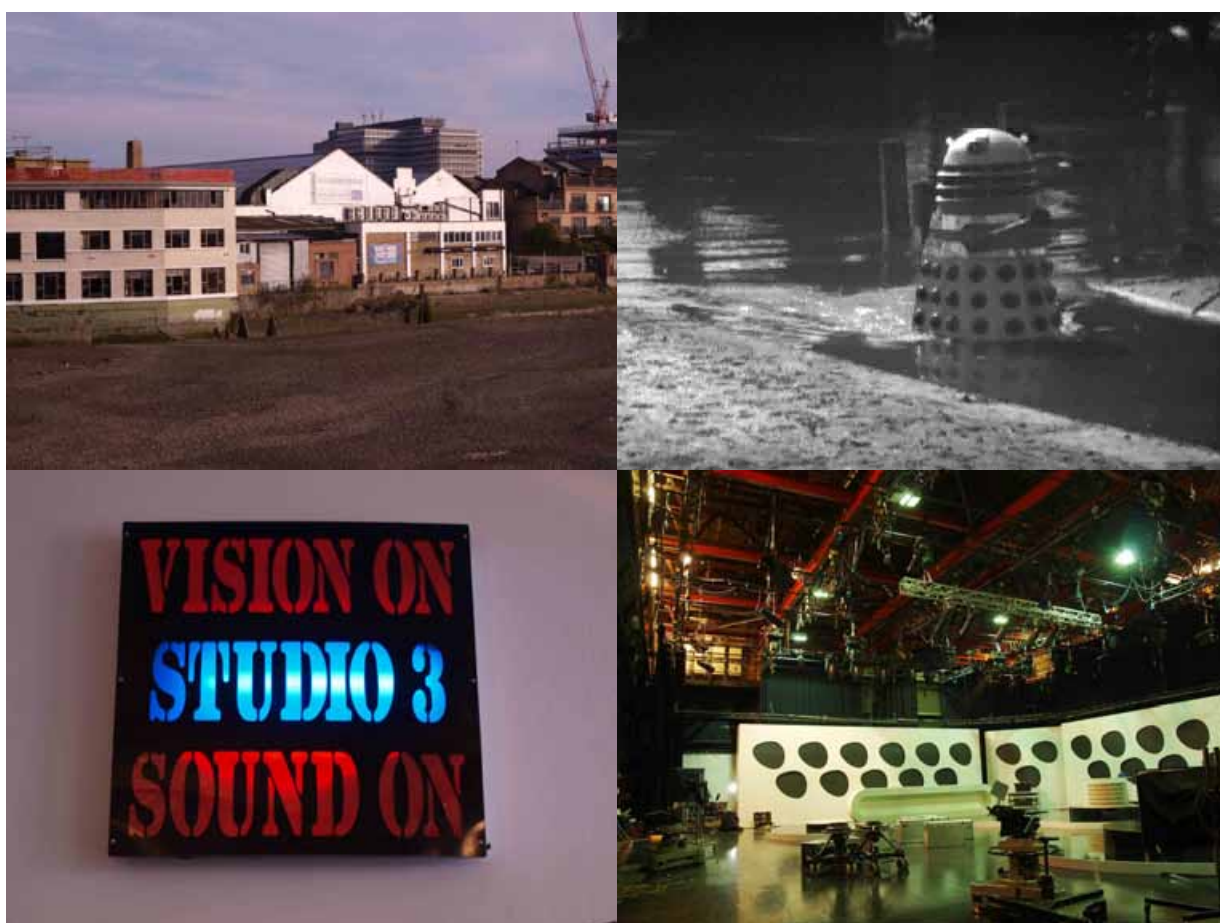


**AN HISTORIC BUILDINGS RECORD
OF
RIVERSIDE STUDIOS AND QUEEN'S WHARF
CRISP ROAD, HAMMERSMITH, LONDON**



**Commissioned by
CgMs Consulting**

**Project No. 6431
Report No. 2013334
Site Code: CRP14**

RIVERSIDE STUDIOS & QUEENS WHARF, CRISP ROAD, HAMMERSMITH,
LONDON W6 9RL

(NGR: TQ 23131 78103)

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January 2014

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SUMMARY

In December 2013 Archaeology South-East (a division of the Centre for Applied Archaeology, UCL) carried out a programme of historic building recording at Riverside Studios, Crisp Road, Hammersmith, London W6 9RL, and of the Queen's Wharf office building adjacent (NGR: 523131 178103). The work was commissioned by CgMs Consulting in relation to the proposed redevelopment of the existing buildings on the site.

*Riverside Studios originated in 1920 as Gwynnes' pump factory, which was expanded in 1932 by William Foster & Co. and sold the following year to the Triumph Film Company, marking the start of the site's long association with film and television production. It was adapted for this purpose with the insertion of two film studios and a dubbing theatre, together with attendant offices, dressing rooms and technical facilities. Mainly used for 'quota quickies' to fulfil the requirement for British-made films, notable productions nevertheless included *The Seventh Veil* and *Father Brown*, starring Alec Guinness.*

*The Studios were acquired by the BBC in 1954 as a temporary facility anticipating the construction of nearby Television Centre, and as a test-bed for various technical aspects of that place, particularly lighting and production control. The building was extended on all four sides and its studios variously refitted and expanded, making this the most technologically advanced facility of its type in the world at that time. A number of notable productions followed, such as *Dr Who* and *Z-Cars*, until the BBC disposed of the site in 1974. It became an arts and theatre space with the involvement of such luminaries as Samuel Beckett, Kenneth Brannagh and Alan Rickman, Yoko Ono and David Hockney, and hosted noted dance companies from Britain and across the world. Latterly the Riverside has returned to television production, spurred by the success of TFI Friday in the mid-late 1990s.*

Adjacent to the Riverside Studios lies Queens wharf, the site of which had been acquired by the engineering firm Rosser & Russell Ltd in 1874. Their factory here was replaced by the present office building in the 1970s.

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1.0 INTRODUCTION

- 1.1 In December 2013 Archaeology South-East (a division of the Centre for Applied Archaeology, UCL) carried out a programme of historic building recording at Riverside Studios, Crisp Road, Hammersmith, London W6 9RL, and of the Queen's Wharf office building adjacent (NGR: 523131 178103). The work was commissioned by CgMs Consulting in relation to the proposed redevelopment of the existing buildings on both sites, and has been designed to meet the requirements of an anticipated planning condition related to these works (Meager 2013b).
- 1.2 The Greater London Archaeological Advisory Service has advised that the building be subject to recording at English Heritage Level 2 prior to its alteration.
- 1.3 The requirement for work was made in accordance with the requirements of the Government's new National Planning Policy Framework (NPPF). The NPPF took effect on the 27th March 2012.

2.0 SCOPE & METHODOLOGY

- 2.1 The scope of work and methodology for the building recording is detailed in a Written Scheme of Investigation produced by CgMs Consulting (Meager 2013b). The work was also carried out in accordance with the relevant IfA standards and guidance and the Greater London Archaeology Advisory Service's *Archaeological Guidance Papers* nos 3-5.
- 2.2 The building was recorded to English Heritage Level 2 as defined in *Understanding Historic Buildings: A guide to good recording practice* (English Heritage 2006). A Level 2 record is essentially a descriptive record, which in this case is to be supplemented by additional contextual information regarding the site's history and present use as a television studio (Meager 2013b, 6).
- 2.3 The site was visited by Michael Shapland, Amy Williamson and Ron Humphrey on the 9-12th December 2013 in order to carry out the recording work. This entailed the compilation of written notes, the verification of existing measured survey drawings, and the production of a photographic record.
- 2.4 The drawn record comprises plans, sections and external elevation drawings of Riverside Studios, and plans of Queen's Wharf. These are based on existing measured drawings supplied by CgMs Consulting, which have been verified for their accuracy, and amended and annotated where necessary. The resulting scaled drawings are included within the report as Figures 5-7, 31 & 32.
- 2.5 The photographic record was made using high resolution digital photography. Within the report selected digital images have been reproduced as plates,

together with a full index of the digital photography and location plots (Appendix 2).

- 2.6 The site is subject to an archaeological desk-based assessment by CgMs Consulting (Meager 2013a): for the purposes of this historic building record, additional background research was undertaken in order to place the building within its social and historical context. Research included examination of the paper archive held at Riverside Studios, oral histories from present staff members, and reference to secondary published sources. Other sources were identified and/or accessed via the internet.

3.0 SITE LOCATION

- 3.1 The site lies within the London Borough of Hammersmith and Fulham, fronting onto the Thames at the foot of Hammersmith Bridge (Figure 1). It is bounded by Queen Caroline Street to the northwest, Crisp Road to the Northeast, the Thames to the southwest and by a narrow passage from Crisp Road to the Thames to the southeast (Figure 2). The Riverside Studios occupies the southeastern half of the site (NGR: 523131 178103) and Queen's Wharf the northwestern (NGR: 523108 178136).

4.0 HISTORIC BACKGROUND

- 4.1 Unless noted to the contrary, the following background history of the site is derived from the existing Desk Based Assessment (Meager 2013a) augmented by Richard Kempton's online history of television studios in London.¹
- 4.2 The origins of the settlement of Hammersmith lie in the Anglo-Saxon period, at which time it is thought to have been centred around the confluence of the Hammersmith Creek with the Thames, at Furnivall Gardens to the northwest of the site. The stretch of Queen Caroline Street, which bounds the site to the northwest, was formerly known as *Hammersmythstrete*, indicating its early importance to the settlement.
- 4.3 The earliest known building on the site was 'The Chancellors', a manor house which gained its name through its origins in the possession of the chancellor of St Paul's Cathedral from at least the mid-17th century (Faulkner 1839). It is shown on several early maps of the area (Meager 2013a, Figs 3-6). The house, which had been demolished by 1867, was 17th century or earlier in date, and lent its name to The Chancellors pub adjacent to the site. This pub was much-frequented by performers and staff from Riverside Studios.
- 4.4 With the arrival of the railways and the burgeoning economic development of Hammersmith, 'The Chancellors' was replaced by a pair of wharfs and

¹ <http://www.tvstudiohistory.co.uk>

several short terraces of housing, including River Terrace, between 1853 and 1867. Little trace of Kensington Vestry Wharf survives, but the adjacent Queens Wharf preserves its name and the adjacent slipway onto Queen Caroline Street.

- 4.5 Queen's Wharf had been acquired by the heating engineering firm Rosser & Russell Ltd in 1874 (Figure 3), who manufactured gunnery systems for Sopwith Camel aircraft there during the First World War. Interestingly, the firm carried out a number of important contracts for the BBC, including at Television Centre, but it is unknown whether these included the Hammersmith Studios (Roberts & Yunnie, n.d.). The factory was replaced by the present office building in the early 1970s (Figures 4-7).
- 4.6 Kensington Vestry Wharf – the later site of Riverside Studios – was purchased by the manufacturing firm Gwynnes Ltd in 1899, who were probably responsible for filling in the wharf and constructing an 'engineering workshop' on the site (Figure 8), depicted on the 1913 Ordnance Survey map of the area (Figure 9). This was principally used for the manufacture of pumps, turbines and hydraulic machinery: during the First World War it was requisitioned for the production of pumps and Clerget aircraft engines for the Admiralty and War Office.²
- 4.7 Although Gwynnes were responsible for developing the industrial use of the site, their factory as depicted in 1913 extends partially beyond the southeast boundary of the site (Figure 9), and its footprint bears limited resemblance to subsequent plans of the building. A notice in *The Times* of 26 March 1920 states that 'New Fitting and machine shops are now nearing completion at Hammersmith' under Neville G. Gwynne, the company's managing director. The core of what became the Riverside Studios building probably therefore dates to this time.
- 4.8 Gwynnes went bankrupt in 1927, and the site was bought by William Foster & Co. of Lincoln, an agricultural machinery company who had used their experience in manufacturing traction engines to develop the first tanks. They acquired Gwynnes' pump factory as a going concern, before relocating it to Lincoln and selling the Hammersmith site to the Triumph Film Company, which marks the beginning of the long history of film and television production on the site. Prior to the completion of this sale in 1933 the premises was partially rebuilt, including the addition of the existing three-storey block towards the northeast end of the building (Figures 10-12).
- 4.9 The Triumph Film Company adapted the existing factory buildings to meet their needs (Figures 13-16). The 1920 range was subdivided to accommodate two large studios, necessitating the removal of the columns running between the two bays of the existing factory, and the insertion of bow trusses to support the new lighting rig. Various associated support facilities were built, whilst the 1932 Three Storey Block block was used for offices and

² <http://www.gracesguide.co.uk/Gwynnes>; accessed 6th December 2013.

dressing rooms. In 1936 it was modified to incorporate a projection room for a new dubbing theatre (Figure 17).

- 4.10 A succession of film studios owned or leased the site – then known as the Hammersmith Studios – between 1933 and 1954. The companies involved and the films made here are detailed elsewhere:³ briefly, the studios were moderately successful under the Triumph Film Company and subsequently the Twickenham Studios, before being given over to wartime films under Jack Buchanan after 1939. *The Seventh Veil* (1946) proved a major post-war success, but financial difficulties from the end of the decade combined with a decline in productions to ensure the studio's fate. Alliance Films bought the site in 1948, and last film to be made there was *Father Brown* (1954), starring Alec Guinness.
- 4.11 The site was purchased in 1954 for use as a television studios by the BBC, who were riding the wave of the medium's renewed popularity following the coronation of 1953 (Figures 18-22). They required the site as a stop-gap whilst a dedicated Television Centre was built at nearby White City, but more than this they intended Riverside Studios as a test-bed for new technologies and methods of production which would later be adopted at the new site (Appendix 3; 1957b: see Appendices 3 & 4). Despite its temporary nature, Riverside Studios was therefore the most advanced studio of its type in the world at that time. Opened in 1956, they were given official recognition by a visit from the Queen Mother on 29 March 1957. Television Centre was completed in 1960, but the BBC did not dispose of Riverside Studios until 1974.
- 4.12 As with the site's history in motion pictures, the television programmes made at Riverside Studios have been detailed elsewhere.⁴ Popular early programmes include the *Six-Five Special*, *Hancock's Half Hour*, *Quatermass and the Pit*, *Z-Cars*, *Dixon of Dock Green* and *Dr Who* (Figures 23-25): due to the prohibitive cost of editing, these were all performed and transmitted live. *Hancock's Half Hour* provides interesting continuity with the pre-BBC Riverside, as its star Sid James had appeared in at least one film made here in that earlier era. *Blue Peter* was regularly filmed here from the later 1960s, and the long-running *Playschool* would be one of the last BBC programmes to be made here. The BBC also has a long history of filming live popular music at the studios, with performances by The Beatles, the Rolling Stones and The Animals for *Open House* in the mid-1960s, regular editions of *The Old Grey Whistle Test*, and episodes of *Top of the Pops*. David Bowie's 2003 performance in Studio 1 as part of the *Reality* tour, which was the biggest interactive music event of its time with live satellite links to cinemas across Europe and Asia, continued this tradition (Figure 26).⁵ It is said that the house band for the *Six-Five Special* would reside in the nearby Chancellor's pub, periodically returning to play when they saw the credits roll on the pub TV: the pub was known in those days as 'Studio 3', and continues to display

³ <http://www.tvstudiohistory.co.uk>

⁴ <http://www.tvstudiohistory.co.uk>

⁵ <http://www.liztray.com/LT/files/bff67ebf100c97798e71cd2265a4a7ee-4.html>

memorabilia from all periods of film and television production at the Riverside on its walls (Figure 27).

- 4.13 The last programmes of the BBC era were made in Studio 1 in 1970, although due to its superb Thameside location the BBC continued to use the facilities to film the Boat Race, which continues to the present (Figure 26).
- 4.14 Following the eventual departure of the BBC in 1974, the Riverside Studios passed to the local council who determined its future use as an arts centre, with the former studios converted to rehearsal and performance spaces, the dubbing theatre as a cinema and the Crisp Road range as a gallery (Figures 28 & 29). The first theatre season was in 1978 under the artistic directorship of Peter Gill, with the support of a fundraising appeal led by, amongst others, Laurence Olivier, John Gielgud, Peggy Ashcroft, Peter Hall, David Hockney, Yehudi Menuhin and the Earl of Snowdon. Early repertory members included Brian Cox and Martin Shaw (Figure 28), and highlights from the many theatrical and dance productions and art installations can be found on the Riverside Studio website.⁶ A complete run of programmes and ephemera from these years, including Samuel Beckett's involvement there shortly before his death (Figure 28), is held within the building's archives.
- 4.15 Studio 2 was sporadically used for television production after 1974, but after financial difficulties the building was refurbished in 1994 under the directorship of William Burdett-Coutts, with Studio 2 as the live performance space and Studio 1 as a dedicated television studio used by *TFI Friday* between 1995 and 2000 (Figure 30).
- 4.16 From 2002 until the present day, television production in Studio 1 has been run by a company called Riverside TV Studios, which refurbished the space using fittings and equipment from their previous studio in Bow. Studio 2 returned to dedicated television work in 2013: the size of both studios continues to make them ideal for comedy, quiz shows, entertainment and live music, with seated audiences of 250-300.

5.0 DESCRIPTION OF THE BUILDINGS

5.1 *Riverside Studios – Layout and External Development*

- 5.1.1 The Riverside Studios comprises a number of structures of different dates, extending up to three stories in height, which have been aggregated together to form a single studio building (Figures 31 & 32). The exterior of each will be first described in turn, then attention will turn to the building's interior.

Gwynnes' Factory (1920)

- 5.1.2 The earliest building on the site is Gwynnes' rebuilt factory of 1920, which runs northeast-southwest from the river front (Plate 1). It is of two ranges of unequal width, each with a double-pitched roof covered in corrugated iron.

⁶ <http://www.riversidestudios.co.uk/theriversidestory/main.cfm>

Plans and elevations of the structure survive from 1932, before its conversion into a film studio (Figures 10-12). The valley between the two roofs across the southwestern half of the building has been modified to enclose a box truss which now supports the roof structure. This was inserted by the BBC in 1955 to replace the building's internal dividing wall in this location, to enable the enlargement of Studio 1 (detailed in Appendix 3).

- 5.1.3 The factory is of yellow London stock bricks in a Flemish bond, rendered on its southwest elevation (Plate 1). It had large flat headed windows with iron lintels and projecting sills, all of which are now blocked (Plate 2). It had wide flat-headed doorways towards the northeast end of both its long elevations, of which only that to the northwest survives, much-widened to provide vehicle and scenery access to Studio 2 (Plate 1). It retains its 1933 soundproof film studio doors, which have cast iron hinges by Charles Collinge of Lambeth. There were three smaller doorways in its southwest elevation, of which one survives, linking Studio 1 with its scenery transit dock (Plate 3). Its two-leaf timber doors and their furniture also date from 1933, albeit much obscured with later insulating panelling.
- 5.1.4 In 1932 the windows along a section of the factory's northwest elevation – comprising much of the wall visible internally in Studio 1 – were opened up to communicate with a single-storey workshop extension, for which plans exist (Figures 10 & 13). Its long wall survives incorporated into the site's boundary wall with Queen's Wharf, showing that it was of London stock bricks in a Flemish bond (Plate 4). A stub of its northeast wall also survives, above the generator block which replaced it in 1955 (Plate 5).

Three Storey Block (1932)

- 5.1.5 The three-storied block runs perpendicularly to the northeast elevation of Gwynnes' Factory, which it abuts (Plates 2, 6 & 7). It was constructed as a pattern makers' shop in 1932 for the General Motor & Tyre Co. (Figures 10-12), who presumably occupied the building between the departure of William Foster & Co. to Lincoln in 1930 and its 1933 sale to the Triumph Film Company. It is of Fletton bricks in an English bond, and has a pitched roof with stepped brick coping which has been modified to accommodate large water tanks within the roof space. Its first and ground floors extend to the northeast with single-pitched roofs: a ground floor extension was demolished with the construction of the Crisp Road range in 1954.
- 5.1.6 Unlike Gwynnes' factory, this block retains many original windows. Most on the northwest elevation have segmental brick heads and projecting brick sills, and are of iron-framed manufacture with pivoting central lights (Plate 2). A larger, flat-headed first floor window would presumably have accommodated a hoist. Those on the southeast elevation are flat-headed with modern fenestration (Plate 7). The wide original entrance on the northwest elevation was replaced by a simple Modernist recessed doorway by the BBC in the 1950s, which then comprised the building's main entrance (Plate 2). Inside, they retained only the stairs and ground-floor dressing rooms from the film

studio era, converting the rest to accommodate a telecine suite, studio control suite, 100-seat restaurant, kitchen and service hoist (Appendix 3, 7; Figures 13-16 & 18-22).

Dubbing Theatre (1933)

- 5.1.7 The dubbing theatre – presently a cinema – was installed across the western quarter of Gwynnes' factory by the Triumph Film Company in 1936, necessitating the demolition of this part of the factory building (Figure 17). It is of concrete framed construction with brick piers and infilled panels of brick, and rises to second floor level (Plate 8): the auditorium itself is at first and second floor level, leaving free space at ground floor level. It has a flat roof and is featureless externally aside from a single steel-framed window with a flat concrete lintel and projecting sill at first floor level. A modern brick lift shaft enabling disabled access to the cinema abuts its southeast elevation (Plate 7).

Crisp Road Block (1955)

- 5.1.8 The Crisp Road block was constructed as part of the BBC's conversion of the Triumph Film Studios, replacing an earlier building on the site (Plate 6). It accommodated a scene transit dock, dressing rooms and carpenters' shop for Studio 2, as well as a new boiler house and chimney for the whole complex (Figure 18). The original plan had been to install a turntable and an additional scene transit dock, but this idea was dropped in view of the size of the vehicles involved (Appendix 3, 7).
- 5.1.9 The block is constructed in the same manner as the other ranges of the BBC era: a concrete frame extending to below-ground sill-beams, infilled with stock brick and painted, and a flat roof (Plate 6). Its simple square chimney is slightly tapering and formed of bricks in an English bond. The original block had no entrances and only modest high-level window lights (Figure 21). This scheme was replaced with large glass panels across the southeastern half of the block in 1993, and a large glazed entrance with cantilevered porch inserted to the large new reception space and café. The upper levels of the former boiler house are now occupied by offices at first floor level. The northwestern half of the block houses Studio 3, a small performance space, and as such retains its blind brick walls.

Southeastern Block (1955)

- 5.1.10 The BBC added a long, narrow block between the southeast wall of Gwynnes' factory and the existing site boundary wall, upon which it rests, in 1955 (Plate 8). It is constructed in identical fashion to the Crisp Road block. It housed an engineers' workshop, stores, and staff facilities (Appendix 3, 7; Figure 18), and is presently divided into dressing rooms and offices. It has a first-floor doorway and metal fire escape in its northeast elevation, and a small metal-framed window adjacent. Both have flat concrete lintels. Its southwest elevation faces the Thames, and as such has a modern inserted

glazed doorway at second floor level with a steel balcony so as to take advantage of the view. The long southeast elevation of the block is plain.

Thameside Block (1933 & 1955)

- 5.1.11 This two-storey block occupies much of the building's Thameside terrace, and abuts the gable end wall of Gwynnes' factory (Plates 1 & 9). It was built as a scenery transit dock for Studio 1, and is of the same flat-roofed concrete-framed construction as the other BBC-era extensions (Figures 18 & 21). It has been partially converted to office use.
- 5.1.12 Adjacent are two small detached structures built for the Triumph Film Studios in 1933 (Figure 13). The northwestern of the pair originated as a workmen's WC: it is two stories in height, constructed of Flemish bonded bricks with blocked flat-headed windows at ground level (Plate 10). The upper level is a modern addition with a single-pitched corrugated plastic roof and an external metal stair. The southeastern detached block was originally an electoral transmission station but is presently used as a workshop. It is of English bonded bricks and has a wide doorway with a flat concrete lintel and a two-leaf steel door, and retains several small louvred windows from its original function. A generator room and film store were constructed adjacent, but no longer survive.
- 5.1.13 The 1955 BBC scenery transit block and the two adjacent, earlier structures are presently incorporated into a single space by an ephemeral corrugated steel and plastic shed, which also extends along the northwestern side of the site (Plate 10). Fire regulations in the 1950s did not permit the BBC to roof this area originally (Appendix 3, 18), but the difficulty of manoeuvring scenery when exposed to the weather has since necessitated its shelter nonetheless.

Generator Block (1955)

- 5.1.14 The generator block abuts the northwest elevation of Gwynnes' factory (Plates 5 & 11). The original building here was a single-storey workshop constructed for Gwynnes' in 1932 and retained by the Triumph Film Studios as a carpenters' shop (Plates 10 & 13). This was replaced by the BBC in 1955 into a two-storey brick structure with four transformer rooms, a switch room, a large property dock, store, ventilation system, an office and a first-floor battery room (Appendix 3, 18; Plates 18 & 19). A large, brick electricity sub-station was installed here by EDF Energy in the mid-2000s, the noise of its construction causing great disruption to the television productions in the adjacent Studio 1.⁷
- 5.1.15 The block is of Fletton bricks in an English bond. It is two stories in height with a flat roof and plain doorways and windows with flat concrete lintels and sills (Plate 5). Several doors have apparently been re-used from the 1932 building: some are labelled 'Dreadnought Ferrous Doors 1930', and another is a four-panelled pine door of a type not seen elsewhere in the Riverside

⁷ Conversation with Trevor Ramell, head of maintenance, 12th December 2013.

(Plate 11). The southwestern end of the structure has a substantial louvered opening at ground level which acts as the air intake for the studio ventilation system. Above, two small iron hatches with concrete lintels give service access to the large fan associated with this system.

5.2 ***Riverside Studios: Internal Ground Floor Description***

Entrance Foyer and Café

- 5.2.1 The present entrance foyer from Crisp Road was installed in 1993. It is simple, bright and modern in style, with white-painted walls, a glazed frontage and exposed services and concrete frame (Plate 12). Decoration is limited to film posters, and reproduction illuminated signs to the cinema and Studio 3, which are copies of earlier examples from the public bar entrances to Studios 1 & 2 (Plate 13). The space was originally subdivided into four dressing rooms; the café and kitchen occupies the double-height space of the former boiler house at the southeast end of the block (Plate 14). It was originally equipped with a pair of cast iron oil-fired boilers and a smaller gas-fired boiler for summer loads. It supplied cast iron radiators throughout the building, of which none now survive (Appendix 3, 23).
- 5.2.2 The foyer extends beneath the southeast part of the Three Storey Block, the former small BBC-era dressing rooms of which have been partially opened up to facilitate circulation (Plate 15; Figure 18). This was the location of the Riverside's reception and booking office between 1974 and 1993, replacing that in the northwest elevation of the Three Storey Block. The hatches of the old reception remain boarded-over in the wall opposite the stair to the cinema (Plate 15). The cinema stair was inserted for the film studios in 1933, and awkwardly obscures the original 1932 windows. It is open well with quarter-space landings and has concrete treads. The balusters are steel with a stainless steel handrail; an early use of architectural stainless steel (Plate 16).
- 5.2.3 Between 1974 and 1993, much of the space formerly occupied by the BBC-era workshop and scene dock was used as an art gallery and bookshop (Figure 29). Many acclaimed artists have shown at Riverside including Nick Danziger, Yoko Ono, Anthony Gormley and David Hockney, the latter of whom had helped lead the fundraising appeal to establish the arts complex here in the mid-1970s.⁸ It was also used for dance performances, particularly when Gaby Agis was choreographer-in-residence at the Riverside 1984-86. Intended as a financial support, the bookshop was a fun place to work, socialise and even perform impromptu DJ sets,⁹ but as was not a financial success, it was closed when the complex was run along more commercial, television-orientated lines from the mid-1990s.

⁸ <http://www.riversidestudios.co.uk/theriversidestory/main.cfm>

⁹ Conversation with Shira Macleod, cinema manager, 12th December 2013.

Public Bar and Thameside Terrace

- 5.2.4 The public bar (Plate 17) is largely contained within the footprint of the 1936 Dubbing Theatre, and was formed from opening up the space occupied by dimmer rooms, a band room and various staff technical facilities from the BBC era (Figure 18). The original concrete piers supporting the first-floor Dubbing Theatre have been left in place, and dominate the bar, which was redecorated in the autumn of 2010.¹⁰ It continues the clean, modern appearance of the foyer with its white walls and exposed ceiling vents and services, but with a much dimmer atmosphere provided by a great number of reproduction industrial ceiling lamps in stainless steel. Also present are a pair of illuminated signs at the entrances to Studios 1 & 2, which have red 'sound on' and 'vision on' warnings in a stencil font to alert the unwary. These appear to be original BBC-era features, and have been replicated at the entrances to Studio 3 and the cinema in recent decades (Plates 13 & 55).
- 5.2.5 The bar's walls continues the tradition of gallery space first begun in the Riverside's Crisp Road block (Plate 18): in 1990 they were transformed by Yoko Ono into a 'graffiti wall', which stills exists beneath the layers of white emulsion.¹¹
- 5.2.6 The bar's kitchen and WCs are contained within the ground floor of the BBC's Southeastern Block (1955). The WCs are in their original locations, but retain only their door swings from this period. The kitchen is located within a large former workshop, which – judging by its location adjacent to the Block 2 control suite - was used for those equipment repairs not sent to the larger maintenance facility at the nearby BBC Lime Grove studios (Appendix 4).
- 5.2.7 The building's Thameside terrace (Plate 19) is presently as a seating area for the bar in clement weather, whence it is accessed via the narrow corridor leading through the Studio 2 dressing rooms. It is bounded to the southeast by the original boundary wall of Gwynnes' factory, which contains a modern door to the public footpath outside, and to the southwest by a railing of stock brick piers and tubular steel, installed by the BBC (see Appendix 3, p. 18). It was used to film a number of notable television sequences including the opening of the first alien pod in *Quartermass and the Pit* (1958/9) and the first Dalek ever to land on earth in an early episode of *Dr Who* in 1964 (Figure 24).¹² To this day, it also remains an ideal place from which to film the Oxford and Cambridge Boat Race (Figure 27).

Studio 1

- 5.2.8 Studio 1 (Plates 20 & 21) was initially constructed in 1933 as one of two stages by the Triumph Film Company (Figures 13 & 15). It was originally contained across the whole width of Gwynnes' 1920 factory, although the

¹⁰ Conversation with Trevor Ramell, head of maintenance, 12th December 2013.

¹¹ Conversation with Shira Macleod, cinema manager, 12th December 2013.

¹² <http://www.tvstudiohistory.co.uk>

row of columns supporting the factory's two ranges remained in place until 1955. A lateral wall was inserted across the factory to form the smaller Studio 2. The southwest elevation is black-painted brick and retains one of the few doorways original to the factory, which retain their 1933 soundproof timber doors (Plate 3). A second such opening, now blocked, lies adjacent. The studio's northwest elevation is unusual in the industry because its brickwork and the blocked, flat-headed windows of the 1920 factory wall have been left visible and unpainted (Plate 22). Many television programmes have therefore taken advantage of this elevation, which is richly textured and takes well to artificial lighting, as the cost-free backing for sets and live music acts (e.g. Figure 26).¹³

- 5.2.9 The BBC retained the 1933 wall dividing Studios 1 & 2. The first Cyberman spaceship was constructed against this wall in 1966, for the series *Dr Who* (Figure 25). The BBC added a large doorway at its northwest end enabling the two studios to be linked for particularly elaborate productions (Appendix 3, 7). As an example, the 1958 film *A Town Has Turned To Dust* (1958), starring William Shatner, has a typical Wild West street running through these doors.¹⁴
- 5.2.10 In 1954 the BBC decided to enlarge Studio 1 beyond the long spine wall dividing the two ranges of Gwynnes' factory. This had many attendant problems, not least that the original angle-trusses of the factory and later film studio roof would need to be supported. To this end, the former spine wall was replaced by a large box-truss at wall-plate level, contained within a new roof structure (Appendix 3, 6; Appendix 3, p. 7-10; Plates 1 & 23). This is supported by large concrete piers on the studio's southwest and northeast elevations.
- 5.2.11 The other major adaptation made by the BBC was the insertion of a free-standing six-legged lighting gantry into the studio, prefabricated off-site by Dorman Long & Co. of Middlesbrough (Appendix 3, 7; Plates 24 & 25). This was to avoid the risk of over-loading the original trusses supporting the studio's roof, which would otherwise have suspended the lighting grid. The gantry piers had foundations dug deeply beneath the studio floor, and its considerable capacity enabled the Riverside to become the first studio in the world to be provided with a comprehensive lighting system (Appendix 4, 21). Its red-painted frame supported 79 motorised lighting hoists, the fixings for which remain: it was duly adopted for the first five studios to be built at the new BBC Television Centre.¹⁵
- 5.2.12 Prior to 1954, the floor of Studio 1 was of timber (Appendix 3, 7). This was sufficient for film work, whose format enabled pre-determined shots to be executed by cameras running on rails, but was unsuited to television work which in those days was filmed and broadcast live, and so required TV cameras to have continuous free movement about the studio. There were

¹³ <http://www.tvstudiohistory.co.uk>

¹⁴ <http://www.tvstudiohistory.co.uk>

¹⁵ <http://www.tvstudiohistory.co.uk>

four television cameras in Studio 1, of which the cranes alone weighed c. 2 tons and had a crew of four (Appendix 4). A strong, perfectly smooth floor of asphalt was duly laid and fitted with eye-bolts to accommodate trapeze wires (Appendix 3, 7). Great brick-built trenches with timber covers crossed the floor to carry the cables for the original television equipment, which were of considerable girth, and to facilitate connecting Studios 1 and 2 for joint productions without trailing cables through the single door between them (Plate 26).¹⁶ The studio floor was re-laid in 2006.¹⁷

- 5.2.13 Another problem anticipated by the BBC at Riverside, and subsequently applied at Television Centre, was the considerable heat that the lighting, personnel and equipment necessary for television production would generate. Ducts supplied from the Generator Block crossed beneath the floor in large brick trenches and ran up the southwest and northeast walls of the studio, supplying cool air below lighting gantry level and extracting it from the roof space (Plate 27). The ducts themselves remain, and are lined with acoustic material to prevent reverberation. Due to their different heat production, and to minimise the risk of a fire spreading, the studios, control rooms and dubbing theatre each had a dedicated ventilation system (Appendix 3, 23).
- 5.2.14 Following the departure of the BBC in 1974, Studio 1 was given over to theatre and dance under successively Peter Gill and David Gothard, and used as rehearsal space by noted dancers such as Michael Clarke.¹⁸ The space fostered the careers of Kenneth Brannagh and David Parfitt, who founded their Renaissance Theatre Company here in 1987 with actors including Emma Thompson, Samantha Bond and John Sessions. The young Hugh Grant and Nigella Lawson also performed here, in a school theatrical production of Brecht's *The Caucasian Circle*.¹⁹
- 5.2.15 The Riverside's financial situation necessitated the return of television to Studio 1 in 1993. Its first great success was *TFI Friday* which occupied the studio between 1995 and 2000 and made prominent use of its setting for live music and celebrity performances. There were few dedicated sets and the substantial audience wandered freely, meaning that much of the unvarnished studio and its equipment, particularly its brick wall and red lighting gantry, were visible throughout each broadcast. The metal stair to the lighting gantry (Plate 28) and first-floor control rooms on the southeast side of the studio also featured heavily, as host and guests made their way from the main performance space to the interview room where the Studio 1 Green Room is presently located (Figure 30). It is a relatively new stair: the truncated 'C'-beam of its predecessor is visible protruding from the wall beneath.

¹⁶ Conversation with Nik Whybrew, operations director, 12th December 2013.

¹⁷ <http://www.tvstudiohistory.co.uk>

¹⁸ Conversation with Shira Macleod, cinema manager, 12th December 2013.

¹⁹ *The Independent*, September 22nd 1994.

Studio 1 Dressing Rooms

- 5.2.16 Like the public bar adjacent, the dressings rooms for Studio 1 lie partially within the area of Gwynnes' 1920 factory and partially within the Southeastern Block of 1955. The engaged piers of the original factory outer wall are visible along the corridor to the Thameside terrace; the doorways to the rooms in the 1955 extension are all later insertions. The area retains much of its 1950s layout and function, excepting that the doorways communicating directly with Studio 1 have been blocked, a former workshop is now the Client Production Office, and the former make-up room has been subdivided into a kitchen store.
- 5.2.17 There are four principle dressing-rooms in this area, which are of very modern fitting and appearance with laminated floors, suspended ceilings and en-suite WCs (Plate 29). They have in most cases been created by joining several smaller BBC-era dressing rooms together. Oddly, there is no dressing room no. 3: when the Riverside TV Studios company which presently operates the facility relocated from their previous premises in Bow they took much of the fittings and equipment with them for the refurbishment of the Riverside, but apparently the sign for dressing room 3 was lost somewhere en-route, necessitating its re-Christening as dressing room 5.²⁰

Studio 1 Scenery Dock

- 5.2.18 The dedicated scenery dock abutting the southwest side of Studio 1 was installed in 1955 to satisfy the need to change scenery more quickly in television production compared to film. This is because an entire TV show had to be rehearsed and broadcast *in toto*, rather than filmed piecemeal like a motion picture, due in part to the high cost of editing at that time (Appendix 4, 6).
- 5.2.19 The main dock is of the same brick-infilled concrete frame construction as the rest of the BBC-era additions to the site (Plate 30). It re-uses an original wide external doorway to the factory to transport the scenery into Studio 1: two other such doorways have been blocked. The structure was formerly double-height and open at ground level, but has since been subdivided into offices at its southeast end, including the insertion of a first floor level and the provision of external windows along the Thameside terrace (Plate 31). The relatively early date of internal steel stairs and external newel indicate this was done soon after the building's construction, probably prior to the BBC's departure in 1974. The focus for storing and maintaining scenery has moved to the former open yard adjacent and its scatter of modified small 1933 brick sheds, which have been wholly enclosed in an ephemeral corrugated steel shelter, in contravention of the prohibition of such a structure due to fire safety by the local council in the early 1950s (Plates 10 & 32).

