

9

The information contained in this report is not intended to convey the complete and detailed fixing and / or application requirements of British Gypsum or other suppliers' materials. For full specification details, please consult the latest relevant Company trade literature.

Acoustics Test Report Number 806 Date 18.1.84

Laboratory Airborne and Impact Sound
Insulation Measurements on a Concrete
Floor with various Gyproc M/F Suspended
Ceiling Constructions.

Test carried out for

British Gypsum Ltd.,
Marketing Department.



Acoustics Services Manager

ACOUSTIC TEST REPORT 806C O N T E N T S

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LABORATORY TEST

Acoustics test report - Confidential

Test code

V 65.7 - 12
V 65.14 - 17

Date tested

Nov. 1983 - Jan. 1984

Type of test

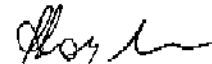
AIRBORNE AND IMPACT SOUND INSULATION

Tested in accordance with

BS 2750 and ISO 140

Report prepared by

P. ROYLE



Specimen description

1. INTRODUCTION

This report describes the results of airborne and impact sound insulation measurements on a Trent 150 mm concrete floor incorporating Structherm panels with various Gyproc M/F suspended ceiling constructions.

The airborne and impact sound insulation test procedures are outlined in Appendix 1 and 2.

2. DESCRIPTION OF THE TRENT 150 mm CONCRETE FLOOR WITH STRUCTHERM PANELS

Three 150 mm deep reinforced concrete beams laid across the test aperture spaced 1270 mm apart; the ends of the beams resting on 12 mm x 50 mm x 100 mm TICO vibration isolation pads (Type CV/D/RS).

80 mm thick Trent Structherm panels laid between the concrete beams. The ends of the Structherm panels rested on 50 mm deep concrete split course blocks which rested on strips of glass fibre slab.

The space between the two outermost beams and the aperture sides was filled with 100 mm wide by 150 mm deep by 315 mm long solid aggregate blocks resting on strips of glass fibre slab.

The 20 mm space between the top of the Structherm panels and the joists was filled with a 5:1 mix of sharp sand/aggregate and cement and this was also brushed over the filler blocks at each end of the test sample. The finished panel surface mass = 90 kg/m². The perimeter was sealed with Webbcryl acrylic caulk.

See Fig. 1 for overall views of the floor, and Fig. 2 for details of the vibration isolation measures around the perimeter of the test aperture.

See Appendix 3 and 4 for a description of the products and addresses of material manufacturers/suppliers.

3. GENERAL CONSTRUCTION OF THE GYPROC M/F SUSPENDED CEILING SYSTEM

Soffit cleats screwed to the structural soffit with the longer leg pointing downwards at 1200 mm centres. M/F perimeter channel fixed to the walls at 600 mm centres and aligned with the intermediate channel at a height of 2713 mm. Strap hangers attached at their top ends to the soffit cleats using nuts and bolts. Intermediate channels screw fixed with two 12.7 mm x No.8 Tek panhead screws to the hangers which are cut to suit the height. The ends of the intermediate channel enter the throat of the perimeter channel. The M/F ceiling sections fixed at 450 mm centres at right angles to the underside using preformed 2.64 mm gauge galvanised spring steel wire clips, located by positioning them over the channels and snap-fixing them to the flanges of the metal furring sections. 80 mm Gypglas glass fibre mat placed on the top of the metal grid when used. Single or double layer 12.7 mm Gyproc wallboard fixed to the metal furring channels and perimeter channels with 32 mm Gyproc screws at 300 mm centres for the first layer and with 36 mm screws for the second layer when relevant. All joints filled and reinforced with Gyproc joint filler and joint tape. The perimeter of the ceiling sealed with Webbcryl acrylic caulk.

See Fig. 3 for views of the M/F suspended ceiling system.

See Appendix 3 and 4 for a description of the products and addresses of material manufacturers/suppliers.

4. DESCRIPTION OF STRUCTURES TESTED

Test Code

V 65.9, 10	Trent 150 mm concrete floor with a single layer Gyproc M/F ceiling and a 80 mm Gypglas 1000 glass fibre mat in the cavity. Floor/ceiling cavity 240 mm.
V 65.11, 12	Trent 150 mm concrete floor with a double layer Gyproc M/F ceiling and a 80 mm Gypglas 1000 glass fibre mat in the cavity. Floor/ceiling cavity 240 mm.
V 65.14, 15	Trent 150 mm concrete floor with a single layer Gyproc M/F ceiling. Floor/ceiling cavity 240 mm.
V 65.16, 17	Trent 150 mm concrete floor with a double layer Gyproc M/F ceiling. Floor/ceiling cavity 240 mm.
V 65.7, 8	Trent 150 mm concrete floor.

5. THE RESULTS

The results of the sound insulation measurements are presented in the form of an airborne or impact data sheet for each test - each data sheet giving a graph and the spectral values together with the single figure ratings. In addition, the spectral values are tabulated separately for the airborne and impact measurements.

The results are summarised below:

<u>Test Codes</u>	<u>Structure*</u>	<u>Airborne</u> <u>Weighted Sound</u> <u>Reduction Index</u> <u>Rw</u>	<u>Impact</u> <u>Weighted Normalized</u> <u>Impact Sound Pressure</u> <u>Level Lnw</u>
V65.9/10	Single layer 12.7 mm wall-board on M/F and 80 mm Gypglas 1000	61 dB	60 dB
V65.11/12	Double layer 12.7 mm wallboard on M/F and 80 mm Gypglas 1000	64 dB	57 dB
V65.14/15	Single layer 12.7 mm wallboard on M/F	57 dB	67 dB
V65.16/17	Double layer 12.7 mm wallboard on M/F	60 dB	64 dB
V65.7/8	Trent 150 mm concrete floor	35 dB	91 dB

* All constructed beneath a Trent 150 mm concrete floor. (See V65.7/8.)

Finally, comparison plots of the airborne and impact sound measurements are presented.

AIRBORNE SOUND INSULATION

Sound Reduction Index R dB

1/3 Octave Band Centre Freq. Hz	V65.9	V65.11	V65.14	V65.16	V65.7
100	32	36	35	36	28
125	44	48	38	43	31
160	46	49	45	48	36
200	52	55	48	51	33
250	52	56	50	52	33
315	59	61	51	55	34
400	60	63	52	57	33
500	58	61	52	56	31
630	56	59	53	55	30
800	60	63	55	57	32
1000	63	66	58	60	33
1250	68	70	60	63	36
1600	69	72	60	63	35
2000	72	75	63	66	36
2500	73	78	63	66	40
3150	71	76	60	67	43
Mean R(100-3150)	58	62	53	56	34
Rw (BS 5821)	61	64	57	60	35

IMPACT SOUND INSULATION

Normalized Impact Sound Pressure Level Ln dB

1/3 Octave Band Centre Freq. Hz	V65.10	V65.12	V65.15	V65.17	V65.8
100	58	55	65	62	70
125	60	52	68	68	72
160	60	53	62	60	71
200	61	58	64	60	72
250	64	62	66	63	78
315	60	56	65	61	81
400	57	55	66	61	81
500	60	57	67	65	84
630	62	59	67	65	85
800	59	56	65	63	88
1000	59	54	65	62	89
1250	57	52	64	61	89
1600	55	51	63	60	89
2000	51	47	57	54	85
2500	49	44	57	54	80
3150	51	47	60	54	78
Lnw (BS 5821)	60	57	67	64	91

