Fire Acoustics Structures

The Building Test Centre British Gypsum East Leake Loughborough Leics. LE12 6NP Tel (0115) 945 1564 Fax (0115) 945 1562 email btc.testing@bpb.com

Report Number BTC 17745A

An Acoustic Test Report covering Laboratory Sound Insulation testing to BS EN ISO 140-3: 1995 and BS EN ISO 140-6: 1998 on a Robust Details Appendix F floor tested with and without the installation of down lighters in the ceiling.

Test Dates: 22nd February and 12th March 2012.

Customer: TLC Southern Ltd The TLC Building Fleming Way Crawley West Sussex RH10 9JY

Customer: TLC Southern Ltd

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Customer: TLC Southern Ltd

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FOREWORD

The test specimen floor was installed by Pete Rigley and Karl Negus between the 13th February and 15th February 2012. The down lighters were installed by Karl Negus on the 12th March 2012.

The Building Test Centre played no role in the design or selection of the materials comprising the test specimen.

REPORTAUTHORISATION

Report Author

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here

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TESTCONSTRUCTION

<u>V17708AA</u>

Base floor comprising of solid timber joists nominally 235mm x 50mm on joist hangers at 450mm centres with 100mm (thick) Isover Acoustic Partition Roll (1200) insulation in the cavity. Joist hangers screw fixed to timber ring beam using 32mm Gyproc drywall screws

Ceiling comprised of an outer layer of 12.5mm (thick) Gyproc WallBoard and an inner layer of 19mm (thick) Gyproc Plank was screw fixed directly to the underside of the joists.

The inner layer was screw fixed at 300mm centres within the field of the boards and at 150mm centres at the ends using 41mm Gyproc Drywall Timber screws.

The outer layer screw fixed at 230mm centres within the field of the boards and at 150mm centres at the ends of the boards using 51mm Gyproc Drywall Timber screws.

All the joints were staggered between layers. All joints and screw heads were taped.

The perimeter taped and sealed with Gyproc Sealant.

The walking surface consisted of a single layer of 15mm (thick) Orientated Strand Board (OSB) screw fixed to joists at 300mm centres using 41mm Gyproc timber screws.

<u>V17708CA</u>

The construction was as in V17708AA with the addition of five down lighters LT FRD 12 (see Figure 3) down lighters installed into the ceiling and located as shown in figure 2.



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Figure 1. Cross section view though partition V17708AA



Figure 2. Layout of down lighters on direct fix ceiling

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Figure 3. Schematic representation of the down lighters tested

The descriptions of individual components making up the test specimen were provided by the customer and were checked for accuracy wherever possible.



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TESTMATERIALS

Plasterboard

i) Nominally 2400mm (long) x 1200mm (wide) x 12.5mm (thick) Gyproc WallBoard manufactured by British Gypsum, ex East Leake.

Surface density:	8.1 kg/m^2
Average thickness:	12.6 mm
Board Code:	16 040 12 06:43

ii) Nominally 2400mm (long) x 600mm (wide) x 19mm (thick) Gyproc Plank manufactured by British Gypsum, ex East Leake.

Surface density:	15.6 kg/m^2					
Average thickness:	19.2 mm					
Board Code:	18 026 12 02:33					

The surface densities were calculated using the actual weight and size of a selection of the boards used in the test specimen.

Insulation

i) Nominally 100mm thick Isover APR 1200 insulation supplied by Saint Gobain Isover.

Average area	11.00	m²
Average weight	10.95	kg
Density	9.95	kg/m³

The density was calculated using the actual weight and size of the insulation used in the test specimen.

Downlighters

i) LT FRD 12 supplied by TLC Southern Ltd



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Fasteners

- i) 32mm Gyproc drywall screws
- ii) 41mm Gyproc drywall Timber screws
- iii) 51mm Gyproc drywall Timber screws

All fasteners supplied by The Building Test Centre

MiscellaneousComponents

- i) Gyproc Sealant supplied by The Building Test Centre
- ii) Joint tape supplied by The Building Test Centre
- iii) Joists hangers supplied by The Building Test Centre

TimberJoists

235 mm x 50 mm timber joists, supplied by The Building Test Centre.

