9**
315	**87.5**
400	**89.4**
500	**91.4**
630	**92.2**
800	**92.0**
1000	**94.3**
1250	**93.3**
1600	**93.9**
2000	**93.3**
2500	**91.2**
3150	**88.1**
4000	84.0
5000	79.1

Notes:1.#N/A = Value not available.
2. Bold values are used to calculate IIC and Ln,w.
3. < indicates that the true value is lower.



Rating according to ISO 717-2:
$L_{n,w}$ (C_I) = 98 (-10) dB $C_{I,50\text{-}2500}$ = -10 dB

Rating according to ASTM E989:
Impact Insulation Class = 12 dB

No. of test report: **T1612-1i** Name of test institute: University of Auckland Acoustics Testing Service.

Date: Signature: **Informal Results**

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Batten&Cradle
Flooring Systems

Sound reduction index, R, in accordance with ISO 10140-2
Laboratory measurements of airborne sound insulation of building elements

Description and identification of the test specimen and test arrangement: Date of test: 31-Mar-16

Airborne sound insulation of a floor system Client: Batten and Cradle Ltd.

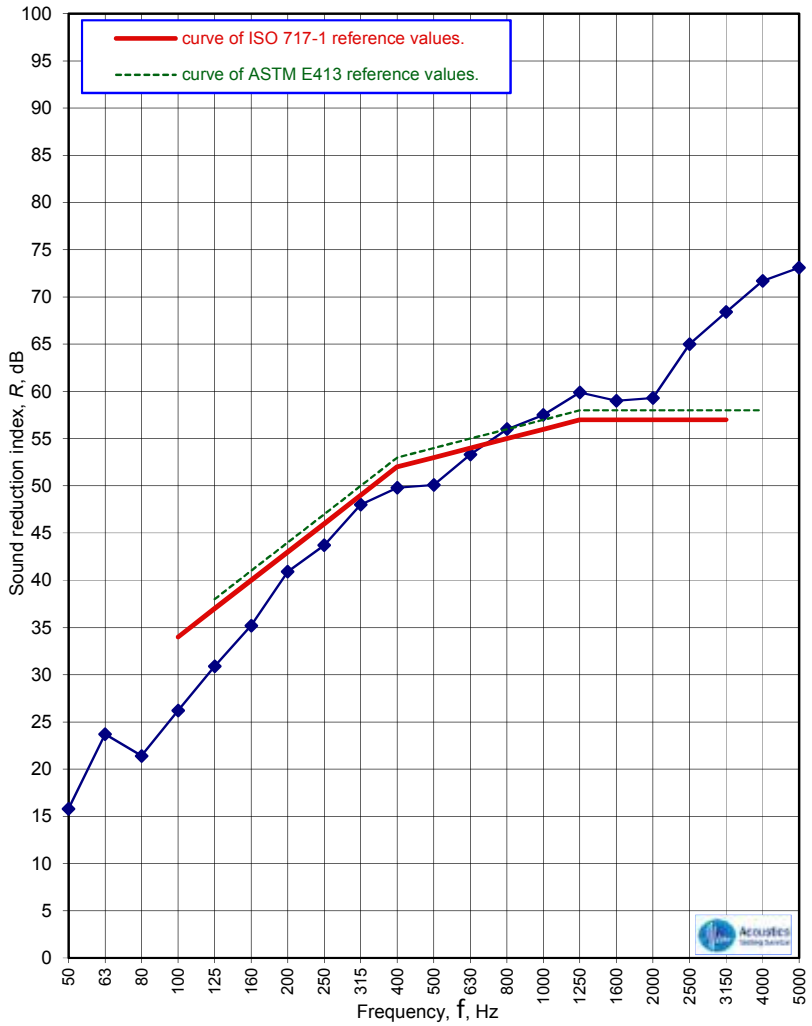
Test Floor Frame: 190mm x 45mm timber joists set at 450mm centres fixed in joist hangers to190mm x 45mm perimeter joists.
Test Floor Linings: Lower floor layer: 1 layer of 19mm *James Hardie Seura* tongue and groove flooring screw fixed at 600mm centres to the 190mm x 45mm timber joists
Upper floor layer: 1 layer of 19mm *James Hardie Secura* tongue and groove flooring screw fixed at 600mm centres on 40mm x 42mm 1.2mm roll formed steel battens spaced at 400mm centres in Acoustiflor rubber cradles loose laid at 450mm centres offset from joist fixings.
Cavity Absorption: 1 layer of *Knauf 11kg/m³ Earthwool* glass fibre insulation placed in the 60mm deep cavity between the battens
Test Floor Lining Joint Filler: *GIB Soundseal*
Test Wall Perimeter Sealant: *GIB Soundseal*

Source chamber: Chamber C, Receiving chamber: Chamber A . Test specimen installed by client. Curing time: 1hr
Computer files: T1612-2.CMG Emmited noise: T1612-2.CMG: ID.67 Received noise: T1612-2.CMG: ID.68 Reverberation time: T1612-2.CMG: ID.63

Area *S* of test specimen: 10.24 m^2
Mass per unit area: 0.00 kg/m^2
Air temp in the test rooms: 23 °C
Air humidity in test rooms: 60 %
Source room volume: 202 m^3
Receiving room volume: 153 m^3

Frequency *f* Hz	*R* One-third octave dB
50	15.8
63	23.7
80	21.4
100	**26.2**
125	**30.9**
160	**35.2**
200	**40.9**
250	**43.7**
315	**48.0**
400	**49.8**
500	**50.1**
630	**53.3**
800	**56.0**
1000	**57.5**
1250	**59.9**
1600	**59.0**
2000	**59.3**
2500	**65.0**
3150	**68.4**
4000	**71.7**
5000	73.1

Notes:1. #N/A = Value not available.
2. **Bold** values are used to calculate STC and R_w.
3. Words in ***Blue Italic*** in the description are manufacturers brand names.



Rating according to ISO 717-1 R_w $(C;C_{tr})$ = **53 (-3 ; -9) dB**
$C_{50\text{-}3150}$ = -5 dB $C_{tr,\ 50\text{-}3150}$ = -16 dB
$C_{50\text{-}5000}$ = -4 dB $C_{tr,\ 50\text{-}5000}$ = -16 dB
$C_{100\text{-}5000}$ = -2 dB $C_{tr,100\text{-}5000}$ = -9 dB

Rating according to ASTM E413 -87
Sound Transmission Class = 54 dB

No. of test report: **T1612-2** Name of test institute: University of Auckland Acoustics Testing Service.
Signature: **Informal Results** Date:

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Batten&Cradle
Flooring Systems

Normalized Impact sound pressure levels according to ISO 140-6
Laboratory measurements of impact sound insulation of floors

Date of test: 31-Mar-16

Description and identification of the test specimen and test arrangement: Client: Batten and Cradle

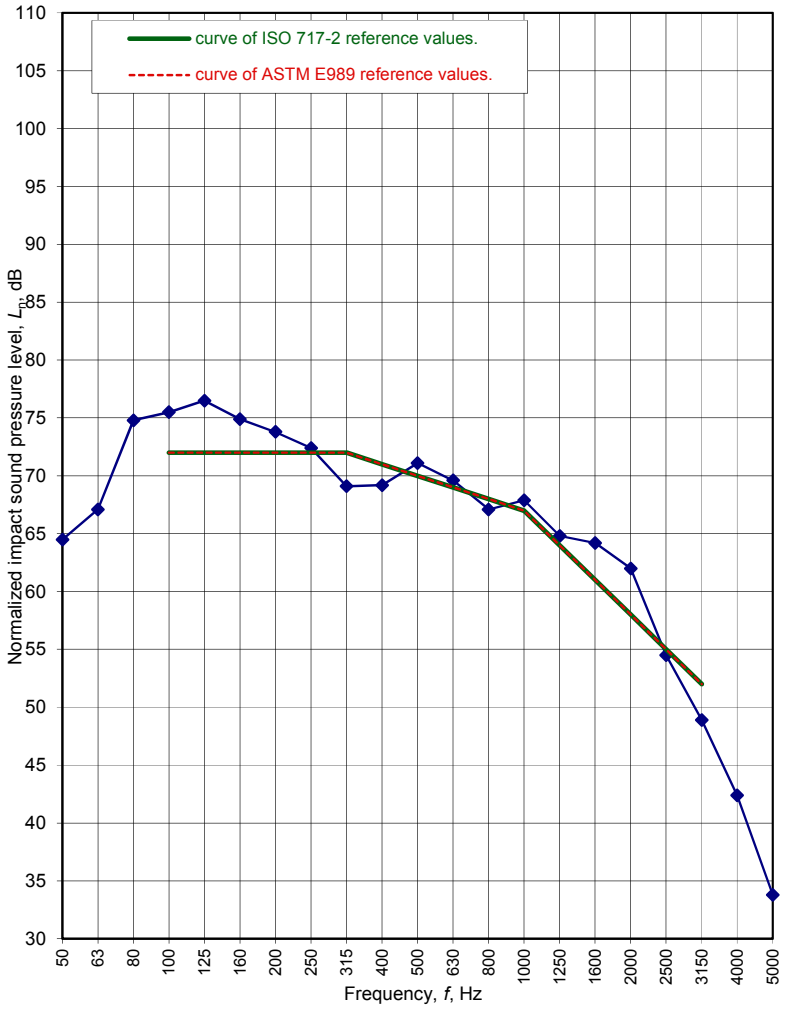
Test Floor Frame: 190mm x 45mm timber joists set at 450mm centres fixed in joist hangers to190mm x 45mm perimeter joists.
Test Floor Linings: Lower floor layer: 1 layer of 19mm *James Hardie Seura* tongue and groove flooring screw fixed at 600mm centres to the 190mm x 45mm timber joists
Upper floor layer: 1 layer of 19mm *James Hardie Secura* tongue and groove flooring screw fixed at 600mm centres on 40mm x 42mm 1.2mm roll formed steel battens spaced at 400mm centres in Acoustiflor rubber cradles loose laid at 450mm centres offset from joist fixings.
Cavity Absorption: 1 layer of *Knauf 11kg/m³ Earthwool* glass fibre insulation placed in the 60mm deep cavity between the battens

Source chamber: Chamber A. Receiving chamber: Chamber B. Test specimen installed by the client. Curing time was: 1hr
Computer Files:

Area *S* of specimen floor: 10.24 m^2
Mass per unit area: 0 Kg/m^2
Air temp in the test rooms: 23 °C
Air humidity in test rooms: 60 %
Receiving room volume: 153 m^3

Frequency *f* Hz	L_n One-third octave dB
50	64.5
63	67.1
80	74.8
100	**75.5**
125	**76.5**
160	**74.9**
200	**73.8**
250	**72.4**
315	**69.1**
400	**69.2**
500	**71.1**
630	**69.6**
800	**67.1**
1000	**67.9**
1250	**64.8**
1600	**64.2**
2000	**62.0**
2500	**54.5**
3150	**48.9**
4000	42.4
5000	33.8

Notes:1.#N/A = Value not available.
2. Bold values are used to calculate IIC and Ln,w.
3. < indicates that the true value is lower.



Rating according to ISO 717-2:
$L_{n,w}$ (C_I) = 70 (-2) dB $C_{I,50\text{-}2500}$ = -1 dB

Rating according to ASTM E989:
Impact Insulation Class = 40 dB

No. of test report: **T1612-1i** Name of test institute: University of Auckland Acoustics Testing Service.

Date: Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

Airborne sound reduction indices according to ISO 140-3
Laboratory measurements of airborne sound insulation of building elements

Client: Batten and Cradle

Date of test: 4-Mar-14
Test rooms: Reverberation Chambers A and B

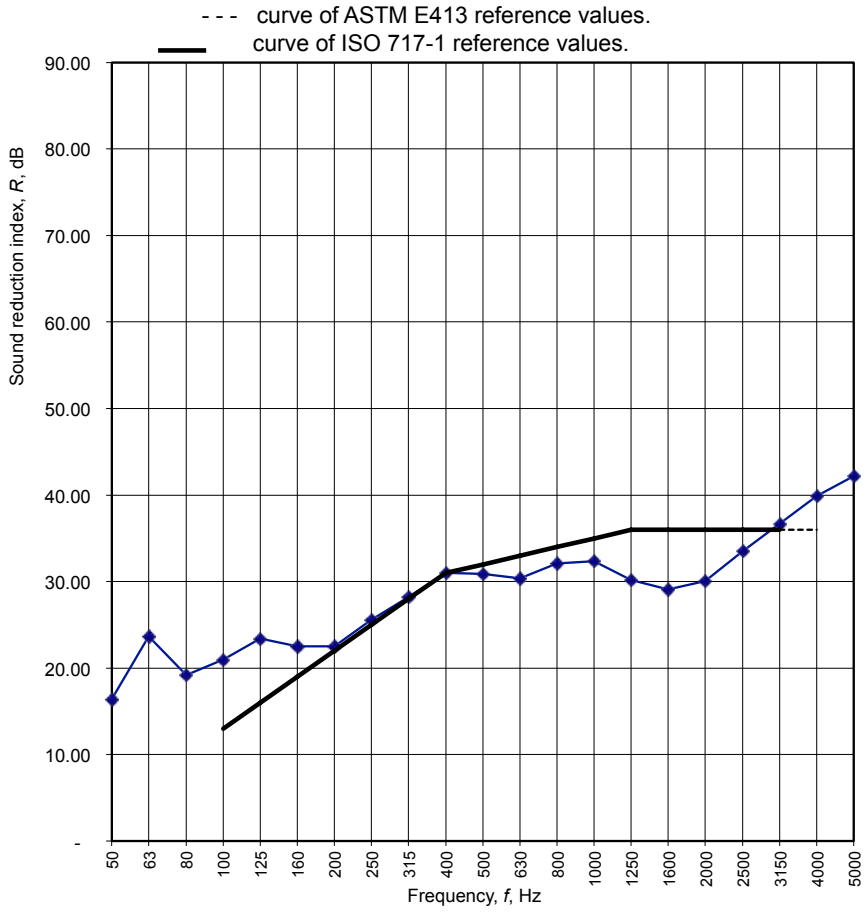
Description and identification of the test specimen and test arrangement:
1 layer of 19mm thick James Hardie Scyon Secura board screw fixed (at 200mm ctrs) to 190mm joists (no ceiling). Hardie board fixed with v joints facing up and all joints and perimeter are sealed with Bostik Acoustic Sealant.

Source chamber was Chamber A and receiving chamber was Chamber B . Test specimen was installed by client.
Computer Files:

Area *S* of test specimen:	10.24 m^2
Air temp in the test rooms:	21 °C
Air humidity in test rooms:	59 %
Source room volume:	208 m^3
Receiving room volume:	153 m^3

Frequency *f* Hz	*R* One-third octave dB
50	16.4
63	23.7
80	19.2
100	**21.0**
125	**23.4**
160	**22.5**
200	**22.5**
250	**25.6**
315	**28.2**
400	**31.0**
500	**30.9**
630	**30.4**
800	**32.1**
1000	**32.4**
1250	**30.2**
1600	**29.1**
2000	**30.1**
2500	**33.5**
3150	**36.7**
4000	**39.9**
5000	42.2

Notes: #N/A = Value not available. **Bold** values are used to calculate STC and R_w.



Rating according to ISO 717-1

R_w (C;C_{tr}) = 32 (-1 ; -3) dB

$C_{50\text{-}3150}$ = -1 dB	$C_{50\text{-}5000}$ = 0 dB	$C_{100\text{-}5000}$ = 0 dB
$C_{tr,50\text{-}3150}$ = -3 dB	$C_{tr,50\text{-}5000}$ = -3 dB	$C_{tr,100\text{-}5000}$ = -3 dB

Rating according to ASTM E413 -87

Sound Transmission Class = 32 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

No. of test report: T1405-1a

Name of test institute: University of Auckland Acoustics Testing Service.

Date:

Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

Normalized Impact sound pressure levels according to ISO 140-6
Laboratory measurements of impact sound insulation of floors

Date of test: 4-Mar-14
Client: Batten and Cradle

Description and identification of the test specimen and test arrangement:
1 layer of 19mm thick James Hardie Scyon Secura board screw fixed (at 200mm ctrs) to 190mm joists (no ceiling). Hardie board fixed with v joints facing up and all joints and perimeter are sealed with Bostik Acoustic Sealant.

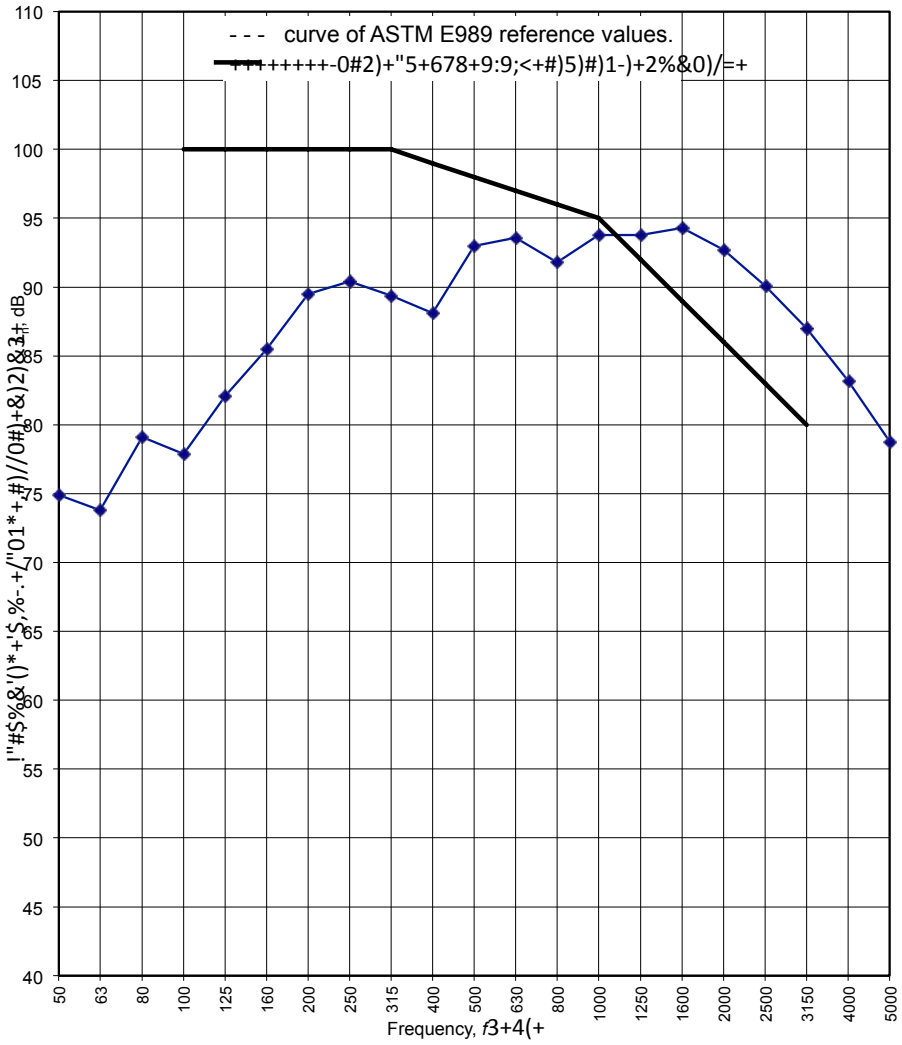
Source chamber: Chamber A. Receiving chamber: Chamber B. Test specimen installed by the client.

