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ACOUSTIC PROBLEMS & SOLUTIONS OF NEW STUDIOS FOR CENTRAL TV

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INTRODUCTION

Central Independent Television has two studio complexes - one in Nottingham to serve the East Midlands area was completed in 1983 whilst the original complex in Birmingham dates back to the 1960's. The Birmingham complex is beside the city centre ring road and is surrounded by office buildings and a hotel. As the company expanded it was necessary to take space in the surrounding office buildings. To bring all the departments under one roof the lease to an area known as the Exhibition Hall between the existing premises and the hotel was acquired. The 12m high Hall was to be divided into three levels, the upper level being for mechanical services plant. Amongst the accommodation provided in the expansion project was Editing Rooms, Office area, a News Gathering Room, E.N.G. rooms, and a Music Studio together with associated Control Room. Towards the end of the project construction Central decided to add a News Studio and Control Room. Having seen similar news presentation methods in America, Central decided that this News Studio should be part of the News Gathering Room with the News Team being seen behind the presenters desk.

Although SRL were involved with advising on all aspects of acoustics, including mechanical services noise, room finishes and the effect of noise from demolition and construction works on both the existing studios and surrounding buildings, this paper describes the problems encountered on providing sufficient sound insulation to the Music Studio and News Studio and how these problems were overcome. Some results of preliminary tests regarding the sound insulation are, also, presented.

2. The Problems

2.1 The Music Studio

A plan and section through the Music Studio are shown on the next page. As can be seen from the layout there were several areas that provided immediate concern regarding achieving sufficient sound insulation:-

- the car park directly under the Studio
- the main plantroom directly over the Studio
- the main circulation corridor for the complex directly over the Studio
- the E.N.G. rooms to the side of the upper level of the Studio
- the offices on two levels to the side of the Studio

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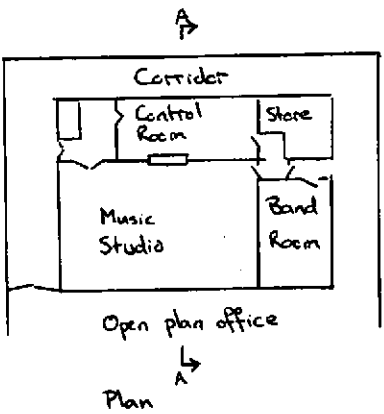

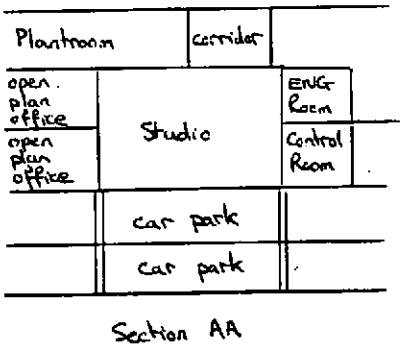

The problem of the plantroom was exaggerated by the structural thickness limitation imposed by developing the existing building in that a lightweight concrete slab was the maximum permissable. Because of the relative background sound levels and the peak sound levels expected for the spaces, the sound reduction of the wall between the Music Studio and the Office area was similar when considered for breakout from, or breakin to the Studio. A mean sound reduction of 65-70 dB was necessary. Early discussions took place with an aim of providing a buffer zone between the Studio and the Office area, but this could not be achieved due to the floor area of Office space required. The Control Room changed its shape several times during the design and at one time two rooms - a Control Room and a Music Room - were to be provided and, in fact, a dividing wall was built and later demolished. The sound reduction between the Studio and Control Room was always going to be dependent on the window.

A further problem became apparent when a noise and vibration survey was undertaken in the location of the Studio. The complex is located approximately ½ mile from New Street Station. Furthermore the existing complex, surrounding offices and hotel are all built on a huge concrete slab. Although the main tunnel from New Street Station is some distance from the complex a branch line passes under the edge of the concrete slab. High levels of vibration from trains using this tunnel were detected during the survey, and it was later found that trains were audible in some of Central's existing offices, which had a much higher background noise level than that necessary for the Music Studio.

