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REFURBISHMENT OF ALBERT HALL, AS A CHAMBER CONCERT HALL

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INTRODUCTION

A paper in last year's IOA conference on auditorium acoustics by R J Orlowski and W Subagio included reference to audience and seating absorption measurements carried out as part of the acoustics design consultancy for the project by BDP Acoustics Unit.

This paper discusses other aspects of the hall's acoustics, and the commissioning measurements carried out on completion.

ORIGINAL HALL

The Town Hall, Bolton, Lancashire, was built in 1875 to a Victorian Baroque design reminiscent of Leeds Town Hall, also by Cuthbert Broderick. The civic hall within was double cube in proportion, impressingly large to suit the organ recitals fashionable in the late nineteenth century.

In November 1981, a serious fire on the ground floor burnt through the floor and roof of the Albert Hall above. The substantial existing walls and doors, as well as the efforts of 150 firemen, saved the rest of the town hall. Adequate insurance cover fortunately made a substantial contribution to the £3.5m necessary for a thorough reinstatement.

The original hall had become somewhat of a 'white elephant': underused because of its poor environmental conditions, great volume, poor vision from uncomfortable wooden seats on flat floor, limited (4.5m) platform depth, and problematic acoustics.

The inherent acoustical drawbacks were the great height and hence long reflection paths, overlong reverberation time (mid frequency value estimated at 7 or more seconds for the empty hall), and square-section proportion. The latter gave rise to undesired enhancement of particular modes during performance. Wooden seating did not allow a good view of the stage and meant that the hall sounded very different when full than when empty. Seating on the flat floor caused an excessive drop-off in sound from the stage towards the rear seats.

RADICAL REFURBISHMENT

A report by the consultants strongly favoured the horizontal subdivision of the hall. The division of the hall into an upper concert chamber and a lower hall was stressed as a positive approach to improving acoustics because the basic acoustical properties are naturally achieved rather than remedial devices installed to a problematic space.

The brief defined in the proposal reports was to create suitable conditions for chamber orchestra concerts as a first priority in a main hall, but with brass band concerts, pop concerts, ballroom dancing, fashion shows, conferences, speech days, banquets, and spectator sports, all as likely additional venues.

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The advantages over an improved full-sized hall were identified as:

- length:width:height proportions made suitable for good reception of classical music; the plan shape was left unchanged because the rectangular form provides strong lateral reflections which give good spatial impression to musical performance
- the reduced-scale main (upper) hall could be tailored to concert usage rather than compromise conditions, as some types of event could go in the lower hall
- the sound path from the performer to the audience via the ceiling is reduced in length and so there is no need for corrective devices, for instance reflector panels over the stage
- a target mid frequency reverberation time in the order of 2 seconds is achieved without the introduction of sound-absorptive wall panelling
- the stage could be more easily rebuilt with greater depth because there was less obstructive masonry at the gallery level.

NEW CONSTRUCTION

New floors divide the upper hall, lower hall, and ground floor accommodation. To provide a high degree of isolation, these are constructed as flat-slab reinforced concrete 356mm thick, with semi-sprung timber dance floor over and plastered ceiling coffers under. Tuscan-order column casings conceal new concrete columns subdividing the lower hall and ground floor spans. By virtue of the new floors and the massive existing construction, a good standard of sound isolation between different areas was achievable: 61dB average between upper and lower hall, 62dB between lower hall and the ground floor accommodation, and 54dB between the lower hall and the 'Lancaster Suite' across the corridor (the last value was intended to be improved by the provision of door seals to corridor doors).

An advance contract enabled early construction of a new roof;this had slated hip form similar to the original roof, but with a raised profile to accommodate ceiling void air supply chambers and winches for chandeliers and lighting barrels. The roof slates were set on battens to counterbattens on ply decking/cavity/insulation/double plasterboard, clerestory windows were reglazed in 12.5mm laminated glass and existing opening lights removed - all measures to exclude external noise measured at 55dBA (L10) outside the windows. Fortunately the town hall clock chimes (up to 101dBA outside the windows) could be turned off electronically during performances.

A further important remodelling feature was the building of a new 225mm solid engineering brick wall behind the stage. This blanked off a semi-circular apse which had been a powerful reverberant chamber for the organ but problematic as regards early reflections from the stage. The space created served to separate the air handling chamber from the upper hall, and create a vertical services duct.

New finishes comprised reinstating the ornate plasterwork to the coffered ceiling and recreating the pilastered walls. This was welcomed by the acoustic consultants for the ability of such features to diffuse reflected sound - a prediction borne out by commissioning tests showing even sound quality and clean linear decay traces in all parts of the upper hall. Decays were measured by an electronic system analysing band-limited noise bursts, 1/3 octave bands in the range 100-5k Hz. Pistol shot measurements were also taken.

Upholstered seating was used for comfort and so the hall would sound similar at different occupancies. A bank of 24 seats (4 rows of 6) were tested in the laboratory at the Department of Applied Acoustics, University of Salford, to predict its absorption effect in the hall. Upper hall seating comprises 10 rows of 27 seats on the flat floor, 9 rows on retractable bleachers with seating rake approximately 10°, and 7 rows of fixed seating at rake approaching 20°. A computer modelling programme was used to analyse different seating arrangements in three dimensions.

SERVICES

Ventilation systems are designed to NR25 in the upper hall and NR30 in the lower hall. Low-velocity supply air is delivered from the fan chamber, up the apse void to a plenum chamber, via large metal ducts to walk-in builder's work ducts, along flexible connections to smaller chambers with a total of 60 circular diffusers integrated into the traditional ceiling pattern. Air is extracted via high-level grilles set behind the organ, and behind retractable seating stacks below fixed seating into a large concrete extract plenum. Boiler plant is remote from the main halls, on the ground floor.

BACK UP FACILITIES

Interview and control rooms are set at the back of the hall, the central light and sound control room isolated by lobby areas. Improved circulation patterns within the town hall were created to serve the new halls.

SUMMARY OF PROPERTIES

<u>Upper Hall (Albert Hall)</u>

Front stage	702 seats
Volume	6 627 cu m (9.4 cu m/occupant)
Dimensions	32m x 17.2m wide x 12.2m high
Stage size	7.5m x 12m (to suit chamber orchestra; extension by rostra if necessary for a larger orchestra)
Finishes	walls: plaster on solid masonry ceiling: fibrous plaster at least 25mm thick rear of hall floor and retractable platforms: carpet flat floor and aisles: semi-sprung timber floor stage: hardwood strips

RT (extrapolated 2/3 full) mid freq 1.95 seconds

<u>Lower Hall (Festival Hall)</u>

Seating	up 400 seats
Volume	1 815 cu m
Dimensions	25m x 17.2m wide x 4.2m high
Finishes	Walls: plaster on solid masonry (absorption panelling or curtains to be added to rear of the hall) ceiling: fibrous plaster floor: carpet/semi-sprung timber floor.

RT (extrapolated 2/3 full) mid freq 1 second

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CREDITS

Client	:	Bolton Metropolitan Borough
Architect & QS	:	Bolton Metropolitan Borough Architects Division
Consultant Engineers (Structural, Mechanical & Electrical Engineering)	:	Building Design Partnership
Acoustics Consultant	:	BDP Acoustics Unit