Computer Files: 0 0 0

Area *S* of specimen floor: 10.24 m^2
Mass per unit area: 38.672 Kg/m^2
Air temp in the test rooms: 21 °C
Air humidity in test rooms: 59 %
Receiving room volume: 153 m^3

Frequency *f* Hz	L_n One-third octave dB
50	74.9
63	73.8
80	79.1
100	**77.9**
125	**82.1**
160	**85.5**
200	**89.5**
250	**90.4**
315	**89.4**
400	**88.1**
500	**93.0**
630	**93.6**
800	**91.8**
1000	**93.8**
1250	**93.8**
1600	**94.3**
2000	**92.7**
2500	**90.1**
3150	**87.0**
4000	83.2
5000	78.8

Notes:1.#N/A = Value not available.
2. Bold values are used to calculate IIC and Ln,w.
3. < indicates that the true value is lower.



Rating according to ISO 717-2:	$L_{n,w}$ **(**C_I**)** = 98 (-10) dB $C_{I,50\text{-}2500}$ =-10 dB
Rating according to ASTM E989:	**Impact Insulation Class = 12 dB**

No. of test report: **T1405-1i**
Name of test institute: University of Auckland Acoustics Testing Service.

Date:
Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

Airborne sound reduction indices according to ISO 140-3
Laboratory measurements of airborne sound insulation of building elements

Client: Batten and Cradle

Date of test: 4-Mar-14
Test rooms: Reverberation Chambers A and B

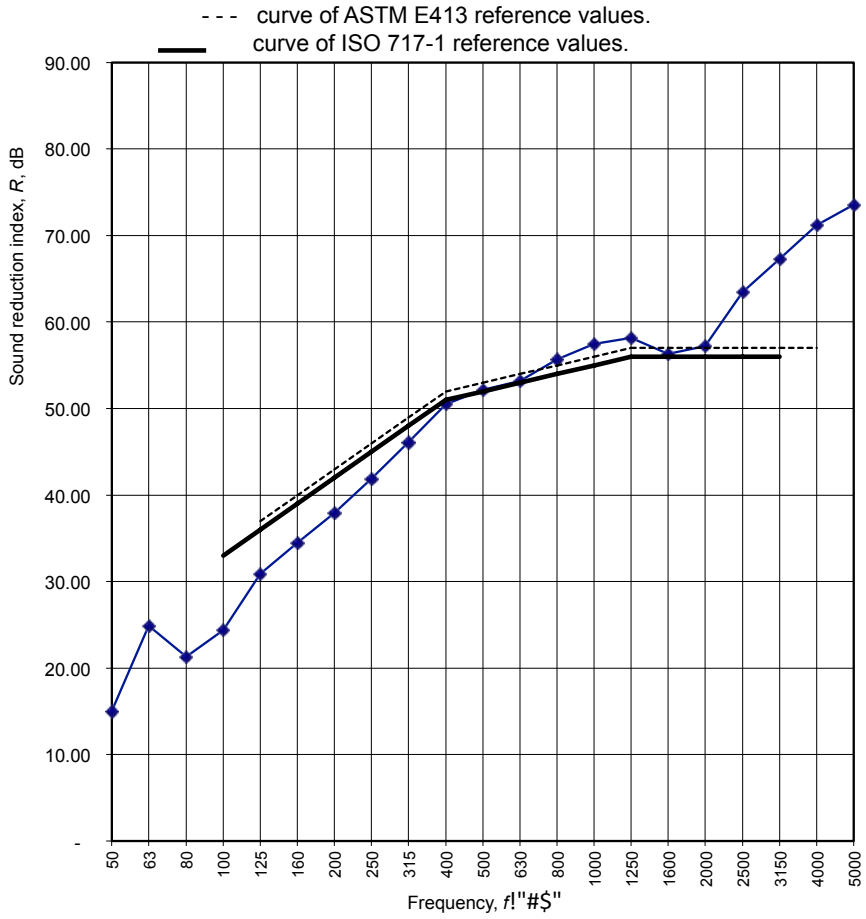
Description and identification of the test specimen and test arrangement:
1 layer of 19mm thick James Hardie Scyon Secura board screw fixed (at 200mm ctrs) to 45mm x 45mm battens set at 400mm ctrs on cradles at 450mm ctrs placed on 1 layer of 19mm thick James Hardie Scyon Secura board screw fixed (at 200mm ctrs) to 190mm joists (no ceiling). Both layers of Hardie board fixed with v joints facing up and all joints and perimeter are sealed with Bostik Acoustic Sealant. The 60mm cavity lined with 75mm Bink Batts Silencer.

Source chamber was Chamber A and receiving chamber was Chamber B . Test specimen was installed by client.
Computer Files:

Area *S* of test specimen:	10.24 m^2
Air temp in the test rooms:	21 °C
Air humidity in test rooms:	60 %
Source room volume:	208 m^3
Receiving room volume:	153 m^3

Frequency *f* Hz	*R* One-third octave dB
50	15.0
63	24.9
80	21.3
100	**24.4**
125	**30.9**
160	**34.5**
200	**37.9**
250	**41.9**
315	**46.1**
400	**50.5**
500	**52.2**
630	**53.2**
800	**55.7**
1000	**57.5**
1250	**58.2**
1600	**56.3**
2000	**57.2**
2500	**63.5**
3150	**67.3**
4000	**71.2**
5000	73.6

Notes: #N/A = Value not available. **Bold** values are used to calculate STC and R_w.



Rating according to ISO 717-1

R_w (C;C_{tr}) = 52 (-3 ; -10) dB

$C_{50\text{-}3150}$ = -5 dB	$C_{50\text{-}5000}$ = -4 dB	$C_{100\text{-}5000}$ = -2 dB
$C_{tr,50\text{-}3150}$ = -16 dB	$C_{tr,50\text{-}5000}$ = -16 dB	$C_{tr,100\text{-}5000}$ = -10 dB

Rating according to ASTM E413 -87

Sound Transmission Class = 53 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

No. of test report: T1405-2a

Name of test institute: University of Auckland Acoustics Testing Service.

Date:

Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

Normalized Impact sound pressure levels according to ISO 140-6
Laboratory measurements of impact sound insulation of floors

Date of test: 4-Mar-14
Client: Batten and Cradle

Description and identification of the test specimen and test arrangement:
1 layer of 19mm thick James Hardie Scyon Secura board screw fixed (at 200mm ctrs) to 45mm x 45mm battens set at 400mm ctrs on cradles at 450mm ctrs placed on 1 layer of 19mm thick James Hardie Scyon Secura board screw fixed (at 200mm ctrs) to 190mm joists (no ceiling). Both layers of Hardie board fixed with v joints facing up and all joints and perimeter are sealed with Bostik Acoustic Sealant. The 60mm cavity lined with 75mm Bink Batts Silencer.

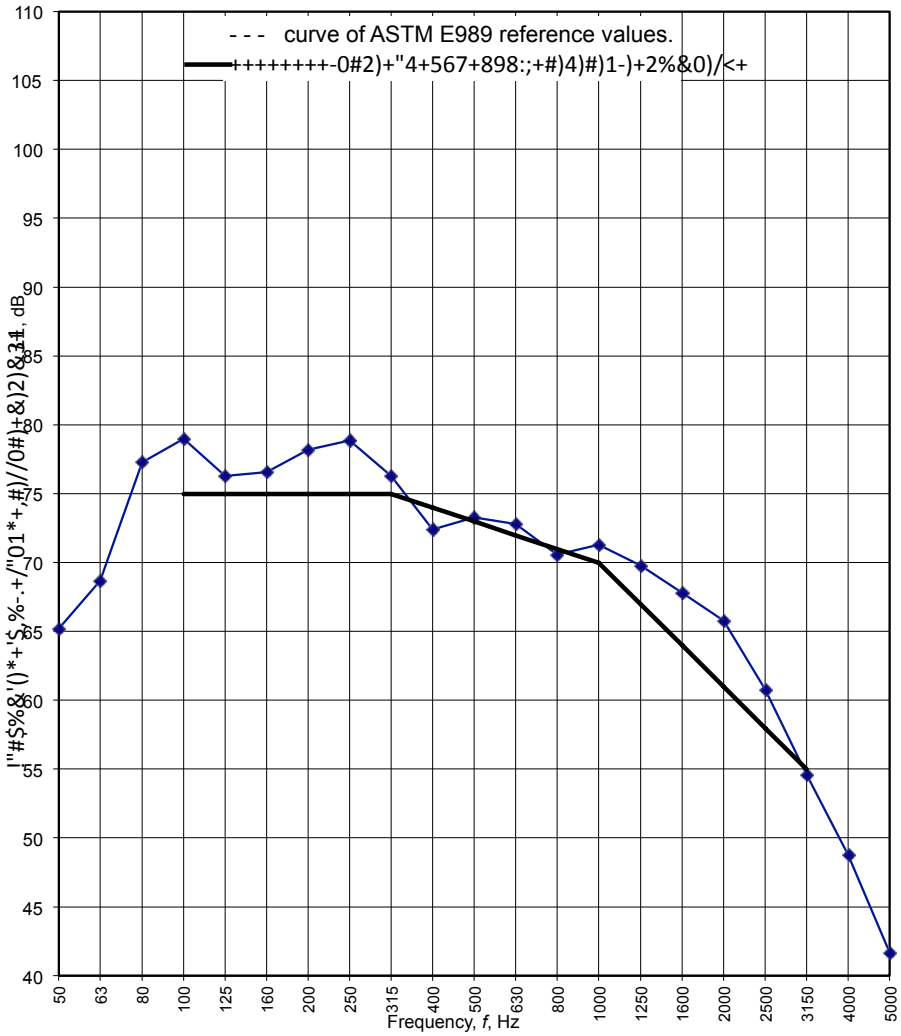
Source chamber: Chamber A. Receiving chamber: Chamber B. Test specimen installed by the client.

Computer Files: 0 0 0

Area *S* of specimen floor: 10.24 m^2
Mass per unit area: 68.408 Kg/m^2
Air temp in the test rooms: 21 °C
Air humidity in test rooms: 60 %
Receiving room volume: 153 m^3

Frequency *f* Hz	L_n One-third octave dB
50	< 65.2
63	68.7
80	77.3
100	**79.0**
125	**76.3**
160	**76.6**
200	**78.2**
250	**78.9**
315	**76.3**
400	**72.4**
500	**73.3**
630	**72.8**
800	**70.6**
1000	**71.3**
1250	**69.8**
1600	**67.8**
2000	**65.8**
2500	**60.8**
3150	**54.6**
4000	48.8
5000	41.7

Notes:1.#N/A = Value not available.
2. Bold values are used to calculate IIC and Ln,w.
3. < indicates that the true value is lower.



Rating according to ISO 717-2:
$L_{n,w}$ (C_I) = 73 (-1) dB $C_{I,50\text{-}2500}$ = -1 dB

Rating according to ASTM E989:
Impact Insulation Class = 37 dB

No. of test report: **T1405-2i**
Name of test institute: University of Auckland Acoustics Testing Service.

Date:
Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

Airborne sound reduction indices according to ISO 140-3
Laboratory measurements of airborne sound insulation of building elements

Client: Batten and Cradle

Date of test: 6-Mar-14
Test rooms: Reverberation Chambers A and B

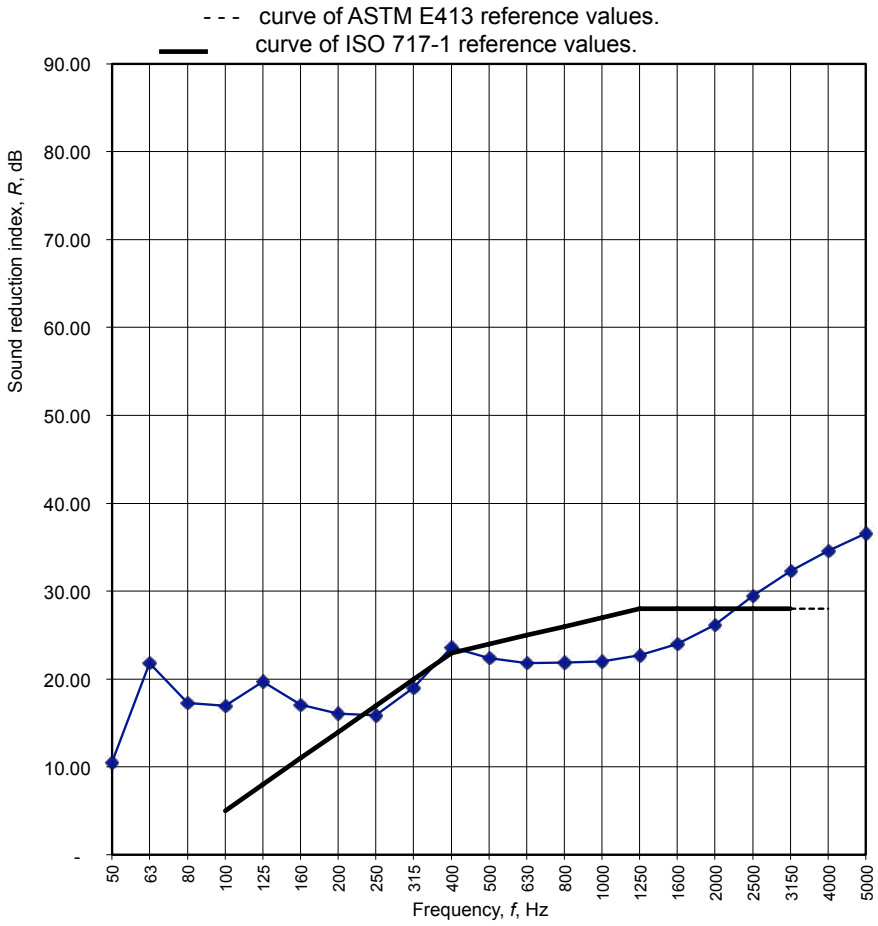
Description and identification of the test specimen and test arrangement:
1 layer of 20mm particleboard screw fixed (at 200mm ctrs) to 190mm joists set at 450mm ctrs) (no ceiling). Particleboard perimeter sealed with Bostik Acoustic Sealant.

Source chamber was Chamber A and receiving chamber was Chamber B . Test specimen was installed by client.
Computer Files:

Area *S* of test specimen:	10.24 m^2
Air temp in the test rooms:	21 °C
Air humidity in test rooms:	57 %
Source room volume:	208 m^3
Receiving room volume:	153 m^3

Frequency *f* Hz	*R* One-third octave dB
50	10.5
63	21.8
80	17.3
100	**17.0**
125	**19.7**
160	**17.1**
200	**16.1**
250	**15.9**
315	**19.0**
400	**23.6**
500	**22.4**
630	**21.8**
800	**21.9**
1000	**22.0**
1250	**22.7**
1600	**24.0**
2000	**26.2**
2500	**29.5**
3150	**32.3**
4000	**34.6**
5000	36.6

Notes: #N/A = Value not available. **Bold** values are used to calculate STC and R_w.



Rating according to ISO 717-1

R_w $(C;C_{tr})$ = 24 (-1 ; -2) dB

$C_{50\text{-}3150}$ = -1 dB	$C_{50\text{-}5000}$ = 0 dB	$C_{100\text{-}5000}$ = 0 dB
$C_{tr,50\text{-}3150}$ = -3 dB	$C_{tr,50\text{-}5000}$ = -3 dB	$C_{tr,100\text{-}5000}$ = -2 dB

Rating according to ASTM E413 -87

Sound Transmission Class = 24 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

No. of test report: T1405-4a

Name of test institute: University of Auckland Acoustics Testing Service.

Date:

Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

Normalized Impact sound pressure levels according to ISO 140-6
Laboratory measurements of impact sound insulation of floors

Date of test: 6-Mar-14

Description and identification of the test specimen and test arrangement: Client: Batten and Cradle

1 layer of 20mm particleboard screw fixed (at 200mm ctrs) to 190mm joists set at 450mm ctrs (no ceiling). Particleboard perimeter sealed with Bostik Acoustic Sealant.

Source chamber: Chamber A. Receiving chamber: Chamber B. Test specimen installed by the client.

Computer Files: 0 0 0

Area *S* of specimen floor: 10.24 m^2

Mass per unit area: 27.051 Kg/m^2

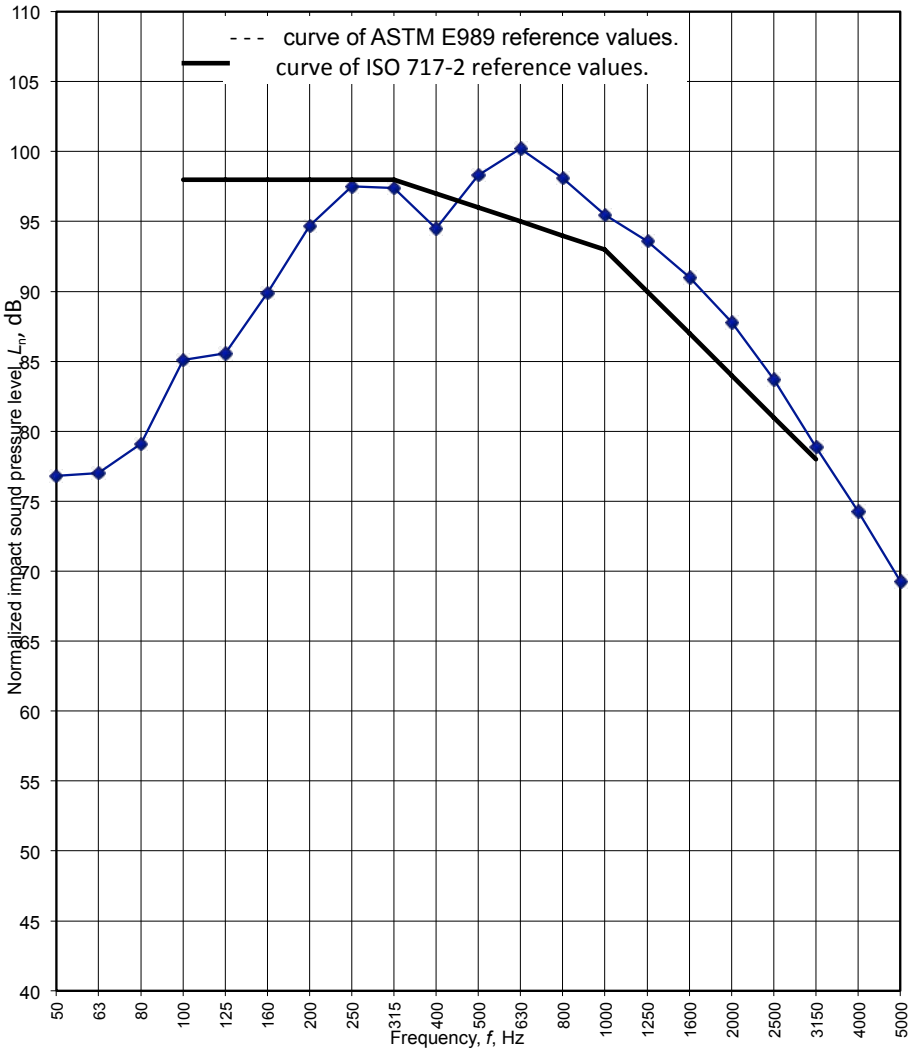
Air temp in the test rooms: 21 °C

Air humidity in test rooms: 57 %

Receiving room volume: 153 m^3

Frequency *f* Hz	L_n One-third octave dB
50	< 76.8
63	77.0
80	79.1
100	**85.1**
125	**85.6**
160	**89.9**
200	**94.7**
250	**97.5**
315	**97.4**
400	**94.5**
500	**98.3**
630	**100.2**
800	**98.1**
1000	**95.5**
1250	**93.6**
1600	**91.0**
2000	**87.8**
2500	**83.7**
3150	**78.9**
4000	74.3
5000	69.3

Notes:1.#N/A = Value not available.
2. Bold values are used to calculate IIC and Ln,w.
3. < indicates that the true value is lower.



