Test Report :

Measurement of rain noise from roofing with and without Wardle Storeys Dedpan® DS2020 RDV

BRE

Test report number 219329

partnership

Prepared for :

Wardle Storeys

2 September 2004

Tested by Signature	Afor.
Name	Mr J Healey
Position	Technician
Date	2 September 2004
Prepared by Signature	Afor -
Name	Mr J Healey / Dr C Hopkins
Position	Technician / Principal Consultant
Date	2 September 2004
Checked by Signature	April-
Name	Dr C Hopkins
Position	Principal Consultant
Date	2 September 2004
Approved on Signature	behalf of BRE
Name	Mr J Seller
Position	Head of Acoustics
Date	2 September 2004
	BRE Enviro

BRE Environment Bucknalls Lane Garston Watford WD25 9XX

Tel : 01923 664300 Fax : 01923 664088

Email : environment@bre.co.uk Website : www.bre.co.uk

This report may only be distributed in its entirety and in accordance with the terms and conditions of the contract. Test results relate only to the items tested. BRE has no responsibility for the design, materials, workmanship or performance of the product or items tested. This report does not constitute an approval, certification or endorsement of the product tested.

This report is made on behalf of BRE. By receiving the report and action on it, the client – or any third party relying on it – accepts that no individual is personally liable in contract, tort or breach of statutory duty (including negligence).

Contents

1	Introduction		4
2	Testing details		4
2.1	Test dates and personnel		4
2.2	Test method and applicable standards		4
2.3	Instrumentation		5
2.4	Rainfall types		5
2.5	Test numbers		6
2.6	Construction details with test numbers		7
2.7	Sound insulation test results		8
2.8	Drawings		9
2.9	Photos		10
3	Test result sheets		12

1 Introduction

BRE Acoustics was commissioned by Wardle Storeys, Durbar Mill, Hereford Road, Blackburn, Lancashire, BB1 3JU to carry out sound intensity measurements on metal roofing with and without Wardle Storeys Dedpan® DS2020 RDV in the BRE rainfall testing laboratory.

This report details the testing outlined in BRE proposal 112246.

2 Testing details

2.1 Test dates and personnel

The measurements detailed in this report were made on 17 August and 18 August 2004 by Carl Hopkins and James Healey of BRE Acoustics.

2.2 Test method and applicable standards

Measurement of sound intensity of each element and under each rain condition was made in accordance with ISO 15186-1:1997 and ISO/CD 140-18 (ISO TC43/SC2 N 0751 Dated 13-1-2004).

The test specimen was constructed by Wardle Storeys and installed in the laboratory by BRE.

2.3 Instrumentation

The equipment used to conduct the tests is identified in Table 1.

Table 1 Equipment list

Equipment description	Manufacturer	Туре	BRE Identification number
Real Time Analyser	NEAS	840	13/003
Intensity Probe (p - p)	GRAS	50AI	04/017
Microphone Calibrator	NEAS	1253	01/002
Intensity Calibrator	GRAS	51AB	01/010

The gain of the real time analyser was adjusted to give a reading of 124.0 dB at 250 Hz using the Norsonic 1253 calibrator.

All equipment is calibrated following BRE procedures, using reference equipment calibrated by a UKAS accredited laboratory.

Sound intensity measurements were taken in the frequency range 100 Hz to 5000 Hz using a 50 mm and an 8 mm microphone spacer.

2.4 Rainfall types

Table 2 lists the types of rainfall conditions simulated by the test rig.

Table 2 Rain cond	ditions used in	the tests	
Rain type	Source	Fall height	R

Rain type	Source	Fall height to centre of specimen (m)	Rain coverage area (m²)	Rainfall intensity (l/min/m ²)	Median drop diameter (mm <u>)</u>
(1) 'Heavy' rain (defined in ISO/CD 140-18)	Tank with perforated base	3.22	≈0.84	0.67	5.0
(2) 'Moderate' rain	Nozzle	≈1.4	≈0.79	0.67	≤ 1.0

2.5 Test numbers

Table 3 lists each test along with its corresponding test number. The construction details for each test can be found from Table 4 by referring to the test number.