²⁰ <http://www.tvstudiohistory.co.uk>

Studio 2

- 5.2.20 Studio 2 (Plates 33 & 34) was the first to be brought into use by the BBC, since it is wholly contained by the larger of the two bays of Gwynnes' 1920 factory and therefore needed relatively little structural modification. It already had non-load-bearing bowstring trusses between its roof trusses, originally installed in both Studios 1 & 2 in 1933 to support the new film lighting grid (Figure 15). This meant that (unlike in Studio 1) a lighting gantry could be supported with only minimal strengthening work (Appendix 3, 18; plate 35). The roof space is therefore dense with steel supports from three different phases of the building's construction and use.
- 5.2.21 A wide external doorway original to the 1920 factory is retained in the northwest wall (Plate 2), with a smaller doorway likely belonging to the 1933 film studio inserted in the wall adjacent. Also of the film studio era is the two-leaf steel fire door leading northeast to the Studio 2 dressing rooms, which was manufactured by Crittall & Co. of Braintree, Essex (Plate 36). The construction of the southeast wall, which was removed in Studio 1, is visible here, consisting of brick piers supporting the 1920 roof trusses, infilled with concrete during the film studio era. It has several blocked doorways within its fabric. The southwest wall is characterised by a layer of thick sound insulation, and a wide BBC-era doorway enabling it to be connected with Studio 1.
- 5.2.22 The BBC installed a floor, cable-runs and ventilation system in this area of the type described above for Studio 1, and provided it with three cameras to its larger twin's four (Appendix 4, 9). As with Studio 1, its red-painted steel lighting grid was of the highest specification for its day (Plate 37), paving the way for how both Lime Grove and the new Television Centre would be equipped. It had 62 motorised hoists in this area, of which the frame and pulleys for one survives beneath the lighting control gallery on the northeast side of the room.²¹

Studio 2 Dressing Rooms

- 5.2.23 The dressing rooms for Studio 2 are contained within the ground floor of the Three Storey Block of 1932, and originate with its conversion to film studio use in 1933 (Figure 13). Unlike the functional BBC-era dressing rooms of Studio 1, several in this location have elaborate coffered ceilings, plaster cornices and moulded architraves (Plate 38), installed in recent years by scenery department as a fitting backdrop for their stars. Three of these dressing rooms have been lost to form a large office servicing the relocated reception desk in the Crisp Road Block. The stair and external doorway at the northwest end of the block date from the 1933 film studio (Plate 39); the stair has quarter-pace landings, a tubular steel handrail and nosed stone or concrete treads.

²¹ <http://www.tvstudiohistory.co.uk>

5.2.24 Several of the larger spaces in this area, such as the make-up room, have been subdivided into smaller dressing rooms, offices and stores. One such is the former store-room for the back-projection screens and equipment, installed by the BBC in 1955 and vital for key television productions such as *Z-Cars* (Appendix 3, 18). This was an essential technology for its day, despite its habit of continuing to run when a vehicle was supposed to be stationary ('don't bother to stop – I'll jump out here'),²² but has long since been superseded.

Generator Block

5.2.25 The generator block was constructed in 1955 abutting the northwest side of Studios 1 & 2, replacing the Triumph Film Studio's 1933 carpenters' shop. It is divided at ground level by an open passage to an inserted doorway to Studio 1. Much of its southwestern end is occupied by an electricity sub-station and inaccessible plant rooms at this level, excepting the high voltage electricity intake room, which is double-height to its first floor gallery level, accessed via a BBC-era steel stair. It has smooth concrete walls dominated by the boxed-in ventilation duct for Studio 1 at ceiling level. It contains modern electricity switch cabinets. Adjacent is a plant room containing 1950s ventilation machinery with a contemporary fuse board and switch (Plate 40).

5.2.26 The area to the northeast of the passage to Studio 1 consists of a number of small, oddly-shaped rooms used for storage and equipment maintenance. The direct entrance between this area and Studio 2 belongs to the film studio era, and is abutted by the concrete of the BBC structure. The wide, timber-covered floor trenches installed by the BBC to carry cables between the two studios survive well in this area (Plate 26).

Studio 3

5.2.27 Studio 3 is a small studio space wholly within the Crisp Road Block, created principally as a theatre space in 1994 from a former carpenters' shop and redundant scene transit dock (Plate 41). It is of concrete-framed construction infilled with brick and painted black, and has retractable banked seating and a modern lighting grid and ventilation system. The lighting grid is simply bolted between the concrete beams of the building's roof. The studio is occasionally given over to television use, such as for Channel Four's weekend show *T4* in 2006.²³

5.3 *Riverside Studios: Internal First Floor Description*

Cinema

5.3.1 The present cinema was built for the Triumph Film Studios in 1936 as a dubbing theatre, wherein the edited movie footage would be projected for a full orchestra to score, or dialogue to be added, which would be recorded for

²² <http://www.tvstudiohistory.co.uk>

²³ <http://www.tvstudiohistory.co.uk>

the finished film's release (Figure 17). The room is a fine survival of the early days of transition away from silent cinema, and would have been the height of contemporary technology. As such it was used to record the music for many films, not limited to those made at the riverside: in the late 1950s a BBC technician found several scores including that for *The Cruel Sea* behind the projection screen.²⁴ It was retained by the BBC in 1955, due in part to a shortage of dubbing space elsewhere in London until Television Centre came into use. Coat hooks and light fittings original to the dubbing theatre survive in the store in the west corner of the room.

5.3.2 Although the dubbing theatre sits within a bay of Gwynnes' original factory building of 1920, it is a wholly new concrete-framed brick structure of 1936. Its combination of a projection booth, excellent acoustics and space enough for an orchestra made it ideal for conversion into a cinema in 1987, when permanent banked seats were installed and a new entrance accordingly made in the northeast wall at second floor level (Plates 42 & 43). The old first floor entrance survives, but now accesses only the cavity beneath the seating, now used as storage for film posters. Wall panels were installed to help the acoustics, and a striking carpet fitted, the pattern of which was intended to evoke the ripples on the water of the Thames.²⁵ A plaque in the auditorium commemorates the cinema's opening by Vanessa Redgrave on 2nd November 1987.

5.3.3 The cinema projection room has been retained from the 1936 dubbing theatre (Plate 44). It has a modern digital projector and a pair of older 35mm film projectors, the one taking over from the other when the time comes to change a reel of film, and there is a bench for the cutting and splicing of film reels. Beneath is a ventilation plant room, a VHS cassette library and a pleasant office used by the cinema manager which is notable for a likely surviving BBC-era desk, one of a handful throughout the building. Due to the flammability of early nitrate-based film stock, this part of the building is separated by fireproof iron Dreadnought doors of Victoria Street, London, dated 1930.

Studio 1 Control Suite

5.3.4 The control suite for Studio 1 was inserted by the BBC within Gwynnes' factory, at the southeast end of the studio (Figure 19). As such, it is of characteristic concrete-framed construction. When installed, there was debate as to the best layout for television production: whether the lighting console should be housed within the same room as the director and vision mixer, or the room where the vision operator racked the cameras. As with other matters, the Riverside was used as a test-bed for best practice at the future Television Centre, meaning that the former arrangement was used for Studio 2 and the latter for Studio 1.²⁶ The layouts of the two control suites were also different, with a viewing window and monitors to the front in Studio

²⁴ <http://www.tvstudiohistory.co.uk>

²⁵ Conversation with Guy Hornsby, executive director, 12th December 2013.

²⁶ <http://www.tvstudiohistory.co.uk>

1 and to the side in Studio 2 (Appendix 4, 11). Two different dimming and control systems were also trialled (Appendix 4, 9, 23).

5.3.5 The layout of the control suite has changed since the 1950s, when it was thought essential that a direct view be provided to the studio floor. Large observation windows were installed, overhanging at 25 degrees from vertical, which gave them the best possible view, reduced reflection and accommodated monitors above (Appendix 3, 15). This contrasts with the present, when television screens alone allow technicians to monitor productions (Plate 45). There were also windows between the various control rooms, motorised to open. Since TV programmes were filmed live, the lighting rig had to accommodate remotely-operated hoists and tracks, and to alter and dim the lighting mid-show. This required close co-operation with the producer, hence the need for adjacent, directly communicating rooms (Appendix 4, 6). The windows between the control suite and the studio still exist beneath later plywood, but they are orphaned from the former use by a new corridor to the Studio 1 gantry level. Vision Control now lies at the northeast end of the suite, then Production Control, then Sound Control, each with modern internal fittings and sound-proof doors. Their most recent refurbishment was early in 2012.²⁷

5.3.6 At the southwestern end of the control suite, the former Apparatus and Maintenance Rooms have been replaced by a computer server room and the Green Room, where artists and performers relax in between filming (Plate 46). During the occupancy by *TFI Friday*, this was the celebrity 'bar' where guests were interviewed beneath a conspicuous iron-framed casement window overlooking the Thames (Figure 30). This was replaced with modern PVC when the room was refurbished in 2003.²⁸ Additional control and client rooms are accommodated along a corridor to the rear of the control suite, within the BBC's 1955 Southeastern Extension, in the place of former offices.

Studio 2 Control Suite

5.3.7 The control suite for Studio 2 lies within the 1932 Three Storey Block. The large windows remain between the studio floor and the Sound and Vision control rooms (Figure 19), now the Lighting and Production Galleries respectively (Plate 47). A new Sound Gallery has been inserted in the former corridor to the studio's upper-level gantry. The present fittings date from 2013, when Studio 2 returned to full-time television use.²⁹

First Floor Offices

5.3.8 Much of the first floor of the Three Storey Block has been given over to office space hired out to various production companies, in place of the BBC-era Apparatus and Maintenance Rooms and Telecine Suite. These had been offices in 1933 (Figure 14): the old corridor running the length of the building

²⁷ <http://www.tvstudiohistory.co.uk>

²⁸ <http://www.tvstudiohistory.co.uk>

²⁹ <http://www.tvstudiohistory.co.uk>

at this level, removed in 1955, has been restored. Offices have spread to the upper levels of the adjacent 1955 Crisp Road Block, where redundant plant and ventilation rooms were formerly located, accessed via an open-air walkway and a doorway inserted in a now-blocked window of the Three Storey Block (Plate 48). Each office is of a clean modern refurbishment, and none retains traces of any former use (Plate 49), although the corridor linking this area to the cinema has a number of 1950s electrical switches and fuse boxes. The Riverside's archive, which mainly preserves material of the post-BBC era, is located adjacent.

Generator Block

- 5.3.9 The upper level of the northeast half of the generator block – being that part used for storage and maintenance – is accessed via an open-well concrete stair with quarter-pace landings opposite the entrance to Studio 2. This cramped space with its small kitchen, sofas and dartboard is the preserve of socialising technicians taking advantage of its relative inaccessibility combined with its close proximity to Studios 1 & 2 (Plate 50). This is well-needed, as productions commonly film during the day, leaving the technical set-up for the subsequent production to carry on through the night.
- 5.3.10 The first-floor gallery level of the southwestern half of the block – being that part occupied by plant rooms – is comfortless in comparison. Its cramped space is dominated by modern electrical switch cabinets, with a space given over to the storage of studio lighting and assorted cabling.

5.4 ***Riverside Studios: Internal Second Floor Description***

Rehearsal Room

- 5.4.1 The rehearsal room – confusingly referred to as 'Studio 3' in earlier sources – is located within the second floor of the Three Storey Block (Plate 51). Now partially subdivided and used as offices – including a strikingly-decorated relaxation space with a false fire surround and Chesterfield sofas – this is a large, light room open to the iron trusses of the building's roof. During the BBC era it was a 200-seater canteen of a new 'dining-car' layout, imposed by its great length in proportion to its width (Figure 20; see illustrations in Appendix 3, 17-20). A service hoist was installed in the building's existing south stair, which is now the main access to the cinema auditorium (Appendix 3, 19).
- 5.4.2 The roof-space at the northwestern end of the building was partially rebuilt in the 1950s to house three large steel water-tanks on brick piles. It is accessed via a fixed ladder on the landing to the stairs at this end of the building. A doorway opening out into mid-air from this space was presumably the route by which the tanks were originally manoeuvred into place.

Southeastern Offices

5.4.3 The upper level of the Southeastern Block (1955) originally housed a ventilation plant room (Figure 20), the services for which are still present, capped by a large wooden box in the floor.³⁰ The space is now subdivided into modern offices, of which that at the southwestern end of the space is well-appointed with a modest balcony overlooking the Thames.

5.5 ***Queen's Wharf: External Description***

5.5.1 Nothing now remains of the Rosser & Russell Ltd manufacturing plant which was established on the site of the former Chancellor's Wharf in 1874 (Figure 3), and replaced by the existing office building in the early 1970s (Plates 52-54; Figures 4-7). The building is three stories in height with an additional storey along its River Terrace frontage and a basement car-park from Crisp Road. The southwest side of the building curves round to follow the site's Thames frontage, which meets Queen Caroline Street at a concrete slipway, a reminder of the site's past function as a wharf. A public footpath runs northeast/southwest beneath the building, connecting Queen Caroline Street with River Terrace. The building itself is of concrete-framed construction infilled with tinted glazing, and has a flat roof studded with lift shafts and ventilation plant. Its northeastern half rests on a plinth of London stock bricks in an English bond, which has louvres ventilating the car park beneath.

³⁰ Conversation with Nik Whybrew, operations director, 12th December 2013.

6.0 DISCUSSION

- 6.1 Despite the Riverside Studios' relative lack of architectural merit – Gwynnes' original factory and its BBC-era accretions are at best functional examples of their type – the building's fabric is of considerable interest and importance for the changes it manifests and the events it has housed. Many late 19th and early 20th century industrial buildings in London have been converted to uses quite different from those originally intended, but few have undergone such a series of profound transformations whilst remaining relatively intact and continuing to influence the activities within. What began as a factory, with the Thames as its main focus and link with the commerce of capital and Empire, became switched around: a functional office block newly-constructed at its rear was now the façade of a film studio which had no use for the Thames and very little even for exterior photography. The building approached by thousands from the river would now be viewed by millions who had never even seen its exterior: its focus was now *internal*, as its newly bricked-up windows turned their blind gaze to the world. In recent decades a balance has been struck as the post-BBC arts space welcomed the public to café, bookshop and riverside bar, and the reception was moved from a side passage to the newly-glazed block fronting Crisp Road. Nevertheless, the building draws its visitors deep within to dark cinemas, enclosed studios and windowless bars. Just as little of the building's function can be seen externally, little of the building can be seen beneath layers of paint and scenery once that purpose has drawn its audience inside.
- 6.2 The interior spaces of the Riverside have been singularly transformed over its nine decades' use. At the top of the Three Storey Block, what began as an office became a 100-seater restaurant in the most modern style, which gave way to a rehearsal space and occasional studio which has since come full circle and become an office once more, albeit one with incongruous flourishes – such as an artificial chimney-piece – which are nostalgic for the era of the building's initial construction. A 1986 cinema occupies a 1933 dubbing studio doubtless used for many of the productions now screened there, which may even have live orchestral accompaniment familiar from before the days of recorded sound, all of which is managed from a desk left over from the era of BBC television which directly replaced motion picture work at this site. A similar story could be repeated for practically every room of the buildings, whose functions oscillate from fabricating pumps to hosting the forgotten arts of the telecine and back-projection to housing cutting-edge computer technology. Other rooms have remained resolutely the same, the extent of becoming constructs of an artificial past, such as the Studio 1 dressing rooms with their coffered ceilings and architraved doors, or the reproduction signs welcoming visitors the cinema and Studio 3 (Plates 13 & 55).
- 6.3 The building's interior has not only changed according to its required purpose over the years but, more subtly, has itself influenced the manner in which these purposes have been carried out. This is inevitable, as technicians daily navigate their way across a palimpsest of eighty years of changing film and

television technology, attaching modern lights to a then-revolutionary BBC lighting grid suspended upon trusses installed by the Triumph Film Company in 1933 beneath a factory roof of 1920 (Plate 35). In this way, a pump factory in Hammersmith which became a BBC studio has influenced the way television production is carried out across the world, through the agency of its far more famous progeny down the road in White City.

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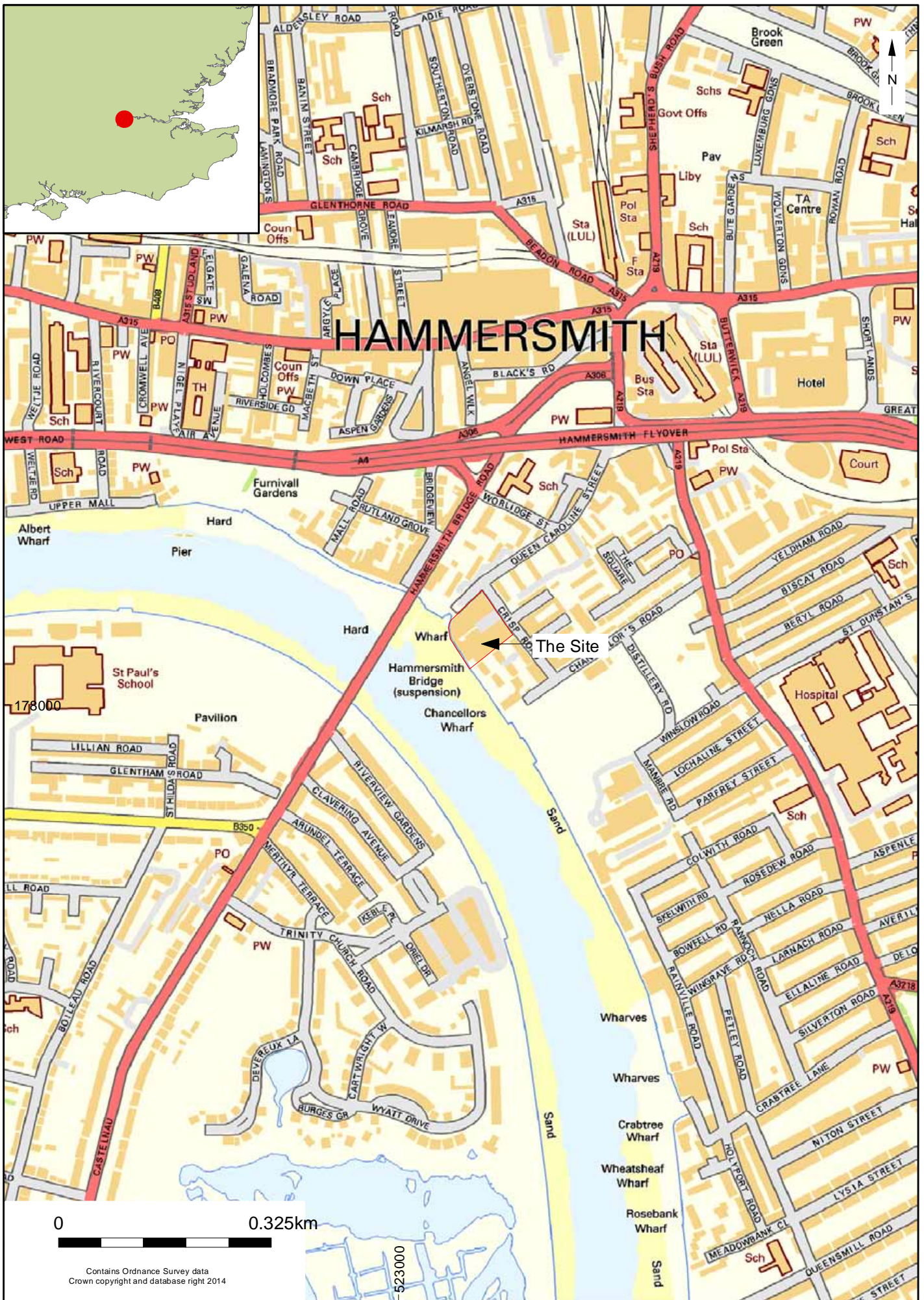
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8.0 DEPOSITION OF THE ARCHIVE

A full archive intended for deposition with the LAARC has been prepared. The archive has been assigned the site code CRP14. The full site archive will be prepared in accordance with the LAARC guidelines *General Standards for the Preparation of Archaeological Archives Deposited with the Museum of London* (Museum of London 1999). The archive will comprise a hard copy of the full report, a pdf version of the report on CD, the full photographic record with registers, field notes and drawings.

9.0 ACKNOWLEDGEMENTS

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© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 1
Project Ref: 6431	January 2014	Site location	
Report Ref: 2013334	Drawn by: MGS		



© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 2
Project Ref: 6431	Jan 2014	Site Boundary	
Report Ref: 2013334	Drawn by: MGS		

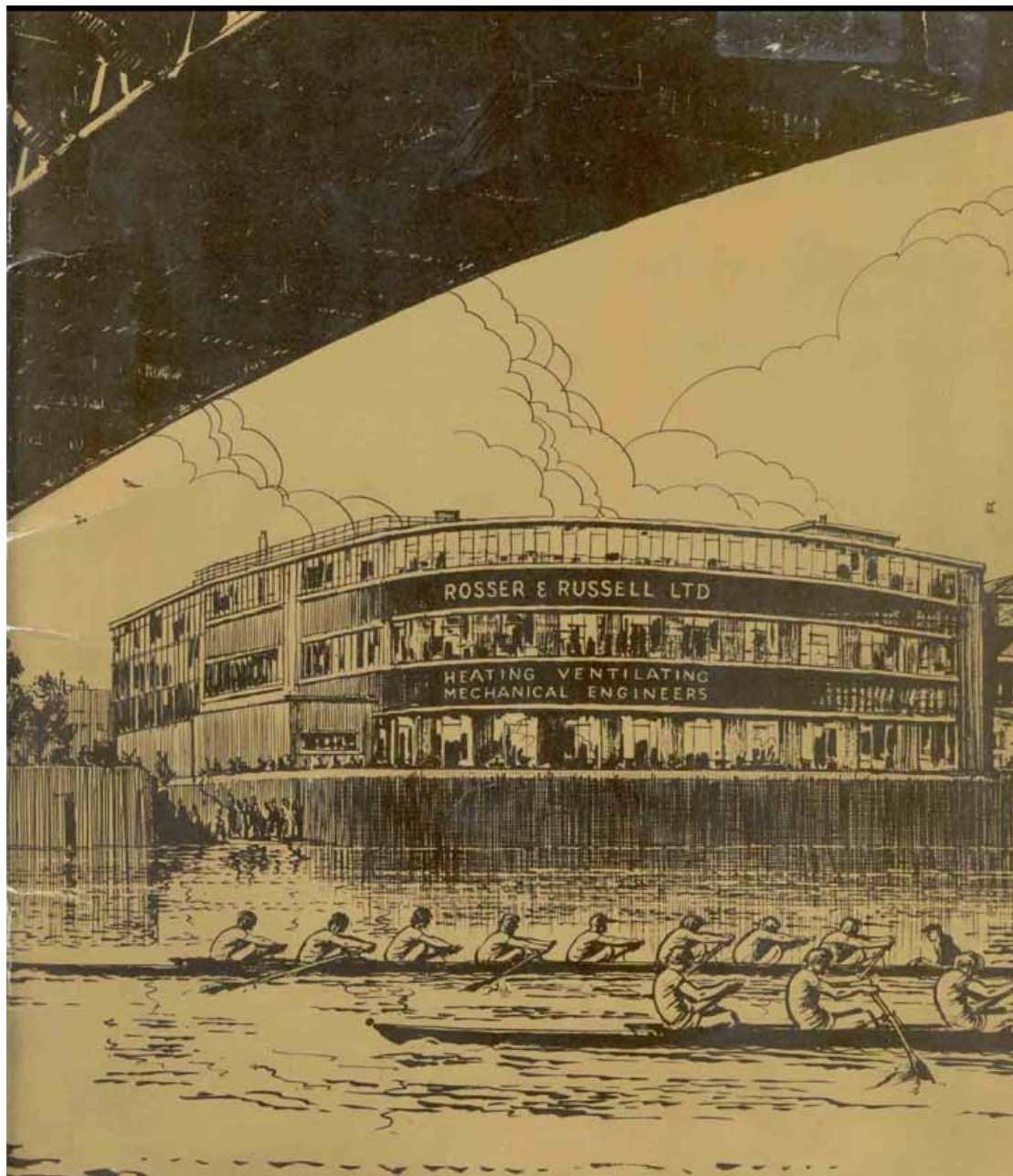


Queens Wharf (right side of photo) before 1882



Queen's Wharf around 1920

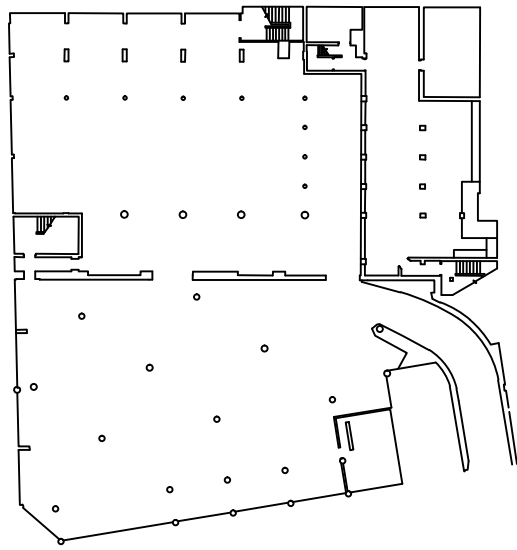
© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 3
Project Ref: 6431	Jan 2014	Early Photographs of Queen's Wharf	
Report Ref: 2013334	Drawn by: MGS		



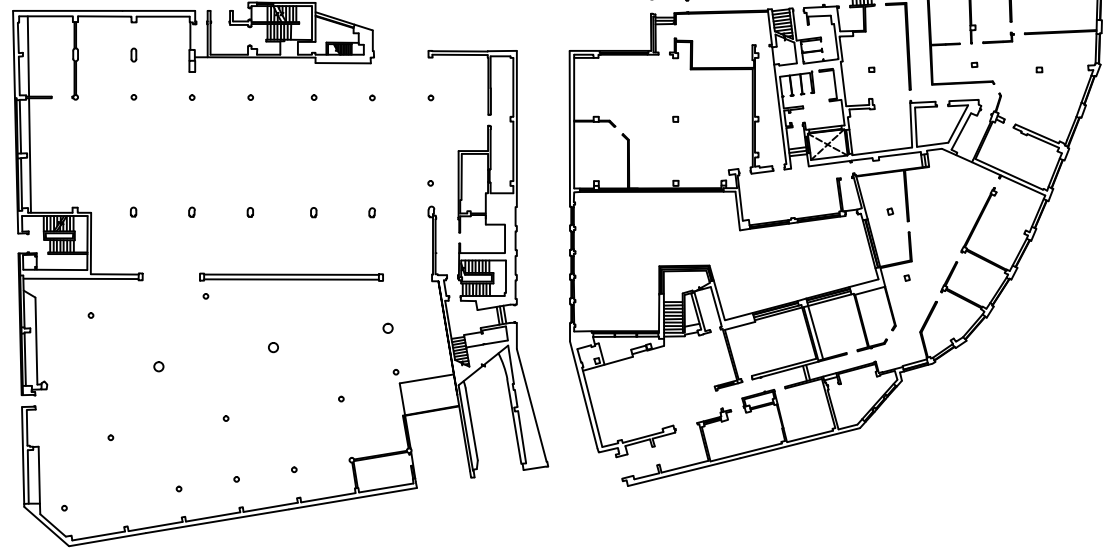
Queen's Wharf viewed from beneath Hammersmith Bridge, 1974

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 4
Project Ref: 6431	Jan 2014	Offices at Queen's Wharf shortly after their construction	
Report Ref: 2013334	Drawn by: MGS		

BASEMENT



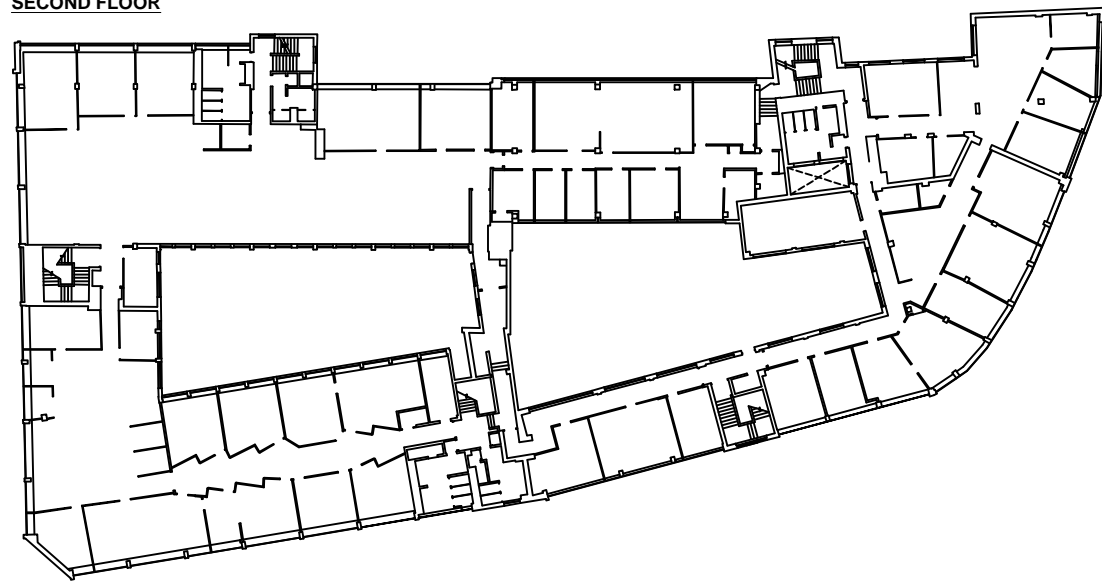
GROUND FLOOR



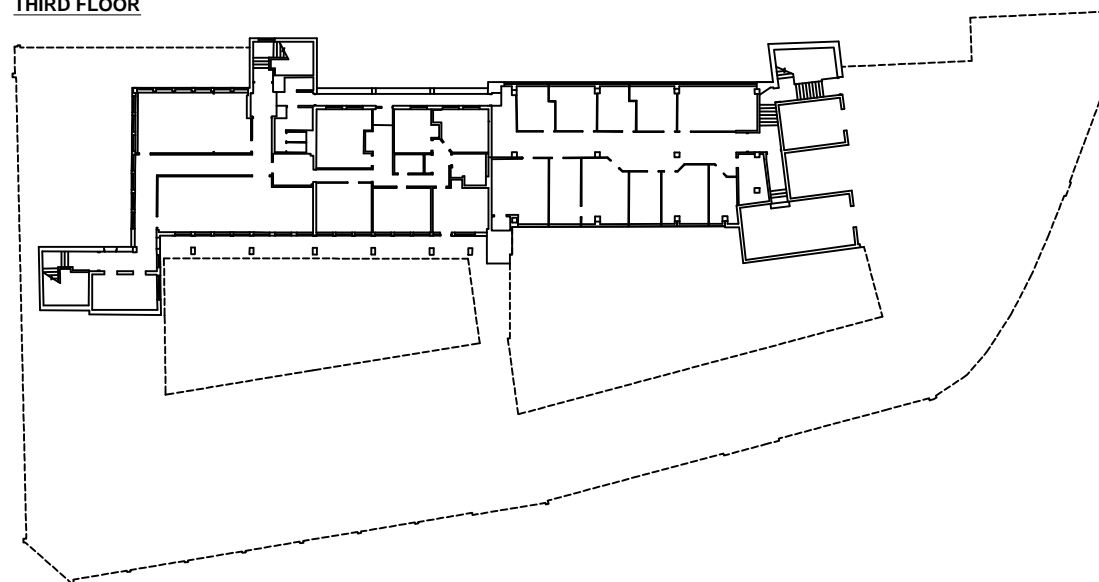
FIRST FLOOR

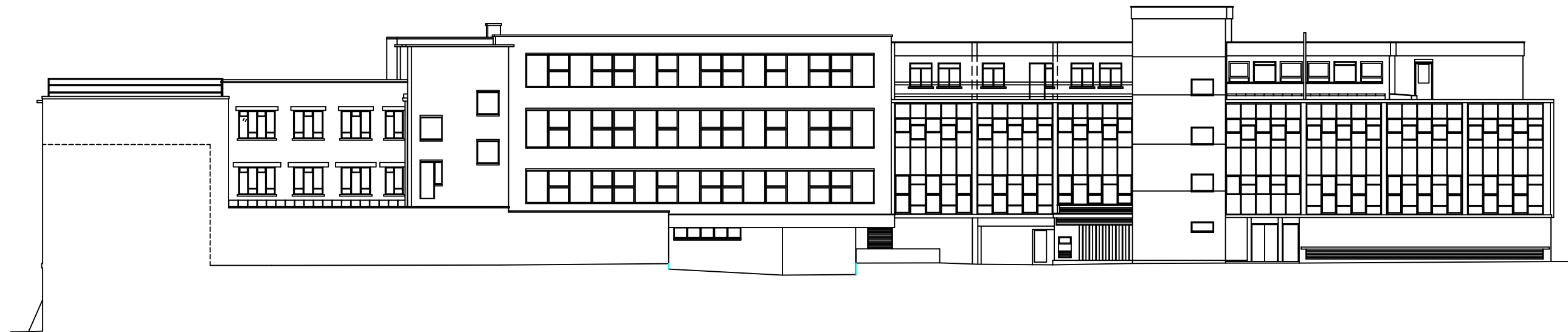


SECOND FLOOR

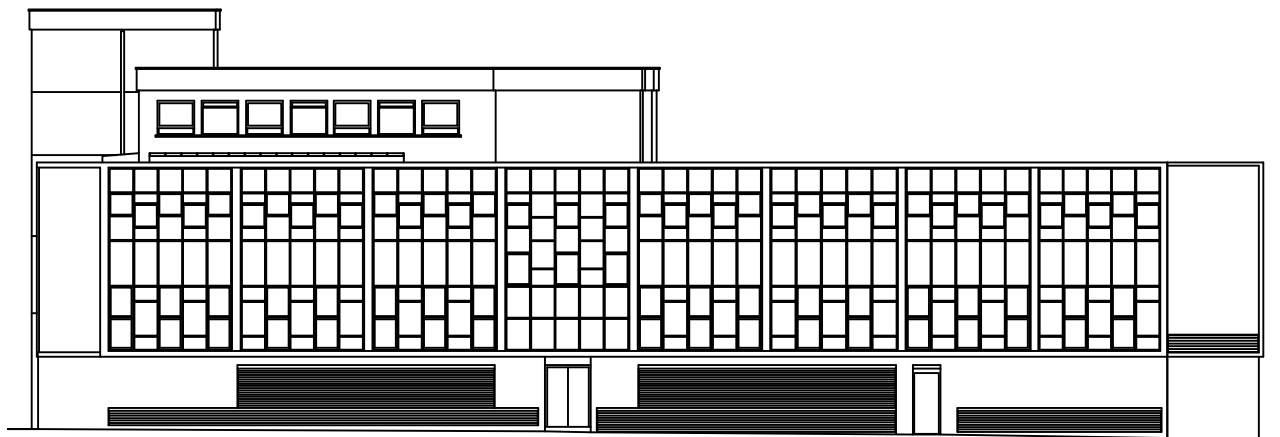


THIRD FLOOR



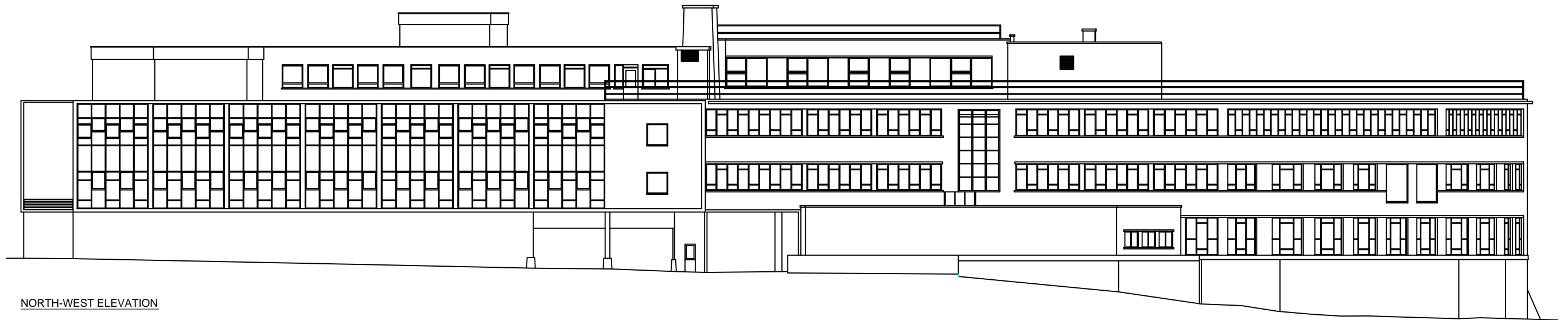


SOUTH-EAST ELEVATION

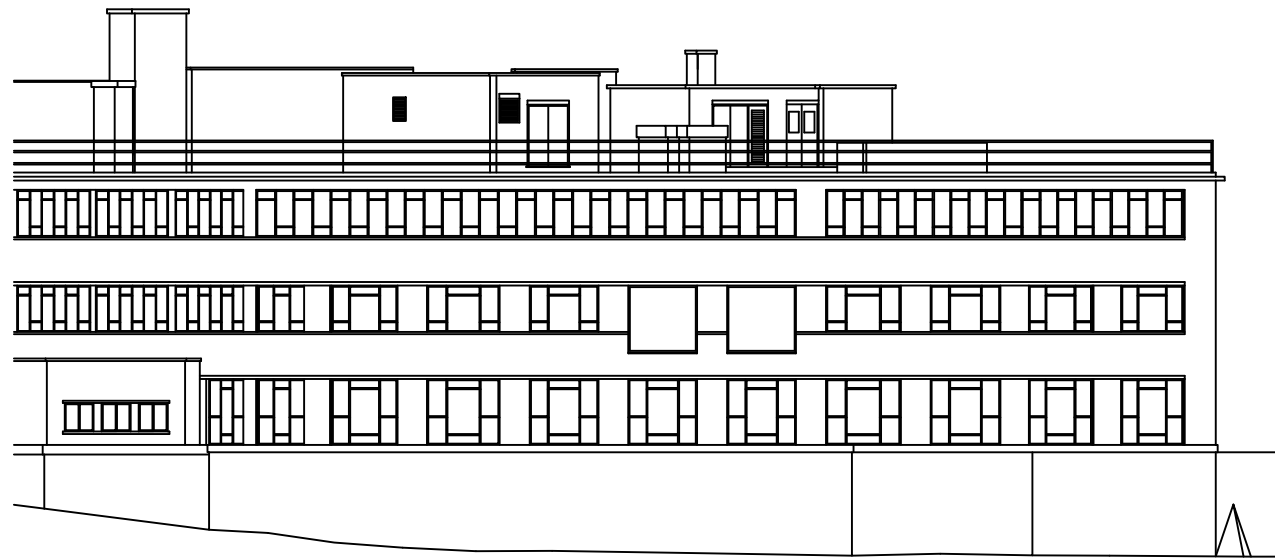


NORTH-EAST ELEVATION





NORTH-WEST ELEVATION



SOUTH-WEST ELEVATION



London County Council.