Rating according to ISO 717-2:

$L_{n,w}$ (C_I) = 96 (-4) dB $C_{I,50\text{-}2500}$ = -4 dB

Rating according to ASTM E989:

Impact Insulation Class = 14 dB

No. of test report: **T1405-4i** Name of test institute: University of Auckland Acoustics Testing Service.

Date: Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

Airborne sound reduction indices according to ISO 140-3
Laboratory measurements of airborne sound insulation of building elements

Client: Batten and Cradle

Date of test: 6-Mar-14
Test rooms: Reverberation Chambers A and B

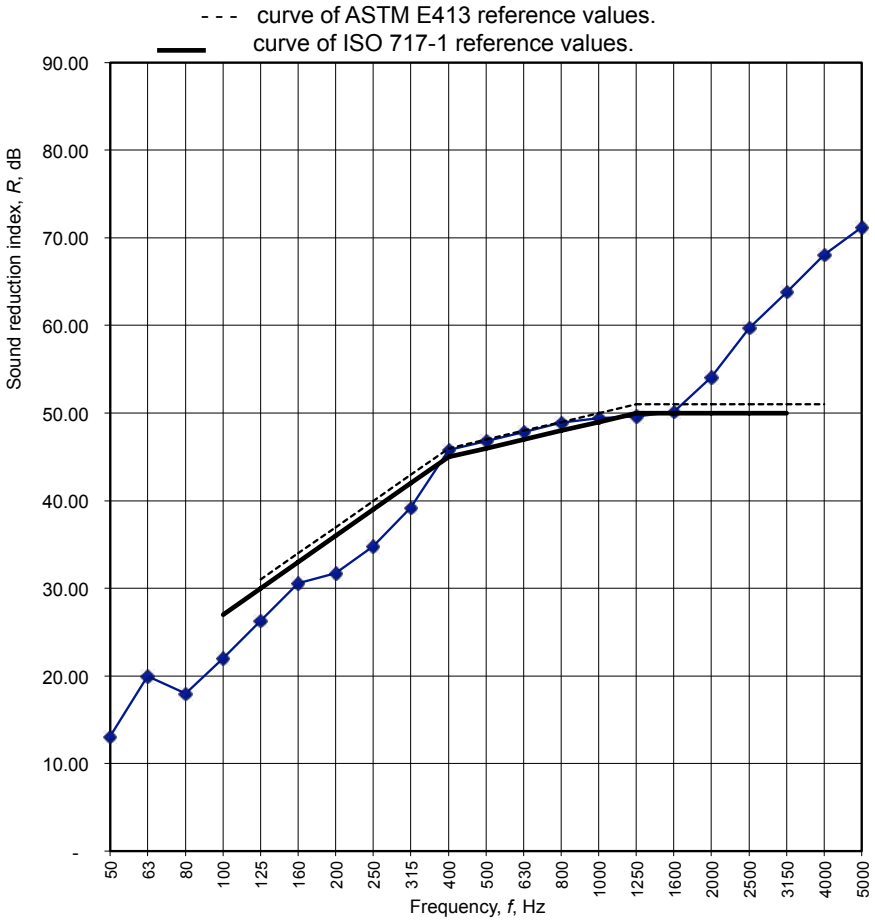
Description and identification of the test specimen and test arrangement:
1 layer of 20mm thick particleboard board screw fixed (at 200mm ctrs) to 45mm x 45mm battens set at 400mm ctrs on cradles at 450mm ctrs placed on 1 layer of 20mm thick particleboard screw fixed (at 200mm ctrs) to 190mm joists set at (450mm ctrs) (no ceiling). Both layers of particleboard are sealed around the perimeter with Bostik Acoustic Sealant. The 60mm cavity lined with 75mm Bink Batts Silencer.

Source chamber was Chamber A and receiving chamber was Chamber B . Test specimen was installed by client.
Computer Files:

Area *S* of test specimen:	10.24 m^2
Air temp in the test rooms:	20 °C
Air humidity in test rooms:	57 %
Source room volume:	208 m^3
Receiving room volume:	153 m^3

Frequency *f* Hz	*R* One-third octave dB
50	13.1
63	20.0
80	18.0
100	**22.0**
125	**26.3**
160	**30.6**
200	**31.7**
250	**34.8**
315	**39.2**
400	**45.8**
500	**46.8**
630	**47.8**
800	**48.9**
1000	**49.4**
1250	**49.6**
1600	**50.1**
2000	**54.1**
2500	**59.7**
3150	**63.8**
4000	**68.1**
5000	71.2

Notes: #N/A = Value not available. **Bold** values are used to calculate STC and R_w.



Rating according to ISO 717-1

R_w (C;C_{tr}) = 46 (-2 ; -7) dB

$C_{50\text{-}3150}$ = -3 dB	$C_{50\text{-}5000}$ = -2 dB	$C_{100\text{-}5000}$ = -1 dB
$C_{tr,50\text{-}3150}$ = -13 dB	$C_{tr,50\text{-}5000}$ = -13 dB	$C_{tr,100\text{-}5000}$ = -7 dB

Rating according to ASTM E413 -87

Sound Transmission Class = 47 dB

Evaluation based on laboratory measurement results obtained by an engineering method.

No. of test report: T1405-5a

Name of test institute: University of Auckland Acoustics Testing Service.

Date:

Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

Normalized Impact sound pressure levels according to ISO 140-6
Laboratory measurements of impact sound insulation of floors

Date of test: 4-Mar-14
Client: Batten and Cradle

Description and identification of the test specimen and test arrangement:
1 layer of 20mm thick particleboard board screw fixed (at 200mm ctrs) to 45mm x 45mm battens set at 400mm ctrs on cradles at 450mm ctrs placed on 1 layer of 20mm thick particleboard screw fixed (at 200mm ctrs) to 190mm joists set at (450mm ctrs) (no ceiling). Both layers of particleboard are sealed around the perimeter with Bostik Acoustic Sealant. The 60mm cavity lined with 75mm Bink Batts Silencer.

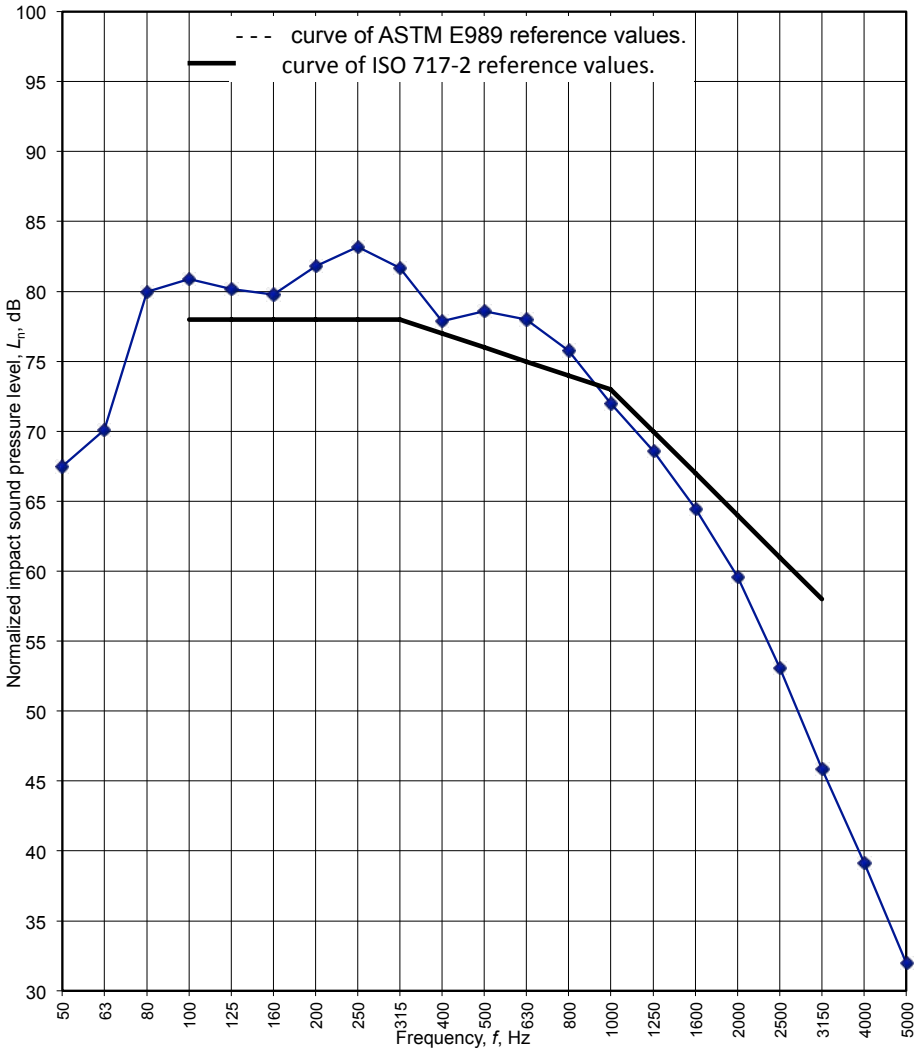
Source chamber: Chamber A. Receiving chamber: Chamber B. Test specimen installed by the client.

Computer Files: 0 0 0

Area *S* of specimen floor: 10.24 m^2
Mass per unit area: 45.117 Kg/m^2
Air temp in the test rooms: 21 °C
Air humidity in test rooms: 60 %
Receiving room volume: 153 m^3

Frequency *f* Hz	L_n One-third octave dB
50	< 67.5
63	70.1
80	80.0
100	**80.9**
125	**80.2**
160	**79.8**
200	**81.8**
250	**83.2**
315	**81.7**
400	**77.9**
500	**78.6**
630	**78.0**
800	**75.8**
1000	**72.0**
1250	**68.6**
1600	**64.5**
2000	**59.6**
2500	**53.1**
3150	**45.9**
4000	39.2
5000	32.0

Notes:1.#N/A = Value not available.
2. Bold values are used to calculate IIC and Ln,w.
3. < indicates that the true value is lower.



Rating according to ISO 717-2:
$L_{n,w}$ (C_I) = 76 (-1) dB $C_{I,50\text{-}2500}$ =0 dB

Rating according to ASTM E989:
Impact Insulation Class = 34 dB

No. of test report: **T1405-5i**
Name of test institute: University of Auckland Acoustics Testing Service.

Date:
Signature: **Preliminary Results Only**

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Batten&Cradle
Flooring Systems

ACOUSTIC TESTING REPORT

Lab Test 1: Insulated B&C with ceramic tiles

Reduction of impact sound pressure levels according to ISO 140-8
Laboratory measurements of the reduction of transmitted impact sound by floor coverings on a standard floor

Client: Batten & Cradle Flooring Systems Ltd.

Date of test: Friday, 19 March 2010
Test rooms: Reverberation Chambers A and B

Description and identification of the test specimen and test arrangement:

A 3.6m x 3.2m Batten & Cradle Flooring system comprising: 600mmx600mm glazed ceramic *PEI 3* tiles adhered with *monoflex C2S2et Tile Adhesive* (applied with 10mm notched trowel) to 6mm thick *James Hardie Tile Underlay* sheets. The *James Hardie Tile Underlay* sheets are screw fixed with 20mm 6g self tapping screws to 3600mmx800mmx20mm (*LengthxWidthxThickness*) *Strandfloor* tongue and groove flooring which is screw fixed with 50mm x 8g screws at 200mm centers to dressed 42mmx42mm fingerjoint timber battens spaced at 450mm centres on *RC-20* rubber cradles spaced at 450mm on the concrete test floor. The 62mm deep cavity space between the battens is lined with 75mm Pink Batts Silencer.

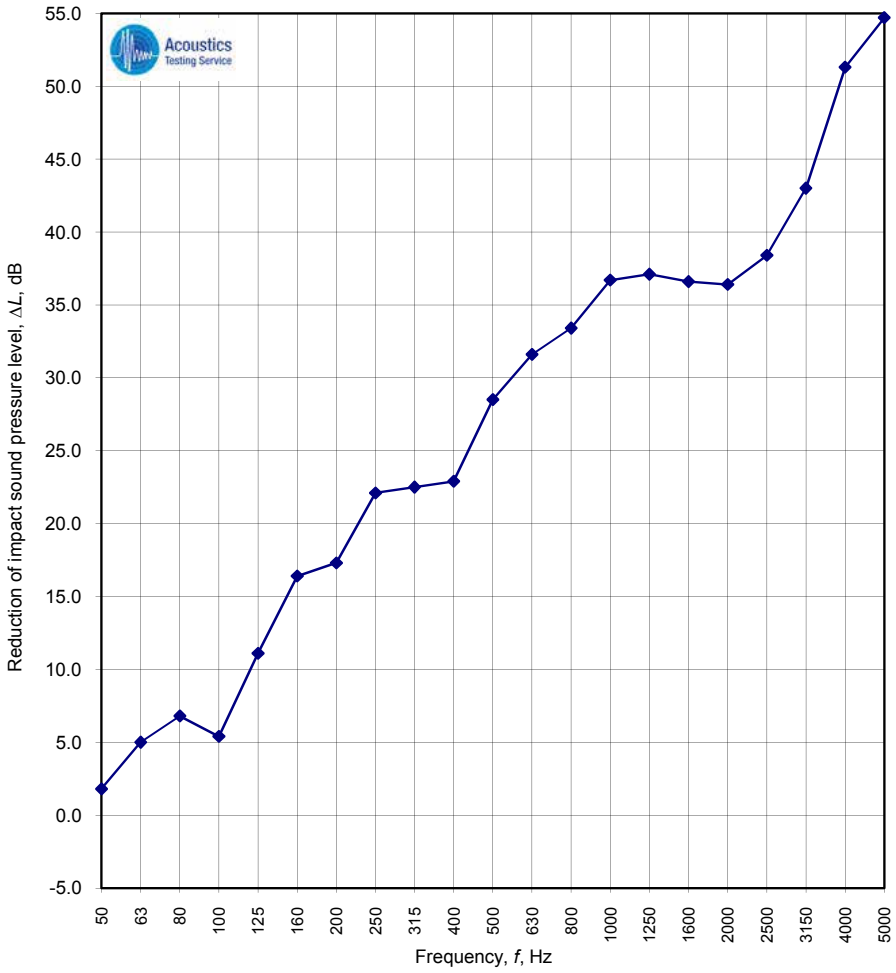
Source chamber was Chamber A and receiving chamber was Chamber B . Test specimen installed by the client. Curing time was 24 hours.

Deviation from standard: The bare test floor used is of uniform thickness for an area of only 2.6m x 2.6m. The description of the bare test floor is given in the full report.

Computer Files: T1006 Bare Floor.CMG(ID.15, ID.16, ID.54, ID.2, ID.0, ID.1)T1006-1 Sample.CMG(ID.14, ID.15, ID.54, ID.18, ID.55, ID.56)

Air temp in the test rooms: 21 °C
Air humidity in test rooms: 57 %
Receiving room volume: 153 m^3

Frequency *f* Hz	$L_{n,0}$ One-third octave dB	ΔL One-third octave dB
50	58.6	1.8
63	52.8	5.0
80	53.8	6.8
100	**63.1**	**5.4**
125	**62.3**	**11.1**
160	**70.0**	**16.4**
200	**66.9**	**17.3**
250	**71.5**	**22.1**
315	**68.4**	**22.5**
400	**73.3**	**22.9**
500	**78.6**	**28.5**
630	**76.4**	**31.6**
800	**71.9**	**33.4**
1000	**72.6**	**36.7**
1250	**72.9**	**37.1**
1600	**79.0**	**36.6**
2000	**78.8**	**36.4**
2500	**76.9**	**38.4**
3150	**75.5**	**43.0**
4000	71.2	51.3
5000	67.4	54.7



Notes: #N/A = Value not available. **Bold** values are used to calculate ΔL_w.
< indicates that the true value is lower.
$L_{n,0}$ are the bare floor impact sound levels.

Rating according to ISO 717-2:

ΔL_w = 31 dB $C_{I,\Delta}$ = 13 dB $C_{I,r}$ = 1 dB $C_{I,50\text{-}2500}$ = 2 dB

These results are based on a test made with an artificial source under laboratory conditions (engineering Method).

No. of test report: **T1006-1**
Date: 26-March-2010

Name of test institute: University of Auckland Acoustics Testing Service.
Signature: **Preliminary Results Only**

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Batten&Cradle Flooring Systems

ACOUSTIC TESTING REPORT

Lab Test 2: Insulated B&C standard system

Reduction of impact sound pressure levels according to ISO 140-8
Laboratory measurements of the reduction of transmitted impact sound by floor coverings on a standard floor

Client: Batten & Cradle Flooring Systems Ltd.

Date of test: Friday, 19 March 2010
Test rooms: Reverberation Chambers A and B

Description and identification of the test specimen and test arrangement:

A 3.6m x 3.2m Batten & Cradle Flooring system comprising: 4 sheets of 3600mmx800mmx20mm (*LengthxWidthxThickness*) *Strandfloor* tongue and groove flooring screw fixed with 50mm x 8g screws at 200mm centers to dressed 42mmx42mm fingerjoint timber battens spaced at 450mm centres on *RC-20* rubber cradles spaced at 450mm on the concrete test floor. The 62mm deep cavity space between the battens is lined with 75mm Pink Batts Silencer.