2.2 The New Studio

A plan and section through the News Studio and Control Room are shown on the next page. The location of the News Studio was governed by the requirement that it should be at the end of the News Gathering Room. The area had originally been part of a large open plan room and the slab of the Reprographics Room had been

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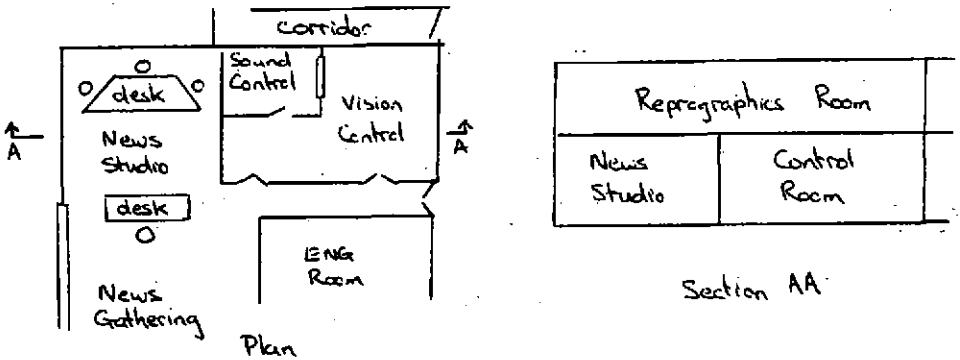

designed on this basis. Thus a 100mm lightweight slab separated an extremely busy Reprographics Room from the Studio and Control Room. A noise survey in the Reprographics Room showed sound levels in excess of 90 dBA from electronic staplers whilst a survey of the Studio and Control Room area showed noise levels between NC35 and NC40 due to these staplers, electric 'joggers' and footsteps. Even ordinary speech could be heard through the slab. Furthermore the staplers and 'joggers' caused a services tray suspended from the slab to bounce quite dramatically. The sound reduction measured through the slab is shown in Table 1.

The obvious problem of sound transmission from the News Gathering Room to the Studio was diminished as it was considered that providing the noise source could be seen, some sound on transmission would be acceptable. Windows in the Studio and News Gathering Room walls to outside allowed traffic noise breakin. One further complication was an 'on-air' date of 20th May, required from a design start date of the end of January.

3. Solutions

3.1 The Music Studio

It was decided that the most predictable way of reducing the train noise would be to use a 'box-within-a-box' structure with the entire Music Studio being constructed on a concrete floating floor. This, also, had the benefit of totally decoupling the inner walls of the Studio from the remainder of the wall construction thus increasing the potential sound reduction above that of the similar coupled structure. The vibration survey indicated that, ideally, the void between the floating and structural slabs should have been of the order of 300mm to adequately reduce the resonance frequency of the trapped air. However, height limitations imposed by the existing structural slab level and the plantroom slab level meant that a maximum of 150mm was allowable.

The wall construction changed several times during the design mainly due to practical considerations. At one stage a 190mm solid dense concrete block was changed first to a 225mm brick wall then to a cavity medium dense block wall because of the relative costs of constructing the various combinations (the solid dense blocks causing concern because of the individual block weights and the associated problems of handling and storage). In the end a triple wall construction consisting of lightweight block built off the floating floor as the inner wall together with two 140mm blocks separated by a 50mm cavity built off the structural slab was used. The cavity between the inner and middle walls varied between 170mm and 450mm, the actual cavity being determined by the position of supporting beams in the existing structure which had to be located under the middle and outer blocks. The overall superficial weight of the construction was just under $500kg/m^2$. The completed wall was plastered on both faces.