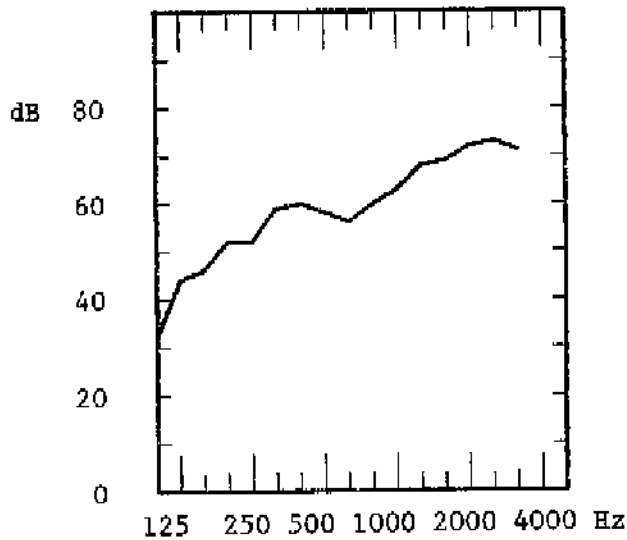
ACOUSTIC TEST DATA SHEET



Laboratory Test Codes V65.9 (Airborne) & V65.10 (Impact)

Sound Reduction Index

R



1/3 Octave
Band Centre
Freq. Hz

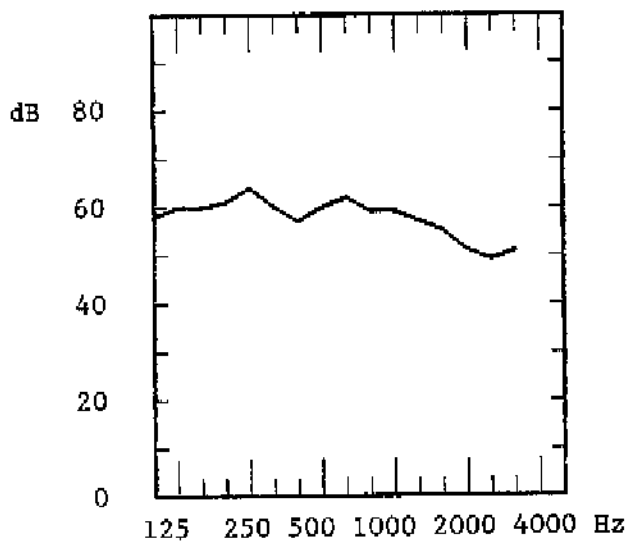
R
dB

Ln
dB

100	32	58
125	44	60
160	46	60
200	52	61
250	52	64
315	59	60
400	60	57
500	58	60
630	56	62
800	60	59
1000	63	59
1250	68	57
1600	69	55
2000	72	51
2500	73	49
3150	71	51

Normalized Impact Sound Pressure Level

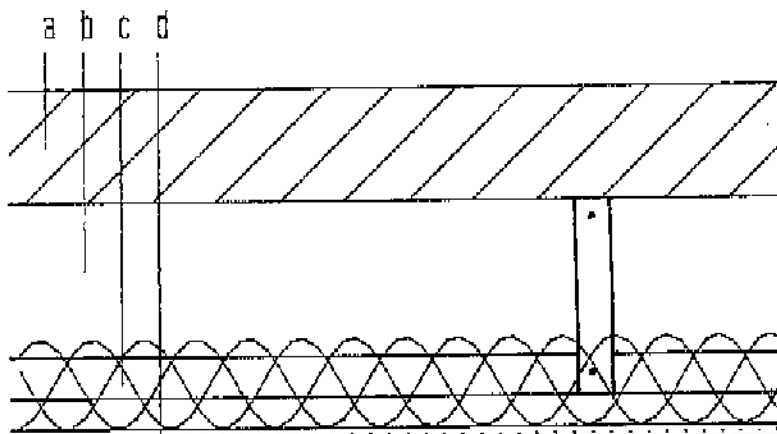
Ln



Rw
Ln

61

60



- a. Trent 150mm concrete floor
- b. 240mm spacing
- c. 80mm Gypglas 1000
- d. 12.5mm Gyproc wallboard in the Gyproc M/F system

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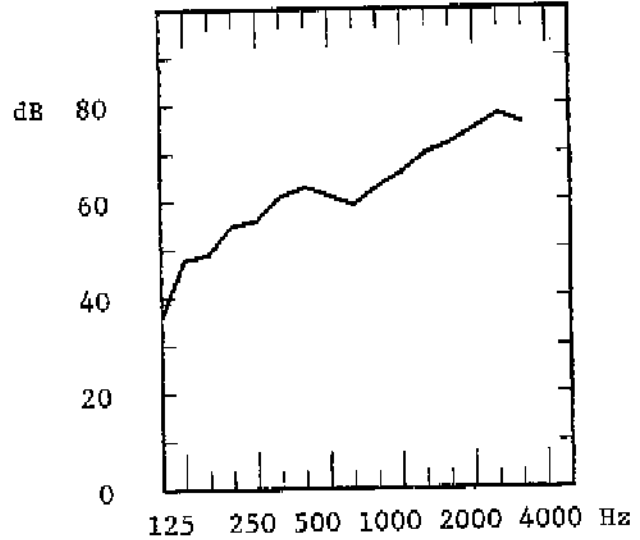
Project Manager (Acoustics)

ACOUSTIC TEST DATA SHEET



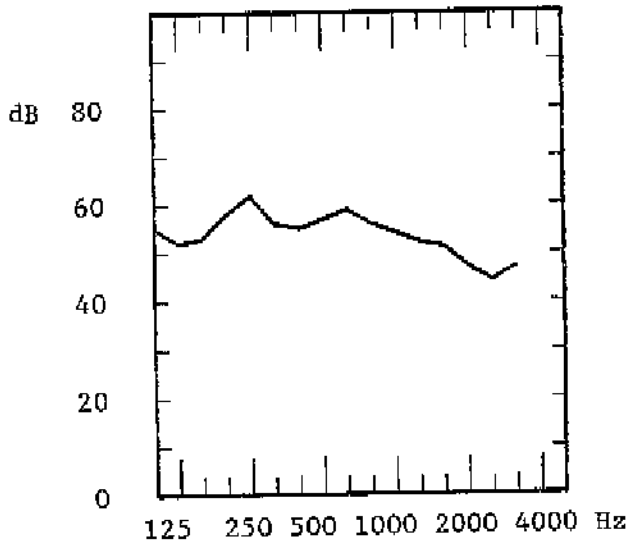
Laboratory Test Codes V65.11 (Airborne) & V65.12 (Impact)