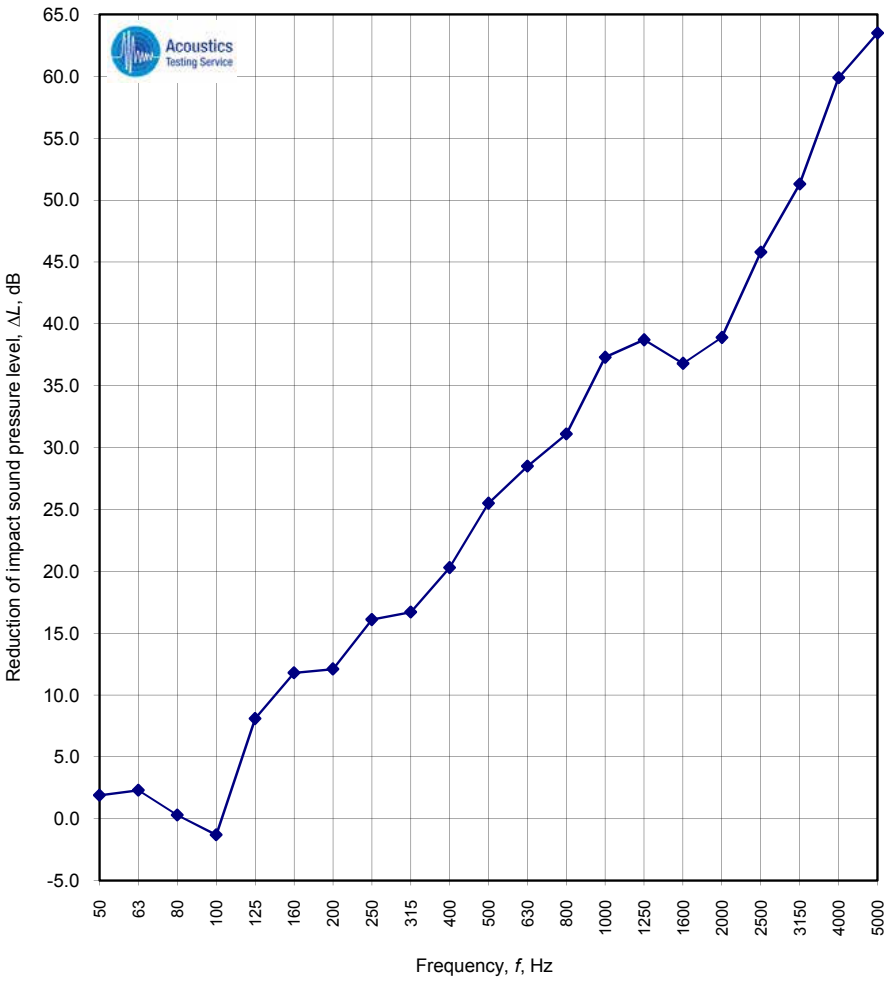
Source chamber was Chamber A and receiving chamber was Chamber B . Test specimen installed by the client.

Deviation from standard: The bare test floor used is of uniform thickness for an area of only 2.6m x 2.6m. The description of the bare test floor is given in the full report.

Computer Files: T1006 Bare Floor.CMG(ID.15, ID.16, ID.54, ID.2, ID.0, ID.1)T1006-2 TL.CMG(ID.15, ID.16, ID.54, ID.2,ID.0, ID.1)

Air temp in the test rooms: 21 °C
Air humidity in test rooms: 55 %
Receiving room volume: 153 m^3

Frequency *f* Hz	$L_{n,0}$ One-third octave dB	ΔL One-third octave dB
50	58.6	1.9
63	52.8	2.3
80	53.8	0.3
100	**63.1**	**-1.3**
125	**62.3**	**8.1**
160	**70.0**	**11.8**
200	**66.9**	**12.1**
250	**71.5**	**16.1**
315	**68.4**	**16.7**
400	**73.3**	**20.3**
500	**78.6**	**25.5**
630	**76.4**	**28.5**
800	**71.9**	**31.1**
1000	**72.6**	**37.3**
1250	**72.9**	**38.7**
1600	**79.0**	**36.8**
2000	**78.8**	**38.9**
2500	**76.9**	**45.8**
3150	**75.5**	**51.3**
4000	71.2	59.9
5000	67.4	63.5



Notes: #N/A = Value not available. **Bold** values are used to calculate ΔL_w.
< indicates that the true value is lower.
$L_{n,0}$ are the bare floor impact sound levels.

Rating according to ISO 717-2:

ΔL_w = 27 dB $C_{I,\Delta}$ = 15 dB $C_{I,r}$ = 3 dB $C_{I,50\text{-}2500}$ = 4 dB

These results are based on a test made with an artificial source under laboratory conditions (engineering Method).

No. of test report: **T1006-2**
Name of test institute: University of Auckland Acoustics Testing Service.
Date: 26-March-2010
Signature: **Preliminary Results Only**

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Batten&Cradle Flooring Systems

ACOUSTIC TESTING REPORT

Lab Test 3: B&C standard system

Reduction of impact sound pressure levels according to ISO 140-8
Laboratory measurements of the reduction of transmitted impact sound by floor coverings on a standard floor

Client: Batten & Cradle Flooring Systems Ltd.

Date of test: Monday, 22 March 2010
Test rooms: Reverberation Chambers A and B

Description and identification of the test specimen and test arrangement:

A 3.6m x 3.2m Batten & Cradle Flooring system comprising: 4 sheets of 3600mmx800mmx20mm (*LengthxWidthxThickness*) *Strandfloor* tongue and groove flooring screw fixed with 50mm x 8g screws at 200mm centers to dressed 42mmx42mm fingerjoint timber battens spaced at 450mm centres on *RC-20* rubber cradles spaced at 450mm on the concrete test floor. The 62mm deep cavity space between the battens is left empty

Source chamber was Chamber A and receiving chamber was Chamber B . Test specimen installed by the client.

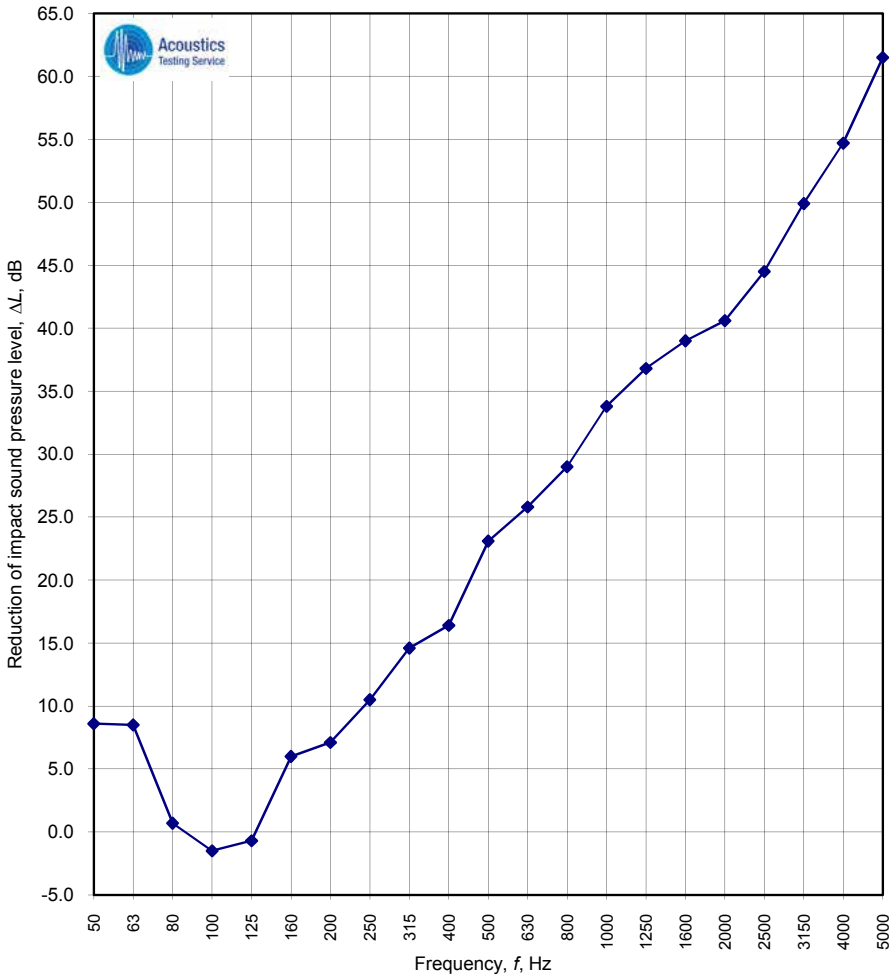
Deviation from standard: The bare test floor used is of uniform thickness for an area of only 2.6m x 2.6m. The description of the bare test floor is given in the full report.

Computer Files: T1006 Bare Floor.CMG(ID.15, ID.16, ID.54, ID.2, ID.0, ID.1)T1006-3 Final Test Sample.CMG(ID.16, ID.17, ID.54, ID.16,

Air temp in the test rooms: 21 °C
Air humidity in test rooms: 56 %
Receiving room volume: 153 m^3

Frequency *f* Hz	$L_{n,0}$ One-third octave dB	ΔL One-third octave dB
50	58.6	8.6
63	52.8	8.5
80	53.8	0.7
100	**63.1**	**-1.5**
125	**62.3**	**-0.7**
160	**70.0**	**6.0**
200	**66.9**	**7.1**
250	**71.5**	**10.5**
315	**68.4**	**14.6**
400	**73.3**	**16.4**
500	**78.6**	**23.1**
630	**76.4**	**25.8**
800	**71.9**	**29.0**
1000	**72.6**	**33.8**
1250	**72.9**	**36.8**
1600	**79.0**	**39.0**
2000	**78.8**	**40.6**
2500	**76.9**	**44.5**
3150	**75.5**	**49.9**
4000	71.2	54.7
5000	67.4	61.5

Notes: #N/A = Value not available. **Bold** values are used to calculate ΔL_w.
< indicates that the true value is lower.
$L_{n,0}$ are the bare floor impact sound levels.



Rating according to ISO 717-2:

ΔL_w = 22 dB $C_{I,\Delta}$ = 13 dB $C_{I,r}$ = 1 dB $C_{I,50\text{-}2500}$ = 2 dB

These results are based on a test made with an artificial source under laboratory conditions (engineering Method).

No. of test report: **T1006-3**
Name of test institute: University of Auckland Acoustics Testing Service.
Date: 26-March-2010
Signature: **Preliminary Results Only**

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Batten&Cradle Flooring Systems

MARSHALL DAY Acoustics

OPINION ON IMPACT INSULATION RATING OF BATTEN & CRADLE FLOORING SYSTEMS WITH STEEL BATTENS

Rp 001 201608av | 5 August 2016

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Project: **OPINION ON IMPACT INSULATION RATING OF BATTEN & CRADLE FLOORING SYSTEMS WITH STEEL BATTENS**

Prepared for: **Batten & Cradle Acoustic Flooring Ltd**
PO Box 5074
New Plymouth 4343

Attention: **Peter Huston**

Report No.: **Rp 001 01 201608av**

Document Control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Draft			4 August 2016	K O Ballagh	M S Dunn

TABLE OF CONTENTS

1.0 INTRODUCTION

Marshall Day Acoustics was asked to provide an opinion on the Impact Insulation Class (IIC) rating that would be achieved by the Batten and Cradle ™ flooring system installed on a typical timber joist floor/ceiling construction. This opinion is based on laboratory tests of the floor system on a light weight timber floor and previous tests and computer prediction models of floor and ceiling combinations without the flooring overlay.

2.0 CONSTRUCTION

2.1 Floor/Ceiling construction

The floor assembly for which the opinion is provided is as follows:

Batten and Cradle – with Secura Flooring

- 19 mm Secura™ flooring system, screw fixed at 600 mm centres to
- Batten & Cradle Steel Battens™ (40 x 42 mm x 1.2mm roll formed batten) spaced at 400mm centres on
- Acousticflor™ rubber cradles spaced at 450mm centres
- 60 mm floor cavity containing an acoustic blanket of minimum 50 mm thickness and of minimum density 10 kg/m^3 (minimum flow resistivity 1400 Rayl/m).

Floor/Ceiling Construction

- 19 mm Secura™ flooring system fixed at 600 mm centres to minimum 190 x 45 mm timber or LVL joists, or minimum 200mm deep Posi-STRUT™ joists
- Either:
  - 2 layers of 13 mm Gib® Fyreline, or
  - 1 x 16mm Gib® Fyreline

  Fixed to either:
  - USG ScrewFix steel frame suspension system comprising 2.5 mm wire hangers at 1200 mm centres supporting DJ38 strongback channels spaced at 600 mm centres maximum, installed in accordance with manufacturers recommendations, or
  - Gib® Quiet Clips® or ST001 Acoustic Mounts fixed to the joists and holding Gib Rondo 308 battens, installed in accordance with manufacturer's recommendation.
- The perimeter of the ceiling is sealed with flexible acoustic sealant such as Gib® Soundseal.
- An acoustic blanket of minimum 75 mm thickness and of minimum density 10 kg/m^3 is placed in the ceiling cavity (minimum flow resistivity 1400 Rayl/m)

3.0 TEST RESULTS

The impact and airborne sound insulation of a light weight floor with and without the Batten and Cradle floor covering was tested by the University of Auckland Acoustics Testing Service (Test Reports T1612-1 and T1612-2 March, 2016). The difference in impact sound and airborne sound transmission between the light weight floor alone and the light weight floor with the Batten and Cradle system was able to be determined from these tests.

4.0 CALCULATIONS

The sound transmission loss and impact sound insulation of the floor/ceiling construction was calculated by using INSUL software to predict the base performance of the assembly with no floor covering. The measured improvement for the Batten and Cradle system on a lightweight floor was then added to the base performance to estimate the performance of the floor/ceiling with a Batten and Cradle system over top.

5.0 OPINION

The estimated laboratory performance of the floor described in Section 2 is given in the table below:

Table 1: Estimated Sound Transmission Loss

Partition	Description	STC	Rw	IIC	L_{nTw}
	Secura flooring on Batten and Cradle™ system on Secura flooring fixed to timber, LVL or Posi-STRUT joists with 2 x 13mm Gib Fyreline ceiling with 75mm Pink Batts Silencer blanket in cavity	>68	>68	59	45
	Secura flooring on Batten and Cradle™ system on Secura flooring fixed to timber, LVL or Posi-STRUT joists with 1x 16mm Gib Fyreline ceiling with 75mm Pink Batts Silencer blanket in cavity	>68	>68	60	47

Note: Airborne values have been limited to not more than STC 68 as flanking transmission will limit on site performance in most situations.

6.0 LIMITATIONS

The above opinions are an estimate of the laboratory performance not the field performance. The estimate is based on the original laboratory tests, the materials as currently manufactured and the construction details set out above. Readers are advised to check that this opinion has not been revised by a later issue. The estimate is expected to be in error by less than 3 IIC/dB.

Note:

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Opinion on Impact Insulation Rating of Batten & Cradle Flooring Systems

April 2014

MARSHALL DAY Acoustics

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Project: **Opinion on Impact Insulation Rating of Batten & Cradle Flooring System on a lightweight floor**

Prepared for: **Batten & Cradle Acoustic Flooring Ltd**
PO Box 5074

New Plymouth 4343

Report No.: **Rp001 r01 201404ar**

Document control

Status:	Issue:	Date:	Prepared by:	Reviewed by:
Current	R00	8 April 2014	K O Ballagh	M S Dunn
Final	R01	17 April	K O Ballagh	M S Dunn

TABLE OF CONTENTS

1.0 INTRODUCTION

Marshall Day Acoustics was asked to provide an opinion on the Impact Insulation Class (IIC) rating that would be achieved by the Batten and Cradle flooring system installed on a typical timber joist floor/ceiling construction. This opinion is based on laboratory tests of the floor system on a light weight timber floor and previous tests and computer prediction models of floor and ceiling combinations without the flooring overlay.

2.0 CONSTRUCTION

2.1 Floor/Ceiling construction

The floor assembly for which the opinion is provided is as follows:

Batten and Cradle – with Scyon Secura Flooring

- 19 mm Scyon® Secura™ flooring system, screw fixed at 200 mm centres to
- Dressed 42 mm x 42 mm finger joint timber battens spaced at 400 mm centres on
- AC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity containing 75 mm Pink Batts Silencer

Floor/Ceiling Construction

- 19 mm Scyon® Secura™ flooring system fixed at 200 mm centres to minimum 190 x 45 mm timber or LVL joists, or minimum 200mm deep Posi-STRUT™ joists
- Either:
    - 2 layers of 13 mm Gib® Fyreline, or
    - 1 x 16mm Gib® Fyreline

    Fixed to either:

    - USG ScrewFix steel frame suspension system comprising 2.5 mm wire hangers at 1200 mm centres supporting DJ38 strongback channels spaced at 600 mm centres maximum, installed in accordance with manufacturers recommendations, or
    - Gib® Quiet Clips® or ST001 Acoustic Mounts fixed to the joists and holding Gib Rondo 308 battens, installed in accordance with manufacturer's recommendation.
- The perimeter of the ceiling is sealed with flexible acoustic sealant such as Gib® Soundseal.

- An acoustic blanket of minimum 75 mm thickness and of minimum density 10 kg/m^3 is placed in the ceiling cavity (minimum flow resistivity 1400 Rayl/m)

3.0 TEST RESULTS

The impact and airborne sound insulation of a light weight floor with and without the Batten and Cradle floor covering was tested by the University of Auckland Acoustics Testing Service (Test Reports T1405-1 and T1405-2 April 2014). The difference in impact sound and airborne sound transmission between the light weight floor alone and the light weight floor with the Batten and Cradle system was able to be determined from these tests.

4.0 CALCULATIONS

The sound transmission loss and impact sound insulation of the floor/ceiling construction was calculated by using INSUL software to predict the base performance of the assembly with no floor covering. The measured improvement for the Batten and Cradle system on a lightweight floor was then added to the base performance to estimate the performance of the floor/ceiling with a Batten and Cradle system over top.

5.0 OPINION

The estimated laboratory performance of the floor described in Section 2 is given in the table below:

Table 1: Estimated Sound Transmission Loss

Partition	Description	STC	Rw	IIC	L_{nTw}
	Scyon Secura flooring on Batten and Cradle system on Scyon Secura flooring fixed to timber, LVL or Posi-STRUT joists with 2 x 13mm Gib Fyreline ceiling with 75mm Pink Batts Silencer blanket in cavity	68	68	55	48
	Scyon Secura flooring on Batten and Cradle system on Scyon Secura flooring fixed to timber, LVL or Posi-STRUT joists with 1x 16mm Gib Fyreline ceiling with 75mm Pink Batts Silencer blanket in cavity	65	64	53	50

6.0 LIMITATIONS

The above opinions are an estimate of the laboratory performance not the field performance. The estimate is based on the original laboratory tests, the materials as currently manufactured and the construction details set out above. Readers are advised to

check that this opinion has not been revised by a later issue. The estimate is expected to be in error by less than 3 IIC/dB.

7.0 INTERPRETATION

7.1 Rating Systems

7.1.1 NZ Building Code

The Impact Insulation Class (IIC) of a floor/ceiling system reflects its ability to prevent impact on its surface from being transmitted as structure-borne vibration and radiating as air-borne noise. Higher IIC ratings indicate that less noise is transmitted to the room below. The existing NZ Building Code requires that new floors have a laboratory rating of IIC 55 or higher. In addition the floor must be constructed to ensure the on-site Field Impact Insulation Class (IIC) is no less than FIIC 50.

7.1.2 Proposed Building Code

The proposed NZ Building Code (G6) requires a Standardised Impact Sound Pressure Level ($L'_{nT,w}$) of 57 dB or less between habitable spaces. This is a rating for the in-situ impact sound measured rather than a laboratory floor performance rating. The lower the $L'_{nT,w}$ the lower the impact noise and correspondingly the higher the performance of the floor.

The calculation of $L'_{nT,w}$ from a laboratory measurement requires an estimation of room size. The results presented in the table above have been based on a receiving room size of 50 m^3. It should be noted that the figures would not be appropriate for rooms considerably larger or smaller than 50 m^3 and calculation of alternative allowances would be required.

The performance estimates have been made considering only vertical transmission of impact borne sound. It should also be noted that whilst $L'_{nT,w}$ describes a field measurement in this instance, no allowance has been made for on-site flanking transmission and no consideration has been given to horizontal transmission. However flanking impact sound should be controlled as the top floor surface is not rigidly connected to the floor structure.

7.2 Field Performance

To ensure the on-site measurements are similar to the laboratory results the products must be installed and constructed in a similar way to the laboratory tests and any substitution of materials must be approved by the project's Acoustic Consultant. In addition, potential flanking paths, such as external walls, need to be considered and mitigated against.

