FROM SALFORD DOCKS TO MEDIACITY:UK - ACOUSTIC DESIGN OF THE STUDIO BLOCK & BBC RADIO STUDIOS

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1 INTRODUCTION

This paper describes the acoustic design of The Studio Block and the fit-out of technical facilities three buildings for the BBC at MediaCityUK.

The Studio Block features seven high definition TV studios and two major audio studios. Also described are radio studios incorporated as part of a fit-out for the BBC over three buildings: Bridge House, Dock House and Quay House.

The Studio Block is owned and operated by Peel Media Ltd with five of the TV studios and the two audio studios leased to the BBC.

The principal design and construction team members were: Fairhurst Design Group (Architect to Studio Block); Chapman Taylor (Architect to BBC buildings) AECOM (MEP Engineer); Jacobs (Structural Engineer); Bovis Lend Lease (Contractor) and Gleeds (Cost Consultants and Project Management). AECOM provided acoustic consultancy services for the shell and core and Cat A fit-out of the three BBC buildings. Sandy Brown Associates were appointed as a sub-consultant to AECOM to provide acoustic consultancy services on the Studio Block and on the Cat B fit-out of studio areas within the three BBC buildings.

2 THE SITE

2.1 History

Opened in 1894 by Queen Victoria, Salford Docks was the terminal of the Manchester Ship Canal and handled millions of tonnes of cargo each year. Following the decline of heavy industry and the containerisation of shipping it finally closed in 1982. During the last 25 years the area has gradually regenerated from a post-Industrial dockland into The Quays, an area of theatres, galleries, museums and residential developments.

2.2 The Development

The Studio Block and BBC buildings are located on a 36 acre site west of the entrance to the former Dock 9. The site also includes offices, residential, a hotel and media facilities for the University of Salford.

The Studio Block features seven TV studios along with a two major audio studios: a Multi-Purpose Audio Studio and a Concert Studio for the BBC Philharmonic Orchestra. The BBC has other accommodation spread over three buildings: Bridge House, Dock House and Quay House.
3 BRIDGE HOUSE, DOCK HOUSE AND QUAY HOUSE

3.1 Facilities

The BBC are tenants of these three buildings which include offices, meeting rooms, 21 radio studios, 28 edit suites and 4 open-plan presentation studios. Acoustically, the radio studios are of most interest and are described here.

3.2 Radio Studios

The radio studios are all of floated box-in-box drywall constructions and are highly glazed. The floors are of floated 70 mm concrete on 30 mm isolation mounts with a mass-spring resonance frequency of no more than 16 Hz. Windows and glazed walls were of wide-air-spaced double glazing using 12.8 mm and 16.8 mm laminates with overall thicknesses of up to 350 mm achieving $R_w = 73$ dB when tested in the sound transmission laboratory at the University of Salford. All windows and glazed walls were angled to control flutter.

The radio studios were required to meet BBC reverberation time criterion 'RT2', which corresponds to an average reverberation time between 0.18 s and 0.28 s in third-octave bands between 250 Hz and 4000 Hz with a rise of up to 0.70 s at 50 Hz. Broadband absorptive treatment was largely provided by perforated metal ceilings and wall panels with 150 mm mineral fibre backings. Low frequency tuning to mitigate modal effects was provided by addition of multi-layered polypropylene sheets to the wall panels.

Each studio is mechanically ventilated by an independent Close Control Unit (CCU) which, as the studios are used for live broadcast, has an identical back-up unit in case of failure. Noise levels were specified to meet the BBC 'GT2' criterion which is approximately equivalent to NR19 but includes additional requirements for minimum noise levels. Supply air from the CCUs was taken through primary and secondary attenuators and then through adjustable parallel-blade dampers to add regenerated noise at mid-to- high frequencies. These were tuned during commissioning tests.

4 THE STUDIO BLOCK

4.1 Facilities

There are seven TV studios, with floor areas ranging from 90 m$^2$ to 1165 m$^2$, and two audio studios: a Multi-Purpose Audio Studio (MPAS) and a concert studio for the BBC Philharmonic Orchestra. Four large TV studios (with floor areas between 420 m$^2$ and 1165 m$^2$) and the two audio studios are located on the ground floor. These are serviced from a central internal access road. Acoustically, the building is designed so that each studio can be used independently no matter what is taking place in other studios. The remaining three TV studios have floor areas of 90 m$^2$ to 135 m$^2$ and are located above the Multi-Purpose Audio Studio. The ground floor layout of the Studio Block is shown in Figure 1.

The Studio Block (also known as 'The Studios') is owned and operated by Peel Media with the BBC having long leases on 5 of the TV studios and the 2 audio studios. The remaining 2 studios are leased on a rate card basis to TV production companies.
4.2 TV studios

The four large studios are located on the ground floor. Each is constructed with a semi-box-in-box construction. The floors are not floated but the structural slab is broken around the perimeter of each studio. The inner walls are of blockwork floated on a perimeter beam with outer independent drylining. Each studio has a lid of concrete on profiled metal decking to complete an inner box. A concrete roof is located above this. The in-situ sound insulation of walls achieved in excess of $D_w$ 68 dB.

The three smaller studios are located on the first floor and are of fully-floated box-in-box constructions. The smaller studios are above the MPAS so high performance floated floors were specified with a minimum surface density of 500 kg/m² on 100 mm isolation mounts specified to achieve a mass-spring resonance of no more than 12 Hz.