Table 3 Test numbers

Test number	Rain type Damping strip width (mm)		Test element area (m²)
L904-002	Moderate	None	
L904-003	Heavy	None	
L904-004	Heavy	82	
L904-005	Moderate	82	2 705
L904-006	Moderate	164	3.705
L904-007	Heavy	164	· · · · · · · · · · · · · · · · · · ·
L904-008	Heavy	246	
L904-009	Moderate	246	

2.6 Construction details with test numbers

The construction details are shown in Table 4. Each damping strip was supplied and fitted by Wardle Storeys.

Table 4 Construction details

Test numbers	Construction details
L904-002	5 bays of 400 mm x 2102 mm x 0.9 mm Stucco emboss plain aluminium roofing (3.53 kg/m ²). Each bay fixed to wooden framing with four screws at the top and bottom of the bays
L904-003	with resilient washers on the upper surface of the roofing specimen.
L904-004	5 bays of 400 mm x 2102 mm x 0.9 mm Stucco emboss plain aluminium roofing (3.53 kg/m^2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing
L904-005	specimen. 1 x 82 mm wide Dedpan® DS2020 RDV self-adhesive strips (1.9 kg/m ²) stuck to underside centre of each bay.
L904-006	5 bays of 400 mm x 2102 mm x 0.9 mm Stucco emboss plain aluminium roofing (3.53 kg/m ²). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen.
L904-007	1 x 82 mm and 2 x 41 mm wide Dedpan® DS2020 RDV self- adhesive strips (1.9 kg/m ²) stuck to underside centre of each bay.
L904-008	5 bays of 400 mm x 2102 mm x 0.9 mm Stucco emboss plain aluminium roofing (3.53 kg/m ²). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen.
L904-009	$1 \times 82 \text{ mm}$ and $4 \times 41 \text{ mm}$ wide Dedpan® DS2020 RDV self- adhesive strips (1.9 kg/m ²) stuck to underside centre of each bay.

2.7 Sound insulation test results

The single number quantities for the sound insulation tests are shown in Table 5. The test result sheets are included in the appendices.

Table 5 A-weighted single-number quantities calculated from measurable frequency

 range between 100 Hz and 5k Hz

Test number	Rain type	Damping strip width (mm)	A-weighted sound intensity level L _{IA} (dB re 10 ⁻¹² W/m ²)
L904-003	Heavy	'None	70.5
L904-004	Heavy	82	• 68.1
L904-007	Heavy	164	66.0
L904-008	Heavy	246	64.3
L904-002	Moderate	None	54.1
L904-005	Moderate	82	50.1
L904-006	Moderate	164	49.4
L904-009	Moderate	246	48.0

2.8 Drawings

Figure 1 Test element: Roof



The roofing has a gradient of 7°.

2.9 Photos



Figure 2 Roof specimen installed in test rig with nozzle used to create 'Moderate' rain



Figure 3 Dedpan® DS2020 RDV self-adhesive strips on underside centre of roofing bays



Figure 4 Standing seam between roof bays

3 Test result sheets

Page number	Test number
13	L904-002
15	L904-003
17	L904-004
19	L904-005
21	L904-006
23	L904-007
25	L904-008
27	L904-009