Committee decided that

ARCHITECT'S DEPARTMENT,
Building Act BRANCH.

REPORT by the ARCHITECT, made on 6th Nov^r 1899
 to the *Building Act* Committee.

Subject of Report *London Building Act
 Section 13.*

Application of Messrs J & M
 Gwynnes of 64 Cannon Street
 & Co for Consent to the erection
 of an engineering workshop
 in a yard situated between
 Queen's Road Hammersmith
 and the River Thames with the
 northwestern angle of the
 building at less than the
 prescribed distance from the
 centre of River Terrace
 16225

Report

River Terrace is a carriageway 30 6
 wide ^{111 2/3 yards long} leading out of the West end of Queen's
 Road & terminating a cul de sac.
 It forms the approach to several

16225.

The Vestry of the Parish of Hammersmith.

Town Hall,
 Hammersmith.

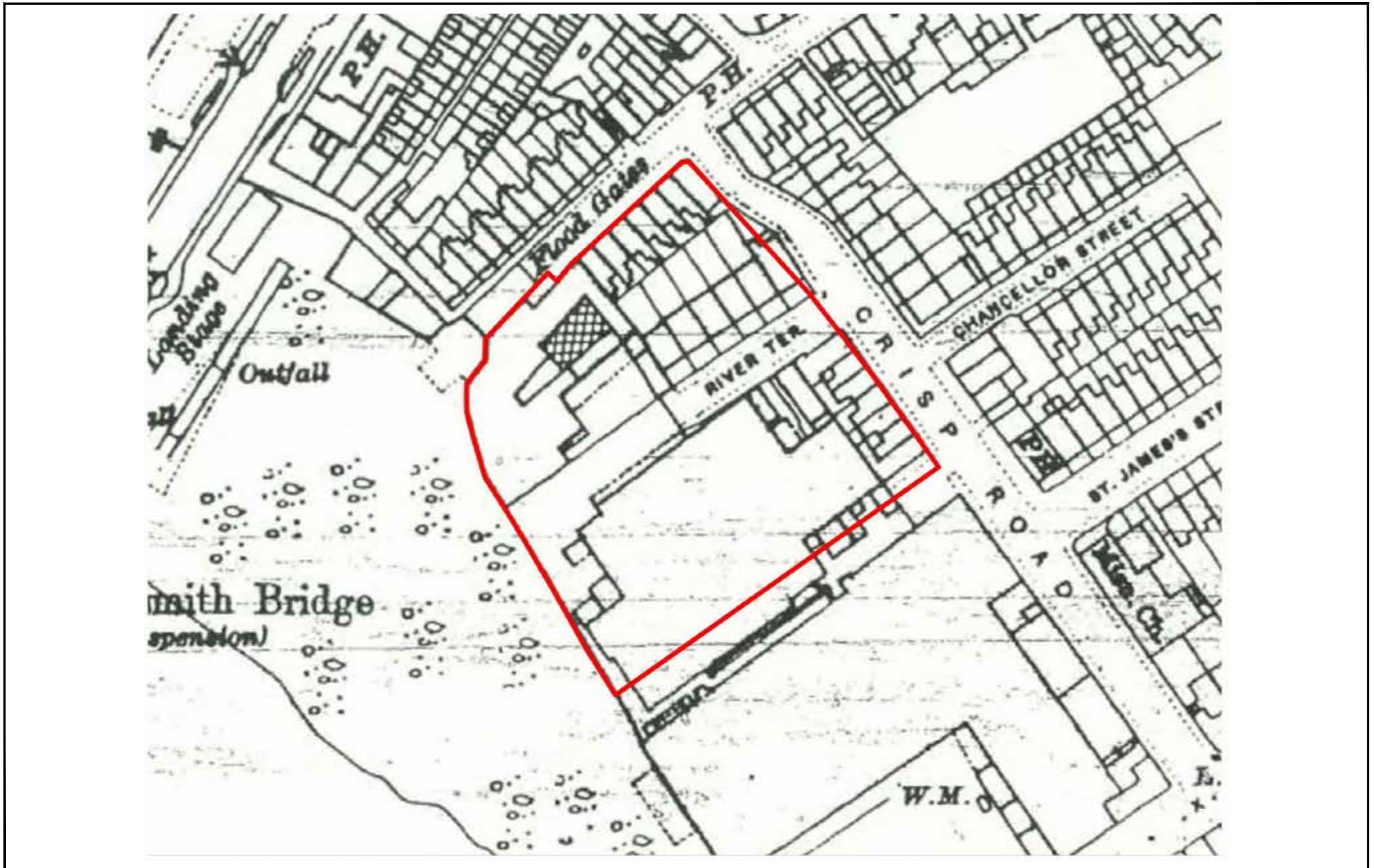
11 NOV. 1899
 17323

Dear Sir,
 Case No. 16225

With reference to the
 application of Messrs J & M Gwynnes
 for the consent of the Council to the
 erection of a building (Foundry) to abut
 upon the east side of River Terrace,
 I am directed to inform you that
 this Vestry has no objection to offer
 thereto.

Yours faithfully,
 W. G. A. [Signature]
 Vestry Clerk

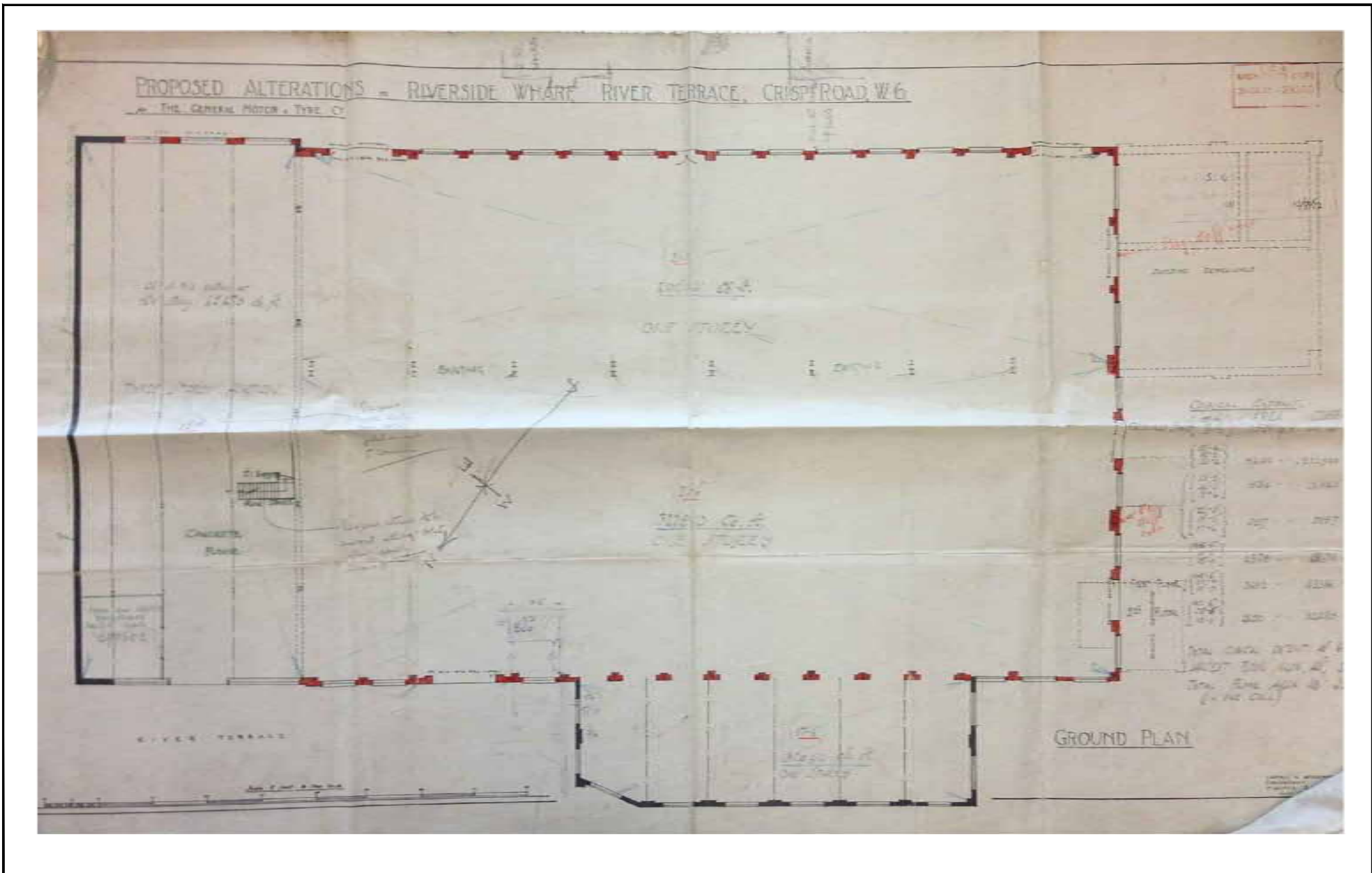
To E. Riley Esq
 Supg Architect
 London County Council



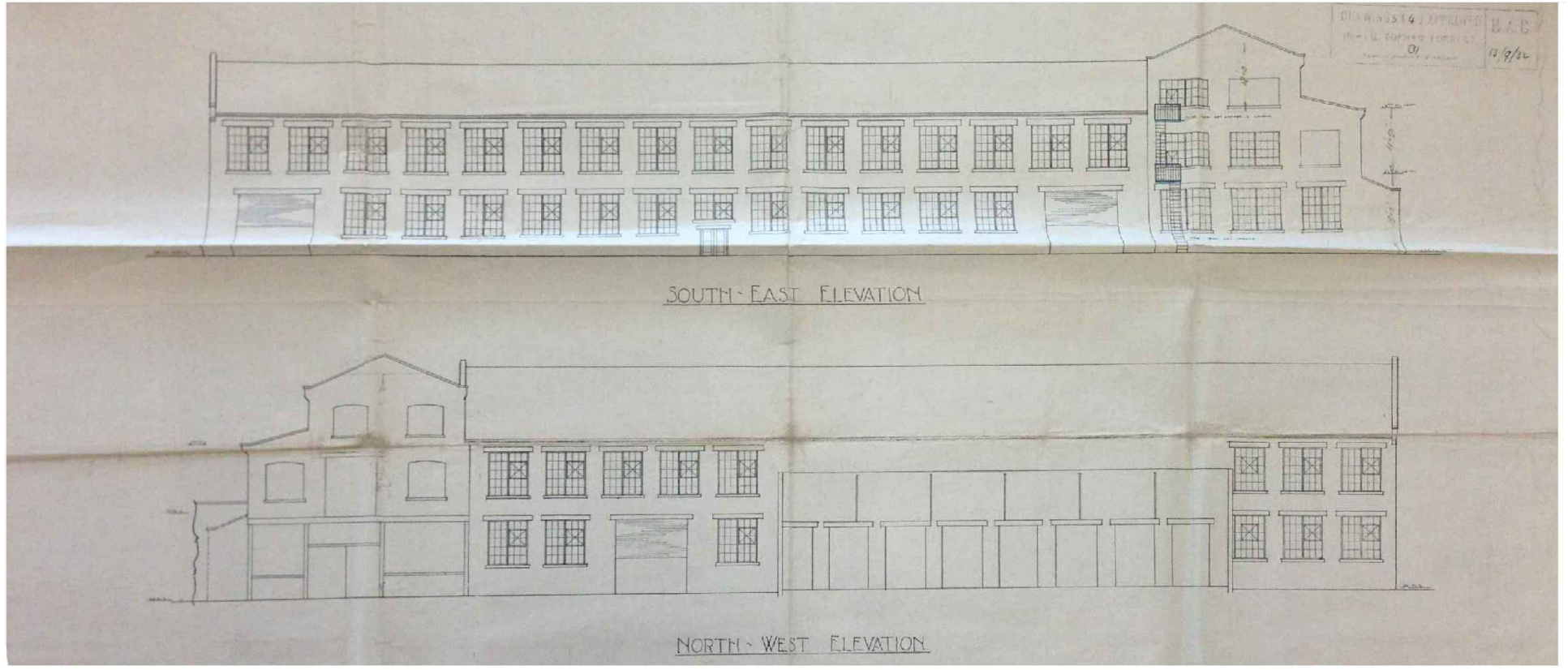
© Archaeology South-East
Project Ref: 6431 Jan 2014
Report Ref: 2013334 Drawn by: MGS

Riverside Studios and Queens Wharf, Crisp Road, Hammersmith
1913 Ordnance Survey map of the site

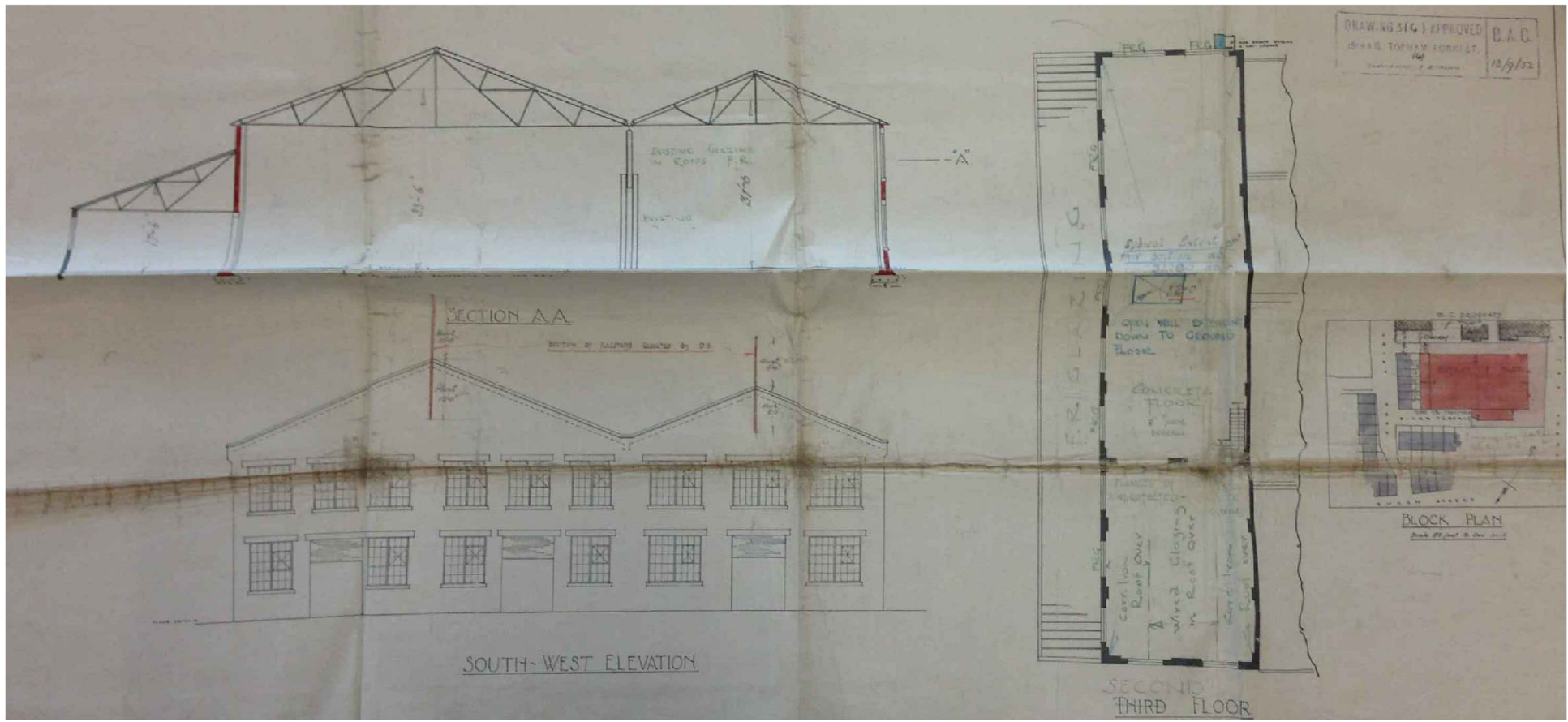
Fig. 9

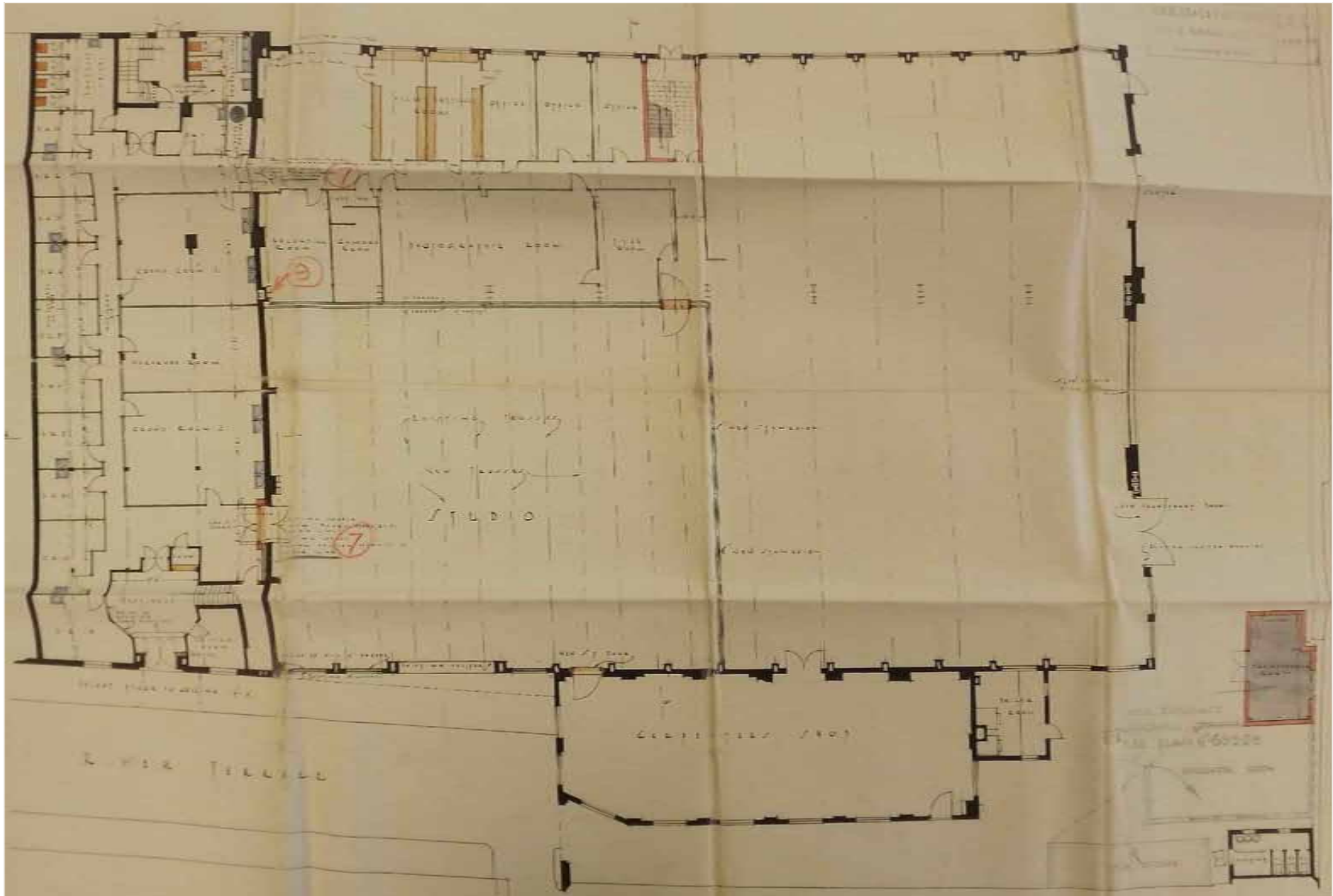


© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 10
Project Ref: 6431	Jan 2014	Ground floor plan of 'Riverside Wharf' in 1932.	
Report Ref: 2013334	Drawn by: MGS	Existing fabric is shown in red, proposed work in black.	



© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 11
Project Ref: 6431	Jan 2014	Northeast and northwest elevation drawings of 'Riverside Wharf' in 1932	
Report Ref: 2013334	Drawn by: MGS		

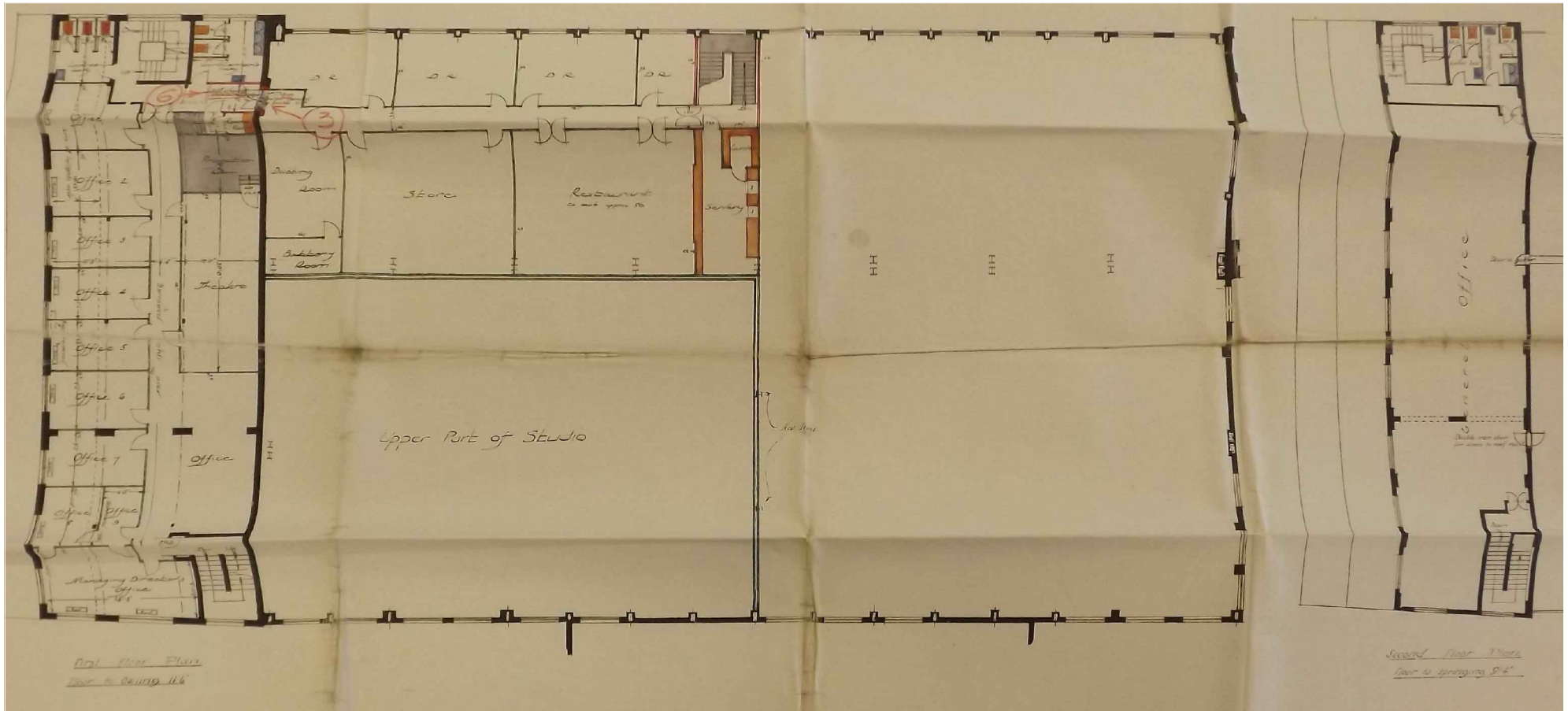




© Archaeology South-East
 Project Ref: 6431 Jan 2014
 Report Ref: 2013334 Drawn by: MGS

Riverside Studios and Queens Wharf, Crisp Road, Hammersmith
 1933 ground floor plan of the Triumph Film Studios

Fig. 13



© Archaeology South-East

Project Ref: 6431

Jan 2014

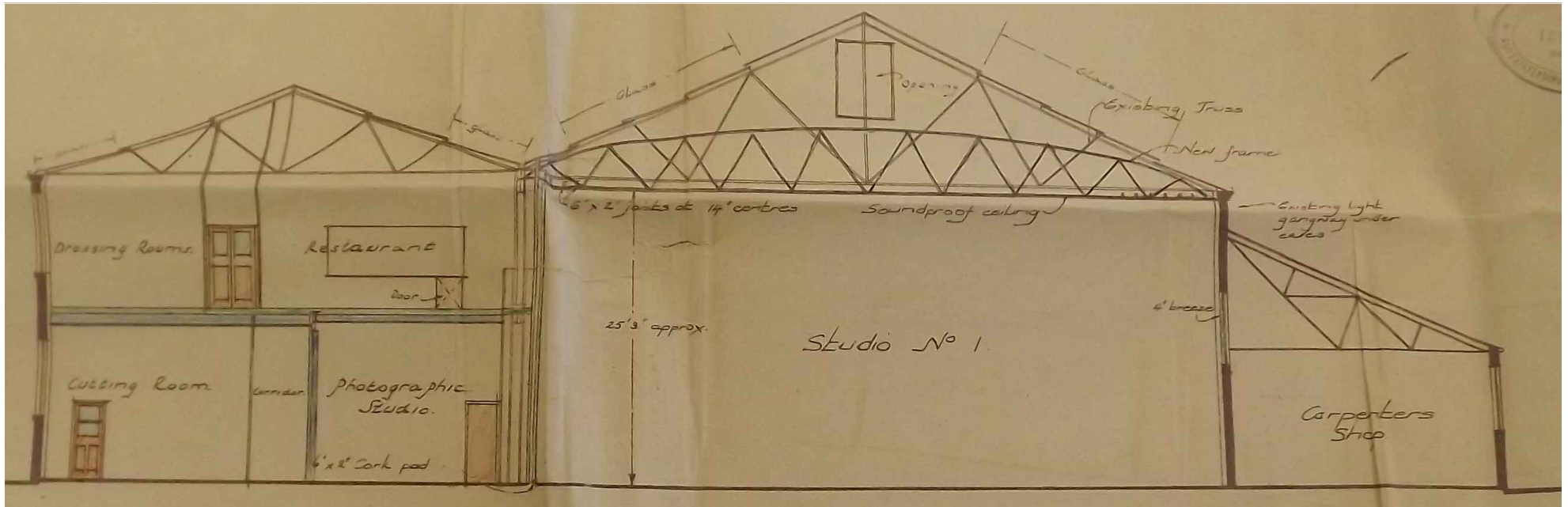
Report Ref: 2013334

Drawn by: MGS

Riverside Studios and Queens Wharf, Crisp Road, Hammersmith

1933 first and second floor plan of the Triumph Film Studios

Fig. 14



© Archaeology South-East

Project Ref: 6431

Jan 2014

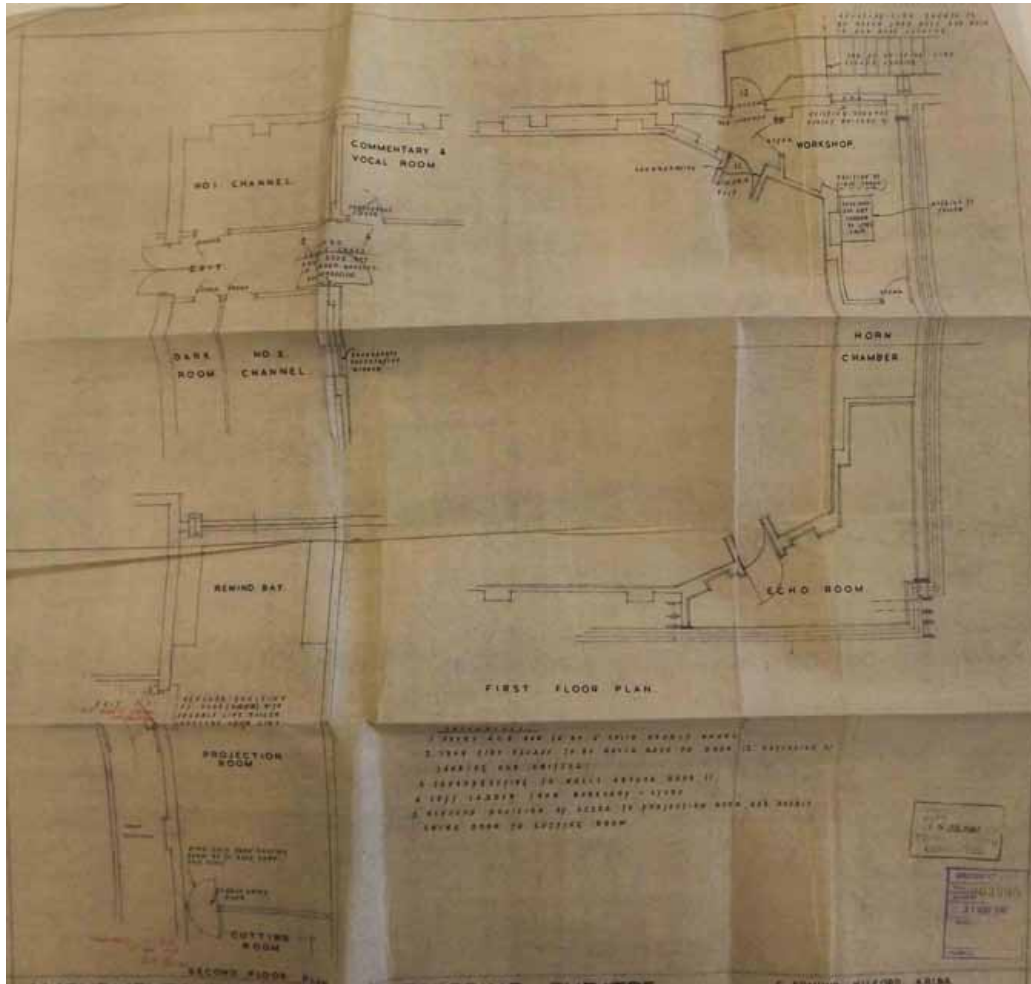
Report Ref: 2013334

Drawn by: MGS

Riverside Studios and Queens Wharf, Crisp Road, Hammersmith

1933 Section drawing of the Triumph Film Studios

Fig. 15

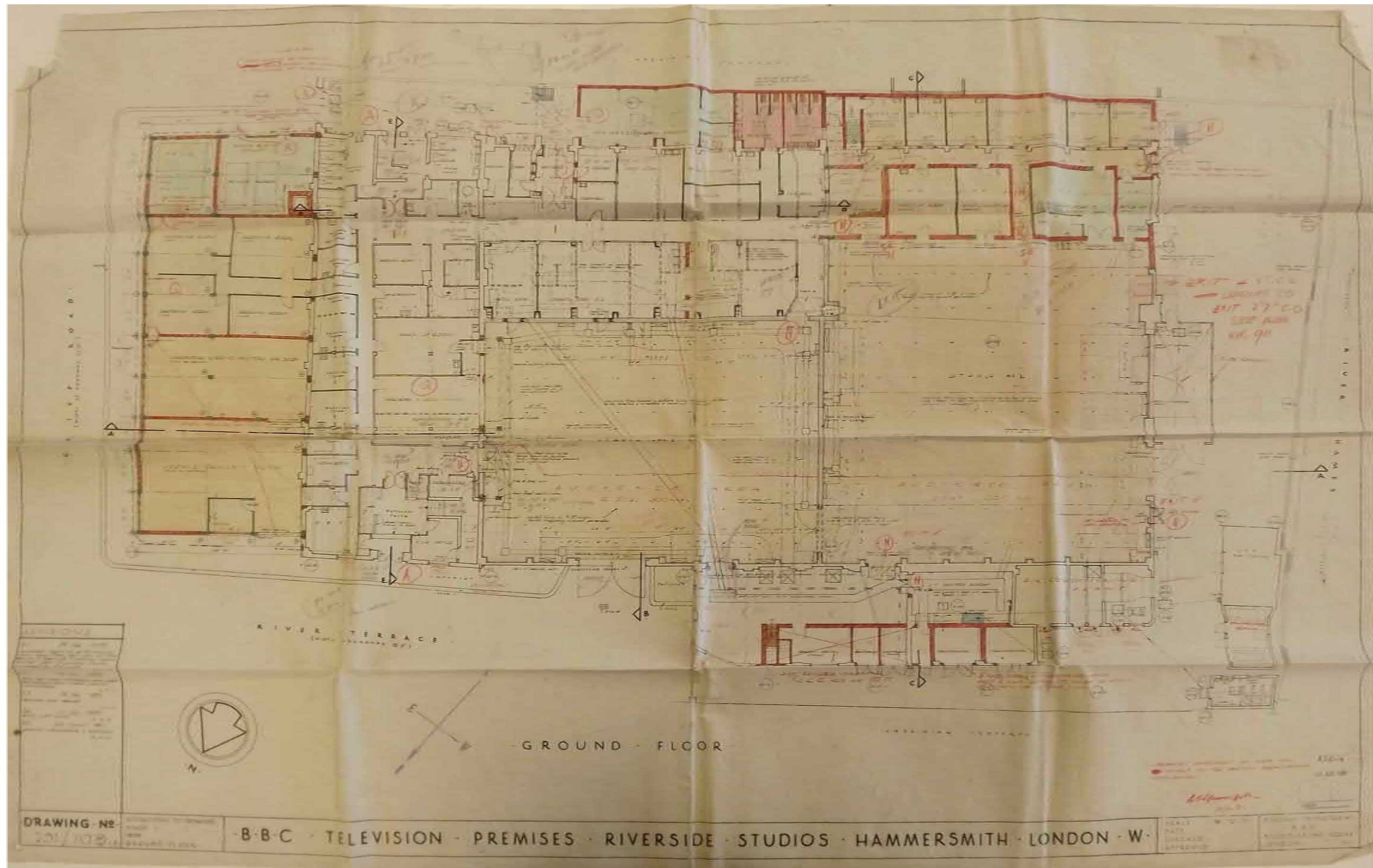


Plan of the proposed Triumph Film Studios dubbing theatre, 1936

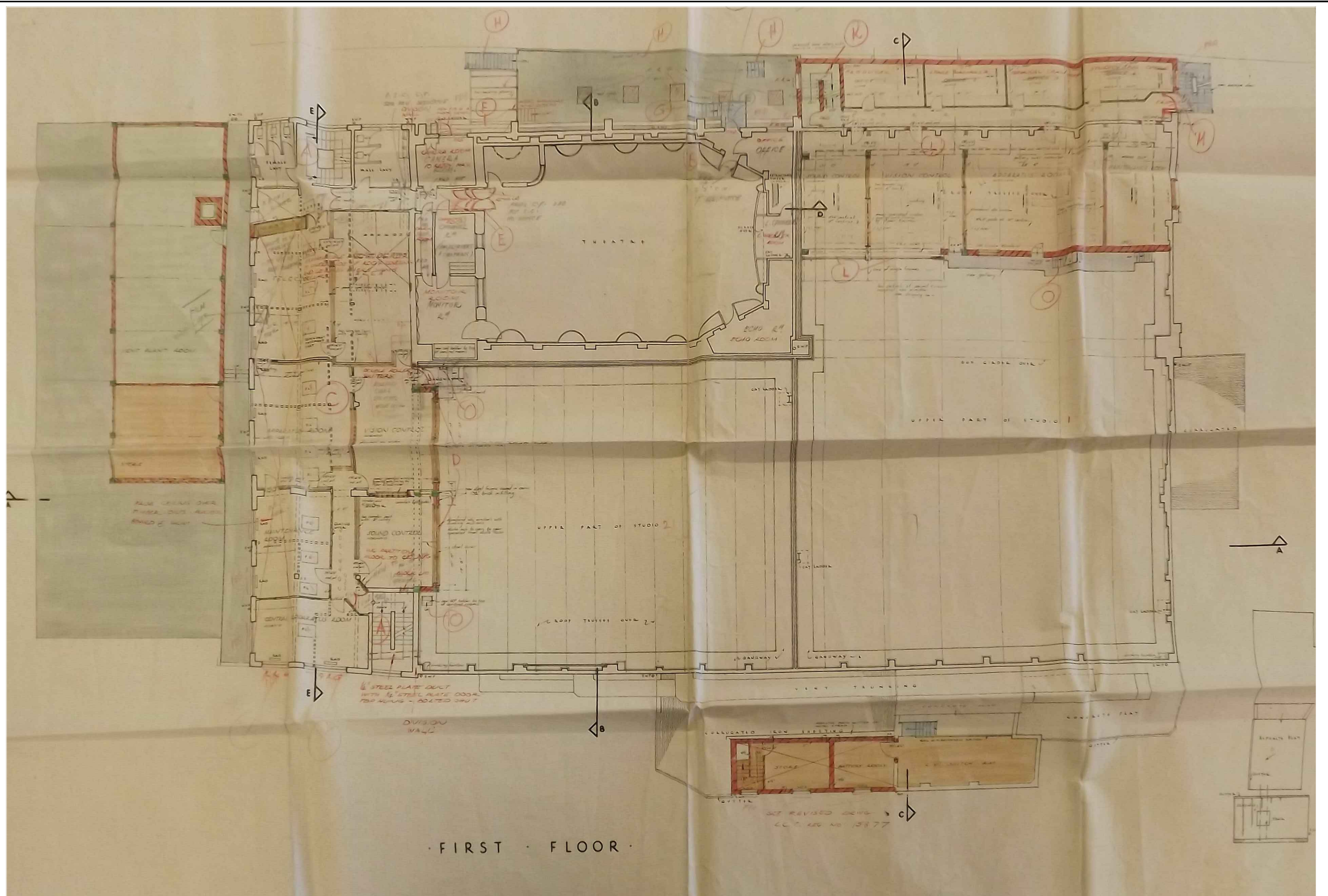


Live orchestral accompaniment in the cinema, evoking its origins in the 1930s as a film dubbing studio