OrientedStrandBoard

15 mm OSB Timber Decking Board supplied The Building Test Centre.

Average surface density:	8.72kg/m ²
Average Board thickness:	15 mm

The surface densities were calculated using the actual weight and size of a selection of the boards used in the test specimen.

When measurements could not be taken weight and dimensions were provided by the customer or the manufacturer, e.g. from material labelling. Material information was recorded according to procedure MAT/1.



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Fire Acoustics Structures

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TESTRESULTS

Test Code	Description	Weighted Airborne Sound Reduction Index R _w (C; Ctr)	Weighted Normalised Impact Sound Pressure Level L _{nv} (Ci)
V17708AA	Timber joists floor incorporating double layer ceiling of 12.5mm Gyproc WallBoard and 19mm Gyproc Plank, 15mm OSB Flooring with 100mm Isover APR insulation with in the cavity.	36 (-2; -5) dB	76 (-1) dB
V17708CA	Timber joists floor incorporating double layer ceiling of 12.5mm Gyproc WallBoard and 19mm Gyproc Plank, 15mm OSB Flooring with 100mm Isover APR insulation with in the cavity. Including the installation of five LT FRD 12 down lighters in the ceiling.	37 (-2; -6) dB	77 (-1) dB

For full data see Appendix A of this report.

Tests conducted in accordance with BS EN ISO 140-3:1995 except for Clause F.2 & BS EN ISO 140-6: 1998 except for Clause C.2 where minimum distances for measurements at frequencies under 100Hz can not be met.

Tests rated in accordance with BS EN ISO 717-1:1997 and BS EN ISO 717-2:1997.

TESTPROCEDURE

The test specimen (3.16 m x 3.16 m) was constructed in a floor dividing two reverberant rooms of approximately 98m^3 and 101m^3 . The accuracy of the test method conforms to BS EN 20140-9:1994, the test procedures used are detailed in Appendix A of this report. Broad-band white noise was used to measure the level differences and broad-band pink noise was used to measure the reverberation times. Third octave band pass filters were used in real time mode. See Appendix B for further information.

A tapping machine, which complies with Annex B of BS EN ISO 140-6:1998, was placed in four different positions within the source room. Measurements were taken in the receiving room below, using the same equipment as above.

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The Building Test Centre Fire Acoustics Structures

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LIMITATIONS

The results only relate to the behavior of the element of construction under the particular conditions of test, they are not intended to be the sole criteria for assessing the potential acoustic performance of the element in use or do they reflect the actual behavior.



Customer: TLC Southern Ltd

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APPENDIXA-TESTDATA



Customer: TLC Southern Ltd

LABORATORY AIRBORNE SOUND INSULATION TEST - BS EN ISO 140-3:1995

Test Code: V17708AA

Test Date: 22/02/2012

			Room T3	Room T4
Specimen Area, S =	9.99 m ²	Room Volume, m ³ : Temperature, deg C	98 15 8	101 16 9
		Rel. Humidity, %RH:	51.5	44.8