BRE

Laboratory n	neasurement	t of sound	gener	to ISO	y rainfal	l on b	uildin	g eler	nents						
BRE Painfall	Teet Labora	ton	rung	10 130	13100-										
Client:	Wardle Stor	ove													
Toet data	17/08/2004	Toel	num	hor IC	04-002	т	oet ol	omon	t. Ro	of					
Test uate.	11100/2004	1031	munn	Der. La	104-002		est ei	emen	IL. 110	01					
Test element	area:	3.71 m ²				N	lass p	er un	it are	a:				3.53	kg/m ²
Test element	description	:													
5 bays of 400	mm x 2102m	m x 0.9mm	Stuce	co emb	oss plain	alumi	nium r	oofing	g (3.5	3 kg/m	2).				
Each bay fixe	d to wooden t	framing with	h four	screws	at the to	p and	bottor	n of th	ne bay	s with	resili	ent			
washers on th	ne upper surfa	ace of the re	oofing	specim	nen.										
						R	ainfal	I tem	perat	ure:				18	°C
						A	ir tem	perat	ure:					21	°C
Rain type:	Moderate (s	ee Table 2))			A	ir rela	tive h	numic	lity:				70	%
		75			-					-	1	-	-		
	L_1		-												
Frequency	One-third														
(Hz)	octave)	1									
	(dB)	65						1							
50	-	00													
63	-														
80	-				1										
100	-														
125	-	55 -			1.5										
160	-	(dB)													
200	-	r,			18 34	1									
250	35.5	evel,													
315	36.4	A110 45						-			-	-			
400	38.7	itens							-				X		
500	40.0	in pr						1							
630	41.8	Soul					/			100				1 1	
800	42.7	35 -				-									
1,000	42.5														
1,250	44.1														
1,600	44./											1.14			
2,000	45.4	OF													
2,500	45.1	20													
3,150	42.9														
4,000	41.5														
5,000	36.2				14.4										
		15	63 20	80	125 -	250 -	315 400	500	800	250	600	500	150	000	
											÷	N N	ŝ	4 10	

Third octave band centre frequency (Hz)

A-weighted sound intensity level, L_{IA} = 54.1 dB

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

3.53 kg/m²

Laboratory Sound inter	measuremen sity measure	t of sound ger ment accordin	erated by rainfall on the second s	on building elements
BRE Rainfa	II Test Labora	itory		
Client:	Wardle Stor	eys		
Test date:	17/08/2004	Test nu	mber: L904-002	Test element: Roof
Test elemer	nt area:	3.71 m ²	Mass per ur	nit area:

Test element description:

Rain type:

5 bays of 400mm x 2102mm x 0.9mm Stucco emboss plain aluminium roofing (3.53 kg/m2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen.

	Rainfall temperature:	18 °C
	Air temperature:	21 °C
Moderate (see Table 2)	Air relative humidity:	70 %

Frequency	δ _{p/0}	F _{pl}	L ₁ One-third octave
(Hz)	(dB)	(dB)	(dB)
50	-		-
63	-	-	-
80	-	-	-
100	-		
125	- 10	-	-
160	-		-
200	-	-	-
250	26.2	6.1	35.5
315	29.6	5.3	36.4
400	36.8	4.8	38.7
500	33.1	5.2	40.0
630	30.8	5.0	41.8
800	25.2	4.6	42.7
1,000	22.3	5.0	42.5
1,250	20.1	5.2	44.1
1,600	19.8	4.9	44.7
2,000	20.4	4.9	45.4
2,500	20.8	4.6	45.1
3,150	21.3	4.3	42.9
4,000	22.5	4.2	41.5
5,000	23.1	4.9	38.2
А			54.1
L			53.8