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 17
Project Ref: 6431	Jan 2014	The 1936 Triumph Film Studios Dubbing Theatre	
Report Ref: 2013334	Drawn by: MGS		

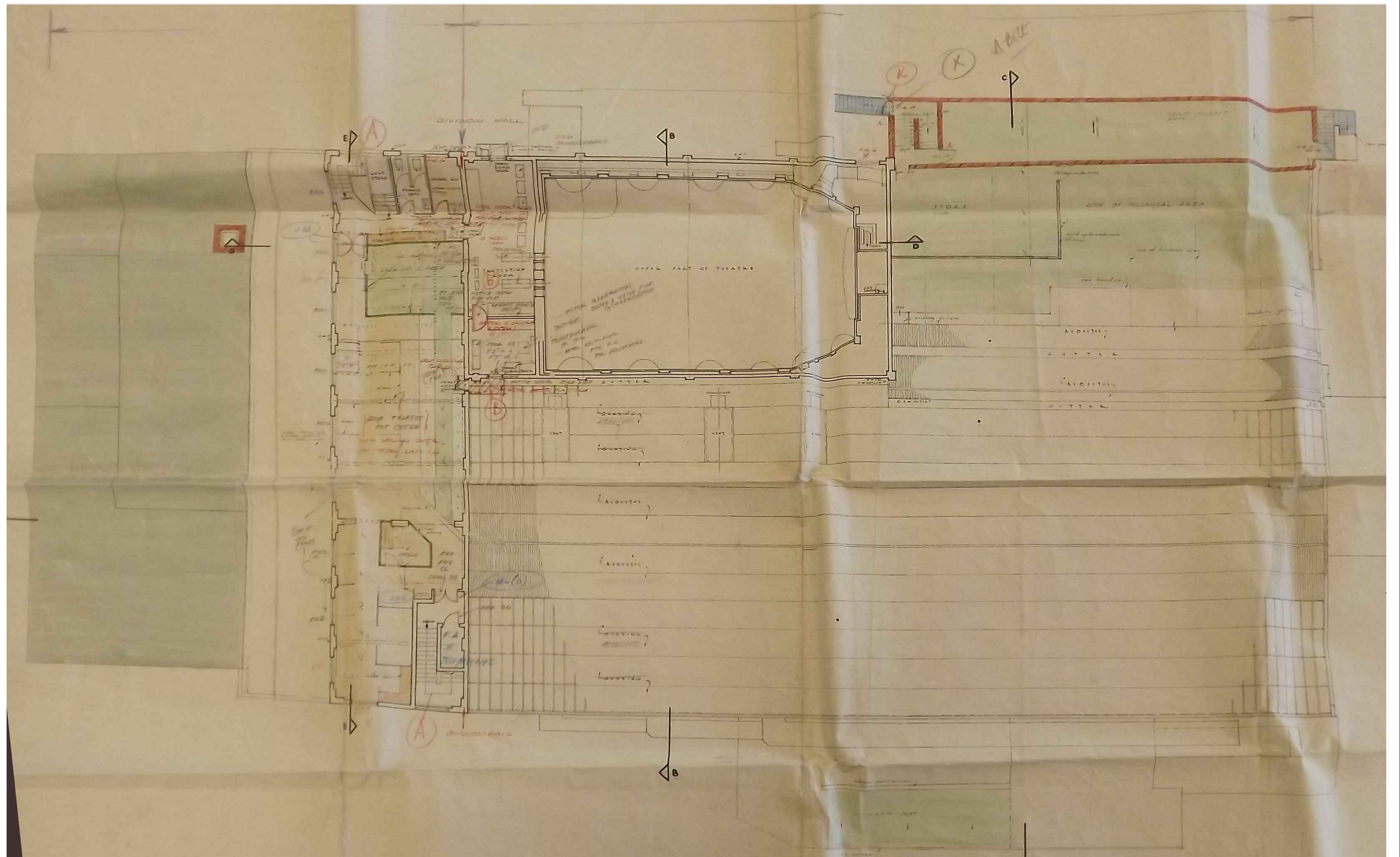


© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 18
Project Ref: 6431	January 2014	Ground Plan of the Riverside Studios for the BBC (1955)	
Report Ref: 2013334	Drawn by: MGS		

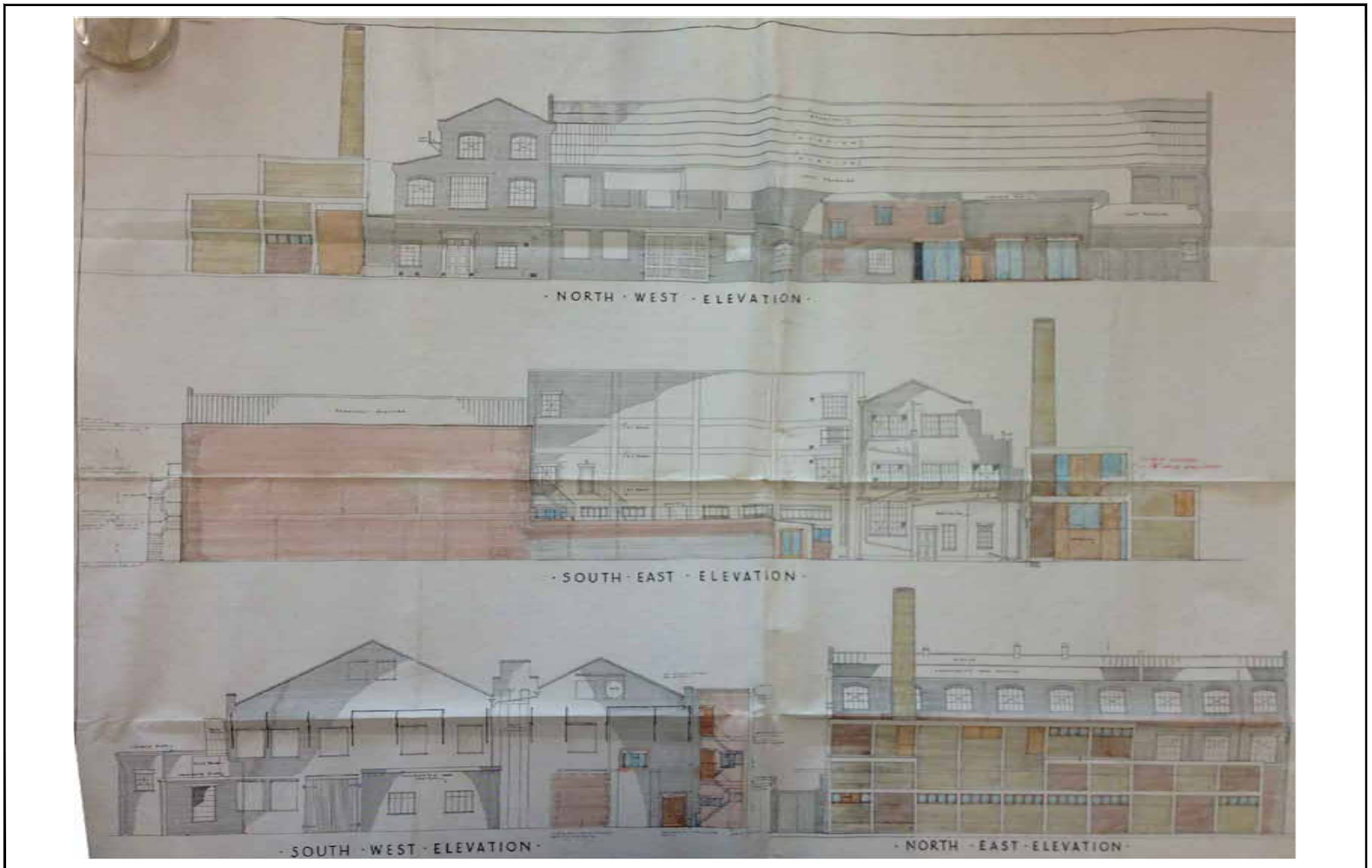


· FIRST · FLOOR ·

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 19
Project Ref: 6431	January 2014	First Floor Plan of the Riverside Studios for the BBC (1955)	
Report Ref: 2013334	Drawn by: MGS		



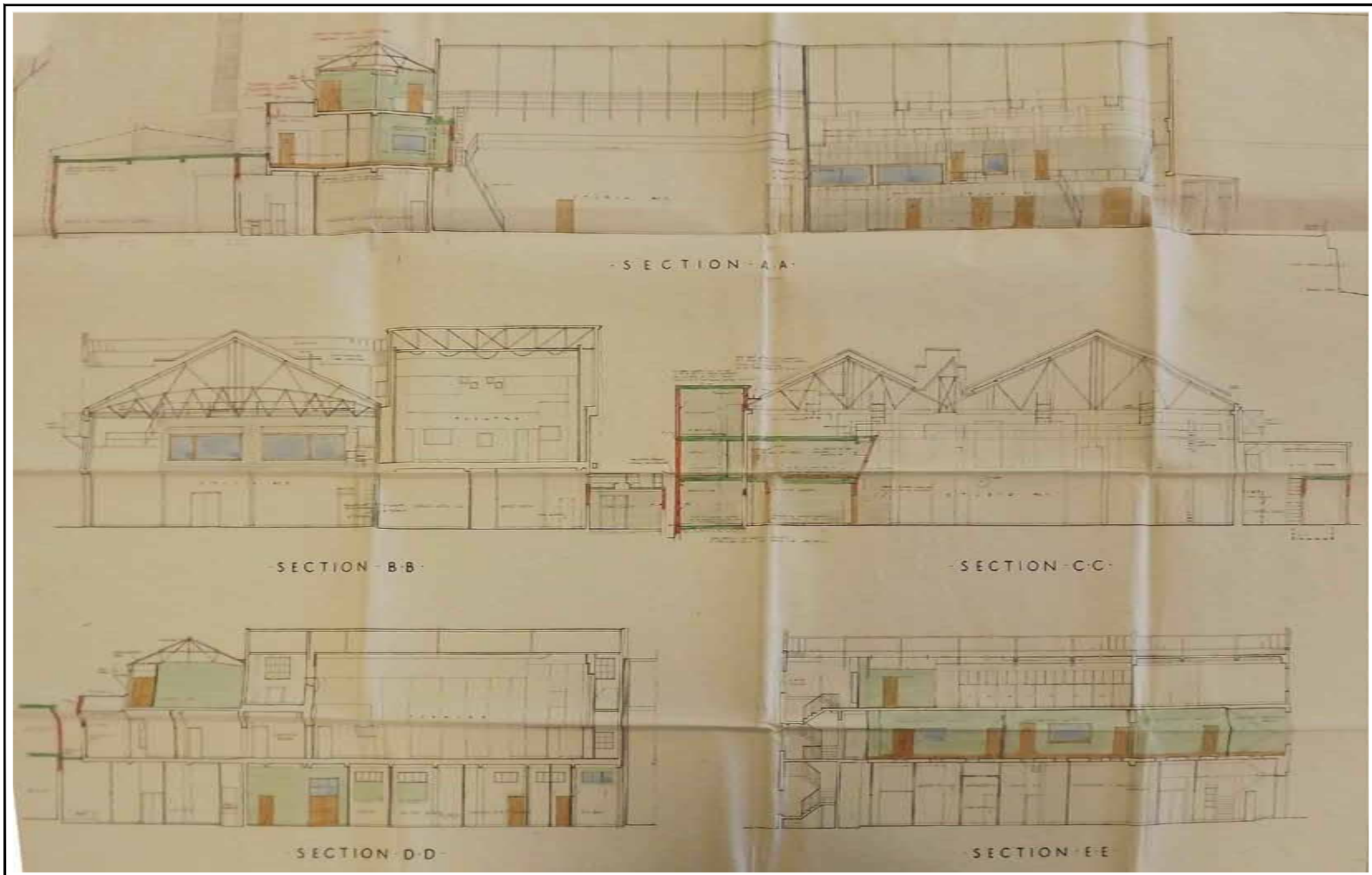
© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 20
Project Ref: 6431	January 2014	Second Floor Plan of the Riverside Studios for the BBC (1955)	
Report Ref: 2013334	Drawn by: MGS		



© Archaeology South-East
 Project Ref: 6431 Jan 2014
 Report Ref: 2013334 Drawn by: MGS

Riverside Studios and Queens Wharf, Crisp Road, Hammersmith
 Elevation drawings of the Riverside Studios for the BBC (1955)

Fig. 21



© Archaeology South-East

Project Ref: 6431

Jan 2014

Report Ref: 2013334

Drawn by: MGS

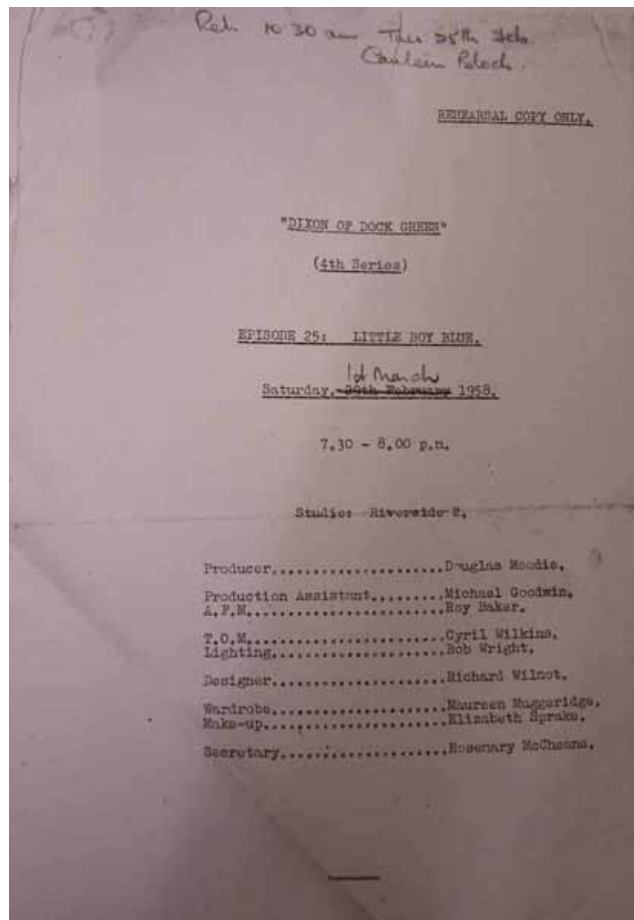
Riverside Studios and Queens Wharf, Crisp Road, Hammersmith

Section drawings of the Riverside Studios for the BBC (1955)

Fig. 22



Filming *Dixon of Dock Green* at the Riverside



A script for *Dixon of Dock Green*, March 1st 1958

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 23
Project Ref: 6431	Jan 2014	<i>Dixon of Dock Green</i> at the Riverside	
Report Ref: 2013334	Drawn by: MGS		

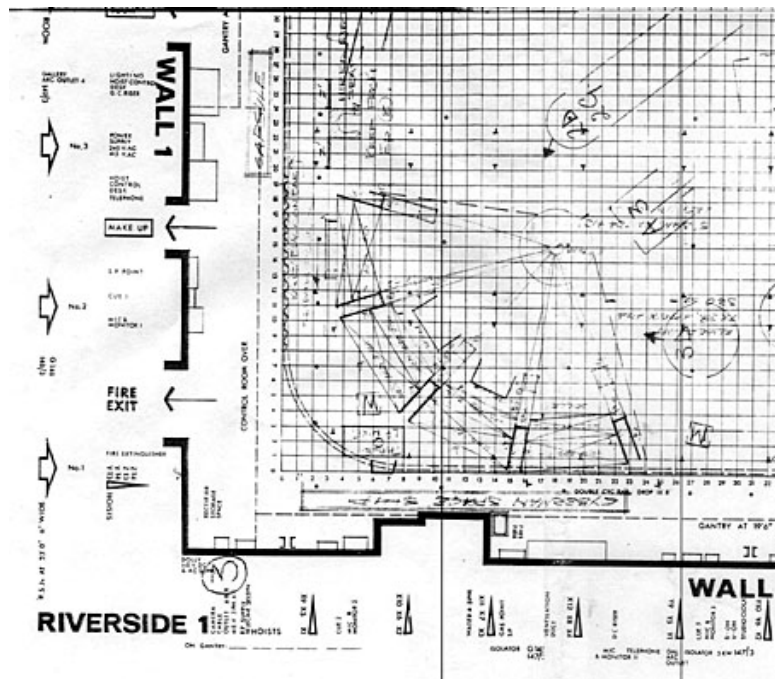


The first Dalek lands on earth, filmed at the Riverside on 27 August 1964



The location of the first Dalek landing in front of the Riverside, viewed from Hammersmith Bridge

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 24
Project Ref: 6431	Jan 2014	Dr Who: The Daleks invade the Riverside	
Report Ref: 2013334	Drawn by: MGS		



The construction of a Cyberman spaceship in the east corner of Studio 1 for the 1966 episode cycle 'The Tenth Planet', the first to feature them and the last to star the first Doctor, William Hartnell.



The interior of the cyberman spaceship during 'The Tenth Planet'.



David Bowie performs in front of the exposed wall of Studio 1, September 8th 2003



Filming the Oxford and Cambridge Boat Race from the Riverside's terrace, March 29 2008

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 26
Project Ref: 6431	Jan 2014	Present-day production at the Riverside	
Report Ref: 2013334	Drawn by: MGS		

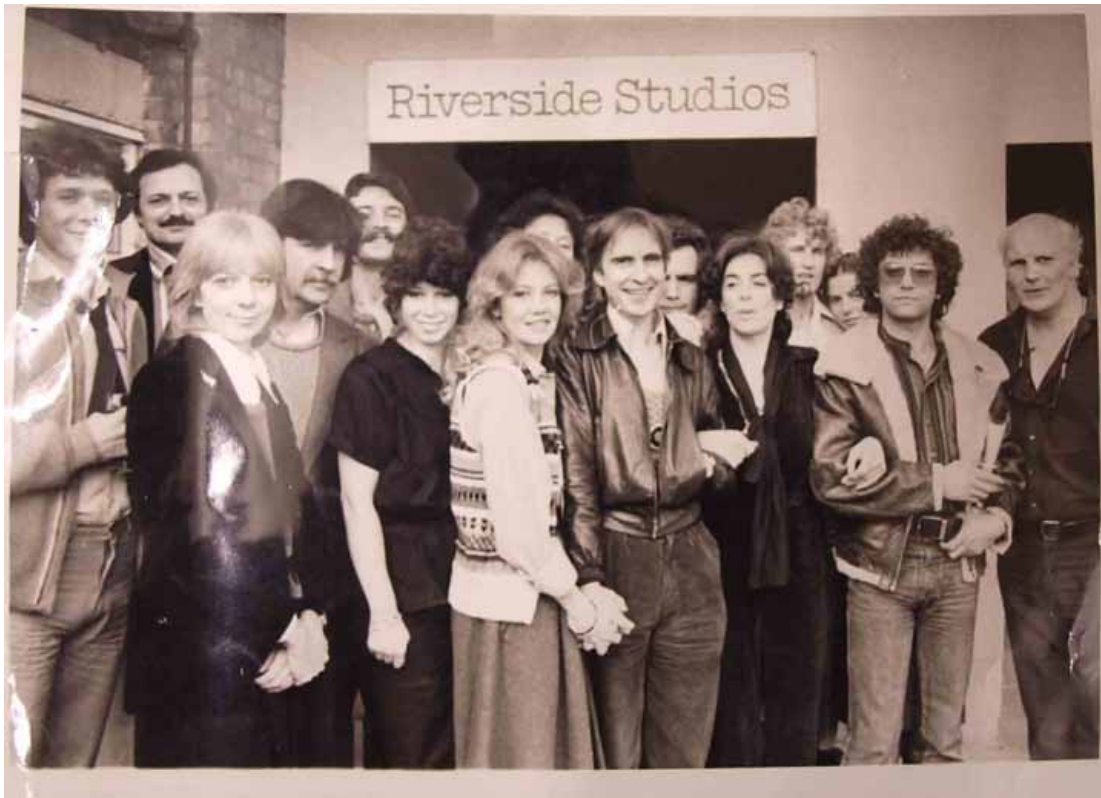


BBC staff outside the Chancellor's pub ('Studio 3'), Crisp Road, in 1967



Mementos of film and television production at the Riverside Studios on display in the Chancellor's pub

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 27
Project Ref: 6431	Jan 2014	The Chancellor's pub, Crisp Road	
Report Ref: 2013334	Drawn by: MGS		



The early days of theatre at the Riverside, including (from left) Alan Bates (4), Peter Gill (9), Brian Cox (10) and Martin Shaw (14)



Samuel Beckett at the Riverside in 1986

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 28
Project Ref: 6431	Jan 2014	Theatre Production at the Riverside	
Report Ref: 2013334	Drawn by: MGS		



Art installation in the Crisp Road Block prior to its conversion: 'Reflections', September 1985



Artists at work at the Riverside, c. 1980. View from outside of the southeast elevation of the Three Storey Block, looking northeast towards Crisp Road

© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 29
Project Ref: 6431	Jan 2014	Art and artists at the Riverside	
Report Ref: 2013334	Drawn by: MGS		

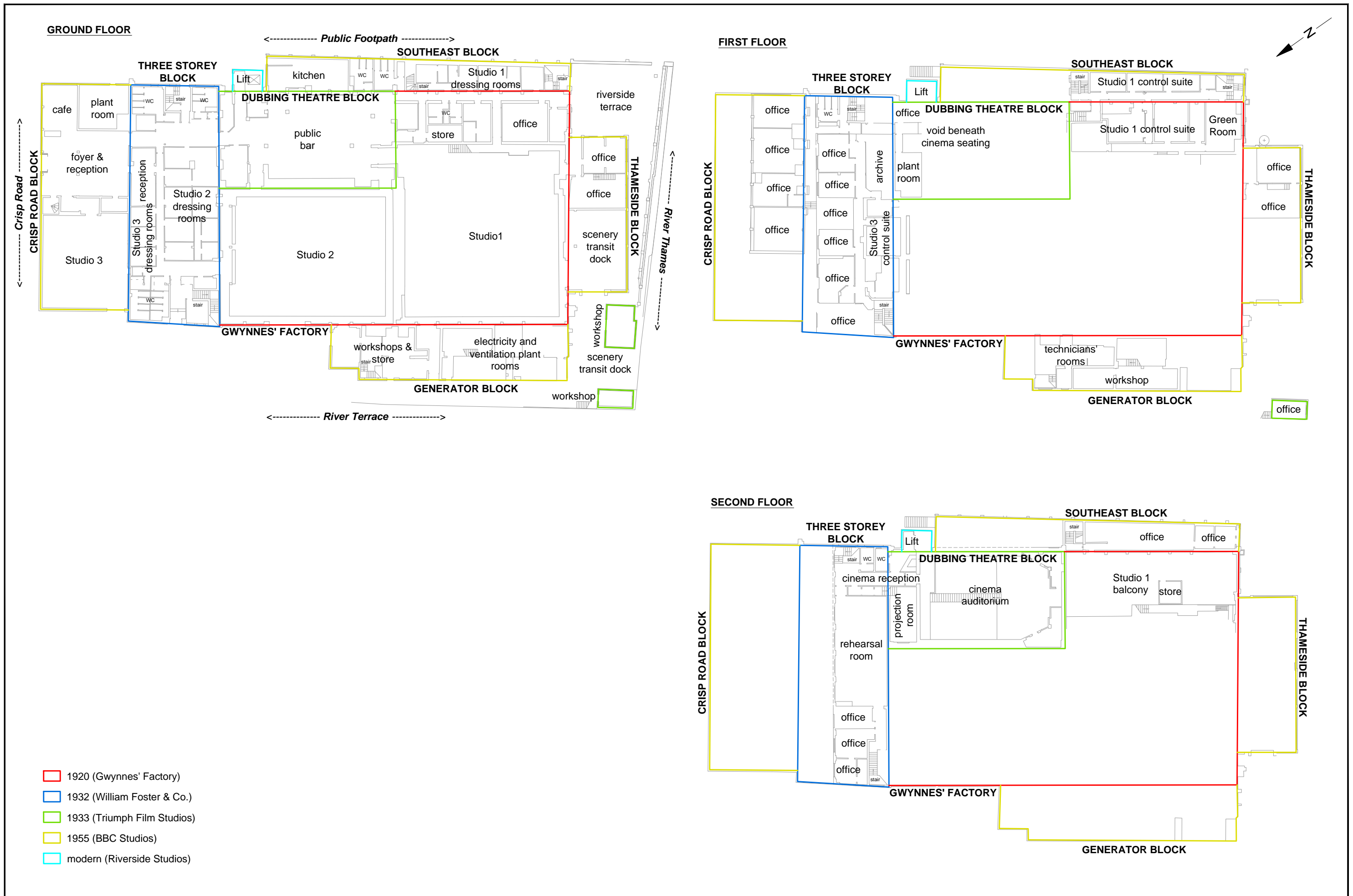


The TFI Friday 'Bar' in the late-1990s: Chris Evans interviews Gerri Halliwell

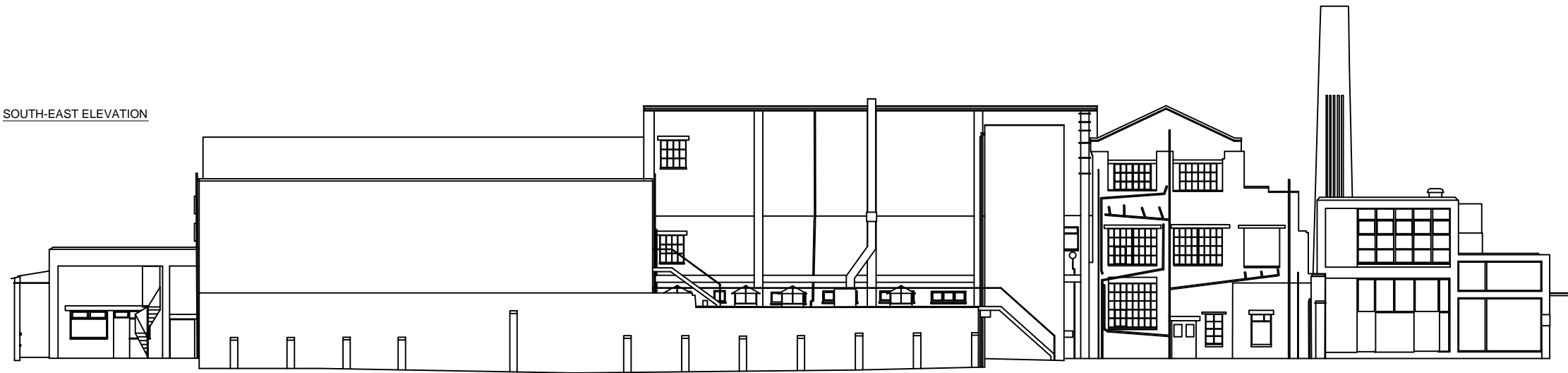


The present appearance of the TFI Friday 'Bar': note even the window has changed

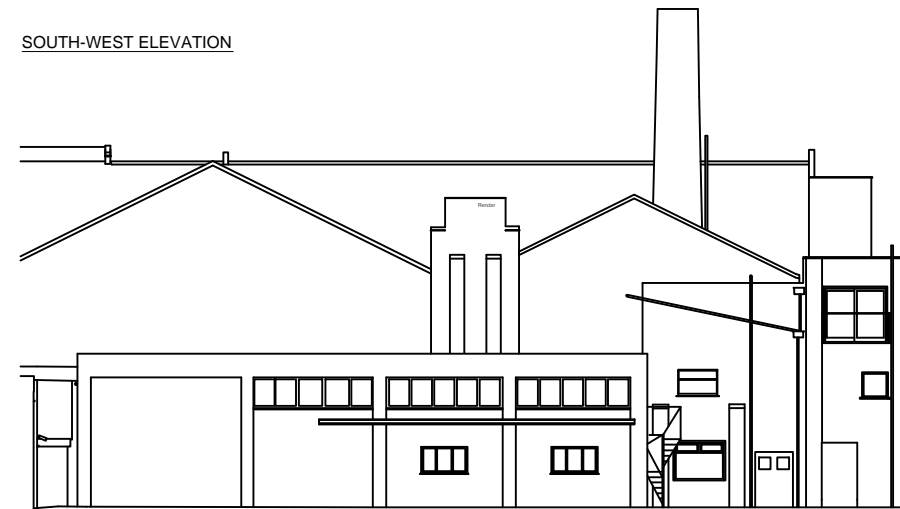
© Archaeology South-East		Riverside Studios and Queens Wharf, Crisp Road, Hammersmith	Fig. 30
Project Ref: 6431	Jan 2014	TFI Friday at the Riverside	
Report Ref: 2013334	Drawn by: MGS		



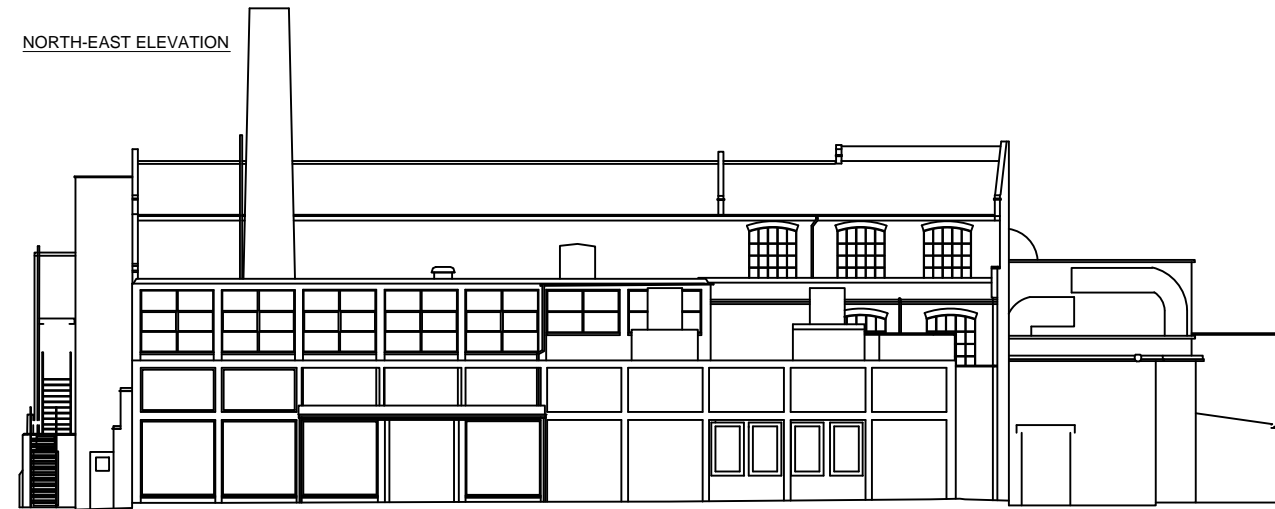
SOUTH-EAST ELEVATION



SOUTH-WEST ELEVATION



NORTH-EAST ELEVATION



NORTH-WEST ELEVATION





Plate 1 (6431-008)

The site's Thames frontage, showing the rendered southwest elevation of Gwynne's factory behind the later Thameside Block. The box truss superstructure lies between the pitch of its two roofs.



Plate 2 (6431-010)

Northeast elevation of Gwynne's factory and the Three Storey Block. The wide doorway to the right of the image is original to the factory's construction.



Plate 3 (6431-023)

Original doorway in southwest wall of Gwynne's factory, now linking Studio 1 to the Thameside Block.



Plate 4 (6431-242)

Boundary wall between Queens Wharf and Riverside Studios. Note the changes in brickwork which preserve the long wall of the 1932 Gwynne's Factory extension.



Plate 5 (6431-005)

The Generator Block, facing south. Note the stub of the 1932 Gwynne's Factory extension where the Generator Block abuts the 1920 factory building.



Plate 6 (6431-002)

Crisp Road and Three Storey Blocks, facing south.



Plate 7 (6431-224)

Three Storey Block, southeast elevation. The lift shaft to the cinema lies on the left hand side of the image.



Plate 8 (6431-225)

Dubbing Theatre, southeast elevation. The Southeastern Block lies to the left hand side of the image; the lift shaft on the right.



Plate 9 (6431-128)

Thameside Block, facing north



Plate 10 (6431-192)

Thameside Block, one of a pair of relic 1933 structures encased by the modern corrugated shelter. Facing northwest.



Plate 11 (6431-006)

Generator Block, northwest elevation. Many of its doors have been re-used from the previous structure.



Plate 12 (6431-140)

Main reception, facing north



Plate 13 (6431-149)

Main reception, entrance to cinema. Facing southeast.



Plate 14 (6431-141)

Main reception café, facing east.



Plate 15 (6431-146)

Main reception: passage to bar. The boarded hatches to the old reception as visible on the right of the image.



Plate 16 (6431-091)

Stair at southeast end of the Three Storey Block, from main reception to cinema. Facing south.



Plate 17 (6431-152)

Public bar beneath cinema, facing east.



Plate 18 (6431-154)

Northwest wall of public bar: art gallery in place of Yoko Ono's 'graffiti wall'.



Plate 19 (6431-129)

River terrace and Thameside Block, facing northwest, with Hammersmith Bridge in the background.