Sound Reduction Index R

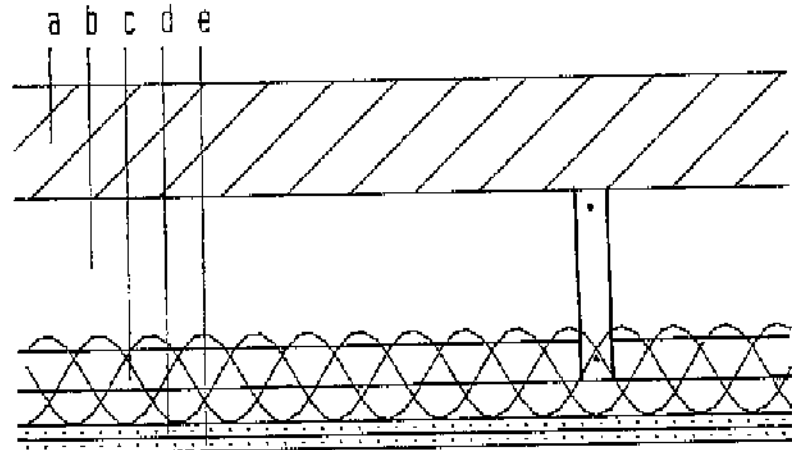


1/3 Octave Band Centre Freq. Hz	R dB	Ln dB
100	36	55
125	48	52
160	49	53
200	55	58
250	56	62
315	61	56
400	63	55
500	61	57
630	59	59
800	63	56
1000	66	54
1250	70	52
1600	72	51
2000	75	47
2500	78	44
3150	76	47

Normalized Impact Sound Pressure Level Ln



Rw 64
Lnw 57



- a. Trent 150mm concrete floor
- b. 240mm spacing
- c. 80mm Gypglas 1000
- d. 12.5mm Gyproc wallboard in the Gyproc M/F system
- e. 12.5mm Gyproc wallboard

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Form Ref: 613/56

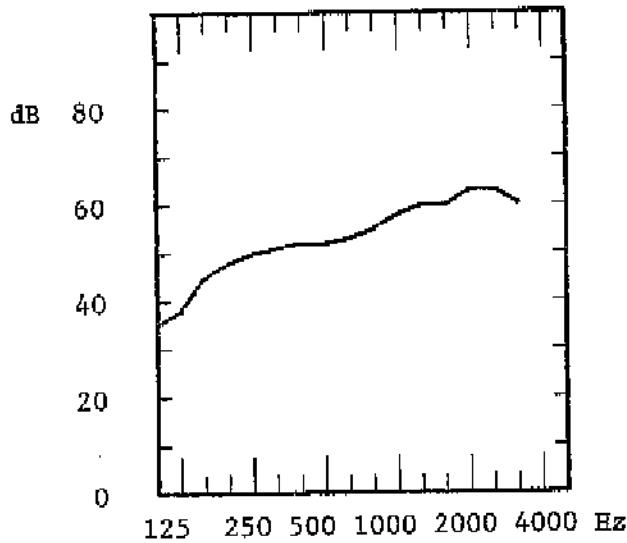
ACOUSTIC TEST DATA SHEET



Laboratory Test Codes V65.14 (Airborne) & V65.15 (Impact)

Sound Reduction Index

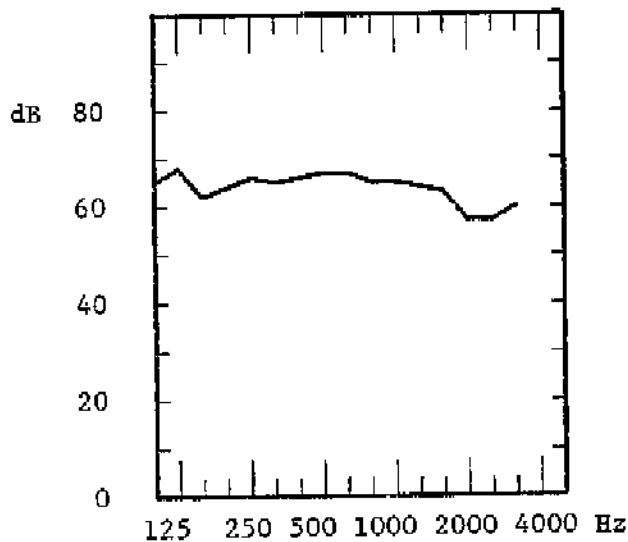
R



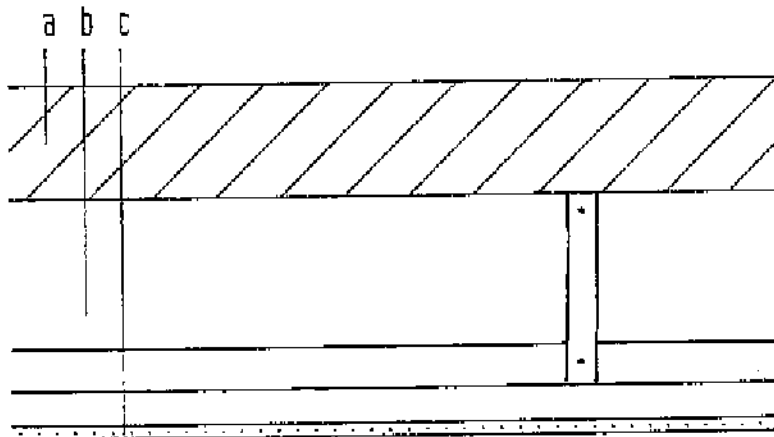
1/3 Octave Band Centre Freq. Hz	R dB	Ln dB
100	35	65
125	38	68
160	45	62
200	48	64
250	50	66
315	51	65
400	52	66
500	52	67
630	53	67
800	55	65
1000	58	65
1250	60	64
1600	60	63
2000	63	57
2500	63	57
3150	60	60

Normalized Impact Sound Pressure Level

Ln



R_w 57
Ln_w 67



- a. Trent 150mm concrete floor
- b. 240mm spacing
- c. 12.5mm Gyproc wallboard in the Gyproc M/F system

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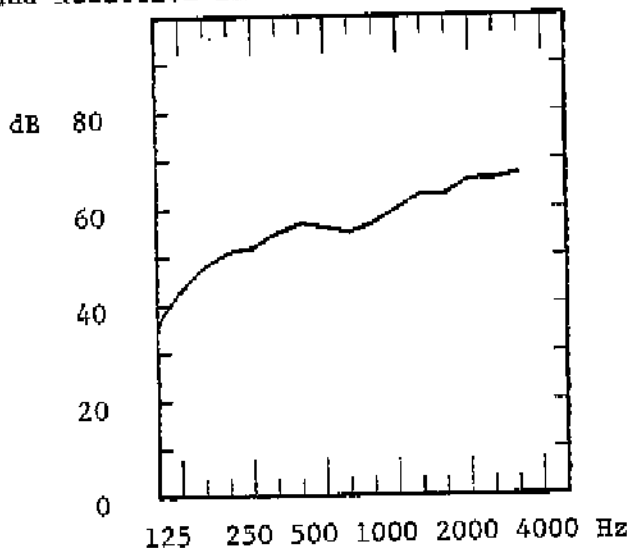
ACOUSTIC TEST DATA SHEET



Laboratory Test Codes V65.16 (Airborne) & V65.17 (Impact)