At the preliminary design stage, prior to SRL's involvement, allowance had been made for three lightweight concrete slabs between the plantroom and the Studio - the plantroom slab, the Studio ceiling and one intermediate slab. Even though the plantroom slab was only to be 150mm lightweight concrete it was decided that the lower concrete slabs were excessive, especially as the Studio was to be completly decoupled. These two lower slabs were, therefore, replaced with prescreeded woodwool slabs. The lower layer was built off the internal wall of the Studio with the unsreeded side facing the Studio and, thus providing absorption within the lower ceiling void and reducing cavity resonances.

The Control Room window was double-glazed using one 10mm pane and one 8mm pane. The cavity was of the order of 350mm and the reveals were acoustically lined. Acoustic doors providing mean SRI of 40 dB were specified for the Studio and 35 dB for the Control Room.

3.2 The News Studio

The main concern regarding the News Studio and the associated Control Room was adequate reduction of noise from the Reprographics Room. There was insufficient floor area to consider constructing a inner box for either the Studio or Control Room, whilst structural limitations severely reduced the scope of adding to the existing slab. Furthermore as the Reprographics Room had only come into operation during the previous few weeks any recommendations which involved any major disruption within this room were not considered favourably. It was therefore decided to tackle the problem in two ways:-

(a) to improve the sound insulation of the slab
(b) to reduce noise levels in the Reprographics Room at source

The sound insulation of the slab was increased by using an isolated ceiling. In the Studio the ceiling consisted of pre-screeded woodwool slabs, whilst in the Control Room Echostop DB

plaster tiles were used (perforated plaster tiles containing absorbent material behind the perforations and backed by 9mm plasterboard). Because of the vibration in the slab due to equipment in the Reprographics Room spring hangers were used for these two ceilings, although in other parts of the building where improvements in sound insulation were required, neoprene hangers had been used. The depth of the studio ceiling void was limited because the Studio lights required the ceiling to be as high as possible and was finally determined by the depth required for the air conditioning ductwork. The final depth was 575mm. Absorption in the void was provided by having the unscreeded face of the woodwool facing up, although this did necessitate an acoustic finish to some areas of the screeded side facing the Studio. The only penetrations through the woodwool slabs were the air conditionings diffusers and grilles and several small access panels. The woodwool panels were isolated from the sidewalls by neoprene strips although it was acknowledged that these walls did provide flanking paths.

The Echostop tiles were chosen for the Control Room as they provided both sound insulation and sound absorption. It was necessary to obtain as much absorption over the ceiling as possible because the dimensions of equipment used in the Control Room significantly limited the scope for acoustic wall panels. Glass fibre was laid in the ceiling void. The ceiling was penetrated by air conditioning grilles and diffusers and light fittings.

It was considered that the improved sound insulation of the slab would be sufficient with regard to speech transfer from the Reprographics Room. A resilient floor finish was recommended to protect against foot fall whilst isolators were recommended to control of the transfer of vibration from the electric 'joggers' which could, otherwise, transmit into the Studio and Control Room via the walls. A dramatic reduction in the transfer of noise to below from the electronic staplers was obtained during a brief experimental exercise by placing the staplers on 20mm thick felt (taken from underneath one of SRL's typewriters). It was recommended that all six staplers be positioned on similar material.

To reduce traffic noise break-in to the Studio the windows to the back and centre of the Studio were filled in with blockwork. The windows at the front of the Studio (level with one presenters desk) together with the windows in the News Gathering Room were to be secondary glazed.

Because of lack of space and structural considerations the wall between the Studio and Control Room could only be a single skin of blockwork supplemented by an independent plasterboard skin. The wall between the Sound and Vision areas of the Control Room was 25mm plasterboard either side of 50mm metal studs. The window between the two sections was a double window with (average) 50mm cavity.

4. Results

Unfortunately some of the results that can be presented are of an approximate nature and do not cover all the octave bands. This is because:-

(a) in some circumstances a louder noise source was required in order to make meaningful measurements in the receiving room. It is hoped that these tests will be repeated at a later date.

(b) in some areas preliminary tests have been carried out prior to completion or final fitting out

(c) in the case of the News Studio preliminary measurements only were possible because of the occupation of surrounding areas slightly in advance of the Studio going 'on-air'.