			Test Room T3	3 to Te	st Room	T4					R
Freq	Source	Rec. (uc	c) Bgrnd	F	Rec. (cor	r) l	Rev.tim	e Corr.	R	U.Dev.	1/1Oct
Hz	dB	dB	dB		dB		Sec	dB	dB	dB	dB
50	59.3	42.6	33.7		42.0		2.80	2.4	19.7		
63	60.0	43.3	27.1		43.3		3.25	3.0	19.7		21.1
80	74.7	46.9	26.5		46.9		1.29	-1.0	26.8		
100	83.4	56.4	23.6		56.4		0.90	-2.5	24.5		
125	103.4	76.4	16.7		76.4		1.04	-1.9	25.1		20.7
160	91.2	72.3	15.9		72.3		1.13	-1.6	17.3	5.7	
200	94.6	73.6	14.8		73.6		1.15	-1.5	19.5	6.5	
250	94.1	67.4	13.0		67.4		1.46	-0.4	26.3	2.7	23.4
315	92.0	54.4	14.7		54.4		1.56	-0.2	37.4		
400	90.9	58.8	14.2		58.8		1.67	0.1	32.2	2.8	
500	90.2	59.0	11.8		59.0		1.60	0.0	31.2	4.8	32.6
630	89.8	54.2	11.9		54.2		1.59	-0.1	35.5	1.5	
800	90.0	51.8	10.0		51.8		1.63	0.0	38.2		
1 000	93.4	53.1	8.7		53.1		1.68	0.2	40.5		39.8
1 250	95.2	54.5	10.4		54.5		1.83	0.5	41.2		
1 600	92.6	52.9	8.8		52.9		1.79	0.4	40.1		
2 000	95.9	55.9	7.0		55.9		1.83	0.5	40.5		41.1
2 500	97.0	54.3	7.5		54.3		1.82	0.5	43.2		
3 150	97.6	51.4	6.6		51.4		1.70	0.2	46.4		
4 000	95.4	43.9	7.2		43.9		1.42	-0.6	50.9		49.6
5 000	99.6	41.7	7.9		41.7		1.21	-1.3	56.6		
6 300											
8 000											
10 000											
Single Fi	igure Rating	ns	Rw	С		Ctr		Total U.	Dev. dB	24	
)07		dD		٩D			2011, a2		l
BS EN IS	50 /1/-1: 19	197	UD OO	uБ							
			36	-2		-5					
			(100-5000)	-1		-5					
			(190 0000)	-		-					
Backgroun	d Corrected		(50-3150)	-2		-6					
RT's > fact	tor 1.5 apart		. ,				[Procedure: ISO14	40/3/B - issu	ue 3	
			(50-5000)	-1		-6		Worksheet: 140_	3_1.XLS		







LABORATORY IMPACT SOUND INSULATION TEST - BS EN ISO 140-6:1998

Test Code: V17708AI

Test Date: 22/02/2012

Specimen Area, $S = 9.99 \text{ m}^2$

	Room T3	Room T4
Room Volume, m ³ :	98	101
Temperature, deg.C:	15.8	16.9
Rel. Humidity, %RH:	51.5	44.8