Sound Reduction Index

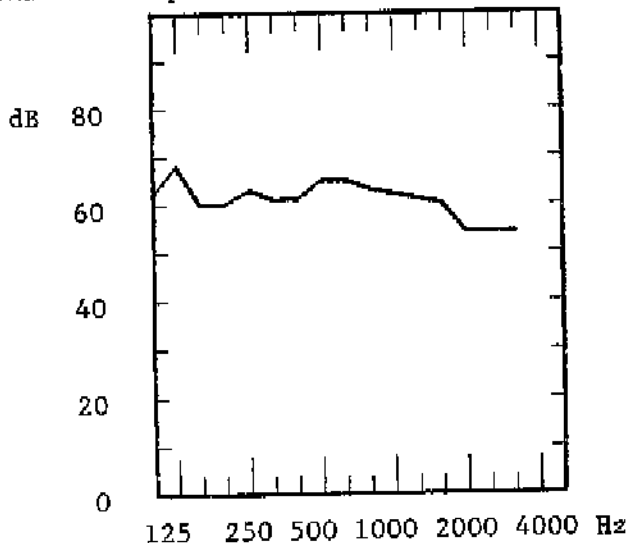
R



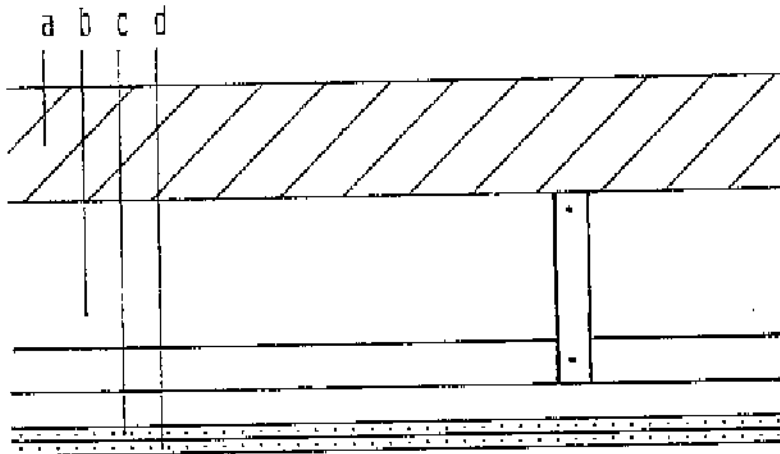
1/3 Octave Band Centre Freq. Hz	R dB	Ln dB
100	36	62
125	43	68
160	48	60
200	51	60
250	52	63
315	55	61
400	57	61
500	56	65
630	55	65
800	57	63
1000	60	62
1250	63	61
1600	63	60
2000	66	54
2500	66	54
3150	67	54

Normalized Impact Sound Pressure Level

Ln



Rw 60
Lnw 64



- a. Trent 150mm concrete floor
- b. 240mm spacing
- c. 12.5mm Gyproc wallboard in the Gyproc M/F system
- d. 12.5mm Gyproc wallboard

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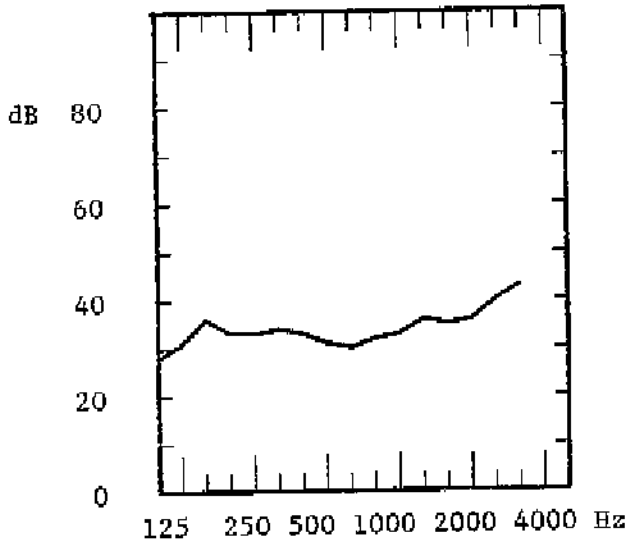
ACOUSTIC TEST DATA SHEET



Laboratory Test Codes V65.7 (Airborne) & V65.8 (Impact)

Sound Reduction Index

R

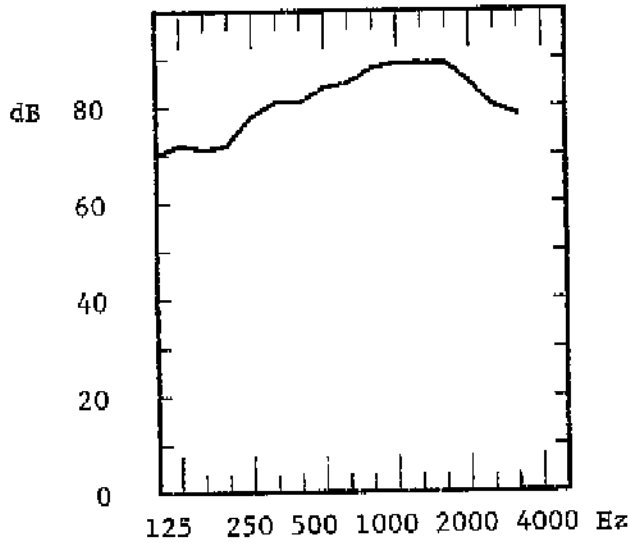


1/3 Octave Band Centre Freq. Hz

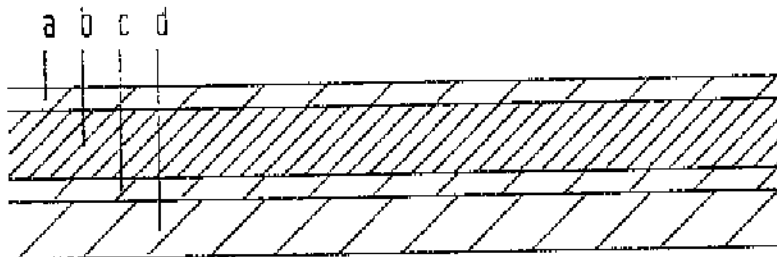
1/3 Octave Band Centre Freq. Hz	R dB	Ln dB
100	28	70
125	31	72
160	36	71
200	33	72
250	33	78
315	34	81
400	33	81
500	31	84
630	30	85
800	32	88
1000	33	89
1250	36	89
1600	35	89
2000	36	85
2500	40	80
3150	43	78