4.1 The Music Studio

Because of the size of the Music Studio the sound source used during the preliminary tests only produced general mid-frequency sound levels just over 90 dB. This sound was completely undetectable in the air-conditioned surrounding areas which in the case of the Open Plan Offices provided a background sound level during the tests of NC30 and in the Band Room NC25. In the case of sound transfer to the Band Room the sound reduction between the noise level in the Music Studio and the mechanical services background in the Band Room was 56 dB at 250 Hz and 61 dB at 500 Hz. As listening at the outer wall of the Studio also failed to provide any detectable sound transfer actual sound reduction is confidently expected to be 10 dB above those levels measured.

As the Control Room had not been fitted out before the preliminary tests the Reverberation Times in the Control Room was significantly above the design. Initial tests showed poor sound reduction between the Studio and Control Room. This was found to be due to transfer through the cable ducts which had not been blanked and through the doors which apparently only provided 31dB mean sound reduction whereas 40 dB for the Studio and 35 dB for the Control Room had been specified. Furthermore one of the Control Room doors had warped quite dramatically with a resultant complete loss of sealing. To give some indication of the potential sound reduction the cable duct was partially blocked with some rags which were the only materials that could be located which would fit into the duct. With this rather inadequate blocking of the cable ducts and the shortfall of the doors a mid-frequency (500 Hz) sound reduction from the Studio to the Control Room of 59 dB was obtained. When the Control Room is fitted out and the design Reverberation Time achieved this should increase to in excess of 65 dB.

No tests on the sound transfer from the plantroom through the ceiling were undertaken as the main criteria - that of stopping the sound transfer of the plant noise - was achieved. Train noise

is, also, inaudible in the Studio although when on one occasion the doors to the Lobby were left open it appeared that a train was about to enter the Studio from the Lobby.

4.2 The News Studio

The sound reduction achieved from the Reprographics Room to the Control Room together with the initial tests results of the slab by itself are shown in Table 1.

	Octave Band Centre Frequency						
	125	250	500	1k	2k	4k	Hz
Slab Alone	31	35	44	50	58	65	dB
Slab & Isolated Ceiling	39	48	57	59	68	72	dB

Table 1

As with tests in the Music Studio area the sound reduction levels measured with the isolated ceiling are significantly affected by the level of sound transfer in relation to the background level in the Control Room. In fact from 500 Hz upwards the sound reduction test failed to register an increase in the background sound level and actual sound reduction values 5-10 dB above those reported are considered to be the true result. The sound reduction produced by the isolated ceiling was better than hoped for and adequately deals with all airborne sound transfer.

On economic grounds it was decided not to undertake the work recommended in the Reprographics Room until the users of the Control Room and News Studio complained of extraneous noises. There is, therefore, some structure borne noise transfer from some of the Reprographics equipment and footsteps which is just audible. Except for one complaint regarding noise from the electric jogger it appears that the users do not find this slightly audible sound transfer to be a problem.

Not all the windows in the News Gathering Room have been double glazed. Although the resultant break-in of traffic noise is within the background noise criteria of the News Studio it has been found that an amplification of low frequency noise in the sound recording system does result in a low frequency rumble to the Sound Engineer. Both SRL and Central's project engineer considered that this rumble should be eliminated by completion of the double glazing as opposed to electronic filtering of the low frequency which was not considered as being acceptable to the Sound Engineers. In fact the Sound Engineers have, apparently without complaint, filtered out the rumble and the double glazing has, as yet, not been required. This simply demonstrates the problems of anticipating the requirements of the end user.

5. Conclusions

The Music Studio and Control Room are currently being fitted out. Although the true test will occur when the Studio is used, the tests to date indicated totally adequate sound insulation. The

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News Studio and Control Room have been operationable from June last year and are considered by Central to be very successful. In fact the News Studio has been used for other local programmes and is likely to be used even more extensively in the future.

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