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SOUND INSULATION IN MULTI-PLEX CINEMAS

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INTRODUCTION

Over the past fifteen years many existing cinemas have been split into two or more auditorium units showing different films simultaneously. The dividing walls as well as requiring a high sound insulation have needed to have adequate structural performance up to seven metres or more and withstand lateral 'panic crush' pressures. Lightweight solutions have fulfilled these requirements as well as minimising the need to provide additional foundations to carry the wall. The general approach has been to construct two leaves of multi-layer plasterboard fixed to steel frameworks, which are as independent as practicable, with a mineral fibre mat in the cavity. Initially the sound insulation target was in the region of a weighted standardized evel difference(D_{nTw}) of 55dB. This was considered realistic in practice and at the outset the indication from laboratory tests was that the type of wall described could just meet this criterion.

CONVERSION SCHEMES

Some designs utilized structural steelwork with infill panels of lightweight metal studs (0.55mm gauge) giving wall widths of 450mm or more. In 1972, the Times Cinema, Baker Street, London, was converted in this way and measurements showed that a D_{nTw} of 58dB was achieved between cinemas. Another approach was to use existing components (boxed 146mm metal studs) with additional bracing on the cavity side which gave a similar wall width. This principle was used in 1978 at the Classic Cinemas, Haymarket, London, where a D_{nTw} of 60dB was measured. On this site a 225mm block wall was abutted by the metal stud wall and was continuous between auditoria. It was suspected that flanking transmission via this path downgraded the middle and high frequency performance.

THE POINT

A new cinema complex in Milton Keynes gave the opportunity to apply this experience on the conversion of existing cinemas into multi-screen complexes, to a 10-screen custom-built building. 'The Point' is the UK's first 'integrated entertainment centre', set up by Bass Leisure and American Multi-Cinema to cope with an attendance of 5000 per night, half of whom may be in the cinemas.

SOUND INSULATION

The project set high standards of sound insulation and structural performance whilst demanding a wall module of 300mm. Suitable twin frame components not being available, the only way that adequate structural performance could be achieved was to build a braced three-leaf wall. This comprised boxed 146mm metal studs lined each side with double layer 12.5mm plasterboard and an additional leaf of the same fixed to metal 'I' section studs horizontally braced to the face of the main partition at 2.4m intervals. Laboratory sound insulation tests showed this wall to have a weighted sound reduction index (R_w of 64dB. Consideration of sub 100 Hz peformance (down to the 50 Hz 1/3 octave) indicated that this was not as good as a wide cavity twin framed wall

but in the event the design was accepted. On site flanking transmission via continuous blockwork external walls was minimised using independent double layer plasterboard linings. On completion of the centre measurements between two pairs of cinemas showed that D_{nTw} = 65dB was being achieved. Subjective assessments in an empty auditorium (ventilation system off) with a Dolby test film running in the adjacent auditorium indicated excellent performance.

VENTILATION NOISE

The ventilation scheme at the Point modified the standard US practice of air handling units mounted centrally over each studio cinema, in mid-span of a lightweight roof structure. The units are mounted in a central spine, on rigid steel framework elevated above the roof, over the projection room. Supply and extract ductwork distributes air within the ceiling voids. Commissioning tests indicated that ventilation systems produce ambient levels within the design criteria set for the cinemas, NR 30-35.

ROOM ACOUSTICS

The interior design of the cinemas was based on use of the standard US sound absorber wall panels hung off the plasterboard-faced partitions. Cost savings resulted in a reduction in carpet area and numbers of sound absorbers. Concern was expressed that the cinemas lacked sufficient absorption, and a significant area of low-cost 'hidden' absorption in the form of 50mm. Rockwool batts were mounted on the wall behind the screen.

The measured characteristics in a typical cinema are ·93 seconds at 125 Hz, ·69 seconds at 500 Hz, and ·67 seconds at 2000 Hz. Given the subwoofer sound system capability, there is a shortage of low-frequency absorption. Sound decay patterns at the front of cinemas show a pronounced flutter echo, which suggests that further sidewall panels would be of benefit.

FURTHER DEVELOPMENTS

In the light of several more centres proposed in the UK a 300mm twin framed wall is now being developed. This comprises two 92mm metal stud frames which when lined with two layers of plasterboard (mineral fibre mat in cavity) are capable of being built to 7 metres with only mid-height cross brace between frames. Laboratory sound insulation tests with different lining combinations have shown that R_w = 65dB can be achieved with better low frequency performance than the three leaf system.