Normalized Impact Sound Pressure Level

Ln



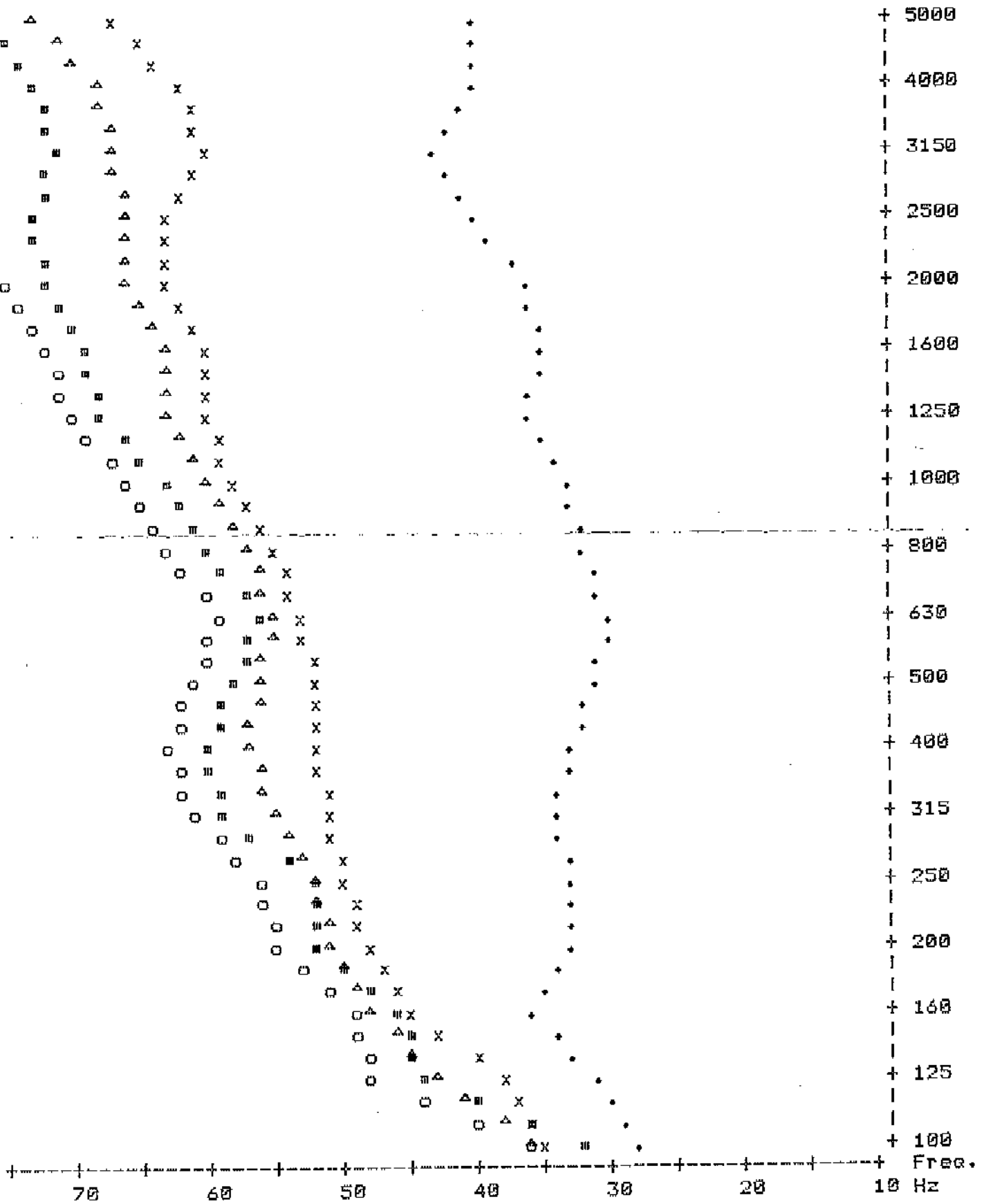
Rw 35
Lnw 91



- a. 20mm concrete
- b/c. 80mm Trent Structherm panel
- d. Trent 150mm concrete beam

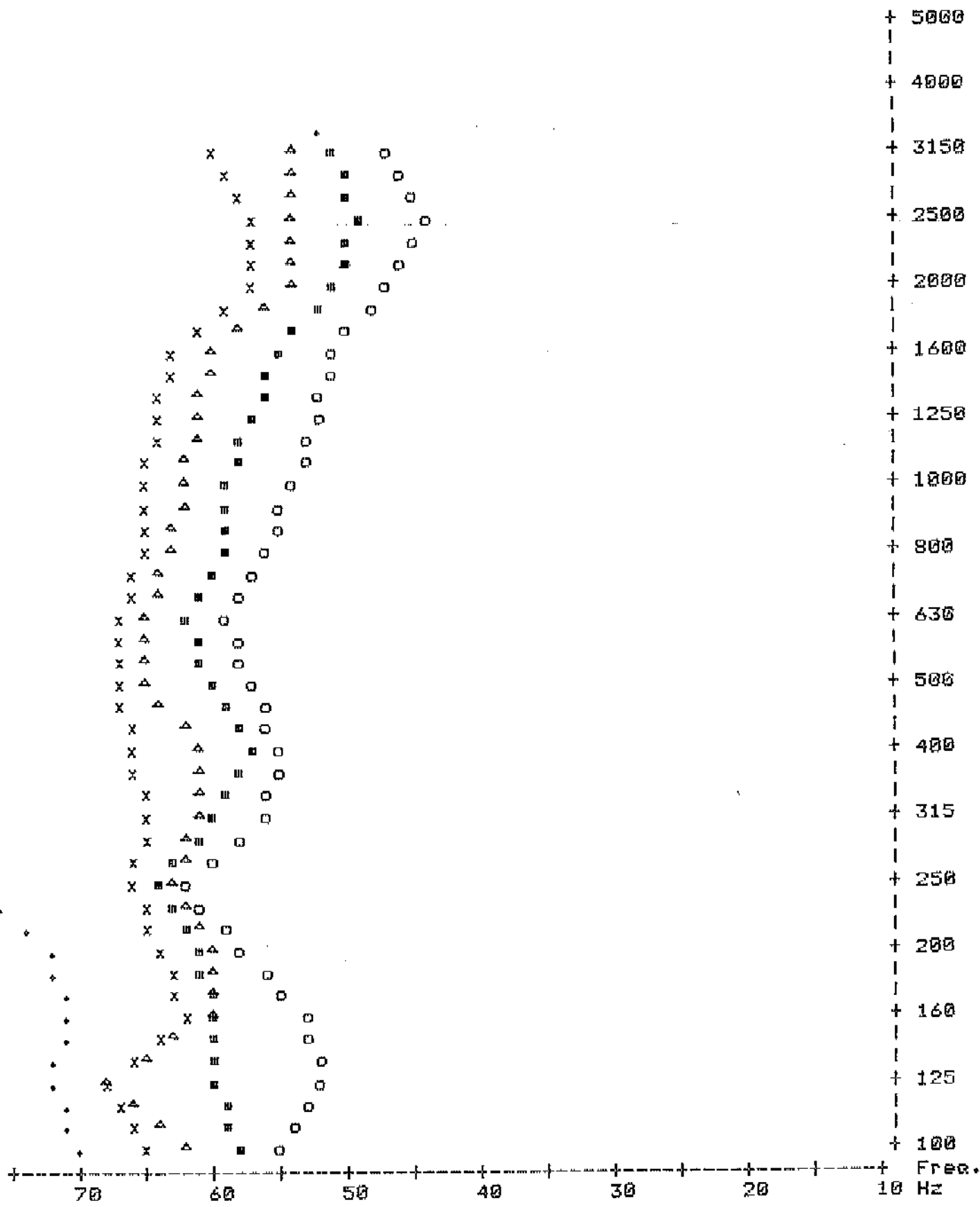
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Sound Reduction Index dB

U65.9	■	Single layer 12.7 mm wallboard on M/F and 80 mm Gypglas 1000
U65.11	○	Double layer 12.7 mm wallboard on M/F and 80 mm Gypglas 1000
U65.14	x	Single layer 12.7 mm wallboard on M/F
U65.16	△	Double layer 12.7 mm wallboard on M/F
U65.7	.	Trent 150 mm concrete floor



Normalized Impact Sound Pressure Level dB

V65.10	■	Single layer 12.7 mm wallboard on M/F and 80 mm Gypglas 1000
V65.12	○	Double layer 12.7 mm wallboard on M/F and 80 mm Gypglas 1000
V65.15	x	Single layer 12.7 mm wallboard on M/F
V65.17	△	Double layer 12.7 mm wallboard on M/F
V65.8	·	Trent 150 mm concrete floor