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

BRE

BRE Rainfall	Test Labora	tory					
Test date:	17/08/2004	eys Test nun	nber: L904-003	Test eler	ment: Roo	f	
Test element	area:	3.71 m²		Mass per	r unit area	:	3.53 kg/m
5 bays of 400	mm x 2102m	m x 0.9mm Stud	co emboss plain a	luminium roo	ofing (3.53	kg/m2).	
Each bay fixe	d to wooden f	raming with fou	r screws at the top	and bottom	of the bays	with resilient	
washers on th	e upper surfa	ace of the roofing	g specimen.				10.00
				Rainfall	temperatu	re:	18 °C
Data france	Hanny (and	Table 2)		Air temp	erature:		ZZ °C
Rain type:	Heavy (see	Table 2)		Air relati	ve numidi	ty:	70 %
	L	/5		•			
Frequency	One-third					2	
(Hz)	octave		and the second				
	(dB)						
50	-	60					
63	-				-		-
80	-						
100	49.7			1	15 15		
125	53.7	55		1			
160	56.7	(dB	/				
200	53.5	I' T'					
250	55.2	leve					
400	57.0	Atist 45					
500	59.2	inter					
630	60.0	pun					
800	61.4	°S					
1.000	59.5	35					
1,250	60.0						
1,600	60.3		1				
2,000	60.6						
2,500	60.3	25			-		
3,150	58.6			1			
4,000	58.8						
5,000	56.1						

A-weighted sound intensity level, L_{IA} = 70.5 dB

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

BRE

Laboratory	measuremen	t of sou	und generated	by rainfall	on building elements	
Sound inter	nsity measure	ement a	according to I	SO 15186-1		
BRE Rainfa	II Test Labora	atory				
Client:	Wardle Stor	reys				
Test date:	17/08/2004		Test number:	L904-003	Test element: Roof	
Test elemer	nt area:	3.71 r	m²	Mass per u	nit area:	3.53 kg/m ²

Test element description:

5 bays of 400mm x 2102mm x 0.9mm Stucco emboss plain aluminium roofing (3.53 kg/m2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen.

Rainfall temperature:	18 °C
Air temperature:	22 °C
Air relative humidity:	70 %

Rain type: Heavy (see Table 2)

Frequency

1,600

2,000

2,500

3,150

4,000

5,000

A

L

 Air relative humidity:

 F_{pi}

	(Hz)	(dB)	(dB)	One-third octave (dB)
Γ	50	-		
	63	10 M - 10 M	- 33	-
	80		-	-
	100	19.3	9.1	49.7
	125	20.1	7.7	53.7
	160	22.2	6.1	56.7
	200	24.2	5.7	53.5
	250	26.2	5.2	55.2
	315	29.6	5.0	55.8
	400	36.8	4.5	57.9
	500	33.1	5.0	59.2
	630	30.8	5.2	60.0
	800	25.2	4.4	61.4
	1,000	22.3	4.8	59.5
	1.250	20.1	5.3	60.0

19.8

20.4

20.8

21.3

22.5

23.1

δ_{pl0}

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

5.2

4.9

4.5

4.2

4.1

5.0

60.3

60.6

60.3

58.6

58.8

56.1

70.5

71.0

BRE



A-weighted sound intensity level, L IA = 68.1 dB

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

Laboratory	measurement of s	ound generated by rainfall of	on building elements
Sound inter	nsity measuremen	t according to ISO 15186-1	
BRE Rainfa	II Test Laboratory		
Client:	Wardle Storeys		
Test date:	17/08/2004	Test number: L904-004	Test element: Roof

Heavy (see Table 2)

Rain type:

Fest element area:	3.71 m ²	Mass per unit area:	3.53 kg/m ²
Test element descript	ion:		

5 bays of 400mm x 2102mm x 0.9mm Stucco emboss plain aluminium roofing (3.53 kg/m2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen. 1 x 82mm wide Dedpan® DS2020 RDV self-adhesive

Rainfall temperature:	18 °C
Air temperature:	22 °C
Air relative humidity:	70 %

Frequency	δαιο	F	L
	- pro	p	One-third
			octave
(Hz)	(dB)	(dB)	(dB)
50	-		-
63	- 12	-	-
80			- 11
100	19.3	8.7	49.1
125	20.1	7.8	53.8
160	22.2	6.2	53.4
200	24.2	5.7	52.8
250	26.2	5.3	53.2
315	29.6	5.1	53.6
400	36.8	4.7	55.4
500	33.1	4.9	57.2
630	27.6	4.7	58.2
800	25.2	4.3	59.2
1,000	22.3	4.8	57.0
1,250	20.1	5.3	57.4
1,600	19.8	5.3	57.5
2,000	20.4	4.9	58.1
2,500	20.8	4.6	57.6
3,150	21.3	4.2	56.2
4,000	22.5	4.2	56.3
5,000	23.1	5.2	53.4
А			68.1
L			68.7