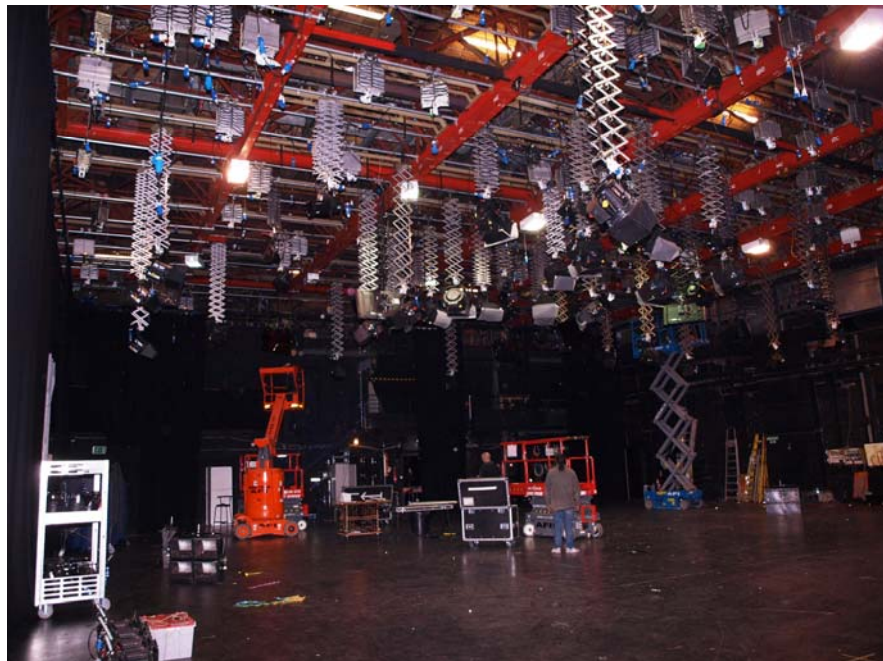


Plate 20 (6431-012)

Studio 1, facing south

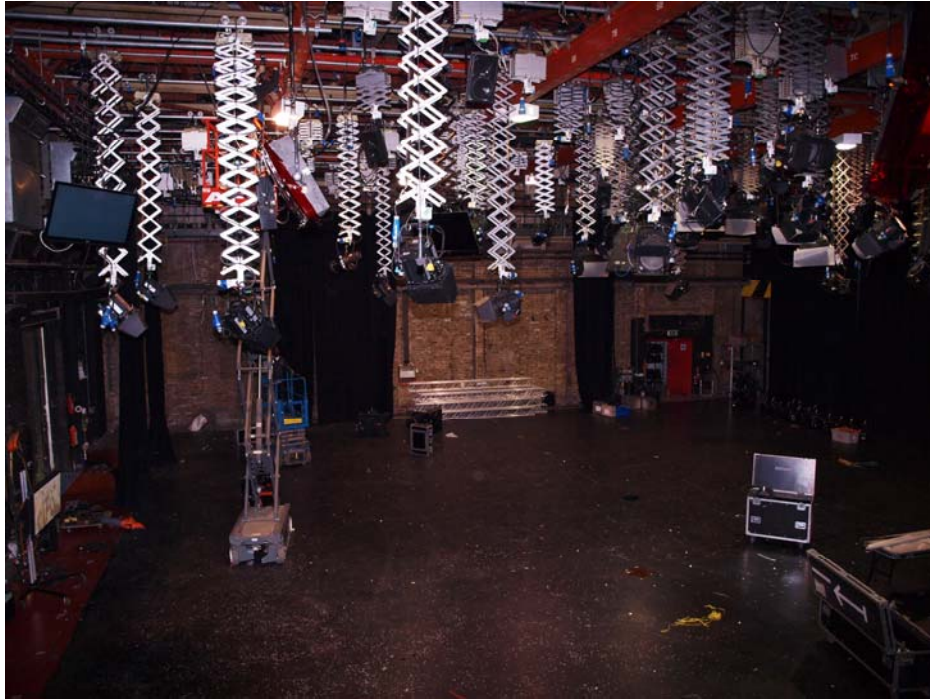


Plate 21 (6431-028)

Studio 1, facing northwest



Plate 22 (6431-186)

Studio 1, exposed northwest wall



Plate 23 (6431-029)

Studio 1 box truss, facing north

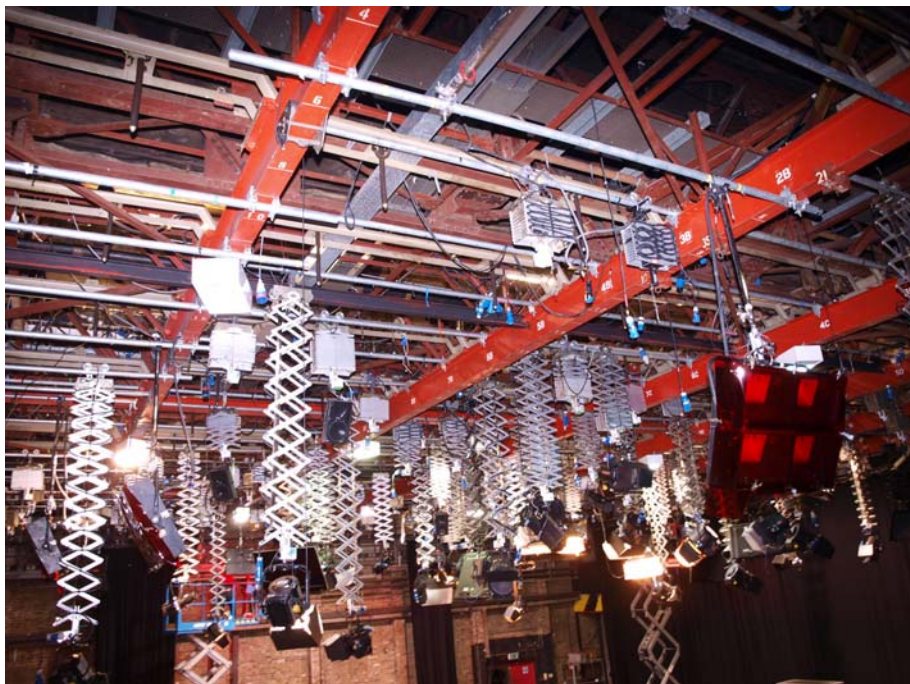


Plate 24 (6431-040)

Studio 1 lighting grid, from below



Plate 25 (6431-180)

Studio 1 lighting grid, from above. It is independent of the factory's original iron roof trusses, which run across the upper part of the image.



Plate 26 (6431-057)

Generator Block, ground floor store facing southeast. Note the timber-covered cable trench in the floor connecting Studios 1 and 2.



Plate 27 (6431-181)

Studio 1 ventilation duct in roof-space, with southwest wall of Gwynnes' Factory in the background.

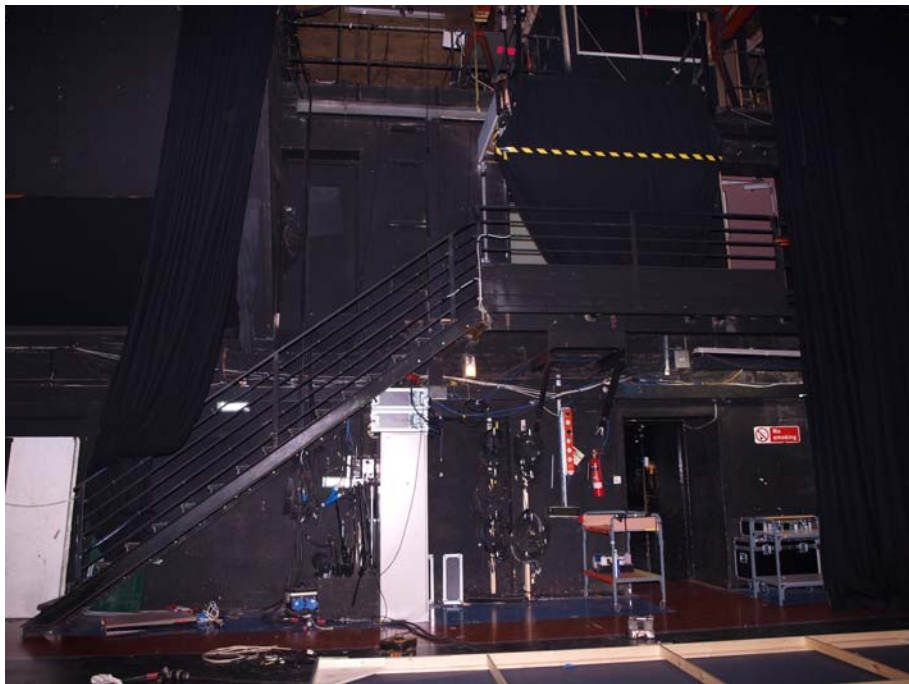


Plate 28 (6431-185)

Studio 1: stair to production suite, looking southeast.



Plate 29 (6431-161)

Studio 1, dressing room 1, looking east



Plate 30 (6431-189)

Studio 1 scenery dock, housed within the Thameside Block, facing east.



Plate 31 (6431-216)

Thameside Block, ground floor: former Studio 1 scenery dock now subdivided into offices.



Plate 32 (6431-193)

Studio 1 scenery dock, looking south towards a relict 1933 brick shed encased by the modern corrugated shelter.



Plate 33 (6431-053)

Studio 2, looking east



Plate 34 (6431-199)

Studio 2, looking north



Plate 35 (6431-201)

Studio 2, showing the 1933 bowstring truss supporting the 1955 lighting grid (right side of image), adjacent to the roof truss of the 1920 factory building (left side of image). View looking southeast.



Plate 36 (6431-068)

Original doorway between Studio 2 and the 1932 Three Storey Block.

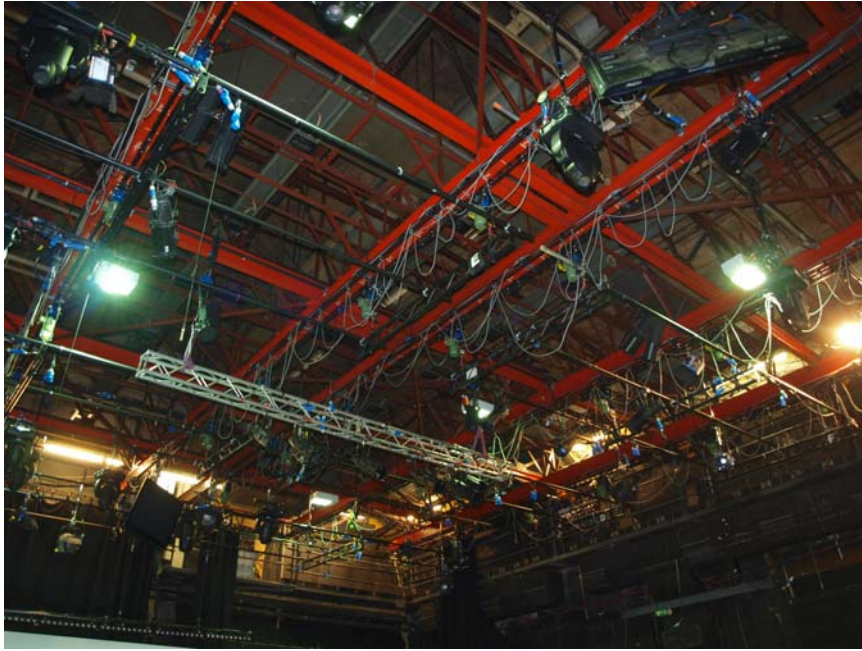


Plate 37 (6431-051)

Studio 2 lighting grid from below.



Plate 38 (6431-139)

Three Storey Block: Studio 2 dressing room 16.



Plate 39 (6431-075)

1933 stair at the northwest end of the Three Storey Block.



Plate 40 (6431-134)

Generator Block: BBC-era switches.



Plate 41 (6431-046)

Studio 3, looking southwest



Plate 42 (6431-113)

Cinema auditorium, looking southwest

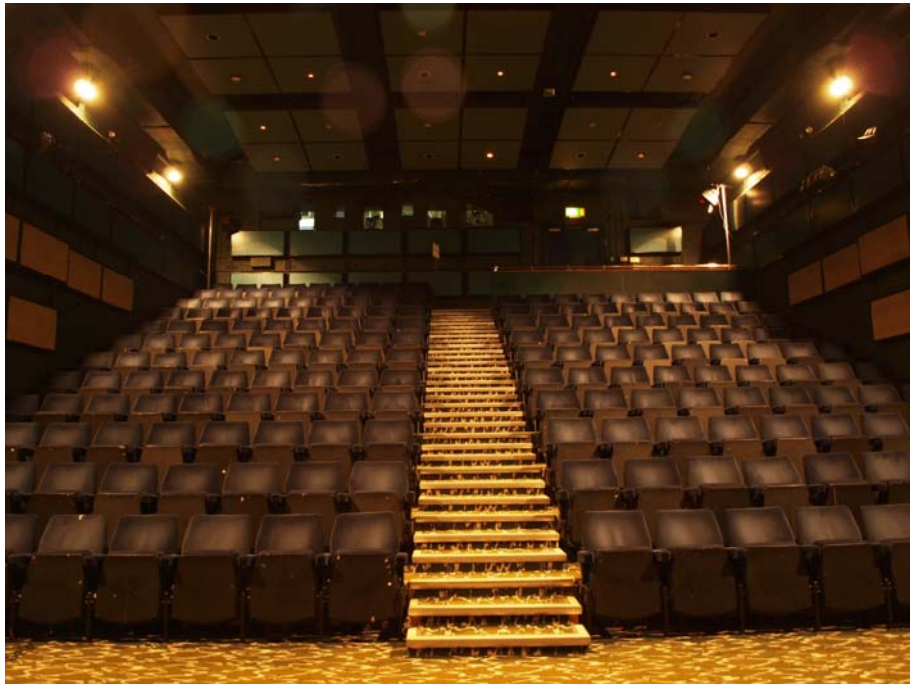


Plate 43 (6431-117)

Cinema auditorium, looking northwest



Plate 44 (6431-106)

Cinema projection room, looking northwest



Plate 45 (6431-175)

Studio 1, first floor production control room



Plate 46 (6431-041)

Studio 1, first floor Green Room.



Plate 47 (6431-101)

Studio 2, first floor production control room



Plate 48 (6431-093)

Crisp Road Block/Three Storey Block connecting first floor walkway, looking southeast



Plate 49 (6431-078)

Three Storey Block, first floor office, looking north



Plate 50 (6431-062)

Generator Block, first floor technicians' room



Plate 51 (6431-205)

Three Storey Block, second floor former rehearsal space, looking southeast



Plate 52 (6431-234)

Queen's Wharf (left) and Riverside Studios (centre), viewed from Hammersmith Bridge, looking northeast.



Plate 53 (6431-237)

Queen's Wharf, northwest elevation



Plate 54 (6431-239)

Queen's Wharf, view from Crisp Road/Queen Caroline Street, looking south.



Plate 55 (6431-155)

Public Bar: entrance to Studios 1 & 2

Appendix 1: OASIS Data Collection Form

Project details

Project name	RIVERSIDE STUDIOS and QUEENS WHARF, CRISP ROAD, HAMMERSMITH: HISTORIC BUILDING RECORD
Short description of the project	<p>In December 2013 Archaeology South-East (a division of the Centre for Applied Archaeology, UCL) carried out a programme of historic building recording at Riverside Studios, Crisp Road, Hammersmith, and of the Queen's Wharf office building adjacent, in anticipation of the proposed redevelopment of the existing buildings on the site. Riverside Studios originated in 1920 as Gwynnes' pump factory, which was expanded in 1932 by William Foster and Co. and sold the following year to the Triumph Film Company, marking the start of the site's long association with film and television production. It was adapted for this purpose with the insertion of two film studios and a dubbing theatre, together attendant offices, dressing rooms and technical facilities. The Studios were acquired by the BBC in 1954 as a temporary facility anticipating the construction of nearby Television Centre, and as a test-bed for various technical aspects of that place, particularly lighting and production control. The building was extended on all four sides and its studios variously refitted and expanded, making this the most technologically advanced facility of its type in the world at that time. A number of notable productions followed, such as Dr Who and Z-Cars, until the BBC disposed on the site in 1974. It became an arts and theatre space, and latterly has returned to television production. Adjacent to the Riverside Studios lies Queens wharf, the site of which had been acquired by the engineering firm Rosser and Russell Ltd in 1874. Their factory here was replaced by the present office building in the 1970s.</p>
Project dates	Start: 01-12-2013 End: 31-01-2014
Previous/future work	No / Not known
Any associated project reference codes	2013334 - Contracting Unit No. CRP14 - Site Code
Type of project	Building Recording
Site status	None
Current Land use	Industry and Commerce 2 - Offices
Monument type	ART AND EDUCATION VENUE Modern
Monument type	COMMERCIAL OFFICE Modern
Significant Finds	NONE None
Methods & techniques	"Annotated Sketch","Photographic Survey"
Prompt	Planning condition
Project location	
Country	England
Site location	Greater London Hammersmith And Fulham. Riverside Studios and

	Queen's Wharf, Crisp Road
Postcode	W6 9RL
Study area	6500.00 Square metres
Site coordinates	TQ 23131 78103 51 0 51 29 16 N 000 13 34 W Point
Project creators	
Name of Organisation	Archaeology South-East
Project brief originator	CgMs Consulting
Project design originator	CgMs Consulting
Project director/manager	Ron Humphrey
Project supervisor	Michael Shapland
Type of sponsor/funding body	Developer
Project archives	
Physical Archive Exists?	No
Physical Archive recipient	n/a
Digital Archive recipient	LAARC
Digital Media available	"Images raster / digital photography","Text"
Paper Archive recipient	LAARC
Paper Media available	"Correspondence","Plan","Report"
Entered by	Michael Shapland (m.shapland@ucl.ac.uk)
Entered on	9 January 2014

Appendix 2: Index of Digital Photographs



6431-001
Crisp Road Block. Facing SW



6431-002
Crisp Road Block. Facing S



6431-003
Crisp Road Block. Facing SE



6431-004
Three Storey Block. Facing S



6431-005
Generator Block. Facing S



6431-006
Generator Block. Facing S



6431-007
Thames Frontage. Facing N



6431-008
Thames Frontage. Facing NE



6431-009
Three Storey Block. Facing SE



6431-010
Three Storey Block and Gwynnes' Factory. Facing E



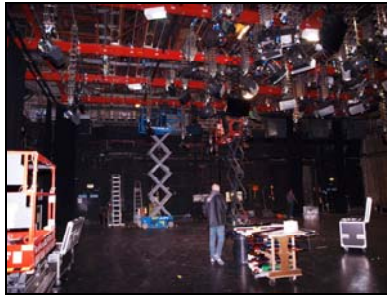
6431-011
Studio 2: Weighting a Camera Boom. Facing S



6431-012
Studio 1. Facing S



6431-013
Studio 1. Facing S



6431-014
Studio 1. Facing SW



6431-015
Studio 1. Facing NW



6431-016
Studio 1. Facing N



6431-017
Studio 1. Facing NE



6431-018
Studio 1. Facing E



6431-019
Studio 1 Lighting Grid. Facing NE



6431-020
Studio 1 River Terrace Entrance. Facing S



6431-021
Studio 1 Box Truss Pier. Facing SW



6431-022
Studio 1 Ventillation Ducts. Facing S



6431-023
Studio 1 Gwynnes' Factory Entrance. Facing SW



6431-024
Studio 1 Gwynnes' Factory Entrance. Facing NE



6431-025
Studio 1 Exposed Wall. Facing NW



6431-026
Studio 1 Exposed Wall. Facing NW



6431-027
Studio 1: Stair to Production Suite. Facing S



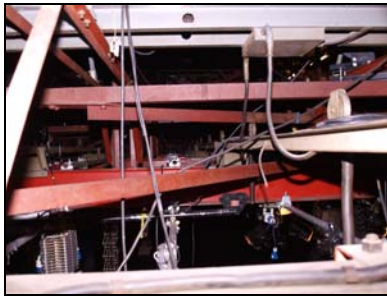
6431-028
Studio 1. Facing NW



6431-029
Studio 1 Box Truss. Facing N



6431-030
Studio 1 Blocked Window. Facing W



6431-031
Studio 1 Lighting Grid. Facing NE



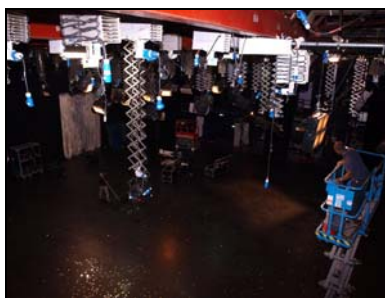
6431-032
Studio 1 Lighting Grid Support. Facing SE



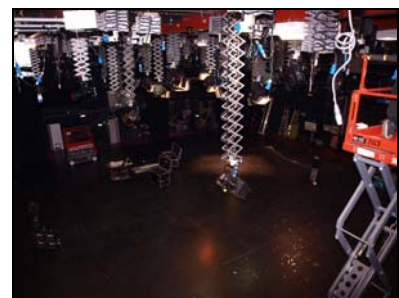
6431-033
Studio 1 Gantry. Facing NE



6431-034
Studio 1 Blocked Window. Facing NE



6431-035
Studio 1: Sweeping Top of the Pops Confetti. Facing E



6431-036
Studio 1. Facing S



6431-037
Studio 1: Lighting Grid and Gantry. Facing SW



6431-038
Studio 1: Lighting Grid and Roof Truss. Facing SW



6431-039
Studio 1: Second Floor Balcony. Facing S



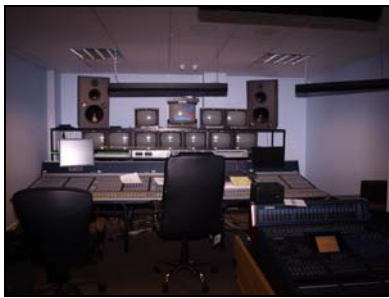
6431-040
Studio 1 Lighting Grid. Facing NW



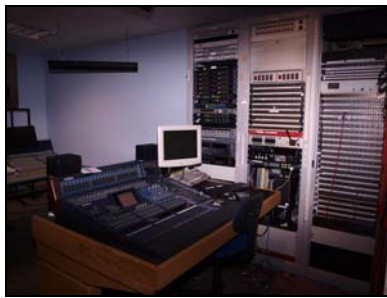
6431-041
Studio 1 Green Room. Facing S



6431-042
Studio 1 Server Room. Facing SE



6431-043
Studio 1 Sound Control Room. Facing SE



6431-044
Studio 1 Sound Control Room. Facing S



6431-045
Studio 3. Facing NE



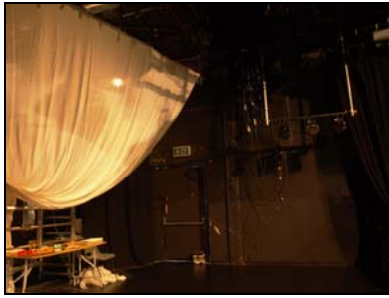
6431-046
Studio 3. Facing SW



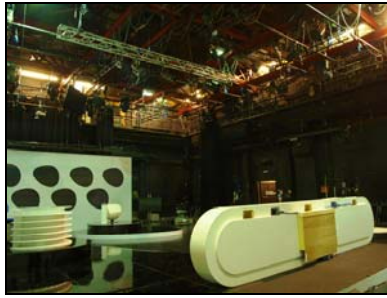
6431-047
Studio 3. Facing SW



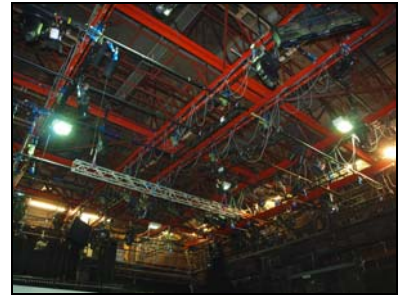
6431-048
Studio 3 Lighting Grid. Facing NW



6431-049
Studio 3 River Terrace Entrance. Facing NW



6431-050
Studio 2. Facing W



6431-051
Studio 2 Lighting Grid. Facing W



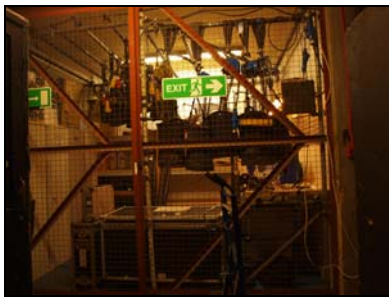
6431-052
Studio 2. Facing N



6431-053
Studio 2. Facing E



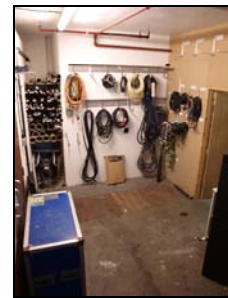
6431-054
Studio 2 Set Detail. Facing SW



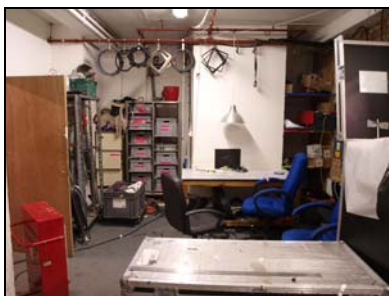
6431-055
Generator Block: Ground Floor Store. Facing NW



6431-056
Generator Block: Abutting Gwynnes' Factory. Facing E



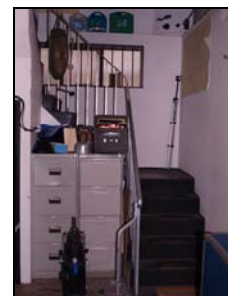
6431-057
Generator Block: Ground Floor Store. Facing SE



6431-058
Generator Block: Ground Floor Workshop. Facing SE



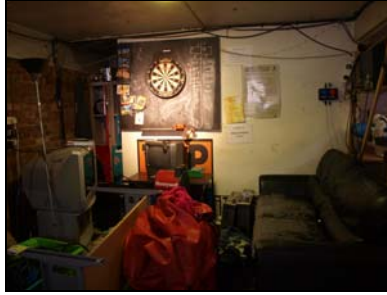
6431-059
Generator Block: Detail of Store. Facing SW



6431-060
Generator Block: Stair to First Floor. Facing NW



6431-061
*Generator Block: First Floor Recreation.
Facing SW*



6431-062
*Generator Block: First Floor Recreation.
Facing SE*



6431-063
*Generator Block: First Floor Workshop.
Facing SE*



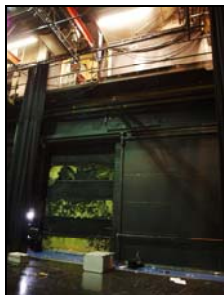
6431-064
*Generator Block: First Floor Kitchen.
Facing NW*



6431-065
*Studio 2: Gwynnes' Factory Internal Wall.
Facing SE*



6431-066
Studio 2. Facing S



6431-067
Studio 2. Facing SW



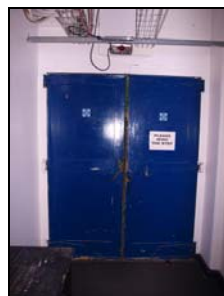
6431-068
*Studio 2: Doorway to Three Storey Block.
Facing N*



6431-069
*Studio 2: Doorway to Three Storey Block.
Facing NE*



6431-070
*Studio 2: Make-Up and Wardrobe.
Facing SE*



6431-071
*Three Storey Block: Doorway to Studio 2.
Facing SW*



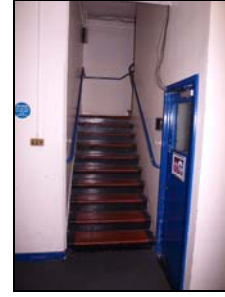
6431-072
*Corridor to Studio 2 Dressing Rooms.
Facing SE*



6431-073
Studio 2 Dressing Room. Facing E



6431-074
Studio 2 Dressing Room: Ceiling Detail. Facing E



6431-075
Three Storey Block: NW Stair. Facing SW



6431-076
Three Storey Block: NW Stair. Facing NW



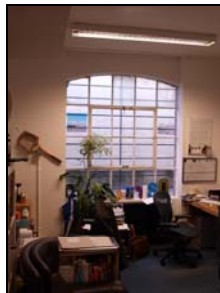
6431-077
Three Storey Block: First Floor Corridor. Facing SE



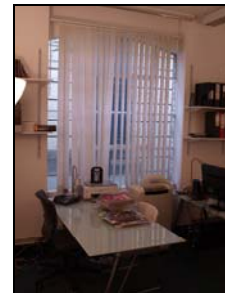
6431-078
Three Storey Block: First Floor Office. Facing N



6431-079
Three Storey Block: First Floor Office. Facing SW



6431-080
Three Storey Block: First Floor Office. Facing NE



6431-081
Three Storey Block: First Floor Office. Facing NE



6431-082
Three Storey Block: First Floor Corridor. Facing SE



6431-083
Three Storey Block: Electrical Switches. Facing W



6431-084
Three Storey Block: Doorway to Cinema. Facing SW



6431-085
*Cinema: First Floor Plant Room
Entrance. Facing NW*



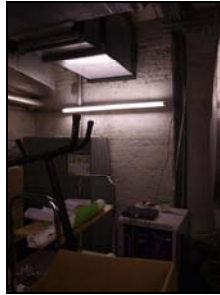
6431-086
Cinema: Film Poster Storage. Facing SW



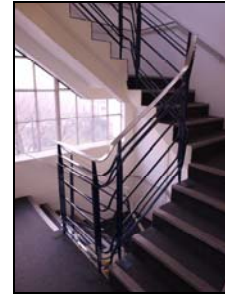
6431-087
Cinema: First Floor Office. Facing S



6431-088
*Cinema: First Floor Plant Room. Facing
W*



6431-089
*Cinema: First Floor Plant Room. Facing
S*



6431-090
Three Storey Block: SE Stair. Facing S



6431-091
Three Storey Block: SE Stair. Facing S



6431-092
Three Storey Block: SE Stair. Facing N



6431-093
*Crisp Road Block/Three Storey Block
Walkway. Facing SE*



6431-094
*Crisp Road Block/Three Storey Block
Walkway. Facing SE*



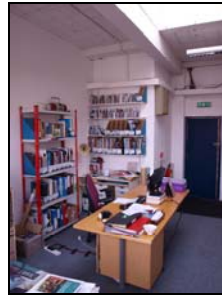
6431-095
*Crisp Road Block/Three Storey Block
Walkway. Facing E*



6431-096
*Crisp Road Block/Three Storey Block
Walkway. Facing NW*



6431-097
*Crisp Road Block: First Floor Office.
Facing NE*



6431-098
*Crisp Road Block: First Floor Office.
Facing SW*



6431-099
Studio 2: Lighting Gallery. Facing S



6431-100
*Cinema: Void Beneath Banked Seating.
Facing SW*



6431-101
Studio 2: Production Gallery. Facing W



6431-102
Studio 2: Production Gallery. Facing N



6431-103
Studio 2: Production Gallery. Facing SW



6431-104
*Cinema Projection Room Entrance.
Facing SW*



6431-105
Cinema Projection Room. Facing NW



6431-106
Cinema Projection Room. Facing SE



6431-107
Detail of Film Editing Reel. Facing NW



6431-108
Cinema Projection Equipment. Facing SW



6431-109
Cinema Projection Room: Film Reels. Facing SE



6431-110
Three Storey Block: SE Stair. Facing E



6431-111
Second Floor: Corridor to Cinema. Facing SW



6431-112
Second Floor: Cinema Reception. Facing S



6431-113
Cinema. Facing SW



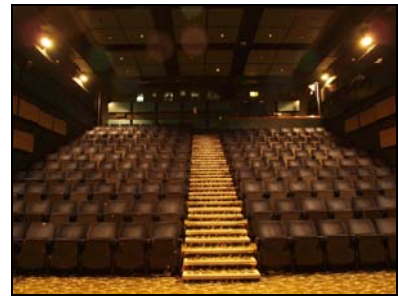
6431-114
Cinema. Facing NW



6431-115
Cinema: Ushers' Seats. Facing E



6431-116
Cinema. Facing SW



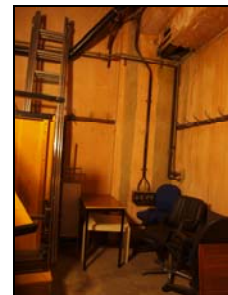
6431-117
Cinema. Facing NE



6431-118
Cinema. Facing E



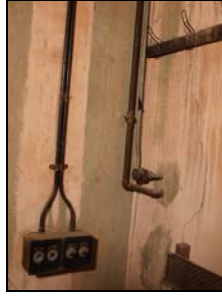
6431-119
Cinema Opening Plaque. Facing W



6431-120
Cinema: Store Behind Screen. Facing SW



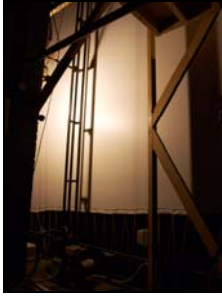
6431-121
Cinema: Store Behind Screen. Facing SE



6431-122
Cinema: Detail of 1933 Fixtures. Facing SW



6431-123
Roof of Southeastern Block. Facing E



6431-124
Cinema: Rear of Screen. Facing NW



6431-125
Southeastern Block: Riverside Frontage. Facing NE



6431-126
Thameside Block. Facing N



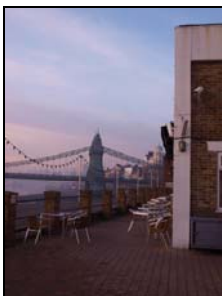
6431-127
River Terrace: Boundary Wall. Facing SE



6431-128
Thameside Block. Facing NW



6431-129
River Terrace and Thameside Block. Facing NW



6431-130
View from River Terrace. Facing W



6431-131
View from River Terrace. Facing SW



6431-132
Thameside Block. Facing N



6431-133
*River Terrace: Entrance to Scenery
Dock. Facing NW*



6431-134
*Generator Block: BBC-Era Switches.
Facing NE*



6431-135
*Generator Block: Ventillation Plant.
Facing SE*



6431-136
Generator Block. Facing NE



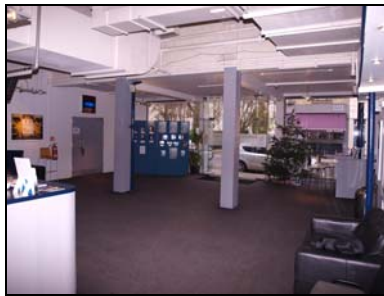
6431-137
*Three Storey Block: First Floor Archive.
Facing NW*



6431-138
*Studio 2 Dressing Room: Ceiling Detail.
Facing SW*



6431-139
Studio 2 Dressing Room. Facing NE



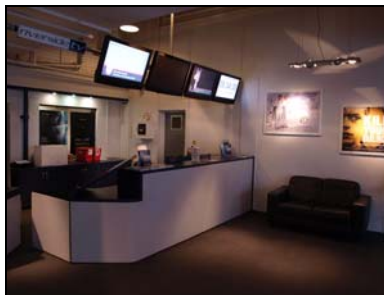
6431-140
Main Reception. Facing N



6431-141
Main Reception: Café. Facing E



6431-142
Main Reception. Facing SW



6431-143
Main Reception. Facing W



6431-144
Main Reception. Facing SW



6431-145
Main Reception: Entrance to Studio 3.
Facing NW



6431-146
Main Reception: Passage to Bar. Facing SW



6431-147
Hatches to Former Reception. Facing W



6431-148
Main Reception: Entrance to Bar. Facing SW



6431-149
Main Reception: Entrance to Cinema.
Facing SE



6431-150
Public Bar. Facing SW



6431-151
Public Bar. Facing N



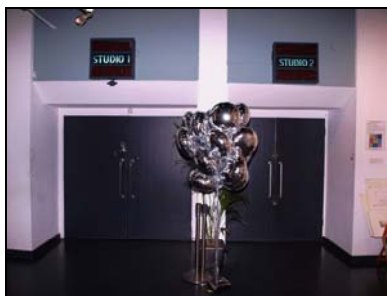
6431-152
Public Bar. Facing E



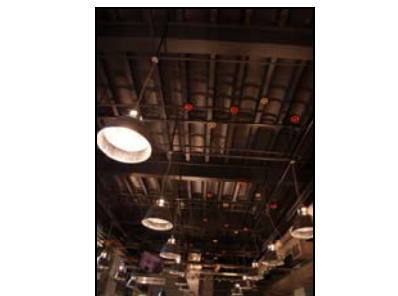
6431-153
Public Bar. Facing S



6431-154
Public Bar: Art Gallery. Facing W



6431-155
Public Bar: Entrance to Studio 1 & 2.
Facing SW



6431-156
Public Bar: Detail of Ceiling. Facing SW



6431-157
Public Bar. Facing SW



6431-158
Ground Floor WC: BBC-Era Door Swing. Facing W



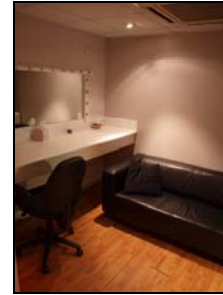
6431-159
Corridor to Studio 1 Dressing Rooms. Facing SW



6431-160
Public Bar Store Room. Facing NW



6431-161
Studio 1 Dressing Room. Facing E



6431-162
Studio 1 Dressing Room. Facing S



6431-163
Studio 1 Make-Up. Facing SE



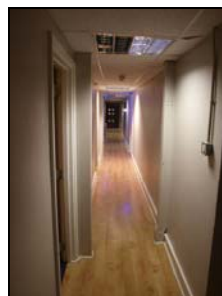
6431-164
Studio 1 Client Production Office. Facing N



6431-165
Studio 1 Client Production Office. Facing E



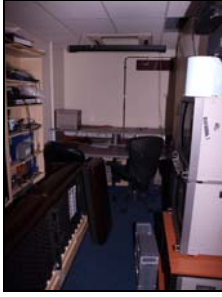
6431-166
Southeastern Block: NE Stair. Facing NE



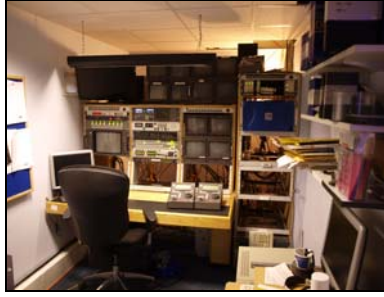
6431-167
Corridor through Studio 1 Production Suite. Facing SW



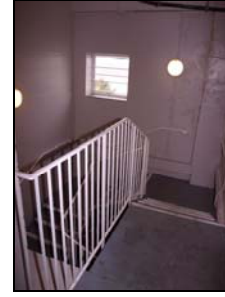
6431-168
Studio 1 Production Suite: Stair to Cinema. Facing NE



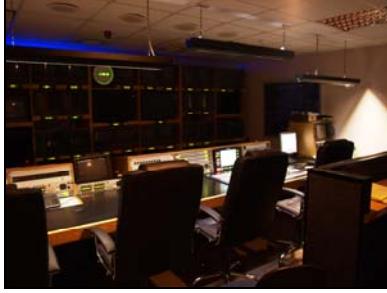
6431-169
Studio 1: Audio-Visual Room. Facing SW



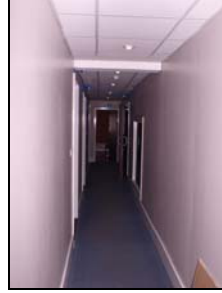
6431-170
Studio 1: VT & EVS Room. Facing SW



6431-171
Southeastern Block: SW Stair. Facing S



6431-172
Studio 1: Sound Control Room. Facing N



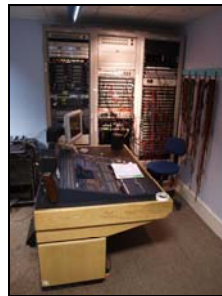
6431-173
Corridor through Studio 1 Production Suite. Facing SW



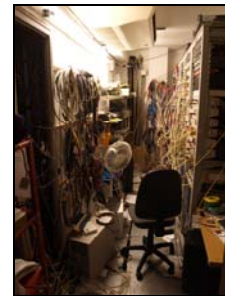
6431-174
Studio 1: Vision Control Room. Facing E



6431-175
Studio 1: Production Control Room. Facing SE



6431-176
Studio 1: Production Control Room. Facing SW



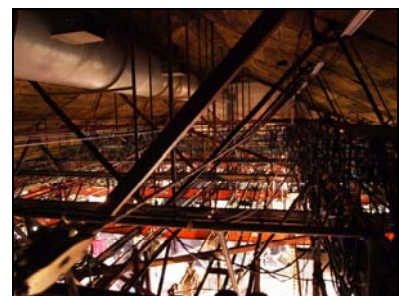
6431-177
Studio 1: Server Room. Facing SE