	TRENT CONCRETE FLOORS Hoveringham, Nottingham	Tel: 0636 830381	by JT	sheet
	Sound Tests		checked	date 19.9.83
	Structherm Panel		reference	1:20

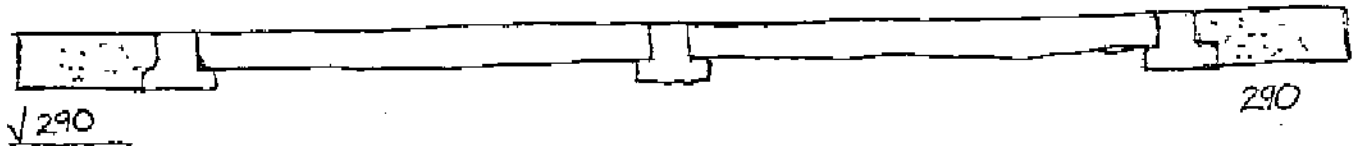
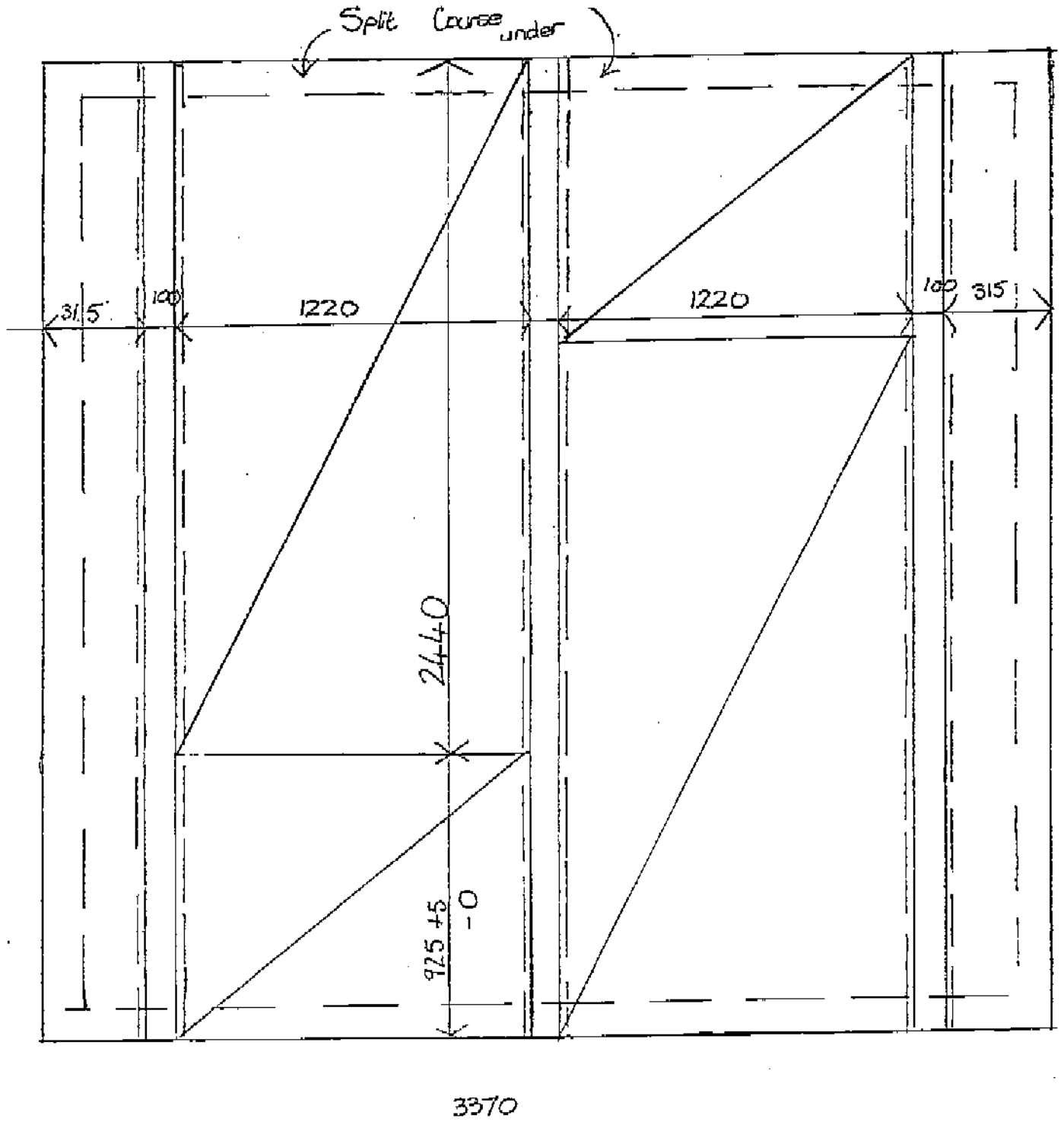
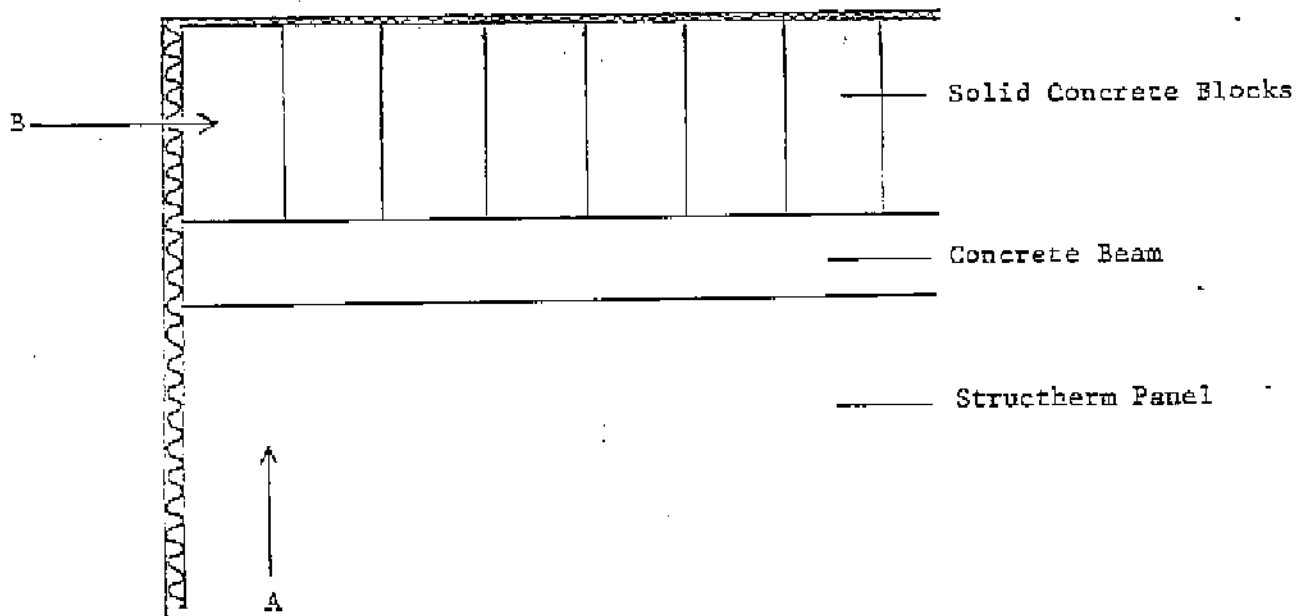
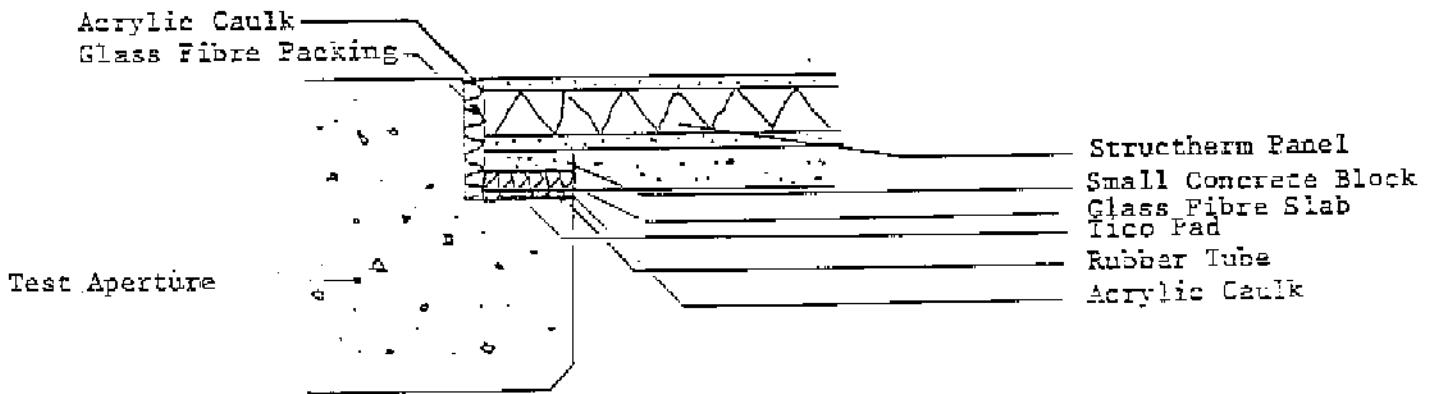