The use of materials other than those referred to in Section 2 or the introduction of additional materials (e.g. underfloor heating), including the lack of any perimeter isolation, can significantly affect the field performance rating (i.e. may result in a failure in

accordance with the NZ Building Code). MDA strongly recommend trial performance testing on site before proceeding with full installation.

Note:

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Opinion on Impact Insulation Rating of Scyon® Secura™ Interior Flooring on Batten & Cradle Flooring Systems with a Villaboard® Ceiling

June 2013

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Project: **Opinion on Impact Insulation Rating of Scyon® Secura™ Interior Flooring on Batten & Cradle Flooring Systems with a Villaboard® Ceiling**

Prepared for: **James Hardie Ltd**
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Auckland 1642

and

Batten & Cradle Acoustic Flooring Ltd
PO Box 5074
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Report No.: **RP002 201305cu**

Document control

Status:	Rev:	Comments	Date:	Author:	Reviewer:
Approved			13 June 2013	K O Ballagh	M Morrow

TABLE OF CONTENTS

1.0 INTRODUCTION

Marshall Day Acoustics was asked to provide an opinion on the Impact Insulation Class (IIC) rating that would be achieved by Scyon® Secura™ Interior Flooring used with the Batten and Cradle flooring system with a variety of typical concrete floor constructions and Villaboard® ceiling types, with and without cavity insulation. This opinion is based on previous tests of the floor systems on a monolithic test slab and previous tests and computer prediction models of floor and ceiling combinations without the flooring overlay.

2.0 CONSTRUCTION

2.1 Floor build-up constructions

The floor coverings for which the opinion is provided are:

A) Batten and Cradle – Bare Floor – No Cavity Infill

- 19mm Scyon® Secura™ Interior Flooring flooring system, screw fixed at 200 mm centres to
- Dressed 40 mm x 42 mm finger jointed timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity with no infill

B) Batten and Cradle – Bare Floor – With Cavity Infill

- 19mm Scyon® Secura™ Interior Flooring flooring system, screw fixed at 200 mm centres to
- Dressed 40 mm x 42 mm finger joinedt timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity containing 75 mm Pink Batts Silencer

C) Batten and Cradle – Tiled Floor – With Cavity Infill

- Glazed ceramic PEI 3 tiles 600 mm x 600 mm adhered with monoflex C2S2et Tile Adhesive (applied with a 10 mm notched trowel) to
- 19mm Scyon® Secura™ Interior Flooring flooring system, screw fixed at 200 mm centres to
- Dressed 40 mm x 42 mm finger jointed timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity containing 75 mm Pink Batts Silencer

2.2 Ceiling constructions

The plasterboard ceilings referred to in Table 1 overleaf are as follows:

- 1 or 2 layers of 9 mm James Hardie Villaboard® (minimum 300 mm ceiling cavity), USG ScrewFix steel frame suspension system comprising 2.5 mm wire hangers at 1200 mm centres supporting DJ38 strongback channels spaced at 600 mm centres maximum. Installed in accordance with manufacturers recommendations.

- The perimeter of the ceiling is sealed with flexible acoustic sealant such as Gib® Soundseal.

2.3 Ceiling cavity absorption

The cavity absorption referred to in Table 1 overleaf is as follows:

- R1.8 Pink Batts, Autex Greenstuff or approved equivalent such as 75 mm thick fibreglass of minimum density 9.6 kg/m^3.

3.0 TEST RESULTS

The floor build-up constructions described in Section 2.1 were tested by the University of Auckland Acoustics Testing Service (Test Reports T1006-1, T1006-2 & T1006-3 March 2010). The impact performance of the laboratory test slab was tested with and without the floor covering described.

The impact performance of the constructions was ΔL_w 22 dB, ΔL_w 27 dB, and ΔL_w 31 dB respectively.

4.0 OPINION: BATTEN AND CRADLE – BARE FLOOR – NO CAVITY INFILL

The following table details the expected impact performance of floor system A as described in Section 2 with various ceiling and floor slab combinations, including whether ceiling cavity insulation is installed:

Table 1 Batten and Cradle – Bare Floor – No Cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		135 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)
No plasterboard ceiling	N/A	IIC 52	58 (0) dB	IIC 55	51 (+2) dB	IIC 56	50 (+2) dB	IIC 56	53 (+1) dB	IIC 53	57 (0) dB
1 x 9 mm Villaboard®	No	IIC 51	52 (+3) dB	IIC 56	45 (+4) dB	IIC 57	44 (+5) dB	IIC 55	47 (+4) dB	IIC 52	51 (+3) dB
	Yes	IIC 68	38 (+1) dB	IIC 71	32 (+3) dB	IIC 72	31 (+3) dB	IIC 72	34 (+2) dB	IIC 69	37 (+2) dB
2 x 9 mm Villaboard®	No	IIC 55	47 (+4) dB	IIC 60	40 (+5) dB	IIC 61	39 (+5) dB	IIC 59	42 (+5) dB	IIC 56	46 (+4) dB
	Yes	IIC 71	36 (+1) dB	IIC 74	30 (+2) dB	IIC 75	29 (+2) dB	IIC 75	32 (+1) dB	IIC 72	35 (+1) dB

Notes: 1. The $L'_{nT,w}$ ($+C_1$) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

5.0 OPINION: BATTEN AND CRADLE – BARE FLOOR – WITH CAVITY INFILL

The following table details the expected impact performance of floor system B as described in Section 2 with various ceiling and floor slab combinations, including whether ceiling cavity insulation is installed:

Table 2: Batten and Cradle – Bare Floor – With cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		120 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)
No plasterboard ceiling	N/A	IIC 57	53 (+0) dB	IIC 64	46 (+1) dB	IIC 65	45 (+0) dB	IIC 62	48 (+0) dB	IIC 58	52 (+0) dB
1 x 9 mm Villaboard®	No	IIC 60	45 (+3) dB	IIC 65	38 (+4) dB	IIC 66	38 (+3) dB	IIC 64	41 (+2) dB	IIC 61	44 (+3) dB
	Yes	IIC 76	33 (0) dB	IIC 80	26 (+2) dB	IIC 80	25 (+2) dB	IIC 80	28 (+1) dB	IIC 77	32 (0) dB
2 x 9 mm Villaboard®	No	IIC 64	41 (+2) dB	IIC 69	34 (+3) dB	IIC 70	33 (+3) dB	IIC 68	36 (+3) dB	IIC 65	40 (+2) dB
	Yes	IIC 79	31 (0) dB	IIC 83	25 (+1) dB	IIC 84	23 (+2) dB	IIC 83	27 (0) dB	IIC 80	30 (0) dB

Notes: 1. The $L'_{nT,w}$ ($+C_1$) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

6.0 OPINION: BATTEN AND CRADLE – TILED FLOOR – WITH CAVITY INFILL

The following table details the expected impact performance of floor system C as described in Section 2with various ceiling and floor slab combinations, including whether ceiling cavity insulation is installed:

Table 3 Batten and Cradle – Tiled Floor – With cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		135 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)
No plasterboard ceiling	N/A	IIC 59	51 (-2) dB	IIC 66	44 (-1) dB	IIC 67	43 (-1) dB	IIC 64	46 (-2) dB	IIC 60	50 (-2) dB
1 x 9 mm Villaboard®	No	IIC 63	41 (+3) dB	IIC 68	34 (+4) dB	IIC 69	33 (+4) dB	IIC 67	36 (+4) dB	IIC 64	40 (+3) dB
	Yes	IIC 79	30 (-1) dB	IIC 83	23 (+1) dB	IIC 83	22 (+2) dB	IIC 83	25 (0) dB	IIC 80	29 (-1) dB
2 x 9 mm Villaboard®	No	IIC 67	36 (+3) dB	IIC 72	29 (+5) dB	IIC 73	29 (+4) dB	IIC 71	31 (+4) dB	IIC 68	35 (+3) dB
	Yes	IIC 80	30 (-2) dB	IIC 86	22 (0) dB	IIC 87	21 (0) dB	IIC 86	24 (-1) dB	IIC 82	28 (-1) dB

Notes: 1. The $L'_{nT,w}$ ($+C_1$) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.

7.0 LIMITATIONS

The above opinions are an estimate of the laboratory performance not the field performance. The estimate is based on the original laboratory tests, the materials as currently manufactured and the construction details set out above. Readers are advised to check that this opinion has not been revised by a later issue. The estimate is expected to be in error by less than 3 IIC/dB.

8.0 INTERPRETATION

8.1 Rating Systems

8.1.1 NZ Building Code

The Impact Insulation Class (IIC) of a floor/ceiling system reflects its ability to prevent impact on its surface from being transmitted as structure-borne vibration and radiating as air-borne noise. Higher IIC ratings indicate that less noise is transmitted to the room below. The existing NZ Building Code requires that new floors have a laboratory rating of IIC 55 or higher. In addition the floor must be constructed to ensure the on-site Field Impact Insulation Class (IIC) is no less than FIIC 50.

8.1.2 Proposed Building Code (2013)

The current proposed NZ Building Code (G6) requires a Standardised Impact Sound Pressure Level ($L'_{nT,w}$) of 57 dB or less between habitable spaces. This is a rating for the impact sound measured rather than a floor performance rating. Therefore, the lower the $L'_{nT,w}$ the lower the impact noise and correspondingly the higher the performance of the floor.

The calculation of $L'_{nT,w}$ from a laboratory measurement requires an estimation of room size. The results presented in the table above have been based on a receiving room size of 50 m^3. It should be noted that the figures would not be appropriate for rooms considerably larger or smaller than 50 m^3 and calculation of alternative allowances would be required.

The performance estimates have been made considering only vertical transmission of impact borne sound. It should also be noted that whilst $L'_{nT,w}$ describes a field measurement in this instance, no allowance has been made for on-site flanking transmission and no consideration has been given to horizontal transmission.

8.2 Field Performance

To ensure the on-site measurements are similar to the laboratory results the products must be installed and constructed in a similar way to the laboratory tests and any substitution of materials must be approved by the project's Acoustic Consultant. In addition, potential flanking paths, such as external walls, need to be considered and mitigated against.

Structure-borne vibration is readily transmitted in all directions in concrete flooring substructures. There is often little difference between measured impact noise levels in

rooms directly below the source room compared with rooms that are diagonally below. Therefore the impact isolation to rooms other than those directly below the floor area should also be considered.

Where horizontal transmission or flanking is likely to be of concern it is recommended that concrete slabs of no less than 120 mm effective (average) thickness be used. Hard floor surfaces on lightweight concrete floors are likely to require specialist isolation to avoid high levels of impact noise being transmitted to adjacent spaces.

The use of materials other than those referred to in Section 2 or the introduction of additional materials (e.g. underfloor heating), including the lack of any perimeter isolation, can significantly affect the field performance rating (i.e. may result in a failure in accordance with the NZ Building Code). MDA strongly recommend trial performance testing on site before proceeding with full installation.

Note:

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Opinion on Impact Insulation Rating of Scyon® Secura™ Interior Flooring on Batten & Cradle Flooring Systems

June 2013

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Project: **Opinion on Impact Insulation Rating of Scyon® Secura™ Interior Flooring on Batten & Cradle Flooring**

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TABLE OF CONTENTS

1.0 INTRODUCTION

Marshall Day Acoustics was asked to provide an opinion on the Impact Insulation Class (IIC) rating that would be achieved by Scyon® Secura™ Interior Flooring used with the Batten and Cradle flooring system with a variety of typical concrete floor constructions and Villaboard® ceiling types, with and without cavity insulation. This opinion is based on previous tests of the floor systems on a monolithic test slab and previous tests and computer prediction models of floor and ceiling combinations without the flooring overlay.

2.0 CONSTRUCTION

2.1 Floor build-up constructions

The floor coverings for which the opinion is provided are:

A) Batten and Cradle – Bare Floor – No Cavity Infill

- 19mm Scyon® Secura™ Interior Flooring flooring system, screw fixed at 200 mm centres to
- Dressed 40 mm x 42 mm finger jointed timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity with no infill

B) Batten and Cradle – Bare Floor – With Cavity Infill

- 19mm Scyon® Secura™ Interior Flooring flooring system, screw fixed at 200 mm centres to
- Dressed 40 mm x 42 mm finger joinedt timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity containing 75 mm Pink Batts Silencer

C) Batten and Cradle – Tiled Floor – With Cavity Infill

- Glazed ceramic PEI 3 tiles 600 mm x 600 mm adhered with monoflex C2S2et Tile Adhesive (applied with a 10 mm notched trowel) to
- 19mm Scyon® Secura™ Interior Flooring flooring system, screw fixed at 200 mm centres to
- Dressed 40 mm x 42 mm finger jointed timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity containing 75 mm Pink Batts Silencer

2.2 Ceiling constructions

The plasterboard ceilings referred to in Table 1 overleaf are as follows:

- 1 or 2 layers of 9 mm James Hardie Villaboard® (minimum 300 mm ceiling cavity), USG ScrewFix steel frame suspension system comprising 2.5 mm wire hangers at 1200 mm centres supporting DJ38 strongback channels spaced at 600 mm centres maximum. Installed in accordance with manufacturers recommendations.

- The perimeter of the ceiling is sealed with flexible acoustic sealant such as Gib® Soundseal.

2.3 Ceiling cavity absorption

The cavity absorption referred to in Table 1 overleaf is as follows:

- R1.8 Pink Batts, Autex Greenstuff or approved equivalent such as 75 mm thick fibreglass of minimum density 9.6 kg/m^3.

3.0 TEST RESULTS

The floor build-up constructions described in Section 2.1 were tested by the University of Auckland Acoustics Testing Service (Test Reports T1006-1, T1006-2 & T1006-3 March 2010). The impact performance of the laboratory test slab was tested with and without the floor covering described.

The impact performance of the constructions was ΔL_w 22 dB, ΔL_w 27 dB, and ΔL_w 31 dB respectively.

4.0 OPINION: BATTEN AND CRADLE – BARE FLOOR – NO CAVITY INFILL

The following table details the expected impact performance of floor system A as described in Section 2 with various ceiling and floor slab combinations, including whether ceiling cavity insulation is installed:

Table 1 Batten and Cradle – Bare Floor – No Cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		135 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)
No plasterboard ceiling	N/A	IIC 52	58 (0) dB	IIC 55	51 (+2) dB	IIC 56	50 (+2) dB	IIC 56	53 (+1) dB	IIC 53	57 (0) dB
1 x 10 mm plasterboard	No	IIC 45	59 (+2) dB	IIC 50	51 (+4) dB	IIC 51	50(+5) dB	IIC 49	54 (+3) dB	IIC 46	58 (+2) dB
	Yes	IIC 54	48 (+4) dB	IIC 57	44 (+4) dB	IIC 58	43(+5) dB	IIC 58	45 (+3) dB	IIC 55	47 (+4) dB
1 x 13 mm plasterboard	No	IIC 49	54 (+3) dB	IIC 55	47 (+4) dB	IIC 55	46 (+4) dB	IIC 53	49 (+4) dB	IIC 50	53 (+3) dB
	Yes	IIC 65	40 (+2) dB	IIC 68	34 (+4) dB	IIC 69	33 (+4) dB	IIC 69	36 (+2) dB	IIC 66	39 (+2) dB
2 x 13 mm plasterboard	No	IIC 53	50 (+3) dB	IIC 58	43 (+5) dB	IIC 59	42 (+5) dB	IIC 57	45 (+4) dB	IIC 54	49 (+3) dB
	Yes	IIC 69	37 (+1) dB	IIC 73	31 (+3) dB	IIC 73	30 (+3) dB	IIC 73	33 (+1) dB	IIC 70	36 (+1) dB

Notes: 1. The $L'_{nT,w}$ ($+C_1$) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

5.0 OPINION: BATTEN AND CRADLE – BARE FLOOR – WITH CAVITY INFILL

The following table details the expected impact performance of floor system B as described in Section 2with various ceiling and floor slab combinations, including whether ceiling cavity insulation is installed:

Table 2: Batten and Cradle – Bare Floor – With cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		120 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ $(+C_1)$ (See Note 1)
No plasterboard ceiling	N/A	IIC 57	53 (+0) dB	IIC 64	46 (+1) dB	IIC 65	45 (+0) dB	IIC 62	48 (+0) dB	IIC 58	52 (+0) dB
1 x 10 mm plasterboard	No	IIC 54	53 (+1) dB	IIC 59	45(+3) dB	IIC 60	44 (+3) dB	IIC 58	48 (+1) dB	IIC 55	52 (+1) dB
	Yes	IIC 63	42 (+2) dB	IIC 66	37(+4) dB	IIC 67	36 (+4) dB	IIC 67	39 (+2) dB	IIC 64	41 (+2) dB
1 x 13 mm plasterboard	No	IIC 58	48 (+2) dB	IIC 63	40 (+3) dB	IIC 64	40 (+3) dB	IIC 62	43 (+2) dB	IIC 59	47 (+2) dB
	Yes	IIC 74	34 (+1) dB	IIC 77	28(+2) dB	IIC 78	27 (+2) dB	IIC 78	30 (+1) dB	IIC 75	33 (+1) dB
2 x 13 mm plasterboard	No	IIC 62	43 (+3) dB	IIC 67	36(+4) dB	IIC 68	35 (+4) dB	IIC 65	39 (+2) dB	IIC 63	42 (+3) dB
	Yes	IIC 78	32 (+0) dB	IIC 81	26(+1) dB	IIC 82	24 (+2) dB	IIC 82	28 (+0) dB	IIC 79	31 (+0) dB

Notes: 1. The $L'_{nT,w}$ $(+C_1)$ has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

6.0 OPINION: BATTEN AND CRADLE – TILED FLOOR – WITH CAVITY INFILL

The following table details the expected impact performance of floor system C as described in Section 2 with various ceiling and floor slab combinations, including whether ceiling cavity insulation is installed:

Table 3 Batten and Cradle – Tiled Floor – With cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		135 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)
No plasterboard ceiling	N/A	IIC 59	51 (-2) dB	IIC 66	44 (-1) dB	IIC 67	43 (-1) dB	IIC 64	46 (-2) dB	IIC 60	50 (-2) dB
1 x 10 mm plasterboard	No	IIC 57	48 (+2) dB	IIC 62	40 (+4) dB	IIC 63	39 (+4) dB	IIC 61	43 (+3) dB	IIC 58	47 (+2) dB
	Yes	IIC 66	38 (+3) dB	IIC 69	33 (+4) dB	IIC 70	32 (+4) dB	IIC 70	34 (+3) dB	IIC 67	37 (+3) dB
1 x 13 mm plasterboard	No	IIC 61	43 (+3) dB	IIC 66	36 (+4) dB	IIC 67	35 (+4) dB	IIC 65	38 (+3) dB	IIC 62	42 (+3) dB
	Yes	IIC 77	32 (-1) dB	IIC 80	25 (+2) dB	IIC 81	24 (+2) dB	IIC 81	27 (0) dB	IIC 78	31 (-1) dB
2 x 13 mm plasterboard	No	IIC 65	39 (+3) dB	IIC 70	32 (+4) dB	IIC 71	31 (+4) dB	IIC 68	34 (+4) dB	IIC 66	38 (+3) dB
	Yes	IIC 79	31 (-3) dB	IIC 84	23 (0) dB	IIC 85	22 (0) dB	IIC 85	25 (-1) dB	IIC 81	29 (-2) dB

Notes: 1. The $L'_{nT,w}$ ($+C_1$) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above..