Sound absorbent wall and ceiling finishes of mesh covered mineral fibre with Zintec panels to provide low frequency absorption. These are to meet BBC reverberation time criteria 'RT6' for the large studios and 'RT4' for the small studios. Results from reverberation time tests in Studio E are shown in Figure 2.

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Sound absorption to control rooms is provided by perforated metal ceiling tiles and fabric-wrapped wall panels.

Figure 2 – Measured reverberation times in TV Studio E with RT4 curves.

Mechanical ventilation to the TV studios provided supply air via a high level plenums with ducted high level extracts to achieve BBC criterion 'GT2'. Each studio is served by dedicated independent AHUs located at roof level. A section showing the construction, high level ventilation arrangement and wall finishes is shown in Figure 3.

Figure 3 – Section of Studio B
4.3 Multi-Purpose Audio Studio (MPAS)

The MPAS is primarily designed for radio drama, Foley work and radio music sessions for smaller bands.

The main studio has dimensions of 16.0 m x 11.5 m x 6.8 m. The construction is a fully floated box-in-box construction with an inner box consisting of a concrete floated floor; floated blockwork walls and an independent concrete lid. The outer box walls are of independent drylining.

In terms of room acoustics, the studio is highly flexible. It is a live-end/dead-end design with variable absorption provided by electronically operated banners hidden behind perforated metal panels. The reverberation time in the main studio can be varied between 0.3 s and 0.8 s (average 250 to 4000 Hz).

One side of the studio opens to a semi-anechoic chamber, which is used for simulating external drama scenes. To the rear of the studio is a 'kitchen' complete with sinks and cupboards, a 'bedroom' with a sliding sash window and a percussion booth. A staircase at the rear has 4 different walking surfaces: timber, concrete, carpet and tiled floors for recording of footsteps.

The mechanical ventilation system provides supply air to the side walls with extract at high level and was designed to BBC criterion GT0, approximately equivalent to NR14.

Figure 4 – Layout of Multi-Purpose Audio Studio
4.4 Philharmonic concert studio

The new concert studio has a volume of 9728 m$^3$ and floor area of 590 m$^2$.

A stage takes approximately half of the floor area with the remaining floor area available for bleacher seating, or for larger orchestra layouts when required. The general arrangement is shown in Figure 6.

The structural floor is concrete on piles with a floated concrete floor above on jack-up isolation mounts. A stage pit is provided to house mechanical risers for an adjustable stage. The walls are a cavity construction of floated dense blockwork inner leaf with an independent plasterboard outer leaf with mineral fibre cavity insulation. The studio has a lid of concrete on profiled metal decking to complete a floated inner box. A concrete roof is located above this.

The studio is air conditioned using a displacement system with a roof mounted dedicated air handling unit. The air supply is fed through sound insulating ductwork at roof level via the roof void and ductwork to low level grilles along the side walls. High level extracts return air through attenuated ductwork through the studio lid and roof void. The ambient noise level was measured at NR12.
Three types of sound absorptive treatment are employed:

- Panels of medium-high sound absorber of 50 mm melamine foam
- Low frequency absorbers of BBC 'D2' modular boxes
- Movable 'duvets' of 100 mm thick fabric-wrapped mineral fibre panels on sliding rails.

Adjustable timber diffusers are used to the sides and rear of the stage, to provide early diffuse reflections and reduce early decay time on the stage. Forty five acrylic reflectors each of and area of approximately 1.4 m² are arranged over the orchestra to provide more support where needed. The overhead and side reflectors are suspended on mechanically operated hoists which are set using the same central control as for the stage risers.

A summary of the measured reverberation times with in various configurations for comparison with the brief requirements is presented in Table 2.
Table 2 - Summary of RT results in Studio with Orchestra

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Variable Absorption</th>
<th>Bleacher Seating</th>
<th>Requirement</th>
<th>RT, s (average 250Hz – 4 kHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Dead (All panels exposed)</td>
<td>Occupied</td>
<td>RT ≤ 1.6</td>
<td>1.44</td>
</tr>
<tr>
<td>B</td>
<td>Live (All panels hidden)</td>
<td>Occupied</td>
<td>RT ≥ 1.8</td>
<td>1.81</td>
</tr>
<tr>
<td>C</td>
<td>Dead (All panels exposed)</td>
<td>Seating exposed</td>
<td>RT ≤ 1.6</td>
<td>1.47</td>
</tr>
<tr>
<td>D</td>
<td>Live (All panels hidden)</td>
<td>Seating exposed</td>
<td>RT ≥ 1.8</td>
<td>1.86</td>
</tr>
<tr>
<td>E</td>
<td>Dead (All panels exposed)</td>
<td>Seating retracted</td>
<td>RT ≤ 1.6</td>
<td>1.60</td>
</tr>
<tr>
<td>F</td>
<td>Live (All panels hidden)</td>
<td>Seating retracted</td>
<td>RT ≥ 1.8</td>
<td>1.86</td>
</tr>
</tbody>
</table>

Following tuning of the stage reflectors with the BBC Philharmonic Orchestra, an average Early Support, S\textsubscript{Early} of -13.0 dB was measured on the stage.

Further details of the Philharmonic Concert Studio design were provided in previous papers by the author\textsuperscript{1,2}.

5 REFERENCES