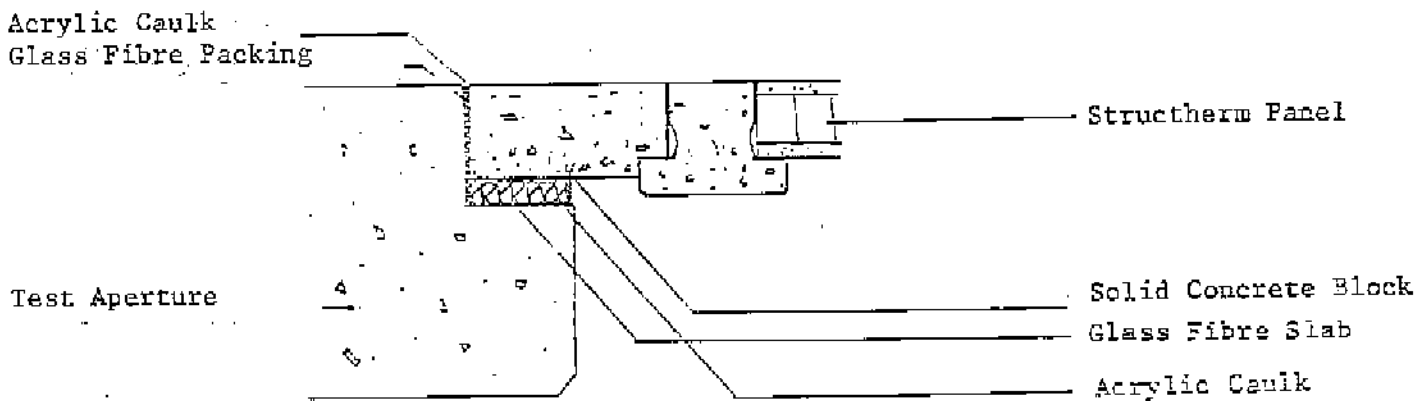
Fig. 1 Trent 150 mm Concrete Floor with Structherm Panels



Plan View of the Floor

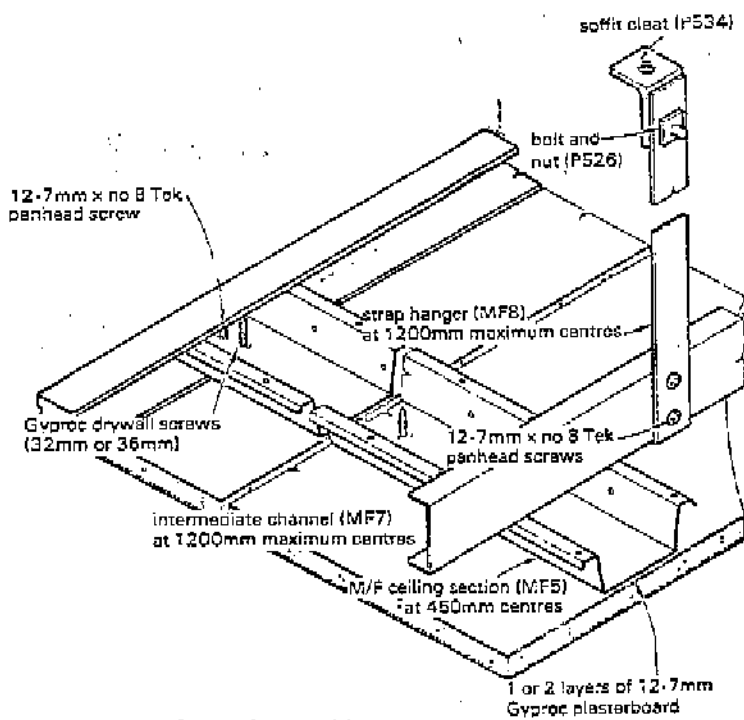


View from A

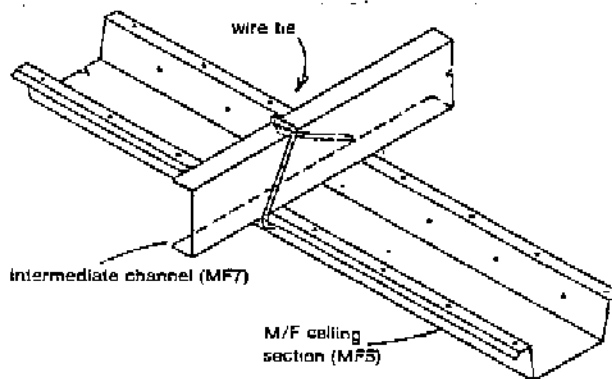


View from B

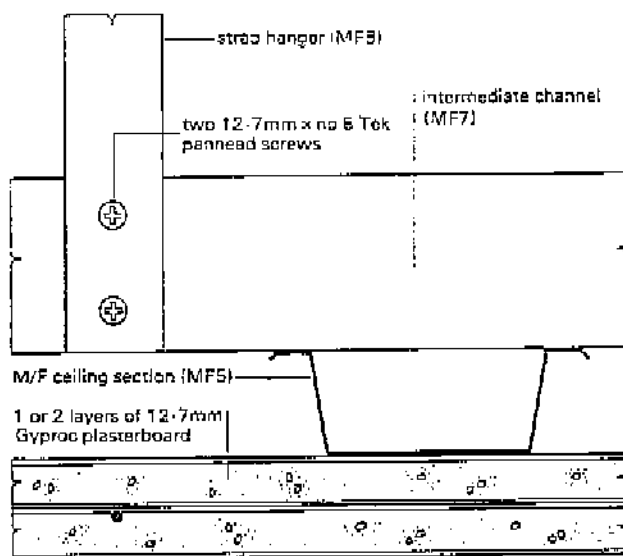
Fig. 2 Details of Vibration Isolation Measures