				Test Roc	om 4 to	Test Roc	om 3						Ln
Freq	Imp.L1	lmp.L2	Imp.L3	Imp.L4	SD	Li (uc)	BKGD	Li (corr)	Rev.time	Corr.	Ln	U.Dev.	1/1 Oct.
Hz	dB	dB	dB	dB	dB	dB	dB	dB	Sec	dB	dB	dB	dB
50	69.8	67.3	68.1	68.9	1.1	68.6	21.5	68.6	2.17	-1.3	67.3		
63	70.7	67.7	67.1	69.9	1.7	69.1	13.0	69.1	2.34	-1.7	67.4		74.0
80	72.7	72.6	72.1	71.8	0.4	72.3	14.2	72.3	1.91	-0.8	71.5		
100	74.9	75.4	75.2	75.6	0.3	75.3	11.1	75.3	2.02	-1.0	74.3		
125	75.9	79.0	77.1	76.1	1.4	77.2	11.5	77.2	1.74	-0.4	76.8		83.6
160	82.9	82.9	78.5	83.2	2.3	82.2	6.9	82.2	1.71	-0.3	81.9	3.9	
200	84.6	82.3	81.8	85.0	1.6	83.6	15.7	83.6	1.34	0.8	84.4	6.4	
250	79.3	77.7	77.4	79.6	1.1	78.6	8.6	78.6	1.31	0.9	79.5	1.5	86.1
315	75.1	75.4	74.9	76.3	0.6	75.5	9.5	75.5	1.27	1.0	76.5		
400	82.0	84.7	80.5	82.8	1.7	82.8	11.5	82.8	1.53	0.2	83.0	6.0	
500	82.0	81.6	81.5	80.6	0.6	81.5	8.7	81.5	1.65	-0.1	81.4	5.4	85.7
630	74.4	76.6	74.5	76.8	1.3	75.7	13.2	75.7	1.66	-0.2	75.5	0.5	
800	74.0	77.3	75.5	74.5	1.5	75.5	6.4	75.5	1.72	-0.3	75.2	1.2	
1 000	73.2	73.2	74.1	73.7	0.4	73.6	6.4	73.6	1.80	-0.5	73.1	0.1	78.0
1 250	70.3	69.4	71.5	70.5	0.9	70.5	7.9	70.5	1.78	-0.5	70.0		
1 600	70.0	67.3	70.6	68.6	1.5	69.3	6.2	69.3	1.86	-0.7	68.6	1.6	
2 000	67.0	64.6	69.2	65.1	2.1	66.9	3.4	66.9	1.80	-0.5	66.4	2.4	71.4
2 500	64.3	60.8	65.7	61.5	2.3	63.5	2.4	63.5	1.65	-0.1	63.4	2.4	
3 150	58.6	56.1	60.5	57.0	1.9	58.4	3.0	58.4	1.56	0.1	58.5	0.5	
4 000	50.8	48.2	52.3	49.6	1.7	50.5	3.6	50.5	1.46	0.4	50.9		59.3
5 000	42.2	39.7	44.0	41.9	1.8	42.2	7.2	42.2	1.26	1.0	43.2		
6 300													
8 000													
10 000													
Single E		tina		n w –	76	dB				Total II	Dov dB	21.0	
Single I		ung		I, VV —	10	uВ				101210.1	Jev., ub	51.9	
150 /1/-	2:1997			•									
				C ₁ =	-1	dB							
			Current		-1	dB							
			€1,50-2	500 -	•	uD							
										10011010			
									Procedure:	ISO140/6/B -	issue 2		
									Worksheet	:140_6.XLS			







Customer: TLC Southern Ltd

LABORATORY AIRBORNE SOUND INSULATION TEST - BS EN ISO 140-3:1995

Test Code: V17708CA

Test Date: **12/03/2012**

		Room T3	Room T4	
9.99 m ²	Room Volume, m ³ :	98	101	
	Temperature, deg.C:	16.3	17.7	
	Rel. Humidity, %RH:	49.5	46	
	Static Pressure, Pa:	100	100	
	9.99 m ²	9.99 m ² Room Volume, m ³ : Temperature, deg.C: Rel. Humidity, %RH: Static Pressure, Pa:	Room T39.99 m²Room Volume, m³:98Temperature, deg.C:16.3Rel. Humidity, %RH:49.5Static Pressure, Pa:100	Room T3 Room T4 9.99 m ² Room Volume, m ³ : 98 101 Temperature, deg.C: 16.3 17.7 Rel. Humidity, %RH: 49.5 46 Static Pressure, Pa: 100 100

