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GRANGE ARTS CENTRE, OLDHAM.

P.I. NEWMAN

PAUL NEWMAN ACOUSTICS CONSULTANCY, EDINBURGH.

Introduction

The main space within the building is a theatre for 400 people with an unusual Greek Cross plan, which is surrounded by music rooms, practice rooms and other accommodation. The building was financed by the Arts Council, the D.E.S. and Oldham Corporation; and designed by Paterson and Associates, Edinburgh. The centre is within the campus of Grange Secondary School and Oldham College of Further Education. It is used by the school during the daytime, and for public performances and community activities in the evening.

The cruciform theatre has bleacher seating in each arm with a flat floor beneath. Angles between each arm are chamfered so that people sitting in one arm are more easily aware of the audience in adjacent arms. Full capacity is obtained with a version of theatre-in-the-round and a variety of other arrangements are achieved with a reduction of seating capacity. It was also anticipated that it could be used as an exhibition hall and T.V. studio; concerts in the Centre have been broadcast by B.B.C. T.V.

The approach to the acoustics of this unusually shaped theatre has been a conventional one, with a preoccupation with reverberation times and background noise levels. The plan was fully developed when the acoustics consultancy commenced in July 1972. Speech intelligibility was identified as being the most important requirement. This was to be achieved by a low level of background noise and a short reverberation time. The main sources of intrusive noise were the four small plantrooms at the back of each arm. A second problem was noise produced by activities in the auditorium and adjacent music rooms penetrating into the adjoining room. As there was no possibility of moving the music rooms and plantrooms away from the auditorium, massive brick walls were asked for, and were constructed 330mm thick.

Theatre-in-the-round must always leave some part of the audience at a relative disadvantage for speech intelligibility. Previous experience with this type of theatre has shown that lack of reflective surfaces in proximity to the actors may deprive them of necessary feed-back, adding strain to their performance. As the incorporation of reflective panels in the spaceframe over the stage would have interfered with productions, the splayed surfaces were thought to be the most practicable area for this purpose. Angled reflecting louvres were proposed but eventually the splays were left with plane surfaces.

Reverberation

The R.T. recommended for speech was 0.9 seconds, although the target was changed to 1.1 seconds after the Architect had expressed concern about the auditorium being "too dead". The volume per person exceeds 4.5m^3 and it was thought that it might be necessary to introduce additional porous absorbents,

as well as panel absorbers. It was evident that large areas of panel absorbers would be required. Suspended ceilings were introduced over the seating areas and timber panelling on the walls. Even so, it was expected that the R.T. would exceed 2 seconds at 125Hz.

The seating consists of bleacher units which can be folded back to leave the floor entirely free. With the large variations in audience size to be anticipated, it was considered necessary to provide the bench seating with porous upholstery which would compensate to some extent for absent audience, so long as the seats were not folded away. In August 1975 R.T. measurements were carried out in the empty auditorium before the seats and stage were installed.

	125 Hz	500 Hz	2000 Hz
Measured R.T.s	2.7	2.9	2.8 seconds
Estimated R.T.s with seats and audience	1.6	1.0	1.0

The low frequency R.T. was still likely to be too long, but not as long as had been expected. In September, when the theatre was complete, further measurements were made with 220 school children spread out evenly throughout the four seating areas. The children vacated each area in succession, with the bleacher seating left extended throughout the test.

		125 Hz	500 Hz	2000 Hz
Measured R.T.s				
Four areas occupied	(all the children)	1.3	1.1	1.0 seconds
Three areas	($\frac{3}{4}$ of children)	1.3	1.1	1.0
Two areas	($\frac{2}{4}$ children)	1.4	1.1	1.0
One area	($\frac{1}{4}$ children)	1.5	1.2	1.1
Empty (but with seating units extended)		1.4	1.3	1.1

Although the low frequency R.T. still exceeds the target, nothing has been done to reduce it further. It is less than anticipated from the earlier measurements.

Noise Control

The other item of major concern during the project was the control of plant noise. Having made the plantroom walls as massive as practicable, the next object was to introduce sufficient attenuation into the ventilation systems to meet N.C.25 throughout the seating areas. The problem was a particularly difficult one for a number of reasons. The plant rooms were very small and the attenuators had to be installed before the plantroom enclosures were complete. Duct runs were very short in most cases, leaving no opportunity for incorporating additional attenuation.

During the course of the project the stage lighting loads were uprated considerably to meet the requirements for colour T.V. productions. The increased heat load required a corresponding increase in the capacity of the ventilation systems. In the event the measured background noise levels were a little in excess of N.C.25.