General assembly



Fixing M/F ceiling sections to intermediate channels



Typical cross-section

Fig. 3 Gyproc M/F Ceiling Details

MEASUREMENT OF AIRBORNE SOUND INSULATION
IN THE VERTICAL TEST SUITE

Test method to BS 2750:1980 Part III and ISO 140 Part III. The test rooms are approximately 100 m³ in volume and the test specimen is 3.16 m x 3.16 m. The level difference at a given 1/3 octave band centre frequency is obtained by measuring the difference in mean sound pressure levels between rooms when one room contains a loudspeaker emitting filtered pink noise. The mean sound pressure level is estimated from the average of the spatial intensities measured within the room. The Sound Reduction Index R for the test specimen is obtained by the addition of the term 10 log₁₀ S/A to the level difference where S is the area of the test specimen and A is the equivalent absorption area in the receiving room.

Accuracy of Results

With the following test method, the measurement of the sound reduction index of a test specimen meets the requirements of BS 2750:1980 Part II and ISO 140 Part II in terms of repeatability.

4 randomly placed stationary microphones to sample pressure levels in each room.

3 reverberation time measurements - one at each microphone location.

The sound reduction index is measured in both directions through the test specimen and the mean value reported.

Expression of Results

The sound reduction index R over the 1/3 octave band centre frequency range 100 - 5000 Hz is presented in tabular form. Four single figure ratings are given; the arithmetic mean of the sixteen spectral values (100 - 3150 Hz) i.e. Mean R, the weighted sound reduction index R_w evaluated in accordance with BS 5821:1980, the sound transmission class STC evaluated in accordance with ASTM E413 and the single figure rating in dB(A) as used in France.

Test Equipment

Norwegian Electronics Sound Insulation Measuring System Type 823 controlled by a Hewlett Packard 9836 microcomputer with Norwegian Electronics Microphone Multiplexers Type 827.

MEASUREMENT OF IMPACT SOUND INSULATION
IN THE VERTICAL TEST SUITE

Test method to BS 2750:1980 Part VI and ISO 140 Part VI. The test rooms are approximately 100 m³ in volume and the test floor is 3.16 m x 3.16 m. The Impact Sound Pressure Level L_i at a given 1/3 octave band centre frequency is obtained by measuring the mean sound pressure level in the lower room for several locations of a Bruel and Kjaer Tapping Machine on the test floor above. The mean sound pressure level (re. 20 μ pa) is estimated from the average of the spatial intensities measured within the room for all tapping machine locations. The Normalized Impact Sound Pressure Level L_n for the test floor is obtained by the addition of the term $10 \log_{10} A/10$ to the impact sound pressure level where A is the equivalent absorption area in the receiving room.

Accuracy of Results

The following test method is expected to give adequate repeatability of the measurement of the normalized impact sound pressure level of a test floor when the assumption of reasonable homogeneity of impact insulation over the floor is valid.

Four random tapping machine locations over the floor.

4 randomly placed stationary microphones to sample sound pressure levels in the lower room.

3 reverberation time measurements - one at each microphone location.

Expression of Results

The normalized impact sound pressure level L_n over the 1/3 octave band centre frequency range 100 - 3150 Hz is given in tabular and graphical form. A single figure rating is given; the weighted normalized impact sound pressure level L_{nw} evaluated in accordance with BS 5821:1980.

Test Equipment

Norwegian Electronics Sound Insulation Measuring System Type 823 controlled by a Hewlett Packard 9836 microcomputer with Norwegian Electronics Microphone Multiplexers Type 827.

APPENDIX 3

DESCRIPTION OF MATERIALS

For the addresses of the suppliers of the materials described below, see Appendix 4.

TICO Vibration Isolation Pads

TICO vibration isolation pads (Type CV/D/RS) are manufactured from a polyisoprene base elastomeric compound modified by the inclusion of cellular particles. Supplied by Textile Industrial Components Ltd.

Trent 150 mm Concrete Floor with Structerm Panels

The lightweight pre-stressed concrete joists and solid building blocks are manufactured from Portland Cement with aggregates and reinforcements to BS 12, BS 882, BS 1165, BS 2691 and BS 3617. Structerm panels comprise 60 mm thick wire reinforced expanded polystyrene with a dense concrete screed of 20 mm thickness on the lower face. Panel surface mass = 47 kg/m² and dimensions are 1220 mm in width by 2440 mm in length and 80 mm thick. Supplied by Trent Concrete Floors Ltd.

Gyproc M/F Suspended Ceiling System

Metal suspension grid for fixing one or two layers of Gyproc wallboard to in order to provide a smooth jointless ceiling. Supplied by British Gypsum Ltd.

Gyproc Wallboard

12.7 mm tapered edge Gyproc wallboard (9.2 kg/m²) is manufactured at British Gypsum's Sherburn-in-Elmet Works to BS 1230:1970. Gyproc wallboard is a plasterboard dry lining panel for internal surfaces. Supplied by British Gypsum Ltd.

Gyproc Screws

Gyproc self-drilling and tapping screws with countersunk Phillips heads; 32 mm long screws used for the base layer and 36 mm screws for the outer layer. Supplied by British Gypsum Ltd.

Gyproc Joint Filler

Gyproc joint filler is a gypsum based bedding compound for filling joints between Gyproc wallboard. Supplied by British Gypsum Ltd.

Gyproc Joint Tape

A 53 mm wide paper tape used for reinforcing joints between Gyproc plasterboard. Supplied by British Gypsum Ltd.

80 mm Gypglas Glass Fibre Mat

80 mm Gypglas 1000 glass fibre mat (12 kg/m³) in 1200 mm widths; spun glass fibre supplied by Gyproc Glass Fibre Insulation Ltd.

Webberyl Acrylic Caulk

Webberyl acrylic caulk is a water based acrylic sealant. Supplied by ECA Industrial Supplies.

APPENDIX 4ADDRESSES OF MATERIAL MANUFACTURERS/SUPPLIERS

British Gypsum Ltd.,
Ruddington Hall,
Loughborough Road,
Ruddington,
NOTTINGHAM.
NG11 6LX

E.C.A. Industrial Supplies,
1 Shipston Hill,
Cadby,
LEICESTER.

Textile Industrial Components Ltd.,
TICO Works,
Hiple Street,
Old Woking,
WOKING,
Surrey.
GU22 9LL

Trent Concrete Floors Ltd.,
Hovingham,
NOTTINGHAM.
NG14 7JX

Gyproc Glass Fibre Insulation Ltd.,
Whitehouse Industrial Estate,
RUNCORN,
Cheshire.
WA7 3DP