6431-178
Studio 1: Green Room. Facing S



6431-179
Studio 1: Dismantling Scenery. Facing N



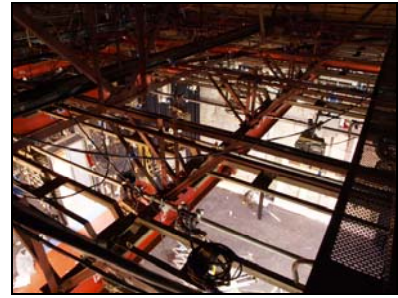
6431-180
Studio 1: Roof Trusses and Lighting Grid. Facing NE



6431-181
Studio 1 Roof: Ventilation Duct & Insulation. Facing SW



6431-182
Studio 1 Roof: Ventilation Duct & Insulation. Facing W



6431-183
Studio 1: Lighting Grid. Facing W



6431-184
Studio 1: Roof Trusses and Access Gantry. Facing SW



6431-185
Studio 1: Stair to Production Suite. Facing SE



6431-186
Studio 1: Exposed Wall. Facing NW



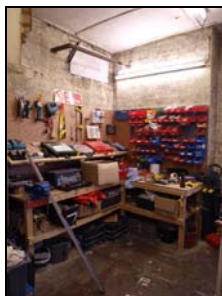
6431-187
Studio 1: Exposed Wall. Facing N



6431-188
Studio 1 Scenery Transit Dock. Facing NW



6431-189
Studio 1 Scenery Transit Dock. Facing E



6431-190
Studio 1 Scenery Transit Dock: Workshop. Facing S



6431-191
Studio 1 Scenery Transit Dock: Workshop. Facing W



6431-192
Studio 1 Scenery Transit Dock. Facing NW



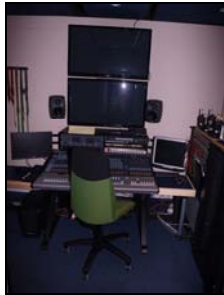
6431-193
Studio 1 Scenery Transit Dock. Facing S



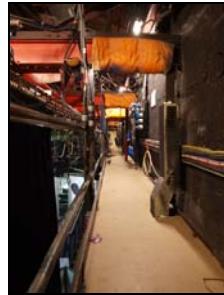
6431-194
Generator Block: Ventillation Louvre. Facing NE



6431-195
Cinema: First Floor Video Library. Facing W



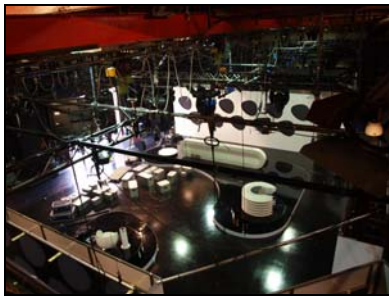
6431-196
Studio 2: Sound Gallery. Facing NW



6431-197
Studio 2: First Floor Gantry. Facing NE



6431-198
Studio 2: First Floor Gantry. Facing NW



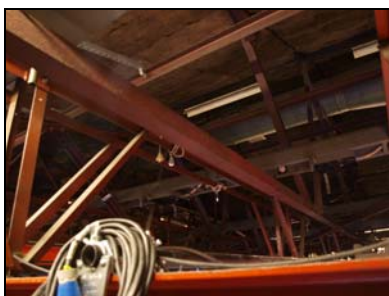
6431-199
Studio 2. Facing N



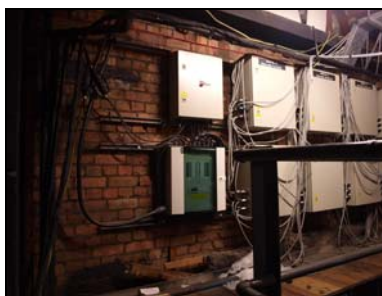
6431-200
Studio 2: Lighting Grid Bowstring Truss. Facing N



6431-201
Studio 2: Lighting Grid Bowstring Truss. Facing SE



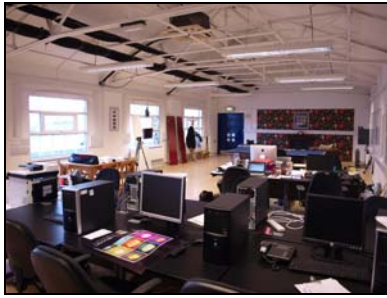
6431-202
Studio 2: Roof Truss. Facing E



6431-203
Studio 2: First Floor Gantry. Facing E



6431-204
Studio 2. Facing S



6431-205
Rehearsal Room. Facing SE



6431-206
Rehearsal Room. Facing SE



6431-207
Rehearsal Room. Facing NW



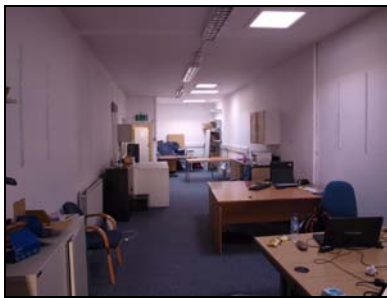
6431-208
Three Storey Block: Roofspace Tanks. Facing W



6431-209
Three Storey Block: Roofspace. Facing NW



6431-210
Southeastern Block: Second Floor Office. Facing SW



6431-211
Southeastern Block: Second Floor Office. Facing NE



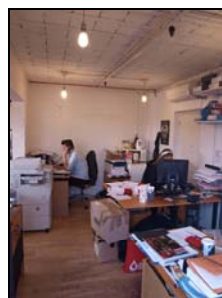
6431-212
SE Block: Second Floor Office Plant Capping. Facing W



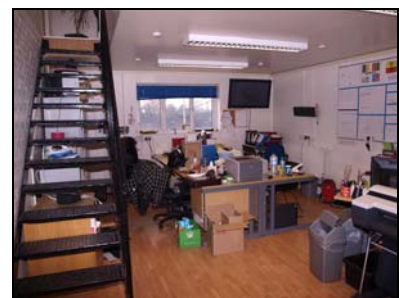
6431-213
Cinema: SE External Elevation. Facing NE



6431-214
Cinema: SE External Elevation Window. Facing NW



6431-215
Thameside Block: Ground Floor Office. Facing NW



6431-216
Thameside Block: Ground Floor Office. Facing SW



6431-217
*Thameside Block: First Floor Office.
Facing NE*



6431-218
*Thameside Block: First Floor Office.
Facing NE*



6431-219
*Thameside Block: First Floor Office.
Facing SW*



6431-220
*Generator Block: High Voltage Intake
Room. Facing SW*



6431-221
*Generator Block: High Voltage Intake
Room. Facing S*



6431-222
*Generator Block: HV Intake First Floor.
Facing SW*



6431-223
*Generator Block: HV Intake First Floor.
Facing N*



6431-224
Three Storey Block. Facing W



6431-225
Cinema and Lift Shaft. Facing W



6431-226
*Three Storey Block & Crisp Road Block.
Facing N*



6431-227
Crisp Road Block. Facing N



6431-228
SE Boundary Wall. Facing SW



6431-229
Three Storey Block: NW Stair. Facing NW



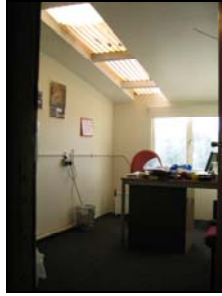
6431-230
Three Storey Block: Second Floor Office. Facing NE



6431-231
Three Storey Block: Second Floor Office. Facing N



6431-232
Three Storey Block: Second Floor Office. Facing NW



6431-233
Studio 1 Scenery Dock: 1st Floor Office. Facing SW



6431-234
Queens Wharf. Facing NE



6431-235
Queens Wharf. Facing E



6431-236
Queens Wharf. Facing SE



6431-237
Queens Wharf. Facing E



6431-238
Queens Wharf. Facing SE



6431-239
Queens Wharf. Facing S



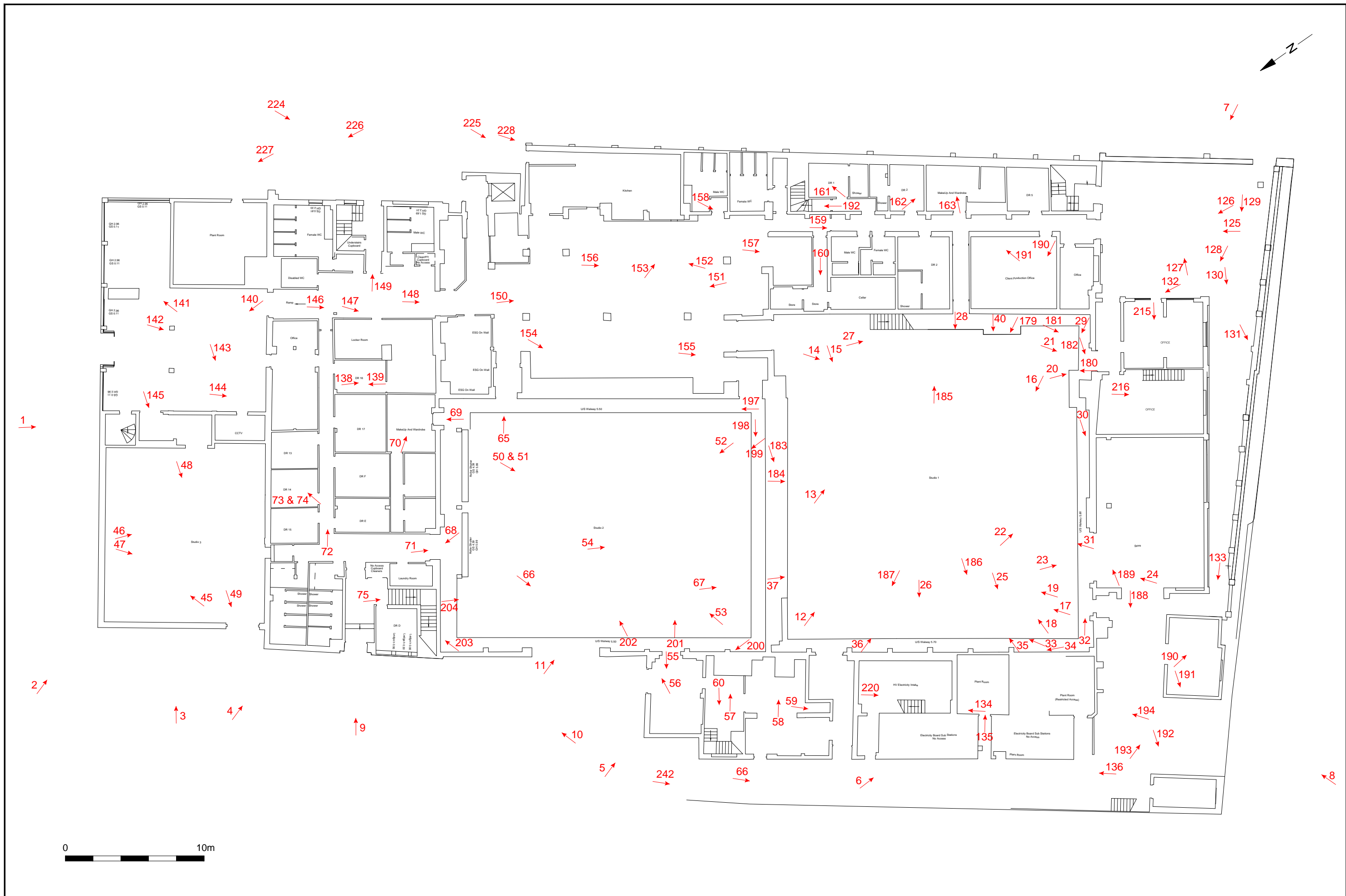
6431-240
Queens Wharf. Facing W

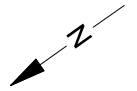


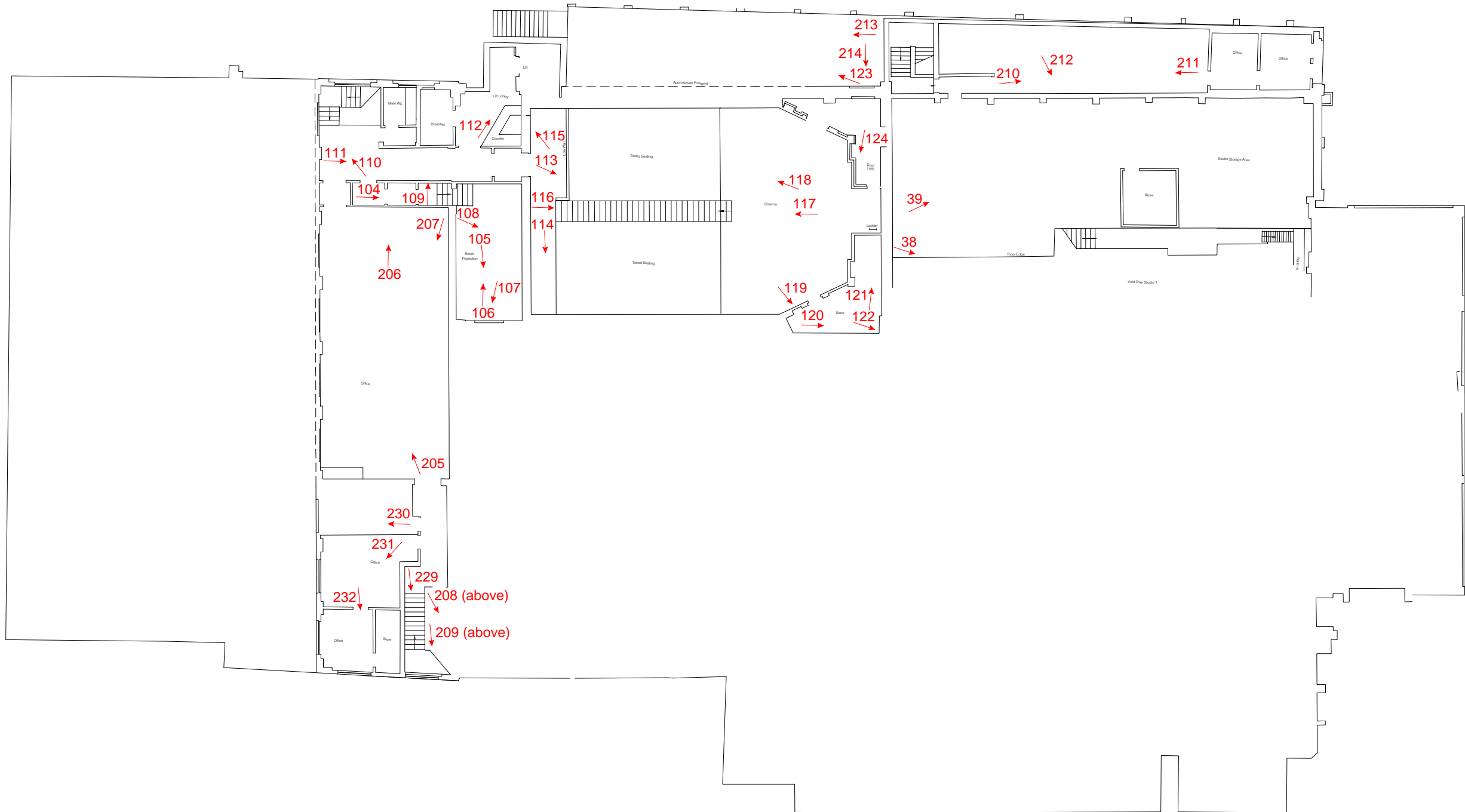
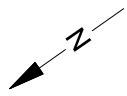
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Queens Wharf. Facing SW

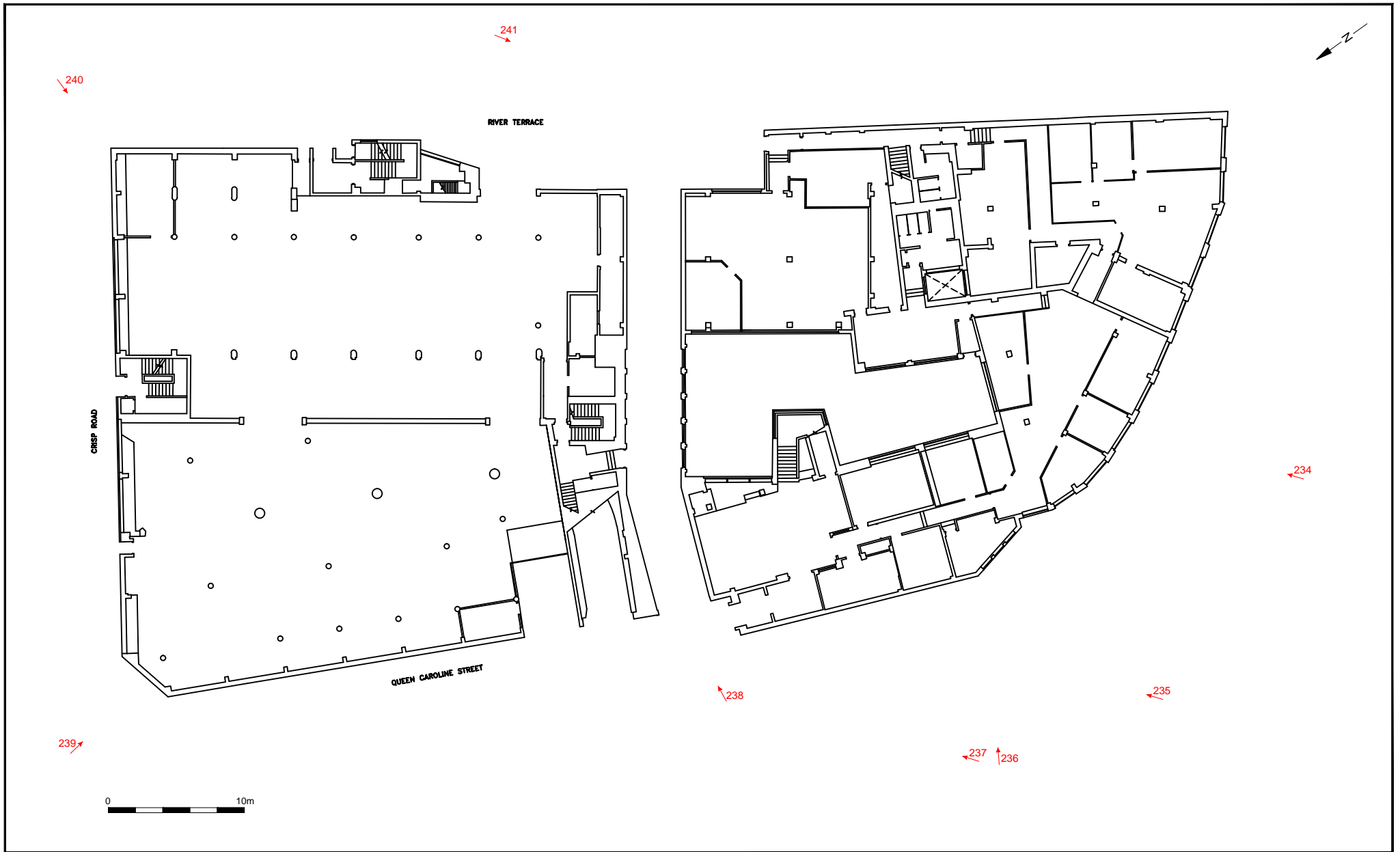


6431-242
*Boundary wall between Queens Wharf
and Riverside Studios. Facing SW*









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BBC

ENGINEERING DIVISION

MONOGRAPH

NUMBER 13: JULY 1957

The BBC Riverside Television Studios:

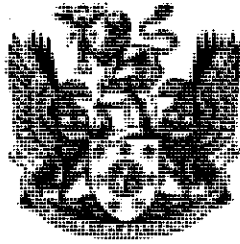
The Architectural Aspects

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Building Department, BBC Engineering Division

BRITISH BROADCASTING CORPORATION

PRICE FIVE SHILLINGS



BBC ENGINEERING MONOGRAPH

No. 13

THE BBC RIVERSIDE TELEVISION STUDIOS:
THE ARCHITECTURAL ASPECTS

by

E. A. Fowler, L.R.I.B.A.

(BUILDING DEPARTMENT, BBC ENGINEERING DIVISION)

JULY 1957

BRITISH BROADCASTING CORPORATION

FOREWORD

THIS is one of a series of Engineering Monographs published by the British Broadcasting Corporation. About six are produced every year, each dealing with a technical subject within the field of television and sound broadcasting. Each Monograph describes work that has been done by the Engineering Division of the BBC and includes, where appropriate, a survey of earlier work on the same subject. From time to time the series may include selected reprints of articles by BBC authors that have appeared in technical journals. Papers dealing with general engineering developments in broadcasting may also be included occasionally.

This series should be of interest and value to engineers engaged in the fields of broadcasting and of telecommunications generally.

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4.	<i>The Design of a Ribbon Type Pressure-gradient Microphone for Broadcast Transmission</i>	DECEMBER 1955
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9.	<i>The Application of Phase-coherent Detection and Correlation Methods to Room Acoustics</i>	NOVEMBER 1956
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11.	<i>Engineering Training in the BBC</i>	MARCH 1957
12.	<i>An Improved 'Roving Eye'</i>	APRIL 1957

SUMMARY

Even before the closing down of the BBC's Television Service upon the outbreak of war in September 1939, attention had been focused on the need to provide permanent accommodation in London adequate for the requirements of a rapidly expanding service.

After the war the problem became still more acute and the Corporation acquired a site of some 13½ acres near Shepherd's Bush, which had once been part of the 1908 Franco-British Exhibition. On this site the BBC's main London Television Centre is now under construction. It was evident that the development of this site to a state in which it could play a leading part in television programme production would take a considerable time, and it was therefore necessary to provide interim studio accommodation.

Various premises have been acquired, the latest of which are the Riverside Television Studios at Hammersmith. At the time of their purchase by the BBC, these studios were being used for film production and considerable modification and adaptation were necessary to convert the premises into a self-contained television studio centre.

It is with the architectural and civil engineering aspects of the development of the Riverside premises that this Monograph will attempt to deal, although, in fact, the whole project involved the closest possible co-ordination with the technical staff responsible for the installation and operation of an immense amount of electrical apparatus.

1. Introduction

The constant need of the BBC Television Service for increased studio accommodation has resulted during the past seven years in the acquisition of a number of properties in south-west London. The natural aim has, of course, been to find buildings as closely allied in function to television premises as possible and attention has, therefore, been directed towards former film studios and theatres. Thus the Lime Grove Studios, formerly belonging to the J. Arthur Rank Organization, were acquired in 1950 as an interim measure pending the provision at White City of the new, permanent, BBC Television Centre. In due course this was followed by the purchase of the old Shepherd's Bush Empire and later of the King's Theatre, Hammersmith. Finally the Alliance Film Company's premises, Riverside Studios, were purchased in September 1954 and work was put in hand to convert them for television use.

As with most premises designed to fulfil a specific function the architectural ideal is to start with an open site and build from scratch, as was the case with the new Television Centre at White City. This state of affairs unfortunately seldom exists within the London area and it has, therefore, become necessary to develop a standard, quite apart from normal structural considerations, by which to assess the potential value of existing property for conversion to television use. Such considerations include the possibility of providing suitable access and storage for scenery, adequate soundproofing and acoustic treatment, facilities for the suspension of studio lighting and accommodation for lighting-dimmer equipment, large unobstructed control room observation windows, adequate ventilation plant space together with camera maintenance and general workshop accommodation, etc. Whilst a con-

siderable amount of work would be required, the potential for such development existed at Riverside, and it is proposed to describe the project under the following headings:

Description of Premises Prior to Alterations.

Terms of Reference for Development.

Planning.

Building Work (Areas 1 to 6).

Requirements of Local Authority.

Two Appendices are included dealing with:

Mechanical Services.

Acoustic Treatment and Soundproofing.

2. Description of Premises as Existing Prior to Alterations

The premises, which were acquired by the Corporation in September 1954, were formerly engineering and foundry works owned by Messrs Gwynnes. The present studio areas appear to have been erected originally as open structures supported on steel stanchions and roofed with corrugated iron sheeting. At a later date the spaces between the stanchions were bricked in, windows inserted, and the whole of the area enclosed. The Crisp Road frontage to the site was, at this time, occupied by seven terrace cottages and between these and the river-bank buildings was located a three-storied warehouse type of building, used as pattern makers' shops. In 1933 the premises were acquired by the Triumph Film Company and considerable work was carried out in converting them to film use, both by this company and the Alliance Film Company, who later disposed of the premises to the BBC. The buildings directly adjacent to the river front were altered to form two studios. The buildings at present forming the large studio—which were formerly separate structures—were converted into one area by the introduc-

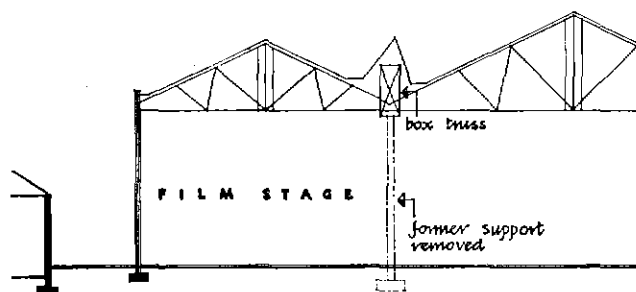


Fig. 1 — Method of supporting roofs to Studio R1

tion of a large box truss supported at each end by lattice stanchions. This structure carries the weight of the roofs formerly supported independently as shown in Fig. 1.

In addition to this work a new and very good film-recording theatre was built at first-floor level and a small review theatre formed in the former pattern makers' building. Offices, dressing-rooms, lavatories, stores, and canteen occupied the remainder of this building.

The party walls separating the Crisp Road cottages from each other were demolished and the whole area covered with a corrugated iron roof and used as a carpenters' and plasterers' workshop. Ventilation plant, property stores, motor-generator room, and switch room were located in a single-storied lean-to building adjacent to the north side of the studio area. Generally, the premises were, as far as could reasonably be ascertained, in fair condition with the exception of the roof coverings which, except that of the film-recording theatre, needed repair throughout. The course taken by some of the drainage was also particularly difficult to trace.

3. Terms of Reference for Development

The original terms of reference for the development of the property were formulated in October 1954 and were, in outline:

- (i) To plan Riverside Studio premises for television production purposes on a permanent basis. The large studio (7,500 ft super) to be developed as a replacement studio for studios D, G, and H at Lime Grove whilst they were being re-equipped. The smaller studio (4,500 ft super) was to constitute an addition to the existing television studio accommodation. In neither case were the new studios to lack any facilities existing at Lime Grove and both were to be provided with a new and improved type of lighting installation.
- (ii) The control areas, comprising a sound and vision control room, an apparatus room, and an advance maintenance room to each studio were to be provided adjacent to their respective studios and were to occupy approximately 1,400 ft super each.
- (iii) Planning was to include for the accommodation

of a telecine suite and central apparatus room, lighting-dimmer equipment, technical workshops, and stores, etc.

- (iv) Additional dressing-room, quick-change, and make-up accommodation was to be provided together with a carpenters' workshop, property store, two scene transit docks, and a turntable on the river frontage approached via a covered way from Crisp Road.
- (v) Restaurant accommodation for approximately 100 persons was also required.

4. Planning

Whilst the above terms of reference were an adequate guide to the general scope of the work, the early stages of planning revealed the necessity for the provision of additional facilities in order to make the premises an efficient operational unit. Sketch plans were produced by the BBC's Building Department incorporating all foreseeable requirements and a schedule of accommodation and building work was prepared by the Superintendent Engineer, Television Studios, on 15 December 1954. The preparation of the schedule was the result of close co-ordination between the Superintendent Engineer, Television Studios, Planning and Installation Department, Central Services Group, and Building Department. During this time an accurate survey was being made of the existing premises and drawings showing the proposals in outline were submitted to the London County Council for approval in principle under the Town and Country Planning Acts on 22 March 1955. This approval, subject to certain conditions relating to external appearance, etc., was received on 22 May 1955. It should perhaps be pointed out that the approval was a limited one and constituted agreement in principle only. Consent under the Building Bye-laws and Sections 20 and 35 of the London Building Acts could be obtained only upon submission of fully detailed drawings which, of course, at this time had yet to be prepared. Whilst approval in principle was being sought it was decided, in order to save time, that the preparation of final drawings and specifications should proceed. The drawings formed the subject of many unofficial discussions with L.C.C. representatives, who were most co-operative throughout. All steps necessary to the preparation of a building contract were also being taken including the transmission of details to the Quantity Surveyors for the preparation of bills of quantities, the selection of potential building contractors for tendering purposes, research on the availability and cost of materials, etc. Considerable attention was, at this stage, also given to the preparation of progress charts, these indicated, as far as could be foreseen, the times and order in which areas could be made available for the installation of various services, i.e. ventilation, heating, wiring, sprinklers, technical equipment, power supplies, etc.

The final prediction resulting from these meetings was that the building work would commence on 1 May 1955, the premises becoming fully operational by mid-July 1956. One of the results of the preliminary planning was the decision that the builders' work should be carried out in two main stages. This arrangement was dictated largely by the availability of materials and equipment and the desire to use Studio R2 in the form in which it existed for a short time for film production purposes. Stage 1, therefore, provided for the development of the large studio area (R1) complete with ancillaries including control rooms, dressing-rooms, offices, ventilation plant rooms, and associated accommodation; the provision of a self-supporting steel structure within the studio area to carry the new lighting installation; the provision of heating and ventilation where necessary throughout the whole of the premises and the execution of such works as were necessary to put the premises into a good state of repair. Stage 2 comprised the development of the smaller studio area, R2, on similar lines to that of R1 but including the provision of lighting-dimmer rooms, the demolition of the building fronting Crisp Road, and the erection on its site of a block to accommodate a scenic transit dock, additional dressing-rooms, carpenters' workshop, boiler house, ventilation plant room, etc.; the construction on the south side of the site of an engineers' workshop, stores, band room, staff rooms, lavatories, locker rooms, etc.; the conversion of the three-storied block to accommodate a telecine suite, studio control suite, restaurant, kitchen, and wash-up, together with the provision of a service hoist from the ground floor to second-floor level; and finally the construction on the river front of a scenic dock to serve studio R1.

5. Building Work—Areas 1 to 6

Pre-contract work having been completed, bills of quantities prepared, and competitive tenders invited, the contract was awarded to Messrs Robert Hart on 5 May 1955. For

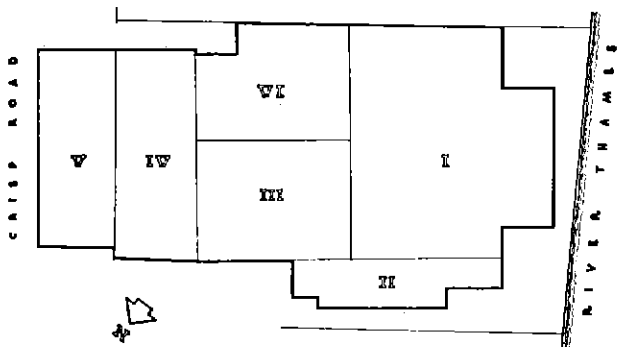


Fig. 2 — Key plan

ease of reference the premises are here shown divided into six main areas (see Fig. 2). All the work will be described in the order shown although, in fact, much of it was carried out simultaneously.

5.1 Area 1, Studio R1

In the final planning of Studio R1, it had been found necessary, in order to achieve maximum floor space within the studio, to extend the control areas beyond the existing south perimeter wall of the main building out to the adjacent boundary wall separating the premises from the Hammersmith Borough Council Depot, thus the technical areas, ventilation plant rooms, and dressing-rooms were to be built partly within and partly outside the main building as shown in Fig. 3. The clear floor space in the

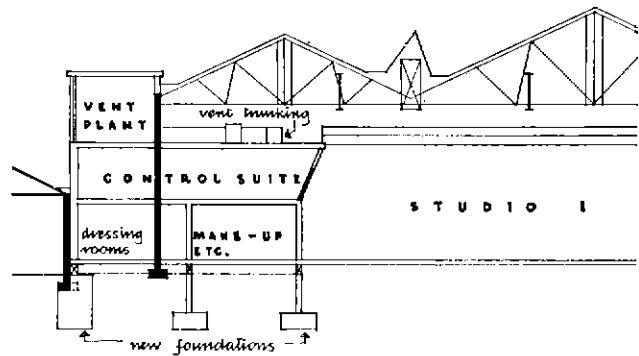


Fig. 3 — Diagrammatic section through new control suite to Studio R1 showing deep foundations

studio resulting from this arrangement was approximately 6,000 ft super, providing the working area for four image orthicon cameras. The original flooring of 1½-in. tongued and grooved boarding laid on battens was to be taken up and replaced by a reinforced-concrete floor and covered with ¼-in. Korkoid linoleum or a composition floor finish in order to provide a good surface for tracking cameras. Threaded eye-bolt sockets were to be grouted into the floor at 8-ft centres to give a maximum flexibility for the fixing of acrobatic or similar equipment. Large inlet ventilating ducts were to be excavated in the floor around the internal perimeter of the studio with sheet-metal extensions projecting up the wall faces and terminating in grilles just below the existing lighting galleries (see Plate A). All concrete duct covers were designed to carry 200 lb. per ft super. Ducts for supply cables and other technical wiring were to be similarly formed. Extract ventilation was to be provided via high-level metal ducts in the roof space above. In view of the fact that the existing roof steelwork was not designed to carry additional loading, the major operation in the studio area was to be the erection of the self-supporting steel structure previously mentioned which was designed to carry remotely con-



Plate A — Progress photograph showing underground vent ducts and vertical metal risers in Studio 1

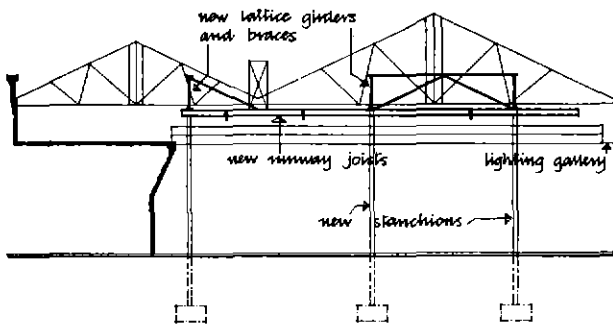


Fig. 4 — Diagrammatic section showing method of supporting runway joists and motorized lighting equipment

trolled motors operating lighting and scenery battens together with their power supply cables. In addition, the structure was to incorporate runway joists for the transit and support of scenery, cyclorama, etc., within the studio. In order to avoid undue delay the steelwork for the lighting structure had been ordered in advance of the placing of the main contract; the design basically comprising a six-legged table framework with the ends cantilevered as shown in Fig. 4.

The steel trusses supporting this structure were to be built up on site and 'threaded' between the members and braces of the existing roof trusses without in any way taking support from them. A new soundproof door 10-ft wide and 12-ft high was to be formed in the existing wall dividing Studio R1 from R2. The existing acoustic treatment of 2-in. rockwool throughout was to be modified to suit television requirements and additional soundproofing material applied to the roof. The lighting gallery was to be retained on three sides of the studio, part of the projecting roof of the control area at the south end of the building being used to complete the fourth side of the gallery. The

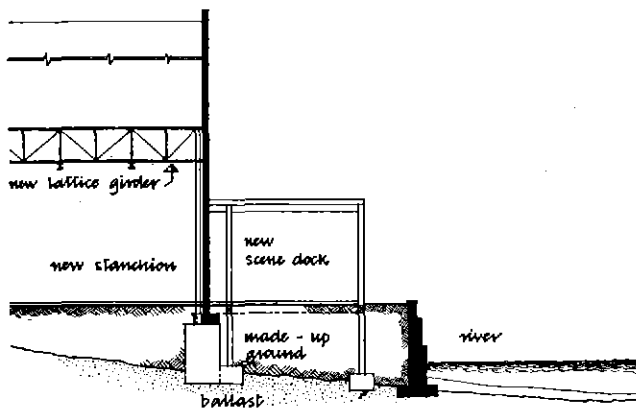


Fig. 5 — Diagram showing foundations adjacent to river wall

work within this area commenced with the removal of all extraneous material, the existing wooden floor was taken up and excavation of concrete bases for structural steel and the formation of underground ventilating ducts put in hand. It was found that the foundations to the existing building extended approximately 4 ft below ground level and it was assumed that the new bases would be approved by the District Surveyor at about 6 ft below ground. Unfortunately, this was not the case and the Surveyor insisted that the bases be taken down to a level at which river ballast would be encountered. At this level a loading of two tons per ft super was permitted. In view of the target date for completion it was deemed inadvisable to lose time in appealing to the L.C.C. against this ruling and it eventually resulted in the excavation of six 6-ft by 5-ft holes each approximately 15-ft deep (see Fig. 5). To fill these excavations with concrete would in itself have created a fresh problem because the proportionate increase in the weight of the concrete over a given base area would have led to the necessity for increasing the surface area at the bottom of the excavation.