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

BRE

Sound intens	sity measure	ment accord	aing to ISO 15186-1		
BRE Rainfall	Test Labora	tory			
Client:	vvardie Store	eys		Test element: Doof	
Test date:	17/08/2004	lestr	1umber: L904-005	Test element: Rool	
Test element	area:	3.71 m ²		Mass per unit area:	3.53 kg/m
Test element	description:				
5 bays of 400r	mm x 2102mi	m x 0.9mm s	Stucco emboss plain a	aluminium roofing (3.53 kg/r	n2).
Each bay fixed	d to wooden f	raming with	four screws at the top	and bottom of the bays with	n resilient
washers on th	e upper surfa	ice of the roo	ofing specimen. 1 x 82	2mm wide Dedpan® DS202	0 RDV self-adhesive
strip stuck to u	underside cer	ntre of each l	bay.	Rainfall temperature:	18 °C
				Air temperature:	22 °C
Rain type:	Moderate (se	ee Table 2)		Air relative humidity:	70 %
		75 -		-	
Frequency	One-third				
(Hz)	octave				
	(dB)				
50	-	65 -			
63	-				
80	-				
100	-				
125	31.5	55			
160	30.8	(B)			
200	30.0	L1 (
250	31.2	vel,			
315	32.7	e ≩ 45			
400	34.9	ensi			
500	37.2	d int			
630	37.7	uno			
800	39.8	0) 25			
1,000	38.5	35			
1,250	40.1				
1,600	40.7				
2,000	41.4				
2,500	40.2	25		-	
3,150	38.7				
4,000	38.1				
5,000	34.2		1983		
		45			

A-weighted sound intensity level, L_{IA} = 50.1 dB

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

Laboratory	measurement of s	ound generated by rainfall o	on building elements
Sound inter	nsity measuremen	t according to ISO 15186-1	
BRE Rainfa	II Test Laboratory		
Client:	Wardle Storeys		
Test date:	17/08/2004	Test number: L904-005	Test element: Roof

Test element area:	3.71 m ²	Mass per unit area:	3.53 kg/m ²
Test element descript	ion:		

Test element description:

Moderate (see Table 2)

Rain type:

5 bays of 400mm x 2102mm x 0.9mm Stucco emboss plain aluminium roofing (3.53 kg/m2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen. 1 x 82mm wide Dedpan® DS2020 RDV self-adhesive

Rainfall temperature:	18 °C
Air temperature:	22 °C
Air relative humidity:	70 %

Frequency	δ _{ρ/0}	F _{pl}	L ₁ One-third octave
(Hz)	(dB)	(dB)	(dB)
50	100 L	-	-
63	-	-	-
80	-	- 6	-
100	-		
125	20.1	8.9	31.5
160	22.2	8.3	30.8
200	24.2	8.3	30.0
250	26.2	6.6	31.2
315	29.6	5.6	32.7
400	36.8	5.5	34.9
500	33.1	5.5	37.2
630	30.8	5.3	37.7
800	29.5	4.6	39.8
1,000	22.3	4.8	38.5
1,250	20.1	4.8	40.1
1,600	19.8	4.7	40.7
2,000	20.4	5.0	41.4
2,500	20.8	4.9	40.2
3,150	21.3	4.4	38.7
4,000	22.5	4.4	38.1
5,000	23.1	5.0	34.2
А			50.1
L			50.0