7.0 LIMITATIONS

The above opinions are an estimate of the laboratory performance not the field performance. The estimate is based on the original laboratory tests, the materials as currently manufactured and the construction details set out above. Readers are advised to check that this opinion has not been revised by a later issue. The estimate is expected to be in error by less than 3 IIC/dB.

8.0 INTERPRETATION

8.1 Rating Systems

8.1.1 NZ Building Code

The Impact Insulation Class (IIC) of a floor/ceiling system reflects its ability to prevent impact on its surface from being transmitted as structure-borne vibration and radiating as air-borne noise. Higher IIC ratings indicate that less noise is transmitted to the room below. The existing NZ Building Code requires that new floors have a laboratory rating of IIC 55 or higher. In addition the floor must be constructed to ensure the on-site Field Impact Insulation Class (IIC) is no less than FIIC 50.

8.1.2 Proposed Building Code (2013)

The current proposed NZ Building Code (G6) requires a Standardised Impact Sound Pressure Level ($L'_{nT,w}$) of 57 dB or less between habitable spaces. This is a rating for the impact sound measured rather than a floor performance rating. Therefore, the lower the $L'_{nT,w}$ the lower the impact noise and correspondingly the higher the performance of the floor.

The calculation of $L'_{nT,w}$ from a laboratory measurement requires an estimation of room size. The results presented in the table above have been based on a receiving room size of 50 m^3. It should be noted that the figures would not be appropriate for rooms considerably larger or smaller than 50 m^3 and calculation of alternative allowances would be required.

The performance estimates have been made considering only vertical transmission of impact borne sound. It should also be noted that whilst $L'_{nT,w}$ describes a field measurement in this instance, no allowance has been made for on-site flanking transmission and no consideration has been given to horizontal transmission.

8.2 Field Performance

To ensure the on-site measurements are similar to the laboratory results the products must be installed and constructed in a similar way to the laboratory tests and any substitution of materials must be approved by the project's Acoustic Consultant. In addition, potential flanking paths, such as external walls, need to be considered and mitigated against.

Structure-borne vibration is readily transmitted in all directions in concrete flooring substructures. There is often little difference between measured impact noise levels in rooms directly below the source room compared with rooms that are diagonally below. Therefore the impact isolation to rooms other than those directly below the floor area should also be considered.

Where horizontal transmission or flanking is likely to be of concern it is recommended that concrete slabs of no less than 120 mm effective (average) thickness be used. Hard floor surfaces on lightweight concrete floors are likely to require specialist isolation to avoid high levels of impact noise being transmitted to adjacent spaces.

The use of materials other than those referred to in Section 2 or the introduction of additional materials (e.g. underfloor heating), including the lack of any perimeter isolation, can significantly affect the field performance rating (i.e. may result in a failure in accordance with the NZ Building Code). MDA strongly recommend trial performance testing on site before proceeding with full installation.

Note:

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Opinion on Impact Insulation Rating of Batten & Cradle Flooring Systems

June 2010

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Project: **Opinion on Impact Insulation Rating of Batten & Cradle Flooring Systems**

Prepared for: **Batten & Cradle Acoustic Flooring Ltd**
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TABLE OF CONTENTS

1.0 INTRODUCTION

Marshall Day Acoustics was asked to provide an opinion on the Impact Insulation Class (IIC) rating that would be achieved by variations of the Batten and Cradle flooring system with variety of typical concrete floor constructions and ceiling types, with and without cavity insulation. This opinion is based on previous tests of the floor systems on a monolithic test slab and previous tests and computer prediction models of floor and ceiling combinations without the flooring overlay.

2.0 CONSTRUCTION

2.1 Floor build-up constructions

The floor coverings for which the opinion is provided are:

A - Batten and Cradle – Bare Floor – No Cavity Infill

- 20 mm Strandfloor tongue and groove flooring system, screw fixed at 200 mm centres to
- Dressed 42 mm x 42 mm fingerjoint timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity with no infill

B - Batten and Cradle – Bare Floor – With Cavity Infill

- 20 mm Strandfloor tongue and groove flooring system, screw fixed at 200 mm centres to
- Dressed 42 mm x 42 mm finger joint timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity containing 75 mm Pink Batts Silencer

C - Batten and Cradle – Tiled Floor – With Cavity Infill

- Glazed ceramic PEI 3 tiles 600 mm x 600 mm adhered with monoflex C2S2et Tile Adhesive (applied with a 10 mm notched trowel) to
- 6 mm James Hardie Tile Underlay, screw fixed to
- 20 mm Standfloor tongue and groove flooring system, screw fixed at 200 mm centres to

- Dressed 42 mm x 42 mm finger joint timber battens spaced at 450 mm centres on
- RC-20 rubber cradles spaced at 450 mm centres
- 65 mm floor cavity containing 75 mm Pink Batts Silencer

2.2 Ceiling constructions

The plasterboard ceilings referred to in Table 1 overleaf are as follows:

- 10 mm standard Gib® on Gib Rondo or USG ScrewFix ceiling batten system, minimum 100 mm ceiling cavity,
- 13 mm standard Gib® or 2 layers of 13 mm standard Gib® as specified (minimum 300 mm ceiling cavity), USG ScrewFix steel frame suspension system comprising 2.5 mm wire hangers at 1200 mm centres supporting DJ38 strongback channels spaced at 600 mm centres maximum.installed in accordance with manufacturers recommendations.
- The perimeter of the ceiling is sealed with flexible acoustic sealant such as Gib® Soundseal.

2.3 Ceiling cavity absorption

The cavity absorption referred to in Table 1 overleaf is as follows:

- R1.8 Pink Batts, Autex Greenstuff or approved equivalent such as 75 mm thick fibreglass of minimum density 9.6 kg/m3.

3.0 TEST RESULTS

The floor build-up constructions described in Section 2.1 were tested by the University of Auckland Acoustics Testing Service (Test Reports T1006-1, T1006-2 & T1006-3 March 2010). The impact performance of the laboratory test slab was tested with and without the floor covering described.

The impcat performance of the constructions was ΔL_w 22 dB, ΔL_w 27 dB, ΔL_w 31 dB respectively.

4.0 OPINION: BATTEN AND CRADLE – BARE FLOOR – NO CAVITY INFILL

The following table details the expected impact performance of floor system A as described in Section 2.0 with various ceiling and floor slab combinations, including whether cavity insulation is installed:

Table 1 Batten and Cradle – Bare Floor – No Cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		135 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ (+C_1) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ (+C_1) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ (+C_1) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ (+C_1) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ (+C_1) (See Note 1)
No plasterboard ceiling	N/A	IIC 48	62 (0) dB	IIC 53	56 (0) dB	IIC 54	54 (+1) dB	IIC 53	56 (+1) dB	IIC 48	62 (0) dB
1 x 10 mm plasterboard	No	IIC 42	63 (+2) dB	IIC 50	55 (+3) dB	IIC 51	54 (+3) dB	IIC 49	55 (+3) dB	IIC 42	63 (+2) dB
	Yes	IIC 50	52 (+5) dB	IIC 55	48 (+3) dB	IIC 56	46 (+5) dB	IIC 55	49 (+3) dB	IIC 50	52 (+5) dB
1 x 13 mm plasterboard	No	IIC 46	58 (+3) dB	IIC 54	50 (+3) dB	IIC 55	49 (+4) dB	IIC 53	51 (+3) dB	IIC 46	58 (+3) dB
	Yes	IIC 61	43 (+3) dB	IIC 68	36 (+3) dB	IIC 69	35 (+4) dB	IIC 67	38 (+2) dB	IIC 61	43 (+3) dB
2 x 13 mm plasterboard	No	IIC 50	53 (+4) dB	IIC 58	45 (+5) dB	IIC 58	45 (+4) dB	IIC 56	46 (+5) dB	IIC 50	53 (+4) dB
	Yes	IIC 65	40 (+3) dB	IIC 73	33 (+2) dB	IIC 74	31 (+3) dB	IIC 71	34 (+2) dB	IIC 65	40 (+3) dB

Notes:
1. The $L'_{nT,w}$ (+C_1) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

5.0 OPINION: BATTEN AND CRADLE – BARE FLOOR – WITH CAVITY INFILL

The following table details the expected impact performance of floor system B as described in Section 2.0 with various ceiling and floor slab combinations, including whether cavity insulation is installed:

Table 2: Batten and Cradle – Bare Floor – With cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		**75 mm Unispan + 75 mm topping**		**200 mm Dycore with 65 mm topping**		**135 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)**		**90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)**	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)
No plasterboard ceiling	N/A	IIC 49	57 (+2) dB	IIC 55	51 (+2) dB	IIC 56	50 (+1) dB	IIC 54	52 (+2) dB	IIC 49	57 (+2) dB
1 x 10 mm plasterboard	No	IIC 42	58 (+5) dB	IIC 50	50 (+5) dB	IIC 51	49 (+5) dB	IIC 49	50 (+6) dB	IIC 42	58 (+5) dB
	Yes	IIC 50	48 (+7) dB	IIC 56	43 (+6) dB	IIC 56	41 (+8) dB	IIC 55	44 (+6) dB	IIC 50	48 (+7) dB
1 x 13 mm plasterboard	No	IIC 46	53 (+6) dB	IIC 54	45 (+6) dB	IIC 55	44 (+7) dB	IIC 53	46 (+6) dB	IIC 46	53 (+6) dB
	Yes	IIC 62	38 (+6) dB	IIC 68	31 (+6) dB	IIC 69	30 (+6) dB	IIC 67	33 (+5) dB	IIC 62	38 (+6) dB
2 x 13 mm plasterboard	No	IIC 50	49 (+6) dB	IIC 58	40 (+7) dB	IIC 59	40 (+7) dB	IIC 57	42 (+7) dB	IIC 50	49 (+6) dB
	Yes	IIC 65	35 (+5) dB	IIC 73	28 (+5) dB	IIC 74	27 (+5) dB	IIC 72	29 (+5) dB	IIC 65	35 (+5) dB

Notes:
1. The $L'_{nT,w}$ ($+C_1$) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

6.0 OPINION: BATTEN AND CRADLE – TILED FLOOR – WITH CAVITY INFILL

The following table details the expected impact performance of floor system C as described in Section 2.0 with various ceiling and floor slab combinations, including whether cavity insulation is installed:

Table 3 Batten and Cradle – Tiled Floor – With cavity Infill – Impact Insulation Prediction

Ceiling		Floor									
		120 mm Hibond (average concrete thickness 90 mm)		75 mm Unispan + 75 mm topping		200 mm Dycore with 65 mm topping		135 mm Stahlton Rib and Infill (minimum concrete thickness 135 mm on 25 mm timber infills)		90 mm Interspan (minimum concrete thickness 90 mm on 25 mm timber infills)	
Thickness /layers	Cavity Insulation Present?	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)	Impact Insulation Class	$L'_{nT,w}$ ($+C_1$) (See Note 1)
No plasterboard ceiling	N/A	IIC 55	55 (-2) dB	IIC 61	47 (0) dB	IIC 62	46 (0) dB	IIC 60	49 (-1) dB	IIC 55	55 (-2) dB
1 x 10 mm plasterboard	No	IIC 49	53 (+4) dB	IIC 57	45 (+4) dB	IIC 58	44 (+4) dB	IIC 56	45 (+5) dB	IIC 49	53 (+4) dB
	Yes	IIC 56	43 (+6) dB	IIC 62	38 (+5) dB	IIC 63	36 (+6) dB	IIC 61	39 (+5) dB	IIC 56	43 (+6) dB
1 x 13 mm plasterboard	No	IIC 53	48 (+5) dB	IIC 61	40 (+5) dB	IIC 61	39 (+5) dB	IIC 60	41 (+5) dB	IIC 53	48 (+5) dB
	Yes	IIC 68	35 (+3) dB	IIC 75	28 (+3) dB	IIC 76	26 (+4) dB	IIC 74	29 (+3) dB	IIC 68	35 (+3) dB
2 x 13 mm plasterboard	No	IIC 56	44 (+5) dB	IIC 64	36 (+5) dB	IIC 65	35 (+5) dB	IIC 63	37 (+5) dB	IIC 56	44 (+5) dB
	Yes	IIC 72	33 (+1) dB	IIC 80	25 (+2) dB	IIC 80	24 (+2) dB	IIC 78	26 (+2) dB	IIC 72	33 (+1) dB

Notes:
1. The $L'_{nT,w}$ ($+C_1$) has been calculated based on a receiving room volume of 50 m^3. No allowance has been made for on-site flanking transmission.
2. Refer to Section 2.0 for construction information in relation to Table 1 above.

7.0 LIMITATIONS

The above opinions are an estimate of the laboratory performance not the field performance. The estimate is based on the original laboratory tests, the materials as currently manufactured and the construction details set out above. Readers are advised to check that this opinion has not been revised by a later issue. The estimate is expected to be in error by less than 3 IIC/dB.

8.0 INTERPRETATION

8.1 Rating Systems

8.1.1 NZ Building Code

The Impact Insulation Class (IIC) of a floor/ceiling system reflects its ability to prevent impact on its surface from being transmitted as structure-borne vibration and radiating as air-borne noise. Higher IIC ratings indicate that less noise is transmitted to the room below. The existing NZ Building Code requires that new floors have a laboratory rating of IIC 55 or higher. In addition the floor must be constructed to ensure the on-site Field Impact Insulation Class (IIC) is no less than FIIC 50.

8.1.2 Proposed Building Code

The proposed NZ Building Code (G6) requires a Standardised Impact Sound Pressure Level + Impact Spectrum Adaptation Term ($L'_{nT,w} + C_1$) of 55 dB or less between habitable spaces. This is a rating for the impact sound measured rather than a floor performance rating. Therefore, the lower the $L'_{nT,w} + C_1$ the lower the impact noise and correspondingly the higher the performance of the floor. The Impact Spectrum Adaptation Term C_1 has been included as, according to the proposed Building Code, this has "been shown to better relate to the problem of low frequency footfall noise, and also high frequency impact sound, such as chairs scraping on hard surfaces." For concrete floors the C_1 figure tends to be negative.

The calculation of $L'_{nT,w} + C_1$ from a laboratory measurement requires an estimation of room size. The results presented in the table above have been based on a receiving room size of 50 m^3. It should be noted that the figures would not be appropriate for rooms considerably larger or smaller than 50 m^3 and calculation of alternative allowances would be required.

The performance estimates have been made considering only vertical transmission of impact borne sound. It should also be noted that whilst $L'_{nT,w} + C_1$ describes a field measurement in this instance, no allowance has been made for on-site flanking transmission and no consideration has been given to horizontal transmission.

8.2 Field Performance

To ensure the on-site measurements are similar to the laboratory results the products must be installed and constructed in a similar way to the laboratory tests and any substitution of materials must be approved by the project's Acoustic Consultant. In addition, potential flanking paths, such as external walls, need to be considered and mitigated against.

Structure-borne vibration is readily transmitted in all directions in concrete flooring substructures. There is often little difference between measured impact noise levels in rooms directly below the source room compared with rooms that are diagonally below. Therefore the impact isolation to rooms other than those directly below the floor area should also be considered.

Where horizontal transmission or flanking is likely to be of concern it is recommended that concrete slabs of no less than 120 mm effective (average) thickness be used. Hard floor surfaces on lightweight concrete floors are likely to require specialist isolation to avoid high levels of impact noise being transmitted to adjacent spaces.

The use of materials other than those referred to in Section 2 or the introduction of additional materials (e.g. underfloor heating), including the lack of any perimeter isolation, can significantly affect the field performance rating (i.e. may result in a failure in accordance with the NZ Building Code). MDA strongly recommend trial performance testing on site before proceeding with full installation.

Note:

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12 August 2016

James Hardie
PO Box 12070
Penrose
Auckland 1642

Attention: Singh Kamboj

Dear Singh

HOBSONVILLE POINT IIC AND STC TEST

Marshall Day Acoustics was engaged to carry out airborne and impact sound insulation tests on the inter-tenancy floor/ceiling system at the new dwellings on the corner of Hobsonville Point Road and De Havilland Road. The tests were undertaken on 2 August, 2016 and were carried out to assess the performance of the system against the New Zealand Building Code Clause G6.

NZ BUILDING CODE REQUIREMENTS

Airborne Sound

With respect to airborne sound transmission, the NZ Building Code specifies that walls and floor/ceiling assemblies must achieve a Sound Transmission Class rating of at least STC 55 in laboratory. This applied to walls/floors between habitable spaces of separate tenancies, and to walls/floors between a common space and a habitable space. Habitable spaces are areas such as living rooms, bedrooms and offices, but not bathrooms, laundries or corridors.

A 5 point leeway is permitted on site, so that the minimum requirement on site is FSTC 50 (Field Sound Transmission Class).

Impact sound

With respect to transmission of impact sound (e.g. footfall noise), Clause G6 of the NZ Building Code specifies that floor/ceiling assemblies must achieve an Impact Insulation Class rating of at least IIC 55 in laboratory. Again, this only applied into rooms such as living rooms and bedrooms that are defined as habitable spaces.

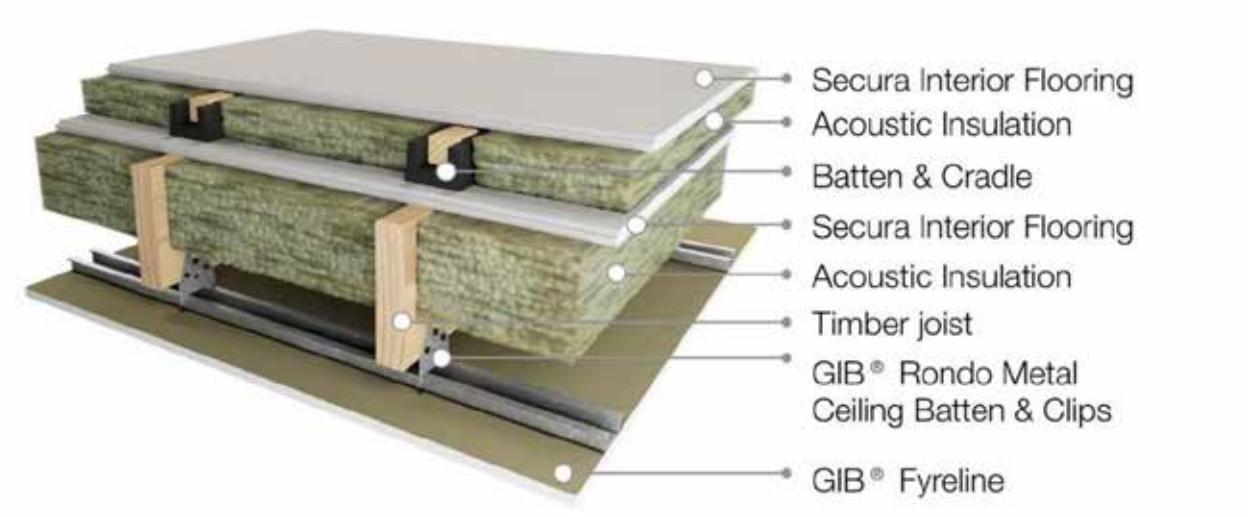
A 5 point leeway is permitted on site, so that the minimum requirement on site is FIIC 50 (Field Impact Insulation Class).