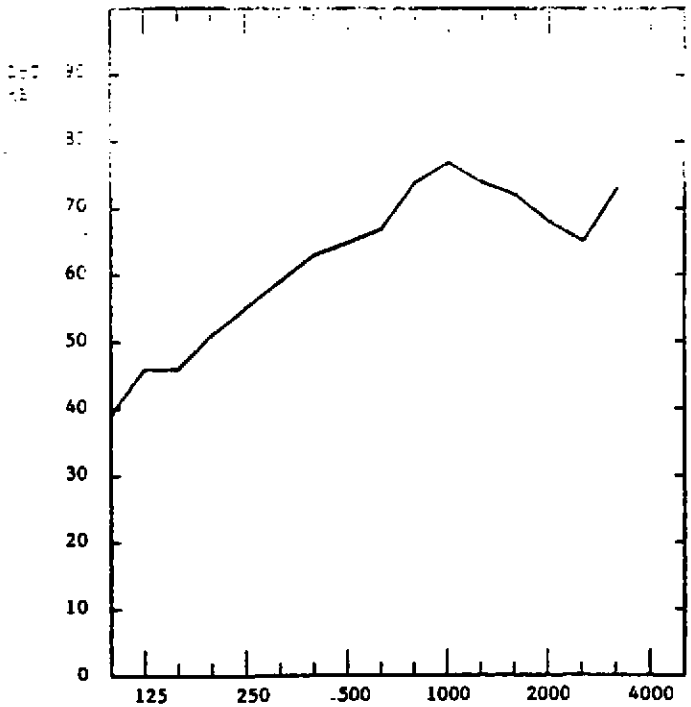
CREDITS

Architects, Consulting Engineers, Quantity Surveyors, Landscape Architect	Building Design Partnership
Acoustic Consultant	Building Design Partnership (in association with University of Salford, Department of Applied Acoustics and British Gypsum Limited)
Silencing Specialist (Ventilation)	Allaway Acoustics

A C O U S T I C T E S T D A T A S H E E T

Field Test Code F008.1 WILDEN LEISURE ENTERTAINMENT CENTRE

Standardised Level Difference DnT



1/3 Octave Band Centre Frequency Hz

Freq.	db
100	39
125	46
160	46
200	51
250	55
315	59
400	63
500	65
630	67
800	74
1000	77
1250	74
1600	72
2000	68
2500	65
3150	73
50	20
63	22
80	28

DnTw = 65

CINEMA 3 - CINEMA 4

BRITISH GYPSUM LTD.

R & D DEPT. EAST LEAKE, LOUGHBOROUGH

P.E.JONES

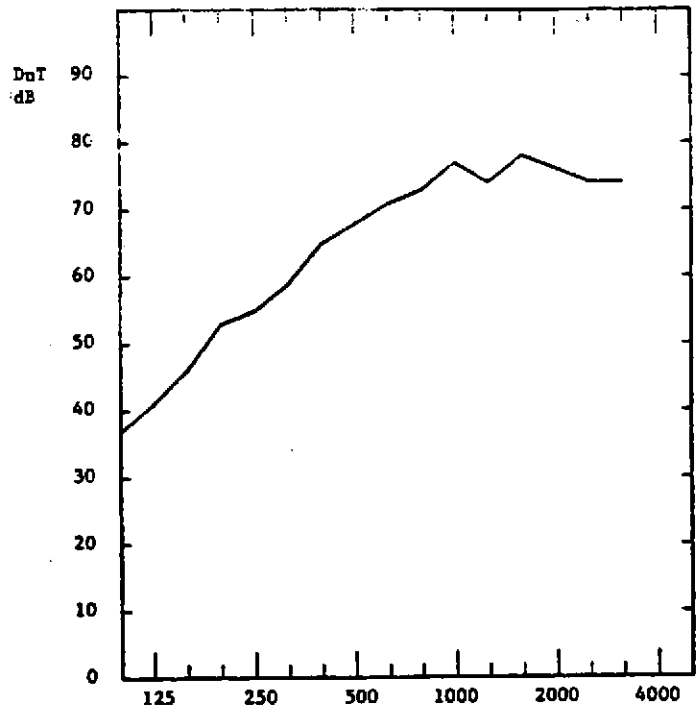
PROJECT MANAGER (ACOUSTICS)

Project Report Confidential

A C O U S T I C T E S T D A T A S H E E T

Field Test Code F22c.2 MILTON KEYNES ENTERTAINMENT CENTRE

Standardized Level Difference DnT



Freq.	db
100	37
125	41
160	46
200	53
250	55
315	59
400	65
500	68
630	71
800	73
1000	77
1250	74
1600	78
2000	76
2500	74
3150	74
50	19
63	21
80	28

DnTw = 65

CINEMA 5 - CINEMA 4

BRITISH GYPSUM LTD.

R & D DEPT. EAST LEAKE, LOUGHBOROUGH

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