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

BRE

Laboratory m	easurement	of sound	generated by	rainfall or	building	elements			
Sound intens	ity measure	ment acco	rding to ISO 1	5186-1					
BRE Rainfall	Test Labora	tory							
Client:	Wardle Store	eys							
Test date:	18/08/2004	Test	number: L90	4-006	Test ele	ment: Roo	of		
Test element	area:	3.71 m ²			Mass pe	r unit area	:		3.53 kg/m ²
Test element	description								
5 bays of 400r	nm x 2102m	m x 0.9mm	Stucco embos	ss plain alu	minium ro	ofing (3.53	kg/m2).		
Each bay fixed	to wooden f	raming with	four screws a	it the top a	nd bottom	of the bays	s with resili	ent	
washers on the	e upper surfa	ice of the ro	oofing specime	n. 1 x 82m	im and 2 x	41mm wid	le Dedpan	® DS2020) RDV
self-adhesive	strips stuck to	o underside	e centre of eac	h bay.	Rainfall	temperatu	re:		18 °C
					Air temp	erature:			20 °C
Rain type:	Moderate (s	ee Table 2)			Air relati	ve humidi	ty:		72 %
		⁷⁵ [+			T	T	
	L_1					a the			
Frequency	One-third		1 . P.						
(Hz)	octave							10.3	
	(dB)	65						1	
50	-								
63	C 15								
80	-					Para Con	1.5	1 Salar	
100	-					1			
125	-	55						i and	
160	30.6	(dB)		1					
200	29.5	. 41							
250	29.6	evel						10.325	
315	32.3	A10 45							
400	34.1	Iten							
500	35.2	nd ir	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1				-		
630	36.8	Sou					-		
800	38.1	35 -			-				
1,000	38.0								IT
1,250	39.1								
1,600	40.1								
2,000	40.7	25							
2,500	39.0	20			1.1.1	-			
3,150	30.1								
4,000	37.5					1 4		1.000	
5,000	04.0								
		15		0 0 0	0 15 00	0 00 00	0 0 0	0 00 00	0 00
			+ +	- = 8 8	N 60 4	6 6 6	1,0	2,5	5,0
				I nird o	octave band o	centre trequer	ncy (Hz)		

A-weighted sound intensity level, L IA = 49.4 dB

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

Laboratory	measurement of s	ound generated by rainfall of	on building elements
Sound inter	sity measuremen	t according to ISO 15186-1	
BRE Rainfal	I Test Laboratory		
Client:	Wardle Storeys		
Test date:	18/08/2004	Test number: L904-006	Test element: Roof

Moderate (see Table 2)

Rain type:

Test element area:	3.71 m ²	Mass per unit area:	3.53 kg/m ²
Test element descripti	on:		

5 bays of 400mm x 2102mm x 0.9mm Stucco emboss plain aluminium roofing (3.53 kg/m2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen. 1 x 82mm and 2 x 41mm wide Dedpan® DS2020 RDV

Rainfall temperature:	18 °C
Air temperature:	20 °C
Air relative humidity:	72 %

Frequency	δ _{p/ 0}	F _{pl}	
			One-third
(11-)	(15)	(15)	octave
(HZ)	(aB)	(aB)	(aB)
50		-	-
63	-	-	-
80	-		-
100			-
125	-		
160	22.2	9.9	30.6
200	24.2	8.4	29.5
250	26.2	7.8	29.6
315	29.6	6.1	32.3
400	36.8	5.4	34.1
500	33.1	5.4	35.2
630	30.8	5.3	36.8
800	29.5	5.2	38.1
1,000	22.3	5.4	38.0
1,250	20.1	5.2	39.1
1,600	19.8	5.2	40.1
2,000	20.4	5.7	40.7
2,500	20.8	5.6	39.6
3,150	21.3	5.2	38.1
4,000	22.5	5.0	37.5
5,000	23.1	5.4	34.3
А		1 Satal	49.4
L	Sector Inde		49.1