DESCRIPTION OF TEST CONSTRUCTION

The flooring system tested is described below and is illustrated in Figure 1.

- 19mm Secura Interior flooring on
- Batten and Cradle floor system with timber battens at 450mm centres sitting on Acoustiflor cradles at 450mm centres with insulation in the cavity on
- 19mm Secura Interior flooring on
- 200mm timber joists with GIB Quiet Clips and one layer of 16mm GIB Fyreline

Figure 1: Floor construction



TESTING PROCEDURES & METHODOLOGY

A calibration check was made both prior to and after the tests and no significant drift was observed.

Airborne sound insulation

The performance for airborne sound insulation has been carried out and verified using the procedures detailed in ASTM E 336, and the field sound transmission class verified using the method described in ASTM E 413.

The loudspeaker was placed in the source room in a position to generate an even distribution of sound throughout the room. The sound analyser was used to generate a steady random noise signal (pink noise) which was reproduced via the loudspeaker source. The sound pressure level was measured in the source room and receiving room over the one-third octave band frequency range 100 Hz to 4000 Hz. Two measurements were made using a moving microphone sweep in each room with a measurement period of ten seconds.

The source was then moved to a new position in the source room and the foregoing tests were repeated.

Following this, a measurement was made to determine the reverberation time in each of the one-third octave bands between 100 Hz and 4000 Hz within the receiving room. An internal programme of the sound level meter was used to generate and cut off the random noise signal, which was reproduced in the room by the active loudspeaker source, and to measure the decay rate of the sound in the room.

The background noise level was measured in the receiving room for a period of 10 seconds.

Impact sound insulation

The performance for impact sound insulation has been carried out and verified using the procedures detailed in ISO 140: Part VII, and the field impact insulation class verified using the method described in ASTM E 989.

The tapping machine was placed on the floor in the source room. The machine was set into operation to generate cyclic impacts on top of the floor. The sound pressure level was measured in the receiving room over the one-third octave band frequency range 100 Hz to 4000 Hz by averaging over two moving microphone sweeping measurement positions for each of four tapping machine locations, to give a total of eight measurements, with each measurement period being ten seconds. Each tapping machine position was placed so that it would not have been parallel to the flooring beams. The measurement positions were selected to determine the average sound level over the whole of the room.

Following this, a measurement was made to determine the reverberation time in each of the one-third octave bands between 100 Hz and 4000 Hz within the receiving room. An internal programme of the sound

level meter was used to generate and cut off the random noise signal, which was reproduced in the room by the active loudspeaker source, and to measure the decay rate of the sound in the room.

The background noise level was measured in the receiving room for a period of 10 seconds.

AIRBORNE SOUND INSULATION TESTS

Table 1 summarises the impact sound insulation tests performed and reports the measured performance with comparison against the Building Code criteria.

Table 1: Airborne Performance Test

Source Room	Receiver Room	Common Floor Area	Receiver Room Volume	Measured Performance (FSTC)	Minimum Requirement (FSTC)	Result
Upstairs Living Room	Downstairs Living Room	≈22 m^2	≈60 m^3	62	50	Pass

IMPACT SOUND INSULATION TESTS

Table 2 summarises the impact sound insulation tests performed and reports the measured performance with comparison against the Building Code criteria.

Table 2: Impact Performance Test

Source Room	Receiver Room	Common Floor Area	Receiver Room Volume	Measured Performance (FIIC)	Minimum Requirement (FIIC)	Result
Upstairs Living Room	Downstairs Living Room	≈22 m^2	≈60 m^3	55	50	Pass

Detailed testing results are appended to this letter.

Yours faithfully

MARSHALL DAY ACOUSTICS LTD

Micky Yang

Acoustician

Apparent sound reduction index according to ISO 140-4
Field measurements of airborne sound insulation between rooms

Client: James Hardie **Date of test:** 2/08/2016

Description and identification of the building contruction and test arrangement, direction of measurement:

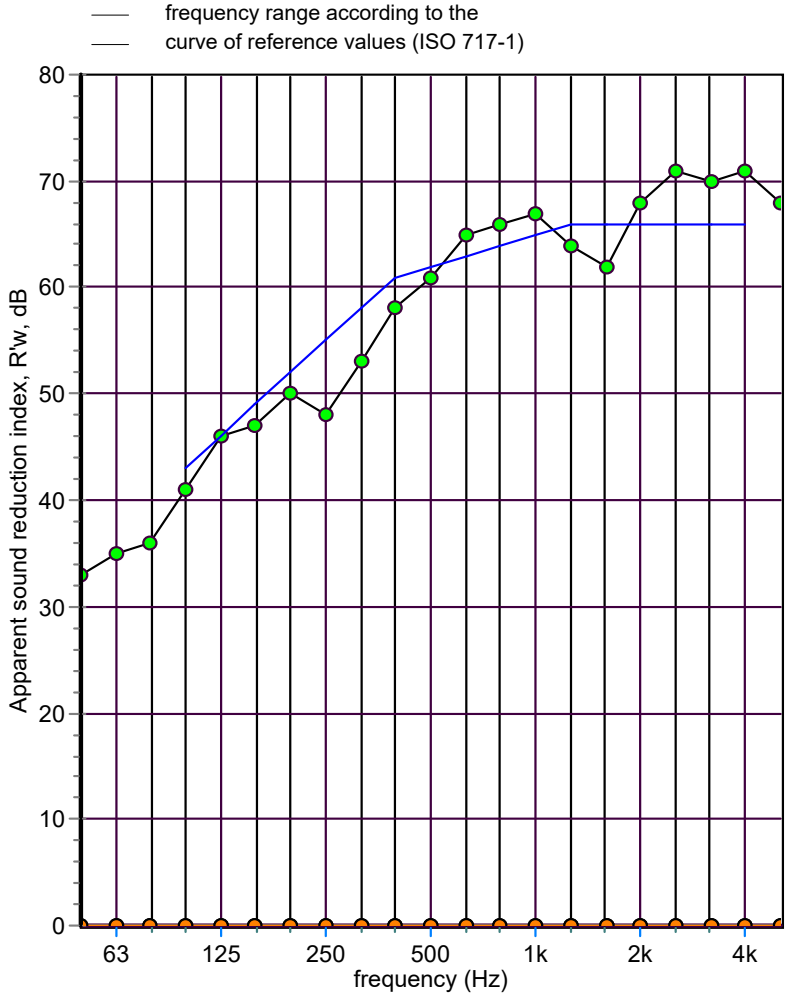
In-situ test of the flooring system.

19mm Secura Interior flooring on;
Batten and Cradle floor system with timber battens at 450mm centres sitting on Acoustiflor cradles at 450mm centres with insulation in the cavity on;
19mm Secura Interior flooring on;
200mm timber joists on GIB Rondo Quiet Clips and one layer of 16mm Fyreline

The description of the construction was provided by the client and was not able to be verified by Marshall Day Acoustics
For further details of tests please refer to accompanying letter

Area S of separating element: 22 m²
Receiving room volume: 60 m³
Source room volume: N/A

Frequency f Hz	R' (one-third) (octave) dB
50	33
63	35
80	36
100	41
125	46
160	47
200	50
250	48
315	53
400	58
500	61
630	65
800	66
1k	67
1k25	64
1k6	62
2k	68
2k5	71
3k15	70
4k	71
5k	68



Rating according to ISO 717-1

R',w(C;Ctr) = 62 (-2 ; -6) dB; C50-3150 = -3 dB; C50-5000 = -2 dB; C100-5000 = -1 dB;

Evaluation based on field measurement results obtained by an engineering method

Ctr50-3150 = -11 dB; Ctr50-5000 = -11 dB; Ctr100-5000 = -6 dB;

Rating according to ASTM E413-87

Field Sound Transmission Class = 62

No. of test report : 2015159A

Name of test institute : Marshall Day Acoustics

Date : 18 Aug 16

Signature :

Normalized impact sound pressure levels according to ISO 140-7
Field measurements of impact sound insulation of floors

Client: James Hardie **Date of test:** 2/08/2016

Description and identification of the building contruction and test arrangement, direction of measurement:

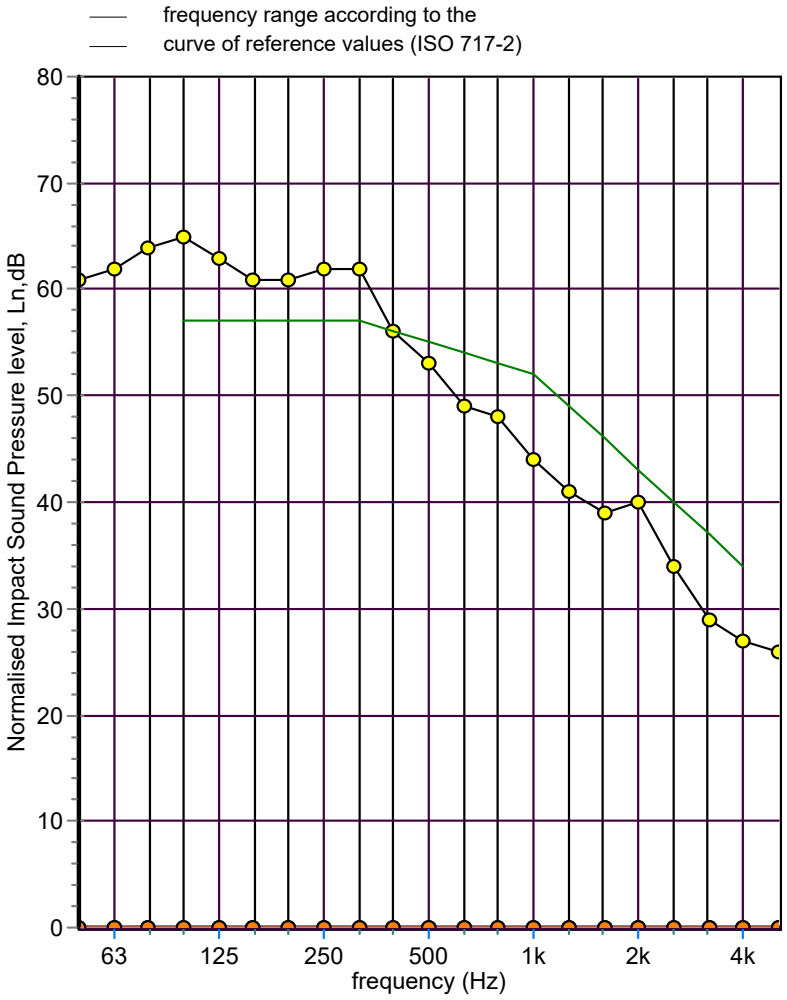
In-situ test of the flooring system.

19mm Secura Interior flooring on;
Batten and Cradle floor system with timber battens at 450mm centres sitting on Acoustiflor cradles at 450mm centres with insulation in the cavity on;
19mm Secura Interior flooring on;
200mm timber joists on GIB Rondo Quiet Clips and one layer of 16mm Fyreline

The description of the construction was provided by the client and was not able to be verified by Marshall Day Acoustics
For further details of tests please refer to accompanying letter

Receiving room volume: N/A

Frequency f Hz	L'n (one-third) (octave) dB
50	61
63	62
80	64
100	65
125	63
160	61
200	61
250	62
315	62
400	56
500	53
630	49
800	48
1k	44
1k25	41
1k6	39
2k	40
2k5	34
3k15	29
4k	27
5k	26



Rating according to ISO 717-2

L'n,w(C1) = 55 (1) dB CI,50-2500 = dB

Evaluation based on field measurement results obtained in one-third-octave bands by an engineering method

Rating according to ASTM E989-89

Field Impact Insulation Class = 55

No. of test report : 2015159A Name of test institute : Marshall Day Acoustics

Date : 18 Aug 16 Signature :

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TEST REPORT

ST1046

LOAD TEST ON BATTEN AND CRADLE FLOOR

CLIENT
Batten and Cradle
Level 1,
20-22 Gundry Street
New Zealand

OBJECTIVE

To carry out concentrated load tests on the Batten and Cradle flooring system using James Hardie 19mm Scyon Secura flooring sheets. Loading was in accordance with AS/NZS 1170.1 "Structural design actions. Part 1: Permanent, imposed and other actions". Reference values for floor loads are set out in Table 3.1.

LIMITATION

The results reported here relate only to the item/s tested.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in the BRANZ Services Agreement for this work.

CONTENTS

FIGURES

TABLES

SIGNATORIES

Author

Roger Shelton
Senior Structural Engineer

Reviewer

Asif Iqbal
Structural Engineer

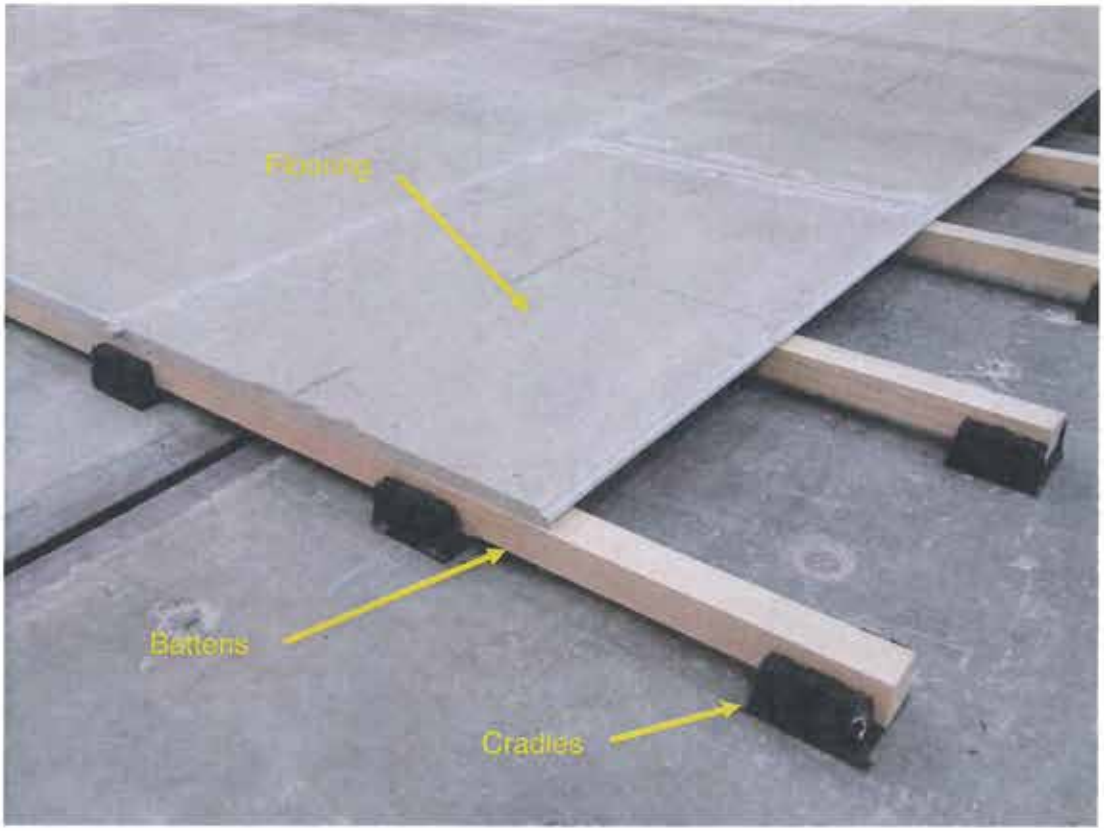
DOCUMENT REVISION STATUS

ISSUE NO.	DATE ISSUED	DESCRIPTION
1	8 October 2014	Initial Issue

1. DESCRIPTION OF SPECIMEN

1.1 Product description

The Batten and Cradle flooring system is a proprietary flooring system utilising recycled rubber cradles laid on a concrete floor slab. Timber battens are placed in the cradles and flooring sheets are fixed to the battens to provide a substrate for various finishes. The flooring system combined with the base slab has favourable acoustic properties, and is intended for use in situations requiring acoustic separation. Photograph 1 shows the main features of the system.



Photograph 1. Main features of Batten and Cradle Floor System

1.2 Specimen construction

A 3.6 m x 2.4 m section of the flooring system was constructed by the client on the floor of the BRANZ Structural Laboratory. Details are shown in Figure 1.

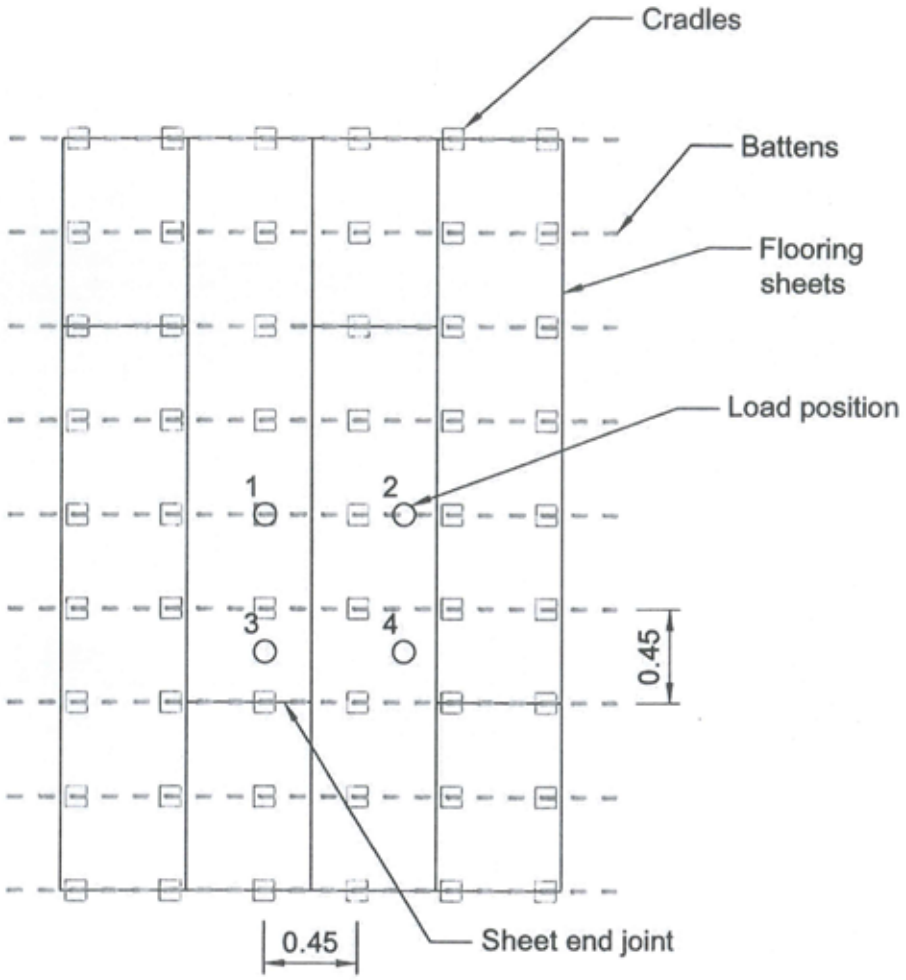


Figure 1 Test specimen set up

Battens were finger jointed Radiata Pine 42 x 42 mm and were not attached to the cradles which were laid directly on the concrete floor. Flooring was James Hardie Scyon Secura sheets, 19 mm thick and 600 mm wide, with long edges machined into a tongue and groove profile. They were cut to length as required to form an offset pattern, and fixed to the battens with 8g screws. Screw spacing was 50 mm from the long edges and 167 mm centres along the batten. The specimen ready for testing is shown in Photograph 2.