	Test Room T3 to Test Room T4									R	
Freq	Source	Rec. (uc)	Bgrnd	F	Rec. (cor	r) l	Rev.tim	e Corr.	R	U.Dev.	1/1Oct
Hz	dB	dB	dB		dB		Sec	dB	dB	dB	dB
50	60.4	40.9	21.0		40.9		2.61	2.1	21.6		
63	60.6	43.1	15.5		43.1		2.49	1.9	19.4		20.9
80	74.2	51.0	16.3		51.0		1.34	-0.8	22.4		
100	82.9	54.5	15.6		54.5		0.99	-2.1	26.3		
125	103.0	78.2	9.7		78.2		1.05	-1.9	22.9		21.4
160	90.9	70.6	9.8		70.6		1.05	-1.9	18.4	5.6	
200	94.9	73.0	14.2		73.0		1.11	-1.6	20.3	6.7	
250	93.8	67.4	14.5		67.4		1.35	-0.8	25.6	4.4	23.9
315	92.0	54.9	19.0		54.9		1.53	-0.2	36.9		
400	91.3	59.7	18.5		59.7		1.59	-0.1	31.5	4.5	
500	90.4	57.9	12.3		57.9		1.54	-0.2	32.3	4.7	32.9
630	89.6	53.5	13.3		53.5		1.57	-0.1	36.0	2.0	
800	90.3	51.7	10.1		51.7		1.59	-0.1	38.5	0.5	
1 000	93.3	52.9	10.2		52.9		1.70	0.2	40.6		40.0
1 250	95.2	54.4	11.1		54.4		1.80	0.5	41.3		
1 600	92.7	53.3	8.7		53.3		1.82	0.5	39.9	1.1	
2 000	95.8	56.2	7.3		56.2		1.89	0.7	40.3	0.7	40.9
2 500	96.9	54.1	7.6		54.1		1.84	0.6	43.4		
3 150	97.5	51.1	7.4		51.1		1.70	0.2	46.6		
4 000	95.3	43.9	7.4		43.9		1.42	-0.6	50.8		49.6
5 000	99.3	42.0	8.2		42.0		1.24	-1.2	56.1		
6 300											
8 000											
10 000											
Single Fi	igure Rating	as	Rw	С		Ctr		Total U.	Dev., dB	30.2	
BE EN ISO 717 1: 1007		5 107	dB	dB		dB			,		l
DO EN IO	50717-1: 19	197		uВ		uD A					
			37	-2		-6					
						~					
		(100-5000)	-1		-6					
		(50-3150)	-2		-7					
RT's > fact	or 1.5 apart						Γ	Procedure: ISO14	40/3/B - issu	le 3	
		(50-5000)	-1		-7	,	Worksheet: 140_	3_1.XLS		







LABORATORY IMPACT SOUND INSULATION TEST - BS EN ISO 140-6:1998

Test Code: V17708CI

Test Date: 12/03/2012

Specimen Area,	S =	9.99	m ²
	-		

	Room T3	Room
Room Volume, m ³ :	98	101
Temperature, deg.C:	16.3	17.7
Rel. Humidity, %RH:	49.5	46
Static Pressure, Pa	100	100