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When first in use there were complaints of sound from rehearsals in the main auditorium being heard in the adjacent music rooms. The acoustic limitations of the building now appear to be accepted and no further acoustic advice has been sought. Earlier experience with other auditoria suggest that where two auditoria are in use simultaneously, the acoustic separation needs to be not less than 80dB.

Conclusions

A number of lessons have been learned or reinforced by this project. From earlier experience it seems inevitable that theatres and other auditoria designed for speech will be used for some musical activities as well. With a few exceptions, in-the-round auditoria are deficient in vertical surfaces providing early lateral energy. If the Arts Centre had been bigger and more emphasis placed on music, the vertical surfaces could have been modelled with diagonal reflectors to throw lateral energy into the seating areas.

It had been anticipated that it would not be feasible to provide sufficient low frequency absorption but in the event the low frequency R.T. was not as long as expected. If it were on a future occasion not possible to increase the area of conventional panel absorbers, it would be worth considering a non-combustible version of the B.B.C. high efficiency, limp panel absorber, or wide band slit resonators.

If there is the slightest possibility of simultaneous activities being carried out in adjacent auditoria, it is unlikely that any practical party wall construction will give adequate separation. Such spaces ought always to be separated by intervening quiet spaces as well as with high performance walls. Similarly, plant rooms ought not to be adjacent to auditoria and there should be facilities for incorporating additional attenuation into the system if required. Perhaps there is a need for supplementary packaged attenuators designed specifically to absorb low frequency sound.

If bleacher seating is anticipated, it is advisable to visit existing installations to check that the type being considered does not produce a disconcerting amount of noise when people walk up and down the stepped aisles. The consultant can expect to have to argue the case for acoustically absorbent upholstery.

Acoustically, the auditorium stands or falls on whether a reasonable standard of speech intelligibility has been achieved. So far the Grange Arts Centre has only been assessed informally by the users; absence of complaint is hopefully interpreted as satisfaction. Lochner and Burger (1) have indicated that R.T. is not a satisfactory predictor of speech intelligibility, and Latham (2) has recently extended their technique by incorporating the ambient noise level into the signal-to-noise ratio. This later work confirms the importance of obtaining low ambient noise levels. It is hoped to be able to present an objective evaluation of the Grange Arts Centre auditorium using these techniques.

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References

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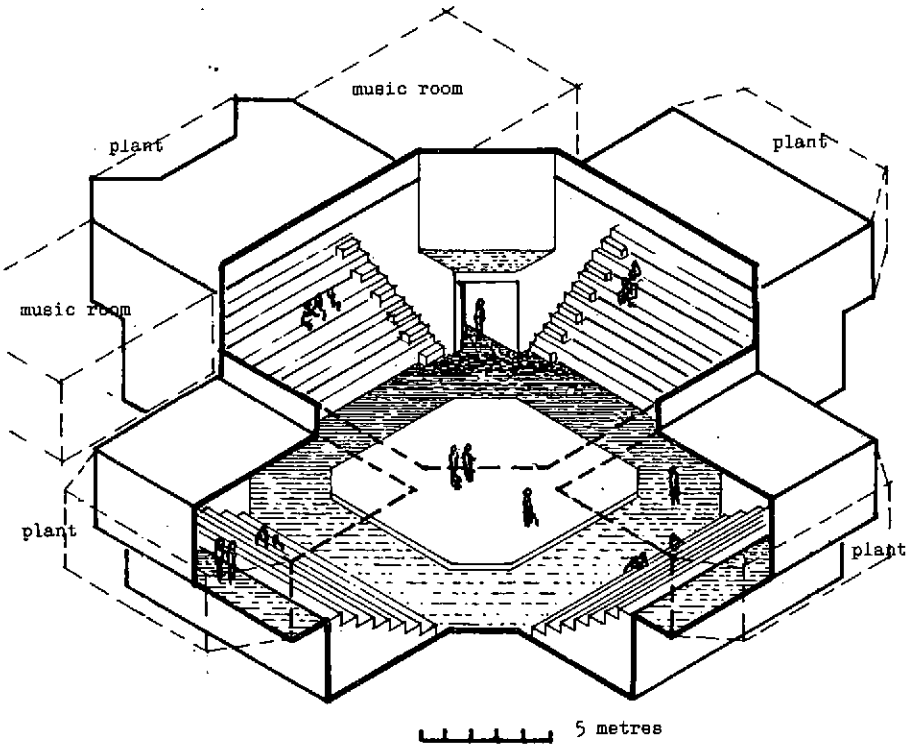

Main Auditorium of the Grange Arts Centre, Oldham.