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

BRE



A-weighted sound intensity level, L IA = 66.0 dB

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

Laboratory measurement of sound generated by rainfall on building elements Sound intensity measurement according to ISO 15186-1 BRE Rainfall Test Laboratory

Client: Wardle Storeys

Rain type:

Test date: 18/08/2004 Test number: L904-007

Heavy (see Table 2)

Test element area:3.71 m²Mass per unit area:3.53 kg/m²Test element description:3.53 kg/m²

5 bays of 400mm x 2102mm x 0.9mm Stucco emboss plain aluminium roofing (3.53 kg/m2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen. 1 x 82mm and 2 x 41mm wide Dedpan® DS2020 RDV

Rainfall temperature:	18 °C
Air temperature:	20 °C
Air relative humidity:	72 %

Test element: Roof

Frequency	δ _{ρί 0}	F _{pl}	L ₁ One-third octave
(Hz)	(dB)	(dB)	(dB)
50	-	-	-
63	-		- 10 - 10 - 10 - 10 - 10 - 10 - 10 - 10
80	-	-	
100	19.3	7.2	48.1
125	20.1	7.3	52.5
160	22.2	6.1	50.4
200	24.2	4.9	51.7
250	26.2	5.1	51.2
315	29.6	4.7	53.7
400	36.8	4.3	54.9
500	33.1	4.7	55.7
630	30.8	4.4	56.1
800	25.2	4.7	56.9
1,000	22.3	5.1	55.5
1,250	20.1	5.2	55.3
1,600	19.8	5.0	55.6
2,000	20.4	5.3	55.9
2,500	20.8	5.1	55.2
3,150	21.3	4.6	54.2
4,000	22.5	4.4	53.9
5,000	23.1	5.2	51.1
А	1.19.5		66.0
L			66.9

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

BRE



A-weighted sound intensity level, L_{IA} = 64.3 dB

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

 Laboratory measurement of sound generated by rainfall on building elements

 Sound intensity measurement according to ISO 15186-1

 BRE Rainfall Test Laboratory

 Client:
 Wardle Storeys

 Test date:
 18/08/2004

 Test number: L904-008
 Test element: Roof

Test element area:	3.71 m ²	Mass per unit area:	3.53 kg/m ²
Test element description	on:		

5 bays of 400mm x 2102mm x 0.9mm Stucco emboss plain aluminium roofing (3.53 kg/m2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen. 1 x 82mm and 4 x 41mm wide Dedpan® DS2020 RDV

Rainfall temperature:	18 °C
Air temperature:	21 °C
Air relative humidity:	72 %

Frequency	δ _{p/ 0}	F _{pl}	L ₁ One-third
			octave
(Hz)	(dB)	(dB)	(dB)
50	- 1		-
63	-	1 10 - 10	
80	-	-	-
100	19.3	7.7	45.2
125	20.1	6.3	48.8
160	22.2	5.9	46.3
200	24.2	4.6	49.0
250	26.2	5.0	49.5
315	29.6	4.3	52.5
400	36.8	4.3	52.9
500	33.1	4.3	55.0
630	30.8	4.2	54.5
800	29.5	4.2	55.0
1,000	22.3	4.8	53.6
1,250	20.1	4.8	53.5
1,600	19.8	4.7	53.7
2,000	20.4	4.9	54.3
2,500	20.8	5.0	53.3
3,150	21.3	4.3	52.9
4,000	22.5	4.3	52.0
5,000	23.1	5.2	48.7
A		1 () () () () () () () () () (64.3
L			65.1

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

Rain type:

Heavy (see Table 2)