T4

	Test Room 4 to Test Room 3												Ln				
Freq	Imp.L1	lmp.L2	Imp.L3	Imp.L4	SD	Li (uc)	BKGD	Li (corr)	Rev.time	Corr.	Ln	U.Dev.	1/1 Oct.				
Hz	dB	dB	dB	dB	dB	dB	dB	dB	Sec	dB	dB	dB	dB				
50	70.2	71.4	69.8	66.9	1.9	69.9	16.2	69.9	1.96	-0.9	69.0						
63	72.2	71.4	70.7	68.0	1.8	70.8	6.7	70.8	2.22	-1.4	69.4		74.6				
80	71.9	72.0	73.8	72.9	0.9	72.7	7.2	72.7	2.43	-1.8	70.9						
100	74.0	74.0	75.5	76.2	1.1	75.0	5.5	75.0	1.97	-0.9	74.1						
125	76.6	77.5	78.0	78.0	0.7	77.6	4.6	77.6	1.96	-0.9	76.7		84.8				
160	85.0	83.3	82.7	84.2	1.0	83.9	2.8	83.9	1.72	-0.3	83.6	4.6					
200	84.6	85.6	83.6	82.4	1.4	84.2	18.6	84.2	1.24	1.1	85.3	6.3					
250	80.3	78.8	78.4	76.0	1.8	78.6	9.7	78.6	1.29	0.9	79.5	0.5	87.0				
315	78.0	76.4	77.5	77.6	0.7	77.4	8.9	77.4	1.27	1.0	78.4						
400	84.0	82.5	83.9	83.0	0.7	83.4	11.6	83.4	1.46	0.4	83.8	5.8					
500	81.3	80.2	80.0	79.1	0.9	80.2	6.8	80.2	1.52	0.2	80.4	3.4	86.2				
630	79.7	78.7	77.3	76.6	1.4	78.2	10.5	78.2	1.60	0.0	78.2	2.2					
800	77.4	79.0	78.9	77.4	0.9	78.2	5.9	78.2	1.67	-0.2	78.0	3.0					
1 000	75.4	75.0	75.7	74.3	0.6	75.1	5.0	75.1	1.82	-0.6	74.5	0.5	80.2				
1 250	71.9	70.9	72.7	72.3	0.8	72.0	10.5	72.0	1.81	-0.5	71.5	0.5					
1 600	70.2	70.2	70.2	70.7	0.3	70.3	6.2	70.3	1.84	-0.6	69.7	1.7					
2 000	66.9	66.8	67.2	67.7	0.4	67.2	3.6	67.2	1.76	-0.4	66.8	1.8	72.1				
2 500	63.5	63.0	63.3	63.5	0.2	63.3	3.0	63.3	1.60	0.0	63.3	1.3					
3 150	58.6	58.0	58.0	58.7	0.4	58.3	3.2	58.3	1.58	0.0	58.3						
4 000	52.0	51.9	51.1	52.1	0.5	51.8	3.7	51.8	1.45	0.4	52.2		59.4				
5 000	44.7	43.7	43.3	42.9	0.8	43.7	5.9	43.7	1.22	1.2	44.9						
6 300																	
8 000																	
10 000																	
Single F	iauro Ra	tina		nw=	77	dB				Total II	Dev dB	31.6					
	0.4007	anng	-								50 V., UD	51.0					
150 /1/-	2:1997			•													
				C ₁ =	-1	dB											
			C1 50 2	500 =	-1	dB											
			1,30-2	2000													
									Procedure		issuo 2						
										Wedge a stid to 0.200							
										:140_6.XLS							

APPENDIX B – LABORATORY DETAILS

An omnidirectional loudspeaker rotating at 1 rpm is used in the source room satisfying Annex C of BS EN ISO 140-3: 1995. The average sound pressure level in each 1/3 octave band is measured using a rotating microphone boom, positioned such that the minimum distance between the microphone and source is 1m and between microphone and room boundaries is 0.7m.

The rotating microphone has a sweep radius of at least 1m and is inclined in relation to the boundaries at an angle of at least 30 to the horizontal. The microphone has a traverse time of 32 seconds, and the sound pressure levels are averaged over 64 seconds, which is equivalent to two complete sweeps of the microphone boom. The equivalent absorption area of each room is determined by producing the arithmetic average of twelve reverberation times and applying this to the Sabine formula.

The laboratory limit for airborne sound insulation measurement due to flanking on a lightweight construction is (combined V0001AA, V0003AA, V0005AA, BTC12598AA and BTC16357AA):

Freq Hz 5000 89.2 50 26.0 100 41.1 125 49.3 160 53.0 250 61.9 315 67.5 400 70.9 500 800 1000 1250 85.5 1600 2000 2500 3150 4000 89.9 63 80 31.0 36.7 R'max 55.3 73.8 75.5 76.1 82.6 86.8 86.5 87.1 87.9

The laboratory limit for airborne sound insulation measurement due to flanking on a concrete based construction is (combined BTC13034AA, BTC12999AA, BTC12996AA, BTC16046AA, BTC16942CA and BTC16942FA):

Freq Hz	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000
R'max	33.9	39.2	42.3	42.3	52.3	53	55.3	60.6	65.8	69.1	74.7	76.8	78.2	80.9	83.8	87.3	88.1	88.7	89.2	90.3	90.8





The figures below show flanking and isolation treatments in the test chamber.

Chamber layout



Ringbeam construction around test aperture



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