The avoidance of this vicious circle resulted in the employment of short lengths of steel stanchions bolted to a 3-ft thick concrete base at the bottom of each excavation in order to lighten the loading. The excavated earth was then back filled, the steel having first received a 2-in. casing of concrete. Whilst the delay resulting from this extra work was most unwelcome, every effort was made to recover lost time and the steelwork for the lighting gantries was erected very quickly once the bases were in. The main gantry having been erected, it was necessary to fabricate light subsidiary steelwork resting upon the gantry in order to support the cable trays carrying the power supply to the independently motorized lighting battens. This light steelwork was pre-drilled and bolted together on site in 'Meccano' fashion in order to give maximum adaptability in a roof space which was, by now, a complexity of struts, braces, ties, members, and ducting—very difficult to visualize clearly in a three-dimensional manner from the drawings available. Fig. 6 gives a diagrammatic view of the steelwork relating to a typical motorized lighting batten (see also Plates B, C, and D). Work in the roof space being completed, the floor ducts were formed in waterproofed concrete, the new reinforced concrete floor slab being laid over them, access panels were provided at strategic points. It had originally been envisaged that a 2-in. sand and cement screed should be put down over the whole of the floor prior to laying the final floor coverings. But time being short and the weather being extremely cold it was decided to substitute asphalt for the cement screed, the advantage being that it could be walked upon almost as soon as it was laid and that the operation would not, as in the case of concrete, be held up owing to the low temperatures prevailing at the time. Some research was necessary to find an asphalt which would suitably meet the conditions of heat normally associated with a television studio and also to be unaffected by heavy rolling

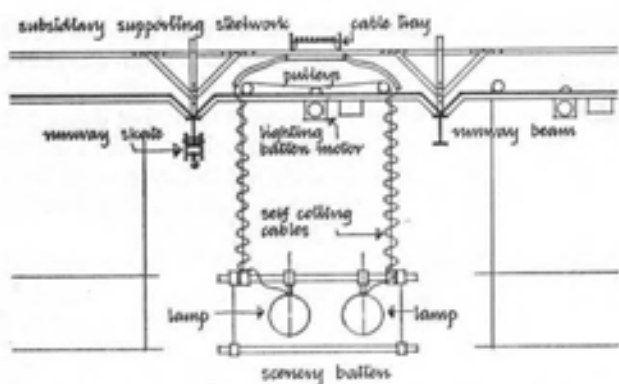


Fig. 6 — Diagram of typical lighting batten arrangement

loads as well as providing a suitable base for a floor covering. The required conditions were successfully met and similar treatment has now become standard practice in BBC television studios. Prior to the laying of the asphalt screed the eye-bolt sockets had been grouted into the floor at 8-ft centres and fitted with threaded caps to prevent the ingress of dust and dirt.

In the later stages of the contract the floor was covered with $\frac{1}{4}$ -in. Korkoid linoleum laid on patent adhesive with a $\frac{1}{4}$ -in. joint between sheets to allow for spreading. The

floor to date has given every satisfaction under operational conditions. The existing 12-in. wall dividing the two studio areas consisted of two 4-in. skins of breeze block with a 4-in. cavity between them. In this wall was formed a door opening 12-ft high by 10-ft wide to allow of the transit of scenery and equipment from one studio to the other. Double soundproof doors were provided and constructed to detail shown in Fig. 9.

The existing acoustic treatment in the studio area was in the main composed of 2-in. rockwool slabs contained in chicken wire netting spiked to 2-in. by 1-in. wooden battens fixed to the walls. The roof treatment being similar but with a layer of $\frac{1}{2}$ -in. soft-board fixed to battens between the rockwool and the asbestos roof covering. This treatment was largely retained except in areas directly affected by building work where it was taken off and not compensated for to any degree elsewhere. The new metal inlet-duct risers above floor level were found to be excessively reverberant and were treated with a thick coating of Bostick adhesive and faced with scrim. The roof was far from soundproof and it was originally decided that additional measures should be taken to improve it. Ultimately this proposal was dropped, in view of cost, and to date no undue sound interference has been experienced either from aircraft or shipping. (See Appendix II, Acoustic Treatment and Soundproofing.)



Plate B — Studio 1. Independently supported steelwork incorporating runway beams, motorized lighting batteries, and cable tray supports

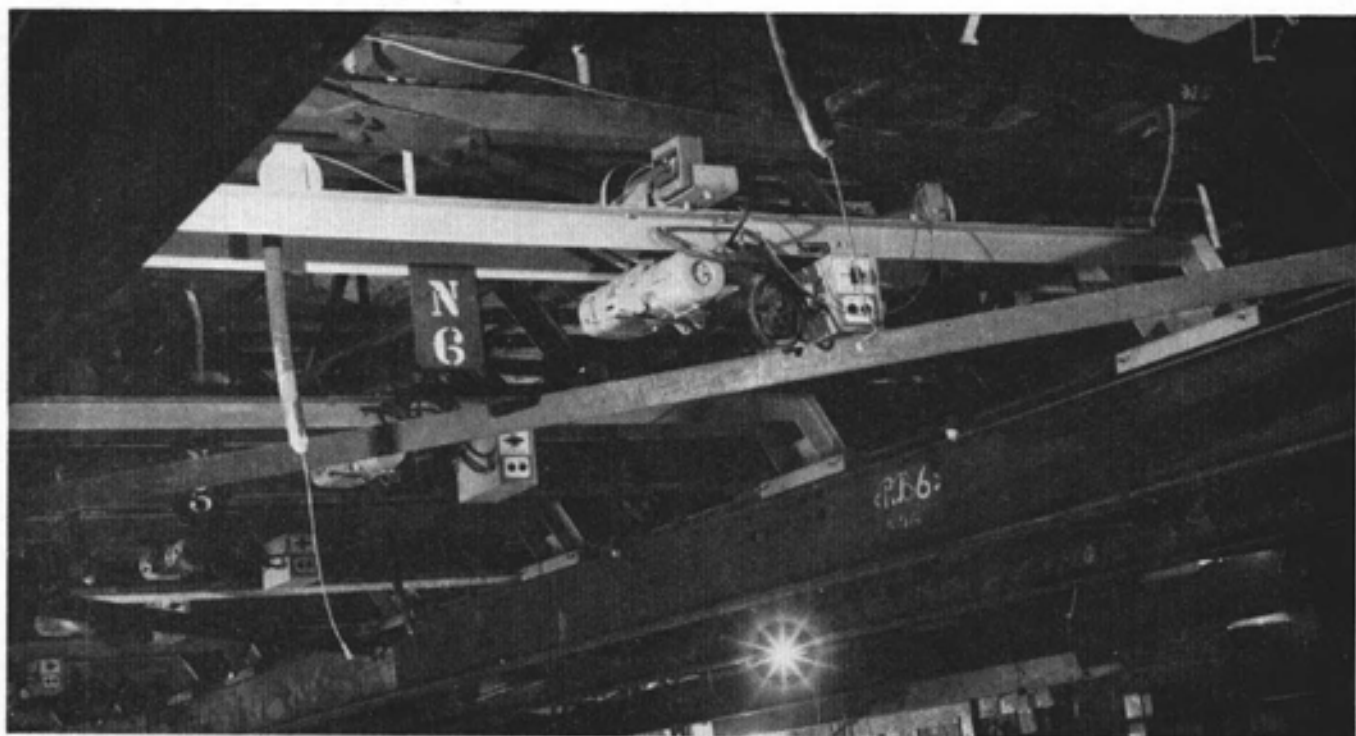


Plate C — Detail of typical motorized lighting batten

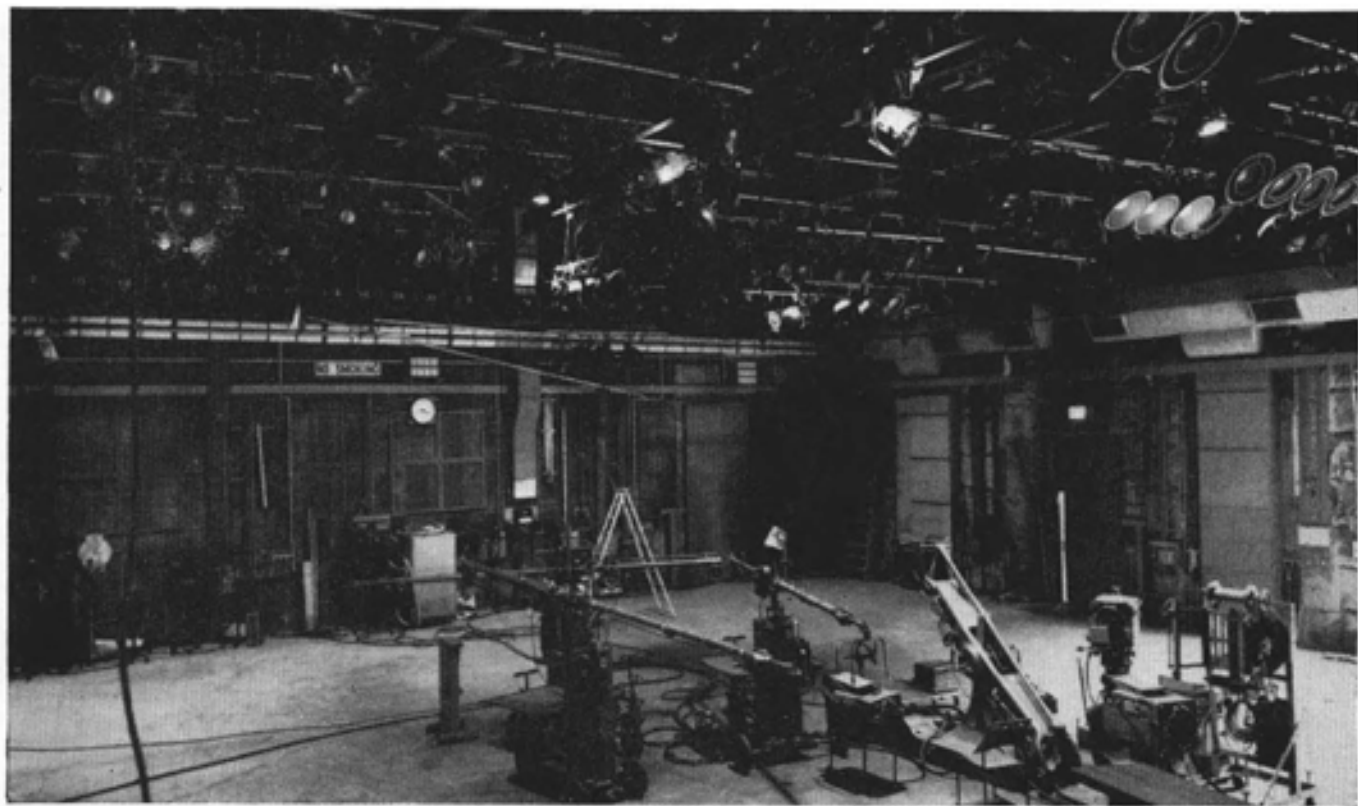
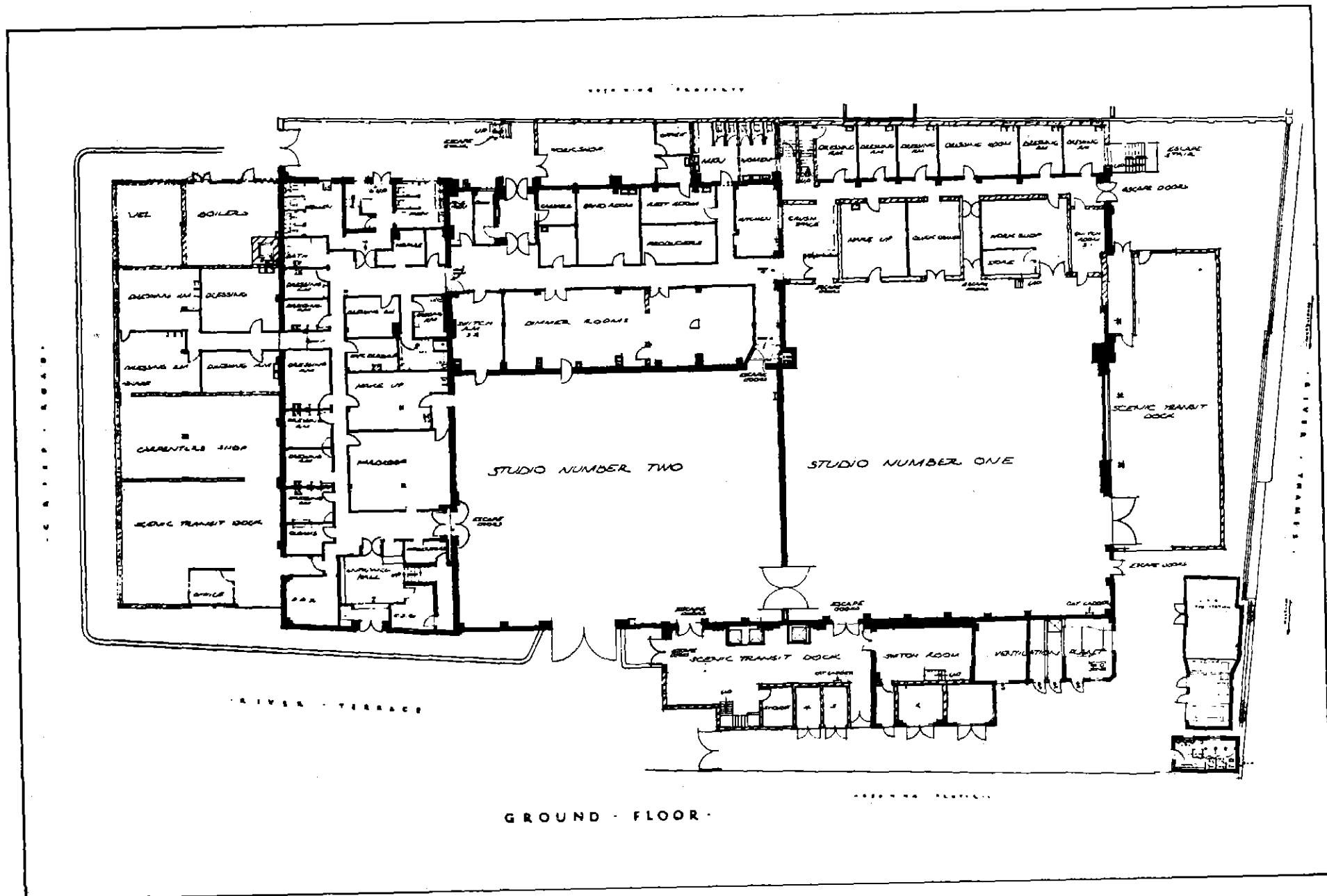
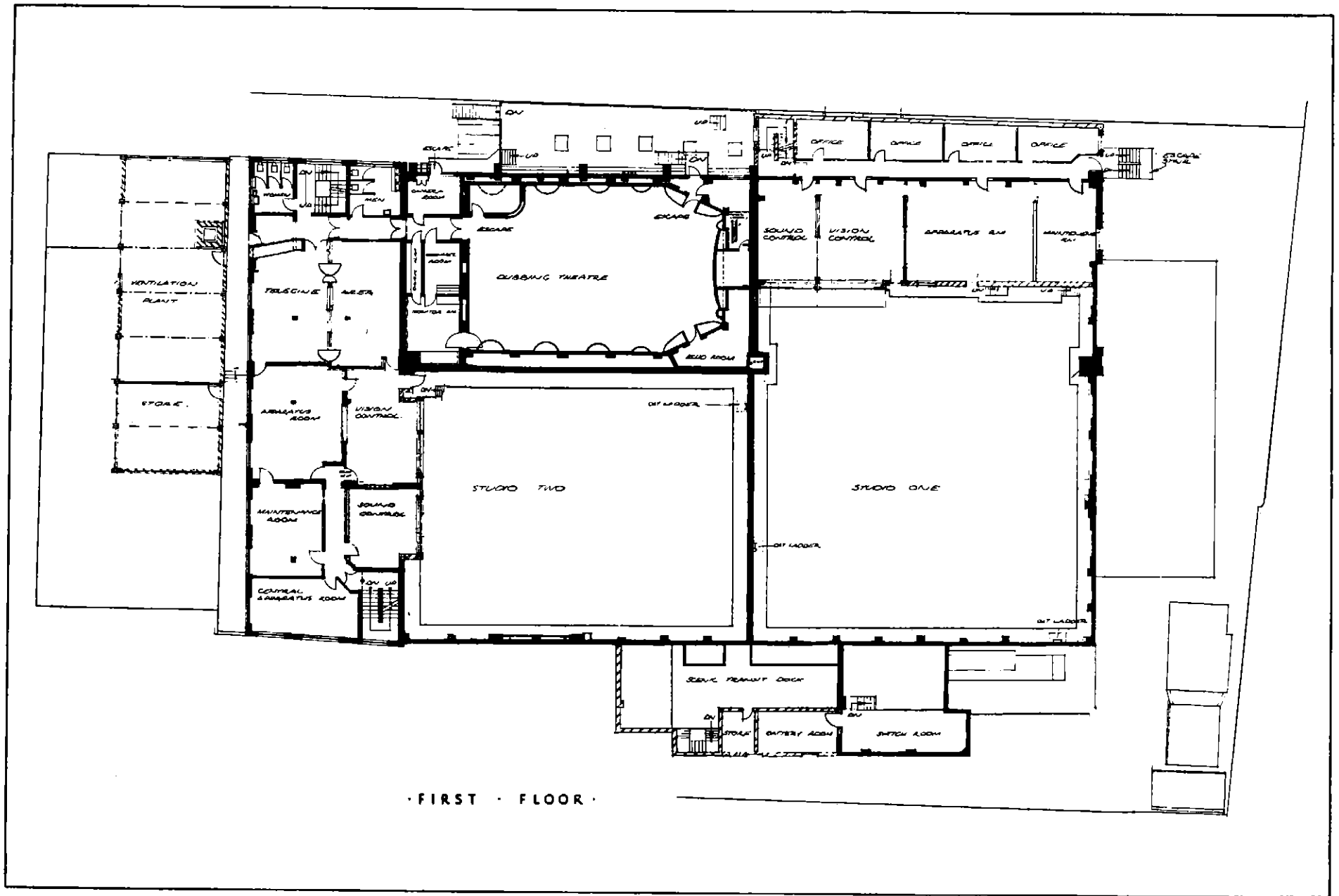


Plate D — View of ceiling of Studio 2 with lighting in position

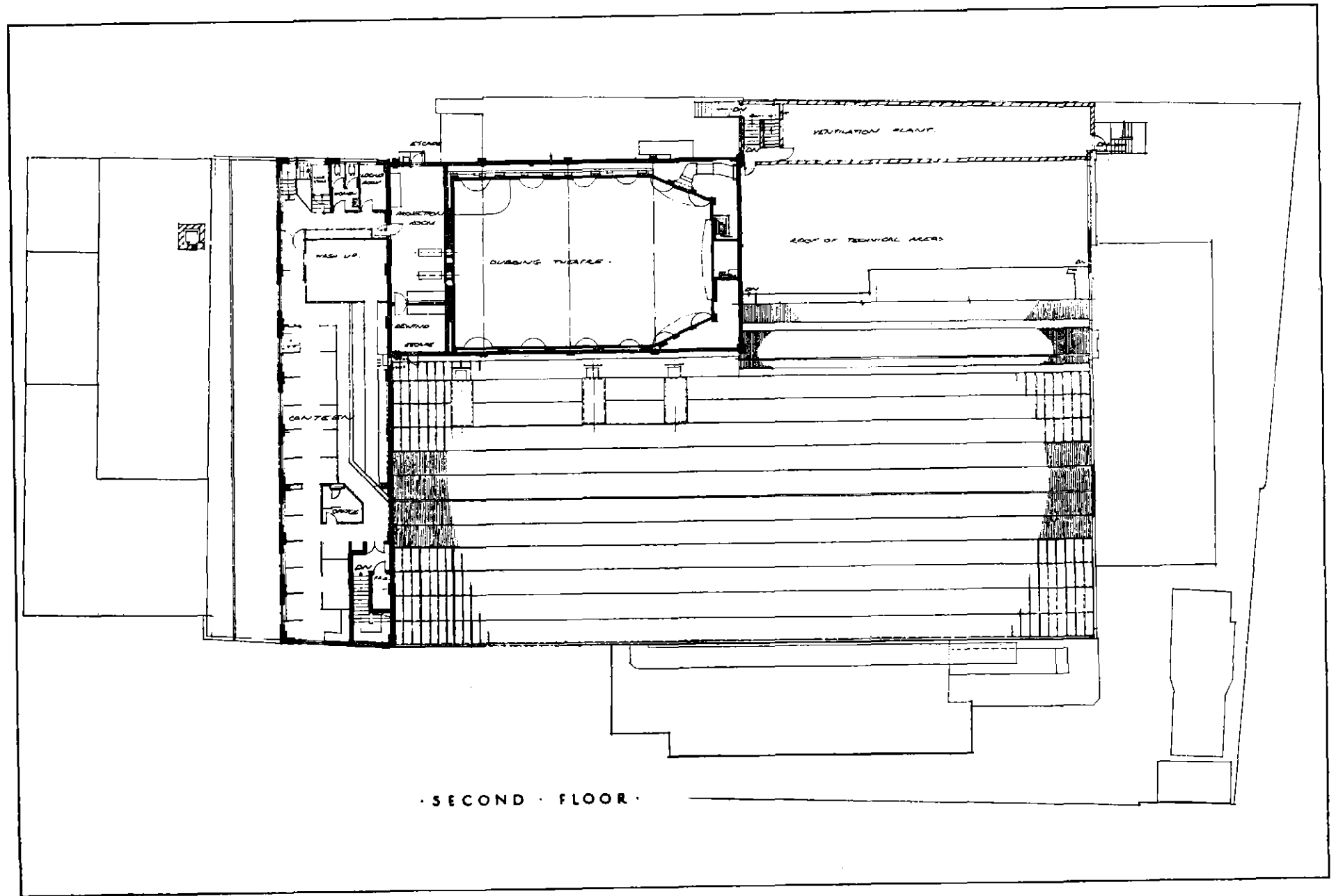


GROUND - FLOOR -

Ground Floor Plan



First Floor Plan



Second Floor Plan

5.2 Studio R1, Control Room and Dressing-room Block

Shortly after the commencement of work in the studio, excavation was commenced for the foundations to the above building. Here again it became apparent that special measures would be required satisfactorily to spread the load of the new building, but in this case, in addition to deep foundations, it was necessary to employ ground beams as indicated in Fig. 7. This form of foundation leaves no part of the structure unsupported by steelwork, all weight being transferred to the stanchion bases. Numerous obstacles were encountered during the excavation including culverts, which had to be diverted, masses of heavy iron from the former foundry which had to be removed; the discovery of a large testing tank full of rubbish and the constant presence of water with its attendant pumping operations also added to the difficulty of the work. Apart from this the construction of this block was of a type conventional in sound-insulated structures, except for the double-glazed observation windows to the first-floor sound and vision control rooms which were exceptionally wide (11 ft and 14 ft respectively) and were tilted outward at an angle of 25 deg. to the vertical in order to give better control room viewing, reduce light reflection, and, most important, to provide a recess in a convenient position above the windows for the location of picture monitors, thus allowing producers and technicians to view

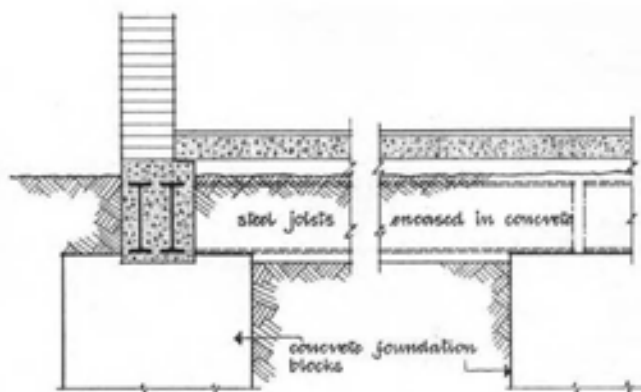


Fig. 7 — Detail of typical ground-beam foundation

the action on the studio floor and in the monitors simultaneously (see Plates E, F, and G). The equipment in these control areas was arranged to allow of 'front viewing' and power-operated windows were provided between the control rooms and apparatus room. The internal partition walling to the technical areas was formed with Camden partitioning. See Fig. 8 for detail.



Plate E — View of Studio 1. Control suite windows from studio

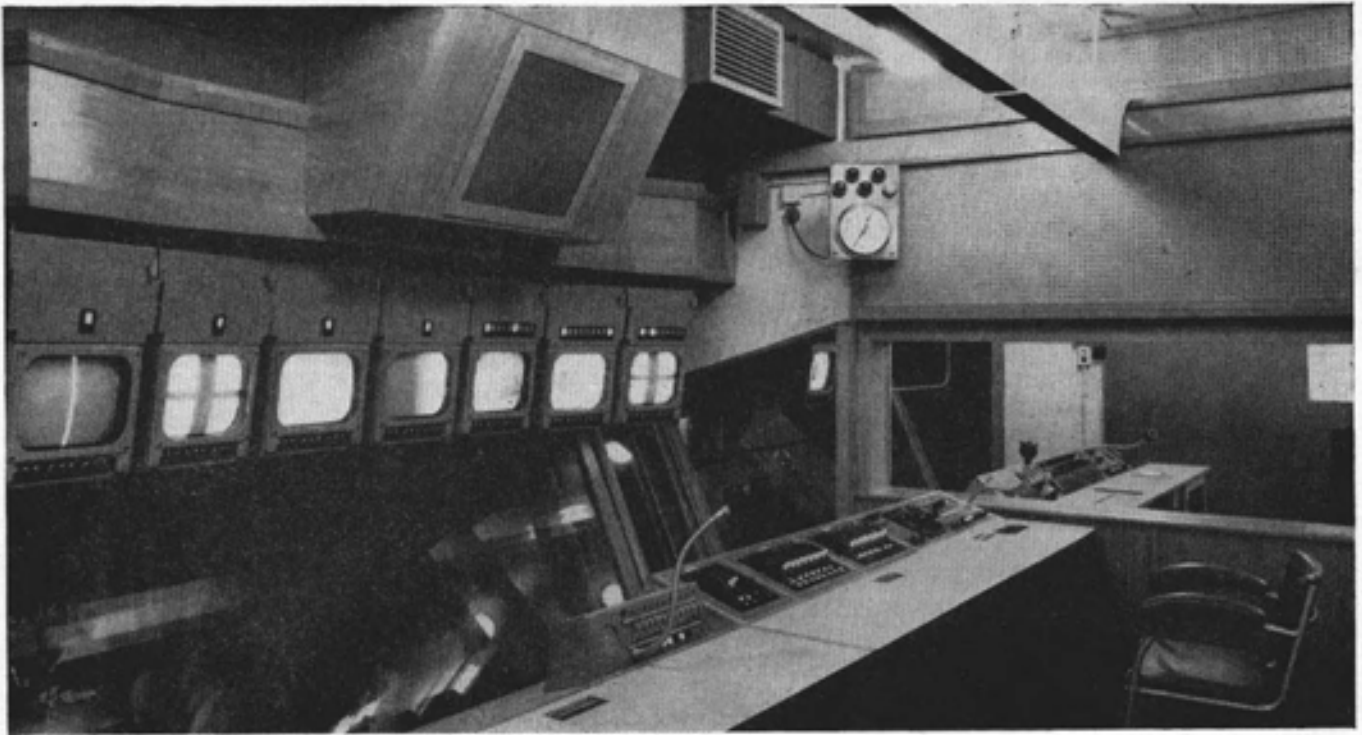


Plate F — View of Studio 1. Control suite windows from within

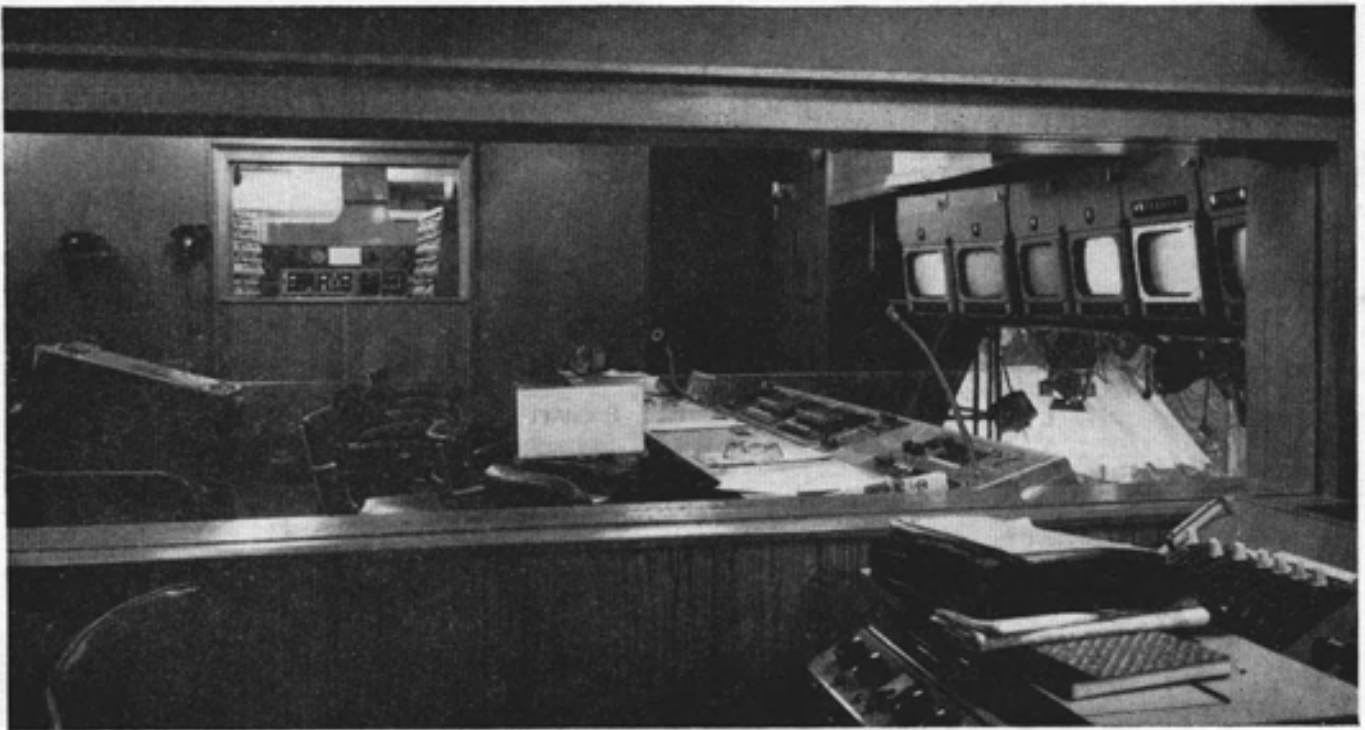


Plate G — View of Studio 1. Control suite power-operated window

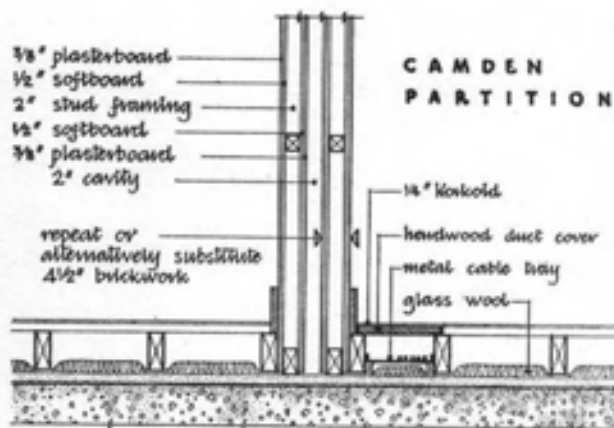


Fig. 8 — Typical detail of control room partitioning and floor

The floors were of hollow-block construction finished on the top side with 1-in. bitumen-bonded glass-wool upon which floor joists were laid and boarded over. Ducts for cables were formed in this false floor, the final finish being $\frac{1}{4}$ -in. Korkoid linoleum. The remaining non-technical accommodation in this block comprised dressing-rooms, make-up room, quick-change room, studio equipment store, and switch room, together with a small self-service

tea-bar and preparation room at ground-floor level (see Plate H), producers' offices at first-floor, and ventilation plant rooms at second-floor level.

5.3 Scenic Transit Dock

The construction of this building was subject to similar conditions regarding foundations to those already described; a further consideration being the proximity of the existing river wall and the danger of surcharging it with the additional loading resulting from the new building. It was decided that even the construction of a reinforced-concrete raft would not adequately counteract this danger and again deep excavations had to be sunk before ballast was reached (see Plate J). Ground beams were again employed and the structure erected as a steel-frame building. 70-ft long by 25-ft wide by 18-ft high, entirely independent of the existing building. An 11-in. cavity wall infilling was employed between the concrete encased steel stanchions and the roof was of hollow-block construction without a screed and finished with asphalt. In view of the restricted space at this end of the site it had originally been intended to install a turntable for scenery transport vehicles. This proposal was, however, dropped in the planning stage as it was considered that such a facility would be of limited value owing to the size of vehicles employed.

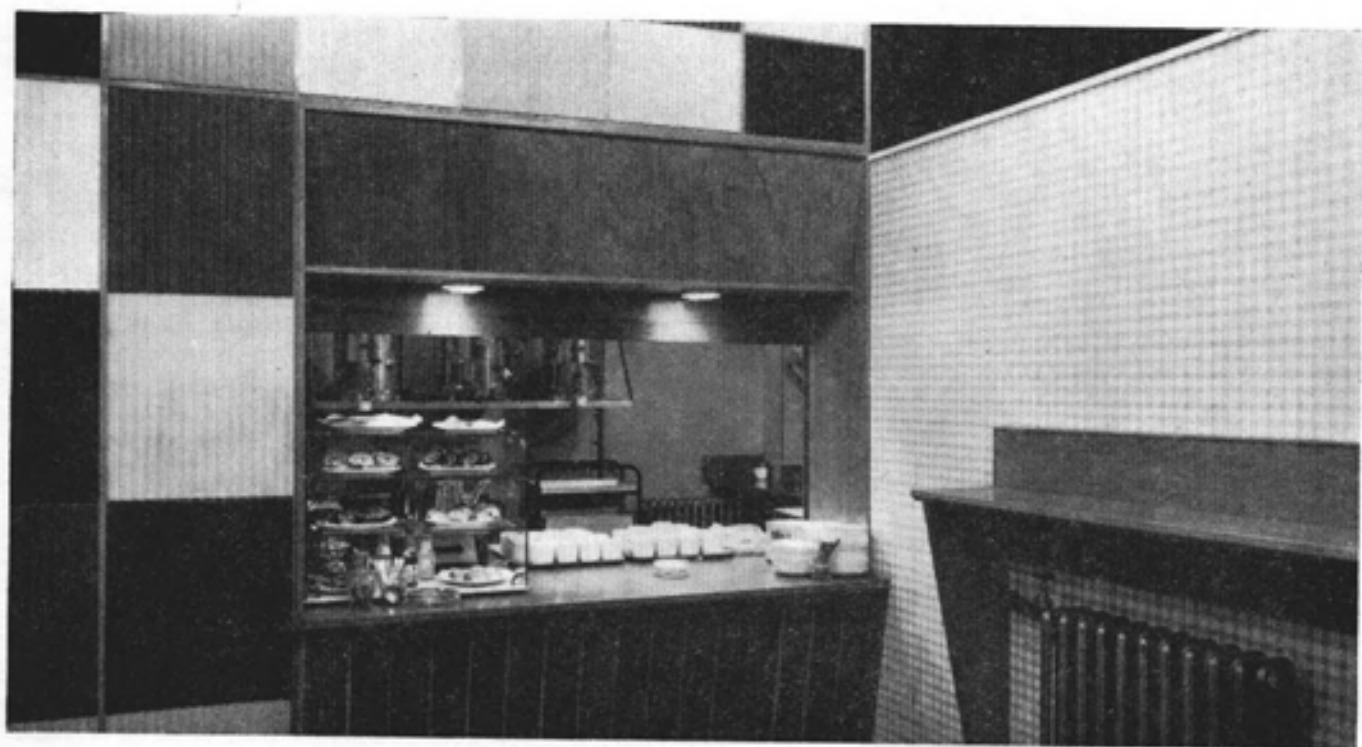


Plate H — View of ground floor tea bar

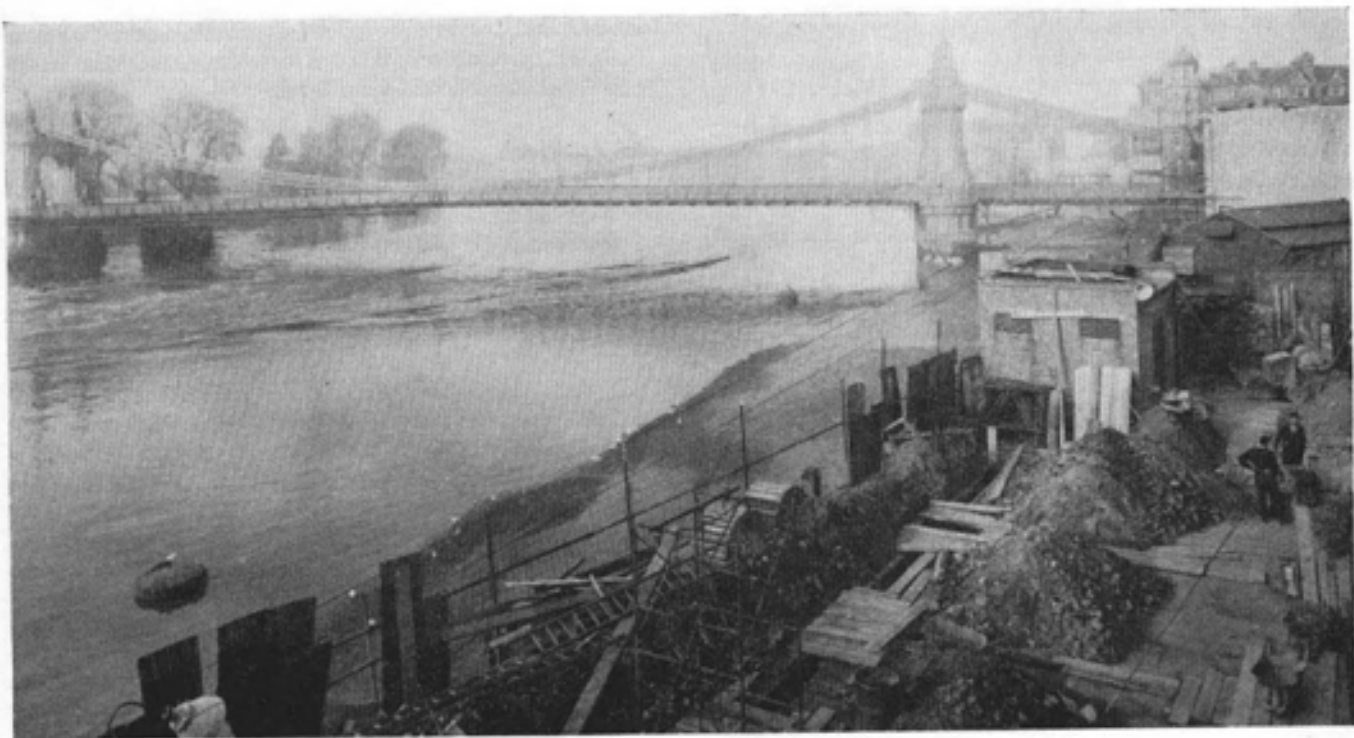


Plate J — Excavation work for Scene Dock in progress

5.4 Area 2, Power Intake and Property Store Block

This block, which formerly comprised a single-storied lean-to structure for film properties and a lofty brick and concrete building accommodating a large motor generator together with ventilating plant, was partly demolished and converted into a two-storey building housing four transformer rooms, switch room, a large property dock with store and office and a battery room at first-floor level. An emergency escape corridor communicating with Studio R1 was also incorporated. In view of the proximity of this part of the premises to those of the adjoining owners (Messrs Rosser & Russell) the L.C.C. insisted that special fire precautions be taken in the transformer room area and heavy steel doors incorporating shutters operated by fusible links were designed, approved, and fitted. Artificial ventilation of the transformers, therefore, became essential and a separate system had to be installed to cope with this requirement. It had originally been proposed that the road running between this block and the adjoining property be protected from weather by a covered way in order to safeguard scenery in transit. But here again the L.C.C. would not permit such a structure to be erected owing to the necessity for the preservation of a fire break between the premises.