Photograph 2. Specimen ready for test

2. DESCRIPTION OF TEST

2.1 Date and location

The test was conducted on 7th October 2014 at BRANZ Limited laboratories, Judgeford, New Zealand in presence of the client.

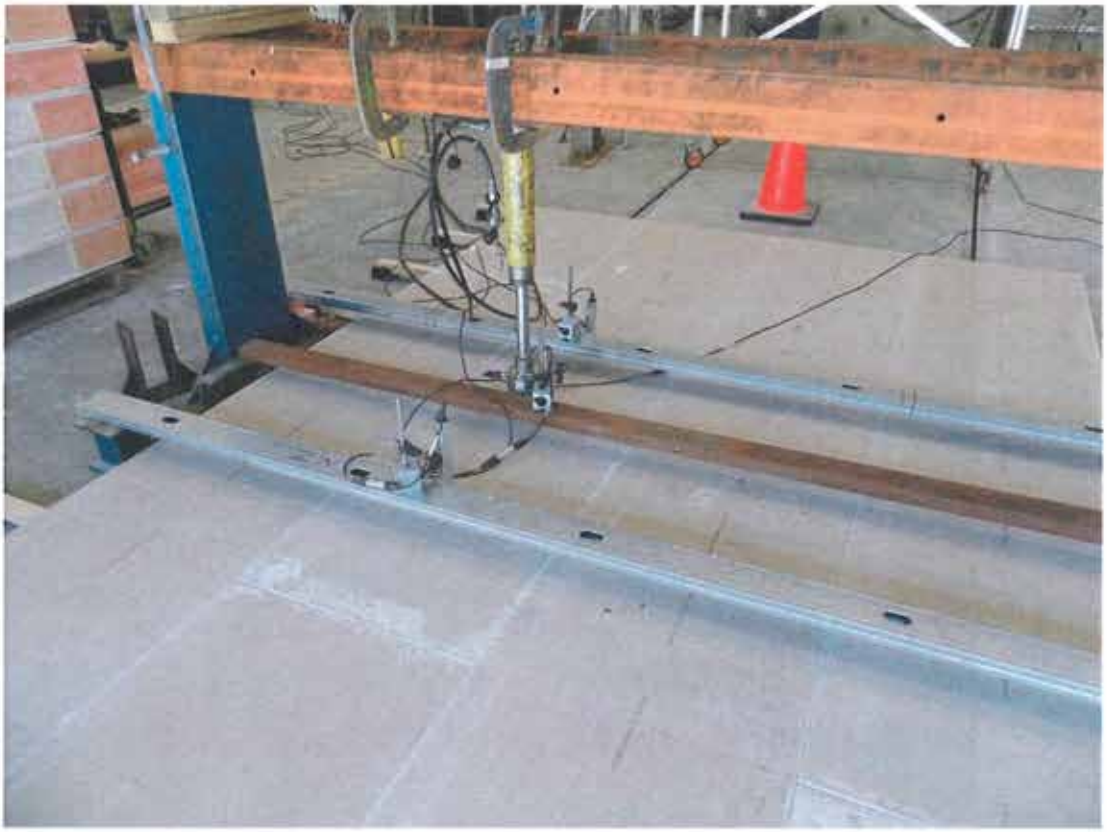
2.2 Test set-up

The specimen was set up on the lab floor as described above. A loading gantry was constructed over it and bolted to the lab floor. A hand pumped hydraulic jack was installed on the loading beam together with a 10 kN load cell and a 100 mm diameter loading applicator. AS/NZS 1170.1 states that the concentrated load should be applied over an area of not greater than 0.01 m^2, which equates to a diameter of 113 mm. The locations of the load application were:

1. Over batten and cradle
2. Over batten between cradles
3. Between battens on cradle lines adjacent sheet butt joint
4. Between battens and cradles.

The locations are shown in Figure 1.

Beams supporting deflection gauges were placed across the specimen at the load point and over adjacent battens. The test set up is shown in Photograph 3.



Photograph 3. Test set up

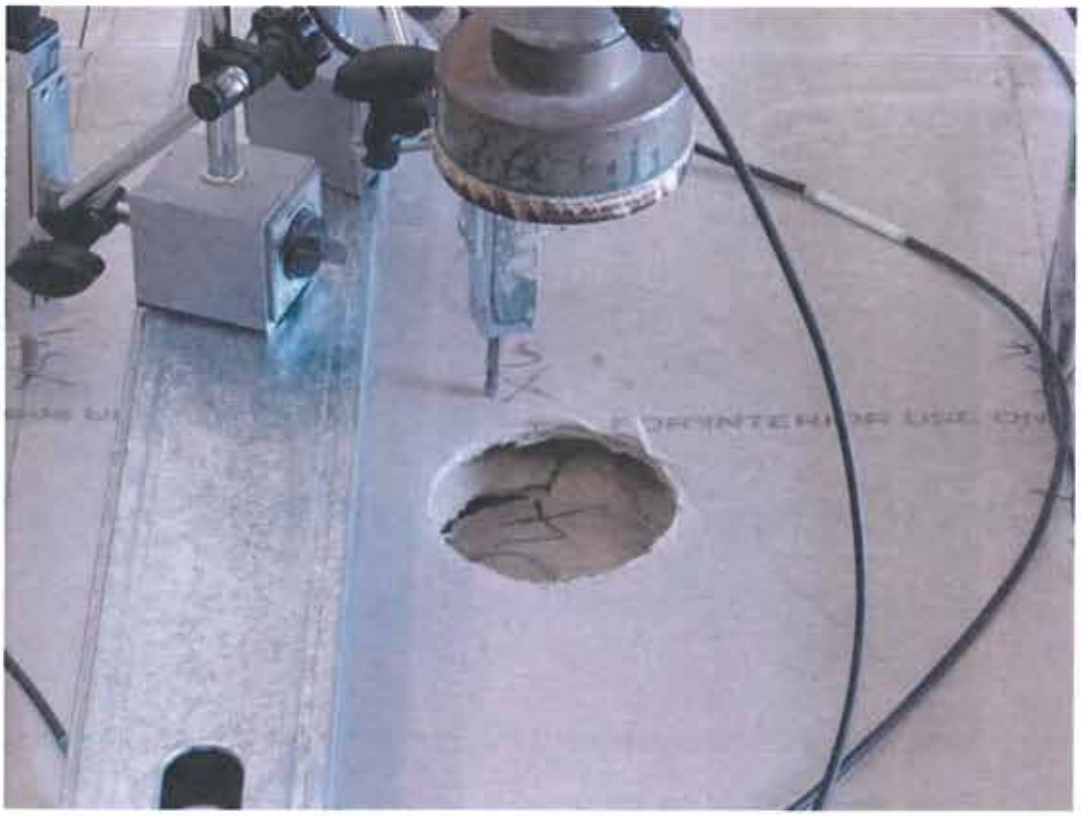
2.3 Test procedure

Load was applied by hand pumped jack gradually increasing up to the 10 kN limit of the load cell. Continuous readings of load and deflection were recorded for analysis.

3. OBSERVATIONS AND RESULTS

Dishing of the flooring around the load application point could quite clearly be seen, and at greater deflections, the joints between the flooring sheets were clearly distorted. Deflections were largely recovered on removal of load, indicating that no inelastic action or permanent effects had occurred. At the end of Test 4 the load applicator punched through the flooring sheet, as shown in Photograph 4. This happened at a load of 10 kN, well above the AS/NZS 1170.1 loading criteria. For "General Office" occupancy the concentrated load criteria is 2.7 kN, and for "Shop floor or retail" occupancy it is 3.6 kN.

Plots of load/deflection as recorded are presented in Figures 2 to 5, and a summary is shown in Table 1. Note that "absolute deflection" is the deflection measured relative to the concrete laboratory floor, and "relative deflection" is the deflection of the load point relative to the flooring sheets over the adjacent battens.



Photograph 4. Punch failure in Test 4

Figure 2. Load/deflection plot, test 1

Figure 3. Load/deflection plot, test 2

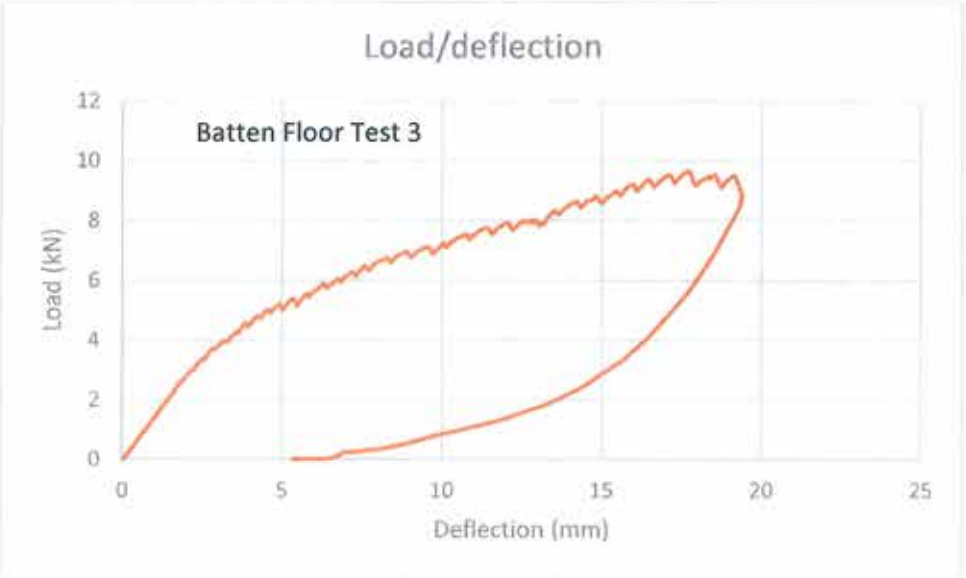


Figure 4. Load/deflection plot, test 3

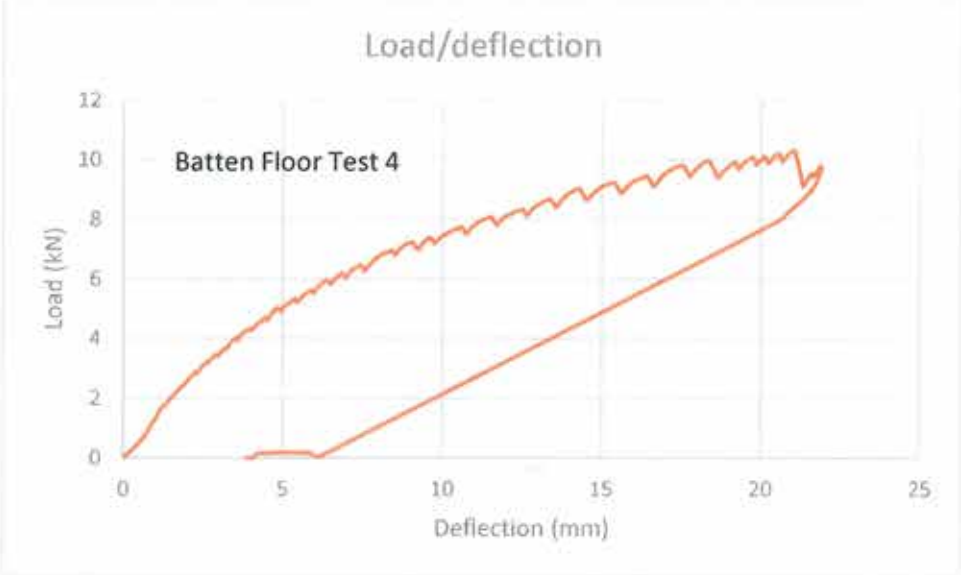
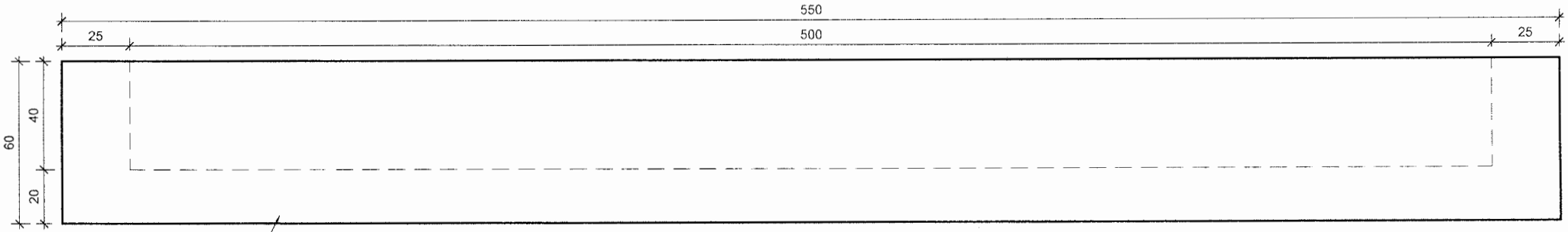


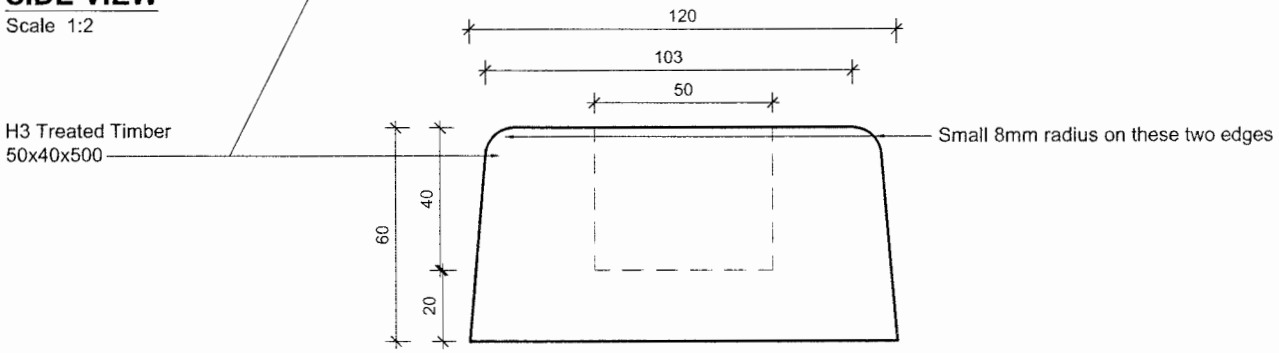
Figure 5. Load/deflection plot, test 4

Test	2.7kN (General Office)		3.6kN (Retail)	
	Absolute	Relative	Absolute	Relative
1	2.7	2.3	3.7	3.1
2	2.6	2.1	3.8	3.0
3	3.4	1.9	4.8	2.7
4	3.7	2.1	5.4	3.1

Table 1. Results summary



SIDE VIEW
Scale 1:2



END VIEW
Scale 1:2

B&C SYSTEMS INTERNATIONAL LTD

AC 550 MOUNT

04 Sep 2015
Scale 1:2

ACM600C | B&C SYSTEMS INTERNATIONAL | Not to scale

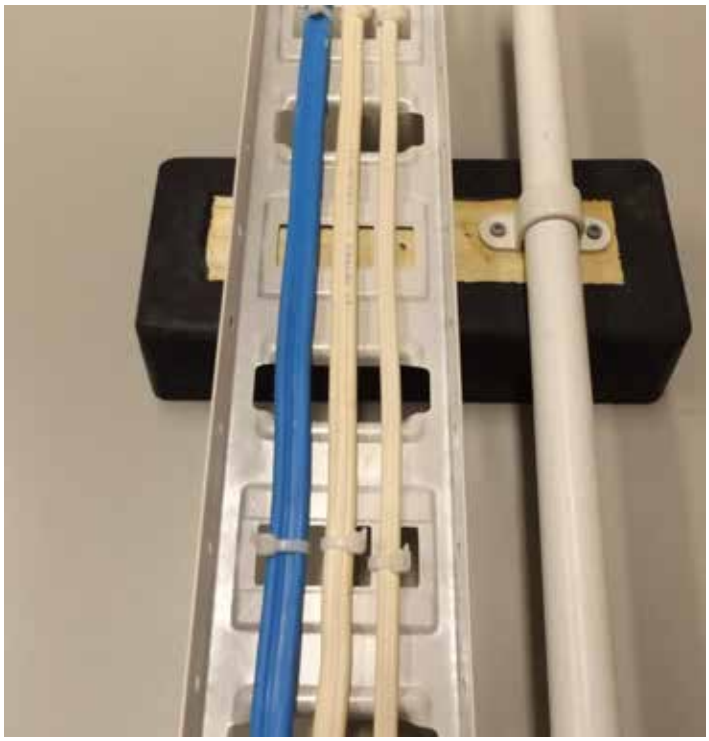
PATENT PENDING

ACM275

Pat. Pending No. 713767

Equipment Mounting Block

ACM275 is an acoustic equipment mounting block, designed specifically for use on membrane surfaces. The ACM275 is installed on top of the membrane surface with approved dob of locating adhesive and doesn't require mechanical fixing. Typically used as a support device for electrical and plumbing services and most mechanical plant. The ACM275 provides sound and impact absorption, is easy to install and is non-invasive on both membrane and applied waterproofing products.



- ☑ Easy to install
- ☑ Protects Membrane Surfaces
- ☑ Sound & Impact Absorption

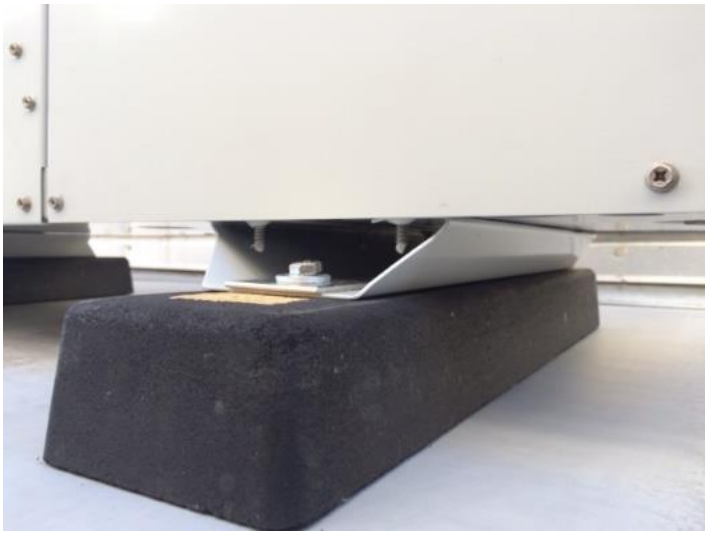
For more information, please visit our website www.battenandcradle.com

ACM550

Pat. Pending No. 713767

Equipment Mounting Block

ACM550 is an acoustic equipment mounting block, designed specifically for use on membrane surfaces. The ACM550 is installed on top of the membrane surface with approved dob of locating adhesive and doesn't require mechanical fixing. Typically used as a support device for air conditioning units and most mechanical plant. The ACM550 provides sound and impact absorption, is easy to install and is non-invasive on both membrane and applied waterproofing products.



- ☑ Easy to install
- ☑ Protects Membrane Surfaces
- ☑ Sound & Impact Absorption

For more information, please visit our website www.battenandcradle.com