BRE

Laboratory m	easurement	of sound	generated	by rainfall of	n building	elements			
Sound Intens	Toot Labora	ton:	ruing to ise	J 15100-1					
BRE Rainial	Mardla Star	lory							
Client:	vvarule Stor	eys	number 1	004 000	Test ele	mont Poof			
Test date:	10/00/2004	Test	number. L	.904-009	lest ele	ment. Roof			
Test element	area:	3.71 m ²			Mass pe	r unit area:			3.53 kg/m ²
Test element	description								
5 bays of 400r	mm x 2102m	m x 0.9mm	Stucco em	boss plain al	uminium ro	ofing (3.53 kg	g/m2).		
Each bay fixed	d to wooden t	framing with	four screw	s at the top a	ind bottom	of the bays w	ith resilie	ent	
washers on th	e upper surfa	ace of the ro	ofing speci	men. 1 x 82r	nm and 4 x	41mm wide	Dedpan	® DS2020	RDV
self-adhesive	strips stuck t	o underside	centre of e	ach bay.	Rainfall	temperature	:		18 °C
					Air temp	Air temperature:			21 °C
Rain type:	Moderate (s	ee Table 2)			Air relati	ve humidity	:		70 %
		75						-	
	L								
Frequency	One-third	1		-					
(Hz)	octave								
	(dB)	65			1				
50	-								
63	(- S				1.500	1.4			
80	-								
100	-				1.1.1	1			
125	-	55 -							
160	28.0	(dB)							
200	27.8	. L.							
250	27.4	evel							
315	32.4	A1 45			and the state				
400	31.8	itens							
500	34.6	ni br	1 4		1.				
630	36.0	Sour					-		
800	37.6	35 -			-				
1,000	36.0			1. B. T.	-/	TI			
1,250	37.3								II
1,600	38.6								
2,000	39.6	25		0.0	T				
2,500	38.3	25 -				1			
3,150	36.9			- of the					
4,000	36.0								
5,000	32.4					-			
		15	2 12 0 0	9 9 9	0 0 0		0 0	0 0 0	0 0
		Ľ	, 9 8 0	15 20 20	31 31 40	50 80 1,00	1,25	2,50	5,00
				Third	octave band	centre frequency	(Hz)		

A-weighted sound intensity level, L IA = 48.0 dB

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

Laboratory	measuremen	t of so	ound generated	d by rainfall on	building elements	
Sound inter	nsity measure	ement	according to I	SO 15186-1		
BRE Rainfa	II Test Labora	atory				
Client:	Wardle Sto	reys				
Test date:	18/08/2004		Test number:	L904-009	Test element: Roof	
	*					
Test elemen	nt area:	3.71	m²	Mass per unit	area:	3.53 kg/m ²

Test element description:

Moderate (see Table 2)

Rain type:

5 bays of 400mm x 2102mm x 0.9mm Stucco emboss plain aluminium roofing (3.53 kg/m2). Each bay fixed to wooden framing with four screws at the top and bottom of the bays with resilient washers on the upper surface of the roofing specimen. 1 x 82mm and 4 x 41mm wide Dedpan® DS2020 RDV

Rainfall temperature:	18 °C
Air temperature:	21 °C
Air relative humidity:	70 %

Frequency	δ _{ρ/ 0}	F _{pl}	L ₁ One-third octave
(Hz)	(dB)	(dB)	(dB)
50		-	-
63	-	-	-
80	-	-	-
100			
125	-	-	-
160	22.2	9.9	28.0
200	24.2	8.9	27.8
250	26.2	8.2	27.4
315	29.6	5.1	32.4
400	36.8	5.6	31.8
500	33.1	5.1	34.6
630	30.8	4.4	36.0
800	25.2	4.6	37.6
1,000	22.3	4.9	36.0
1,250	20.1	4.8	37.3
1,600	19.8	4.7	38.6
2,000	20.4	5.0	39.6
2,500	20.8	5.2	38.3
3,150	21.3	4.6	36.9
4,000	22.5	4.5	36.0
5,000	23.1	4.9	32.4
А			48.0
L			47.8

This page may only be distributed with the test report in its entirety and in accordance with the terms and conditions of the contract

Test report number 219329 Commercial in confidence © Building Research Establishment Ltd 2004 Page 28 of 28