5.5 Area 3, Studio R2

The conversion of this studio to television purposes closely followed the lines employed in the case of Studio

R1. Certain inherent advantages, however, existed in this area which reduced the amount of work which had to be carried out. Whereas in the planning stages it had been decided that priority should be given to the completion of Studio R1, the difficulties which have been outlined had retarded progress to such a degree that it was agreed that priority should now be switched to R2 as it was apparent that this studio could be made operational in a comparatively short time. The existence of non-load-bearing bow-string trusses between the roof trusses was one of its chief advantages as their presence obviated the necessity for providing a self-supporting lighting gantry. Whilst certain strengthening measures were required to the trusses, once this work was carried out, the runway beams and superimposed subsidiary steelwork and lighting equipment could be erected without further support and costly excavation and steel erection avoided. The floor was treated in an exactly similar manner to that of R1 including the formation of underground ventilation and cable ducts, etc. Additional excavation was necessary, however, in the formation of stanchion bases for the steelwork required to support part of the vision control rooms which were built to project into the east end of the studio at first-floor level although the main control suite areas were accommodated within Area 4. The space beneath the bays thus formed was utilized as a store for back-projection screens. Acoustic treatment for this studio was as described for Studio R1 and, of course, the new 10-ft wide sound-proof doors were common to both studios.

5.6 Area 4, Three-storied Block

The development of this block entailed an almost complete internal gutting of the building, although it was found possible to retain elements of the existing dressing-room accommodation. The final layout of this area was largely governed by the planning of the new accommodation in Area 5. The existing main entrance was extremely cramped and was consequently redesigned to create a greater impression of spaciousness and light. A contemporary style of decoration was employed. The first floor, which was to accommodate Studio R2 control suite, a telecine suite, and central apparatus room, was planned as indicated, the majority of the internal partitioning being of Camden construction. The formation of the projecting bay into the studio area was, in view of its length, a rather difficult operation as it was necessary to carry the weight of a large section of gable-end wall upon which was supported the floor of the restaurant above and entailed manœuvring the supporting steelwork within a very limited space. Certain L.C.C. requirements regarding the fire protection of buildings under Section 20 of the London Building Acts (Amendment) Act also influenced its construction (see Requirements of Local Authority). The soundproofing and acoustic treatment in these areas followed closely that employed in Studio R1 control suite. (See Appendix II, Acoustic Treatment and Soundproofing.) The formation on the second floor of a restaurant area was regarded as an opportunity for introducing a type of layout not hitherto

employed in Corporation premises. The extreme length of the available area compared with its width was utilized to give a dining-car effect with fixed seating running parallel to the service counter, but separated from it by a glazed screen. This arrangement allows of good circulation and adequate access to the escape stairs at either end. The existing open roof space was closed by a false ceiling constructed with $\frac{1}{2}$ -in. slotted asbestos panels on light metal angles and covered on the top side by bitumen-bonded glass-wool for the dual purpose of sound deadening and thermal insulation. A small service hoist was installed within the existing south stair well to serve the kitchen. This unit operates within a self-supporting metal framework and was constructed in this manner to avoid the necessity of transferring any additional load to the existing light roof steel.

5.7 Area 5, Crisp Road Block

This building, which was entirely new, was designed to accommodate the boiler house and oil storage, carpenters' workshop, scenery transit dock, and four 'crowd' dressing-rooms at ground-floor level with a ventilation plant room and technical equipment store at first-floor level. Both the boiler house and the scenic transit dock were double-height areas; the dressing-rooms being located between them. The building is of steel-frame construction with 11-in. cavity walls and hollow-block floor slabs (see Plate N). The foundations in this instance were also con-



Plate K — Service counter to restaurant

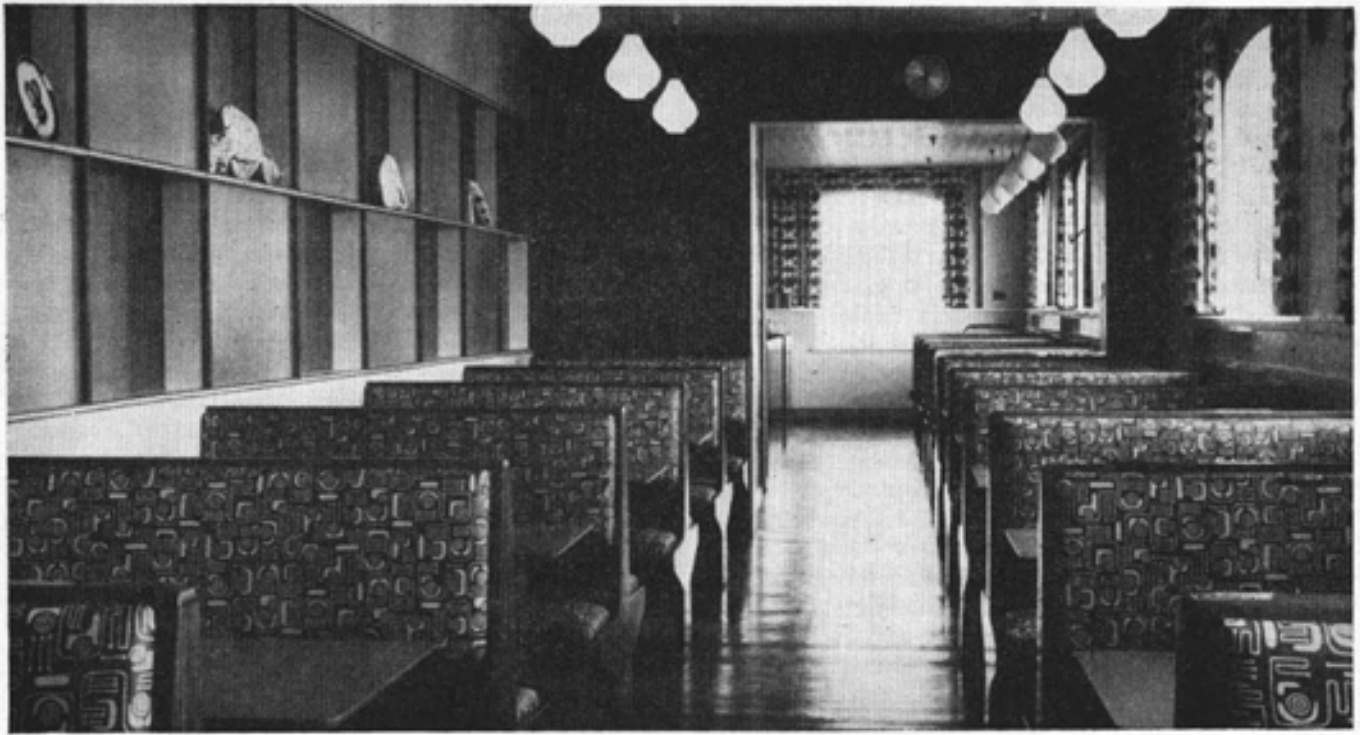


Plate L — View of restaurant seating area from east end



Plate M — View of restaurant seating area from west end

ventional, the bearing capacity of the ground being considerably better than that adjacent to the river. The main difficulty in construction was occasioned by the necessity to underpin the existing high and rather bulging wall which separated the new block from the old building. The new stanchions along this boundary were inserted in the thickness of the existing wall in order to save space and thus it had, in effect, to be cut into independent sections to allow of the steel being positioned. The new stanchion bases were, of course, considerably below the existing wall foundations. With the exception of the dressing-rooms the internal finish in this building is fair-faced brickwork painted two coats emulsion paint, the dressing-rooms being plastered.

5.8 Area 6

This portion of the premises is again a mixture of old and new construction. The ground floor of the existing part of the building was completely replanned to house two lighting-dimmer rooms, a switch room, a new rear entrance, with accommodation for commissionaire, firemen, and telephone booth, whilst the provision of a band room, producers' room, manual-staff room, and cashier's room completed the layout. Workshop accommodation for house engineer and staff electricians was formed between the old building and the existing south boundary wall and lavatory accommodation provided to

serve Studio R2 and its ancillary areas. The first floor of this part of the building, which comprised the old recording theatre, was left virtually untouched although it was necessary to construct a soundproof room within the theatre for commentary dubbing purposes and this was used during the noisier stages of the building operations. The formation of the dimmer rooms necessitated a considerable amount of work to the floors in order to form cable ducts and bases for equipment. This area was separated from Studio R2 by an existing cavity wall of similar construction to that dividing the two studios. The house engineer's workshop building was subject to conditions imposed by the adjoining owner regarding disturbance likely to result from noisy operations within the workshop and in consequence the walls and ceiling were lined with 2-in. Stramit before being plastered. The building was constructed with 9-in. brick walls, one side being erected on the existing party fence wall. The roof is of hollow-block construction trimmed to accommodate domed roof-lights.

6. Requirements of Local Authority

The influence of L.C.C. requirements and Conditions of Consent on the building work at Riverside was considerable although, in view of the rather piecemeal way in which our proposals had, of necessity, to be presented, it

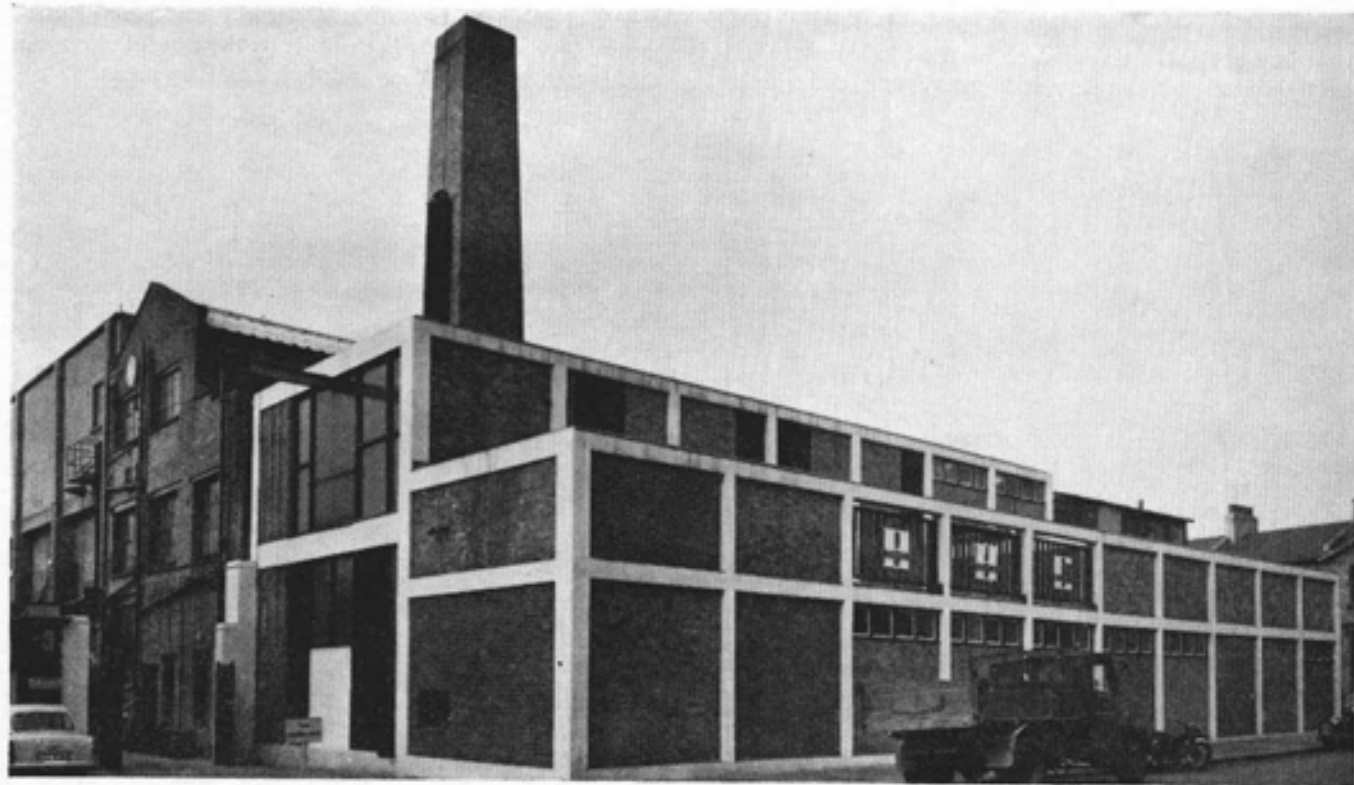


Plate N — Frontage to Crisp Road

was not possible accurately to assess in advance the manner in which they would be applied. As previously mentioned, application for approval was made under three main headings: Town and Country Planning, Bye-laws, and Sections 20 and 35 of the London Building Act. Whilst approval under Town and Country Planning was essential before the work could commence, consents under the other headings were, to a great extent, dependent on the evolution of the project, certain aspects of which became apparent only as the work proceeded. The implementation on site of the Bye-laws is primarily the responsibility of the District Surveyor, to whom considerable discretionary powers are delegated. Whilst the alterations were planned to conform with ascertainable requirements, in the case of the foundation works the final decision as to what constituted a satisfactory load-bearing surface rested with the District Surveyor. Similarly the decision partly to demolish and rebuild the property store block was largely the result of his condemnation of the existing building, in view of the proposed alterations. The interpretation on site of the Conditions of Consent under Sections 20 and 35 relating to the excess cubical extent of the premises and Means of Escape respectively also rested with the District Surveyor. It should, perhaps, be mentioned that where, as in this case, a building falls into the category of excess cubical extent (i.e. over 250,000 cubic feet content) the regulations relating to the prevention of fire become very stringent, an example being the necessity for providing automatically operated steel shutters on both sides of the observation windows to Studio R2 control suite. In addition the materials permitted to be used in construction throughout the building are, to a great extent, determined

by their fire-resistant qualities. The ventilation system also is closely scrutinized to ensure that all risk of fire spreading through ducting is avoided. The regulations applying under Means of Escape are similarly very comprehensive and relate, among other things, to the adequate positioning and sign-posting of emergency exits, types of door fastenings to be used, protection of staircases and corridors, details relating to secondary means of illumination, etc.

It should, perhaps, be noted that the methods employed in obtaining L.C.C. Consents in connection with this project were not those to be recommended, and had time permitted it would have been very much more satisfactory and economical to have prepared the scheme in its entirety and obtained all consents prior to the actual commencement of the work.

7. Conclusion

Riverside Studios represent the latest and most modern practice in the equipment of television studios in the country. The layout and facilities which have been provided depend in no small measure upon the work described in the foregoing sections of this Monograph and the studios have proved adequate for the purposes for which they were intended. Some very ambitious productions have been staged at Riverside with the maximum efficiency.

The incorporation of many new features on the engineering side of television production, particularly in the fields of lighting control and co-ordination of the production and engineering staff involved in the staging of programmes, has been made possible by the careful planning and layout of the studios and their auxiliary areas.

APPENDIX I

Contributed by L. NORTON, B.Sc.(Eng.), M.I.H.V.E.
Building Department, BBC Engineering Division

Riverside Studios, Mechanical Services

The mechanical services associated with these Studios include ventilation of studios, technical areas, office accommodation, dressing-rooms, dubbing theatre, and restaurant; heating, hot-water service throughout, and compressed-air, gas, and fire-prevention arrangements.

Ventilation

The intensity of lighting in television studios is high and also variable in location and power so that large air quantities are involved and the distribution internally has to be as flexible as possible. At Riverside the air is brought in through fabric-type filters and delivered to the studios through sound- and heat-insulated external ducts thence into underground brick and concrete floor ducts to rise at selected points in the studio itself. The rising ducts feed into horizontal distributing ducts under the lighting gallery arranged to give proper distribution over the entire floor area and also to 'blow' into the sets; the supply grilles are above backcloth level and each grille can be individually closed and its supply air directed elsewhere.

The supply air enters below lighting level and the exhaust is arranged in the higher part of the studio to exhaust the warmest air and cut down the effect of a roof space at a high temperature. The return air can be recirculated or thrown to waste automatically depending on weather conditions.

The technical areas consist of the sound control room, vision control room, apparatus room, and maintenance areas associated with each studio, also telecine areas, dimmer rooms, transformer rooms, and central apparatus room. In all these areas electronic equipment has to be cooled and the technical areas kept at a comfortable working temperature. Care has to be exercised in distributing large volumes of air without draughts in restricted areas full of equipment, all with reasonable sound levels. The passage of sound between the various areas is taken care of by the positioning of grilles and the layout and lining of the service air ducts with acoustic material.

The offices, restaurant, and dressing-rooms are dealt with in a conventional manner, care being taken to prevent the spread of odours in the last two cases.

Generally five ventilation plant rooms are in service, one for each of the large studios, two serving the technical areas associated with the studios, and the fifth serving the dubbing theatre. This was done to economize ductwork and to enable stable conditions to be maintained in the various areas, each having diverse ventilating loads. This results in studios and technical areas being separately ventilated and the normal working areas also are subdivided as mentioned above.

In densely populated areas a high proportion of recirculated air is undesirable, due mainly to the evaporation of moisture from the human body and the possibility of spreading infection and odours.

In the case of the studios and technical areas, the air volume for cooling, due to the heavy technical heat emission and lighting loads, is greatly in excess of normal standards and thus a high degree of recirculation can be used still maintaining a very good quantity of fresh air per hour for the occupants. This high degree of recirculation enables the scale of the air-heating plant to be reduced, as the electric power dissipated as heat is used to temper the incoming fresh air when required.

Arrangements have been made to make the operation of these systems as automatic as possible and compressed-air controls are used throughout. Indicating thermometers are fitted in the plant rooms to enable the attendant to read air temperatures at various points in the system and in the occupied areas. Static pressure controls governing the studio air supplies are also provided.

Heating and Hot-water Services

The boiler plant is centralized in one boiler house and consists of two cast-iron sectional boilers each rated at 1,982,000 B.Th.U.s per hour, with fully automatic oil-burning equipment for use with 200-seconds oil.

These boilers deal with all the heating and hot-water service requirements in the winter, and in the summer there is a small gas boiler to take over the summer load for domestic hot water. The duplicate calorifiers providing the hot-water storage for domestic purposes are housed in the ventilating plant room immediately over the boiler house, forming a compact unit. This also permits a gravity circulation without using the pumps in the summer. The heating installation served from the boilers consists mainly of cast-iron radiators except in the canteen, where specially designed convector units incorporated with the seating arrangements were used.

The distribution mains were run at high level in corridors to avoid the construction of expensive floor ducts and every effort has been made to eliminate pipework from studio and technical areas. Thermostatic control in the form of motorized valves and room thermostats has been provided to control the room temperature in selected areas, viz. technical areas and dressing-rooms, which are also ventilated.

Compressed-air Services

A twin-cylinder compressor electrically driven and water-cooled, capable of 100 c.f.m. at 70 lb. per square inch, is sited in an out-building remote from the studio and

serves a general-purpose compressed-air distribution system. Special care was taken to ensure the removal of moisture and foreign matter from the air supply and instantaneous-type couplings were fitted at the supply points.

Gas Services

Gas services are also provided for the studio 'effects' purposes. Special precautions were taken in the form of armoured flexible hoses for studio use to guard against mechanical damage which could easily occur in a television studio during a production.

Fire Prevention

Fire prevention installations are normal CO₂ equipment in technical areas on account of the electrical equipment and the normal sprinkler system in studios and elsewhere.

Fire-warning devices are also incorporated in air duct-work to give warning of local temperature rise and fire-dampers to L.C.C. approval have also been fitted. The exhaust air from the telecine area has been separately dealt with as a precaution to avoid the possible spread of fire through the main ventilation ducts throughout this portion of the building.

APPENDIX II

Contributed by

ALEXANDER BROWN, D.A.(Edin.), A.R.I.B.A.,
Building Department, BBC Engineering Division

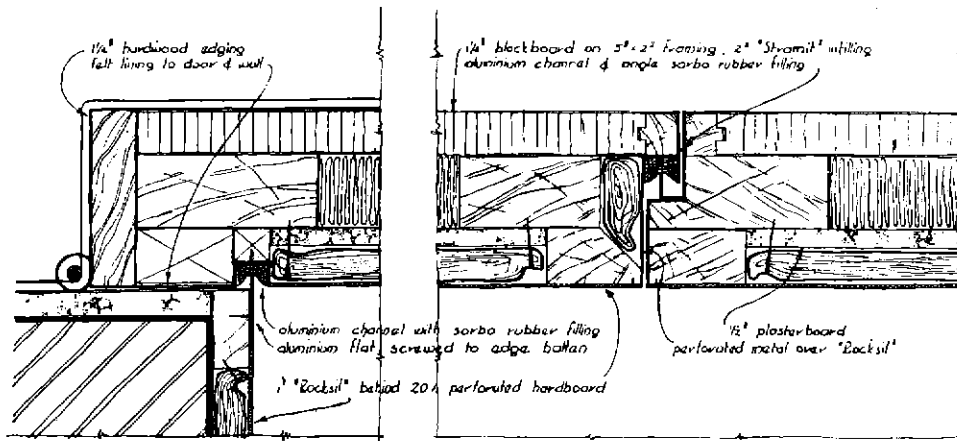
Riverside Studios, Acoustic Treatment and Soundproofing

At the outset it was obvious that the sound insulation value of the roofs of Studio R1 would be very low, and some investigation was, therefore, made into this and into the type of ambient noise level to be expected over the site. British European Airways had intended to make the proposed helicopter service between Waterloo and the London Air Terminal follow a route along the river. This would have been likely to produce high noise levels in the studios, as measurements of helicopter noise made by the BBC's Research Department showed. Fortunately, however, the river route was replanned by B.E.A. to by-pass the large bend at Hammersmith and the problem resolved itself. Aircraft and river traffic, nevertheless, still presented a problem. It was not practicable to suspend a ceiling inside the studios because of the vast amount of unrelated steelwork, and measures to improve the sound insulation were, therefore, designed as an external treatment to the roof. These were subsequently abandoned on grounds of cost. This decision could be termed a 'calculated risk', which, so far, has been justified in practice, as no serious complaints have been received from the users. The sound insulation of the studios to the outside must nevertheless be classed as sub-standard.

The two studios are divided by an original party wall consisting of two leaves of 4-in. clinker blocks with a cavity of 4 in. The insulation of this wall was measured and found to be 59 dB average. This is an unusually high value for this form of construction, probably owing to the large cavity, the acoustic deadness of the two adjoining studios, the large area of the walls, and the absence of connecting ties between them.

It was required to form a new opening in this wall between the two studios without reducing the insulation. Two pairs of doors were fitted giving a 10-ft by 12-ft opening. Each of these doors is 5-in. thick and weighs 11 lb. per sq. ft. The construction is shown in the attached sketch, Fig. 9. Special care was taken to secure a good seal at all edges of the doors.

Acoustically the studios were typical of those used for filming. Applied treatment to the walls and ceilings consisted of 2-in. thick rockwool mats fixed to battens covering almost all of the available area. The result of this type of treatment is usually a very dead acoustic condition with a downward slope at high frequencies and a steep rise in the bass. The measured curves for both studios (see Fig. 10) were as expected except that, probably due to the poor insulation of the roof, the rise in reverberation at bass frequencies was not very pronounced. The volumes of Studios R1 and R2 are 214,000 ft³ and 146,000 ft³ respectively. From experience at Lime Grove and elsewhere optimum reverberation times for various enclosures have been plotted for television purposes. The optimum reverberation time for Studio R1 is 0.80 secs. and for Studio R2 is 0.70 secs. In Studio R2 it was decided to introduce some further absorption at bass frequencies by means of membrane absorbers. These consist of a bitumen-felt membrane over an air space damped with rockwool, their absorption characteristic being very much higher than rockwool at low frequencies. At the same time these units have little absorption value at high frequencies and this would tend to level the curve. The measured values after treatment are shown in Fig. 10. This curve is very slightly higher than the optimum, and this is borne out



Detail at Jamb

Detail at Meeting Stiles

Fig. 9 — Detail of soundproof door between studios R1 and R2

by the experience of the users since the studio was put into service. Measures are being considered to effect this slight reduction. It is intended to introduce some further bass absorption in Studio R1. This will be in the form of double-

is flamboyant in the extreme, consisting of 'poly-cylindrical diffusers' fixed irregularly on the walls. There is no applied porous material and the result is the curious curve shown in Fig. 10. In order to satisfy the needs of the Tele-

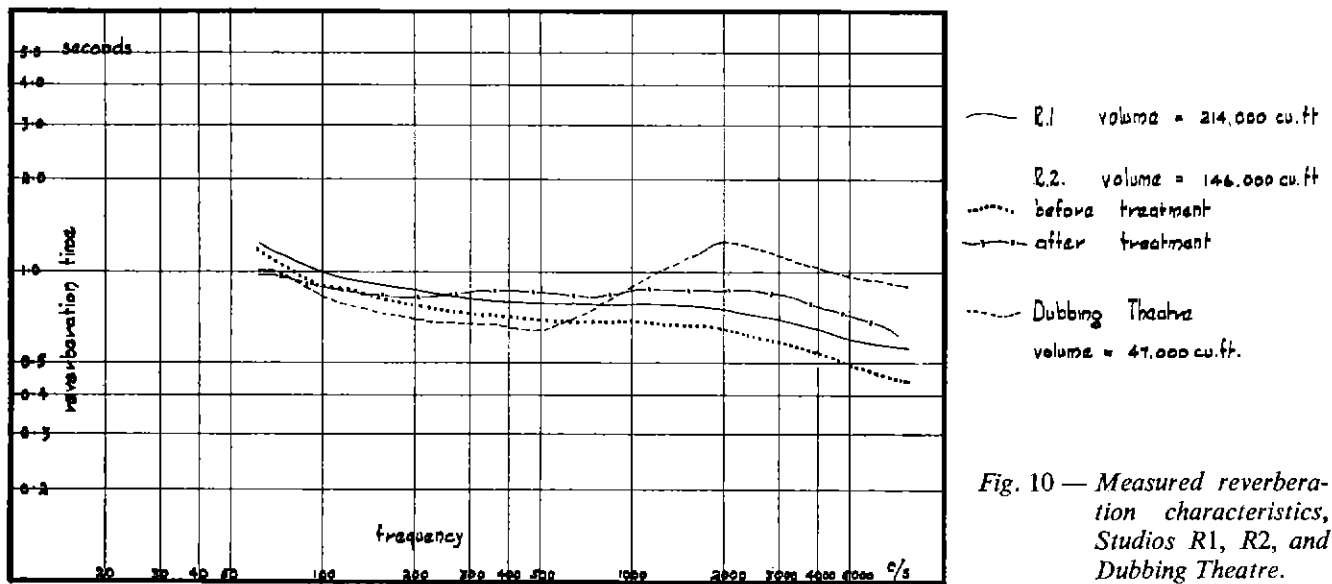


Fig. 10 — Measured reverberation characteristics, Studios R1, R2, and Dubbing Theatre.

sided membrane absorbers, and will be hung, as all the available wall space has been used. Bearing in mind the foregoing slight reservations regarding the acoustics of the studios, it should be said that both have been used for very ambitious productions, and have been found eminently satisfactory. The small modifications which have been proposed are in the nature of 'final tuning'.

The original 'sound-stage' in the premises is at present in use as a dubbing theatre. The existing acoustic treatment

vision Service it will be necessary to add some bass absorption, and a considerable amount of absorption tuned to 3,000 c/s. The studio control rooms have been treated with perforated-metal tray-tiles on the ceilings, and porous and membrane type absorbers on the walls covered with slotted hardboard. All these areas have been designed for a flat curve, and the average measured reverberation time of the sound control room to Studio R2, which is typical, is 0.43 secs.

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The BBC Riverside Television Studios: Some Aspects of Technical Planning and Equipment

by H. C. NICKELS

(Planning and Installation Department, BBC Engineering Division)

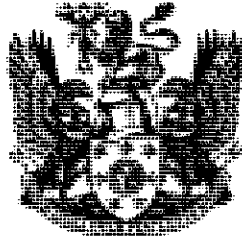
and

D. M. B. GRUBB

(Assistant to Superintendent Engineer, Television Studios, BBC Engineering Division)

BRITISH BROADCASTING CORPORATION

PRICE FIVE SHILLINGS



BBC ENGINEERING MONOGRAPH

No. 14

THE BBC RIVERSIDE TELEVISION STUDIOS:
SOME ASPECTS OF TECHNICAL PLANNING AND EQUIPMENT

by

H. C. Nickels

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OCTOBER 1957

BRITISH BROADCASTING CORPORATION

FOREWORD

THIS is one of a series of Engineering Monographs published by the British Broadcasting Corporation. About six are produced every year, each dealing with a technical subject within the field of television and sound broadcasting. Each Monograph describes work that has been done by the Engineering Division of the BBC and includes, where appropriate, a survey of earlier work on the same subject. From time to time the series may include selected reprints of articles by BBC authors that have appeared in technical journals. Papers dealing with general engineering developments in broadcasting may also be included occasionally.

This series should be of interest and value to engineers engaged in the fields of broadcasting and of telecommunications generally.

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2.	<i>Absolute Measurements in Magnetic Recording</i>	SEPTEMBER 1955
3.	<i>The Visibility of Noise in Television</i>	OCTOBER 1955
4.	<i>The Design of a Ribbon Type Pressure-gradient Microphone for Broadcast Transmission</i>	DECEMBER 1955
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6.	<i>A V.H.F./U.H.F. Field-strength Recording Receiver using Post-detector Selectivity</i>	APRIL 1956
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9.	<i>The Application of Phase-coherent Detection and Correlation Methods to Room Acoustics</i>	NOVEMBER 1956
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12.	<i>An Improved 'Roving Eye'</i>	APRIL 1957
13.	<i>The BBC Riverside Television Studios; The Architectural Aspects</i>	JULY 1957

SUMMARY

Riverside Studios in Hammersmith, comprising two film stages together with the necessary ancillary accommodation, were purchased by the BBC in 1954. The premises have been converted to form two television studios with the associated technical, production, and general accommodation and facilities required to form a self-contained unit served by the main television studios at Lime Grove and the scenery manufacture and property facilities at the Television Centre. The studios are known as Riverside Studio No. 1 (R1), with a floor area of 6,000 sq. ft and Riverside Studio No. 2 (R2), with a floor area of 4,200 sq. ft.

The original intention was to use R1 as a replacement studio and it was brought into service on 26 September 1956 in place of the light entertainment studio, Studio 'G' at Lime Grove, whilst the latter was being re-equipped. It is now apparent, however, that R1 will continue to be used as the principal light entertainment studio even after the return of Studio 'G' to service. R2 was brought into service on 30 July 1956.

The planning of the Riverside premises and the technical installation represent the outcome of experience gained in the operation of television studios for a considerable number of years, yet include certain novel features—untried in previous BBC studios—where it has been thought necessary to gain direct experience for the future. The facilities offered at Riverside are more comprehensive than those available at any of the earlier BBC studios.

This Monograph deals with the engineering equipment at Riverside Studios and should be read in conjunction with Monograph No. 13 which deals with the architectural aspects of the planning and building of the premises.

TERMINOLOGY

Waveform Terminology (As agreed by the British Standards Institution)

1. **BLANKING LEVEL** In the video signal, the boundary level between the picture information and synchronizing information: the reference level of the video signal.
2. **BLACK LEVEL** In positive transmission, the minimum permissible level of the picture signal.
3. **WHITE LEVEL** In positive transmission, the maximum permissible level of the picture signal.
4. **PEDESTAL** In the picture signal, the separation in level between the black level and the blanking level.
5. **SYNC. LEVEL** The level reached by the tips of the synchronizing pulses.
6. **PEAK WHITE** The level in the vision signal corresponding to white.
7. **FRONT PORCH** The interval of time immediately preceding the line synchronizing signal during which the video signal is maintained at blanking level.
8. **BACK PORCH** The interval of time immediately following the line synchronizing signal during which the video signal is maintained at blanking level.
9. **FIELD** In monochrome television: a sub-division of the complete television picture consisting of a series of sequentially scanned lines spaced equidistantly over the whole picture area, the repetition rate of the series being a multiple of that of the picture.
10. **PICTURE** In monochrome television: the displayed television image containing the whole of the transmitted information.
11. **PICTURE SIGNAL** The signal which conveys the picture information, as generated by the scanning device.
12. **VIDEO SIGNAL** The combined picture and synchronizing signals.
13. **VISION SIGNAL** The signal produced by the modulation of the vision carrier by the video signal.

General

14. **S.P.G.** Synchronizing Pulse Generator.
15. **MIXED SYNCs.**
MIXED BLANKING } Pulse Signals—containing field and line components.
16. **MASTER OSCILLATOR**
FREQUENCY Usually twice line frequency in a 405 line system 20,250 cps. from which the various components necessary for synchronizing the system are generated after division.
17. **GENLOCK** A system of locking a local S.P.G. to a remote S.P.G. so that the pictures from either source are coincident in time. It is a necessity for 'inlay', mixing or superimposing, local and remote picture signals.
18. **RASTER** The scanned patch on a cathode-ray tube.
19. **FOLDBACK** The feeding of one, or more, studio loudspeakers with sound not originating in the studio itself, simultaneously with the mixing of that same sound into the studio programme output.

1. Introduction

The BBC started the first regular public high-definition Television Service in the world from Alexandra Palace in 1936. This service was maintained until September 1939 when it was closed down upon the outbreak of war.

Television broadcasting was re-started in June 1946 and it was not long before it was realized that the two studios at Alexandra Palace were inadequate, both in size and facilities, to meet the rapidly expanding needs of the service.

After several possibilities had been examined, land was acquired at the old White City Exhibition site in West London on which to build the main Television Studio Centre and administrative headquarters. It was not, however, possible to commence work on this new site at once, because of the national policy of restriction on capital expenditure.

It was, nevertheless, essential to provide additional studio space and, in 1950, the Lime Grove Film Studios of the Rank Organization were acquired by the BBC. Between that time and 1953 four studios were equipped and central presentation facilities provided, thus allowing all Television Studio Operations to be transferred to these premises.⁽¹⁾ Of the four studios at Lime Grove, however, only one, Studio 'E', was equipped on a permanent basis; the other three being, as a matter of necessity, developed on austerity lines, using equipment originally built for outside broadcasts.

In 1954, the Shepherds Bush Empire was purchased and quickly developed, again on an austerity and temporary basis, as a Television Theatre to satisfy the growing demand for a studio suitable for the spectacular type of production requiring the presence of an invited audience.

By this time the planning of the new Television Centre on the White City site was proceeding rapidly. It was clear, however, that before this project could be completed it would be necessary to re-equip the three austerity studios at Lime Grove and to provide a further studio to give some scope for the immediate future expansion of programme hours and complexity; possibly even to provide additional studio space for an alternative programme.

It was therefore decided to equip two new studios, one as a replacement studio which could be used in place of the studios at Lime Grove whilst each in turn was refurbished; the second as an additional studio. It was with this object in view that the BBC purchased, in 1954, the Alliance Film Company's Riverside Studios in Crisp Road, Hammersmith. The choice of this particular building was no doubt tempered by its reasonable proximity to Lime Grove and to the new Television Centre but, in choosing a film studio building, it is clear that some advantages are gained at the outset.

Planning was put in hand immediately upon taking possession of the premises with the object of providing, with the minimum of alteration, two television studios to be known as Riverside 1 or R1 and Riverside 2 or R2 together with the basic ancillary accommodation and facilities. Consideration was to be taken of the fact that the studios would be able to draw upon supplies and ser-

vices from the Television Studios at Lime Grove and the scenery workshops at Television Centre. The final layout of the premises is shown in Figs. 1 and 2.

At first sight it may be thought that there is little difference between a film studio and a television studio and that, as a result, all that is necessary in converting the one to the other is the addition of technical accommodation and the installation of the necessary equipment. The fundamental difference in the operation of the two media should not be lost sight of however; on the one hand, film making is essentially a non-continuous process with short studio takes, whilst, on the other, television demands a continuity of performance which is inevitably the governing factor in studio technique. The extent of the alterations to the building consequent upon these differing techniques, before the installation of television plant was practicable, was greater than had at first been expected.

In considering the replanning of the Riverside premises, it was necessary to discard many features which, on first sight, may appear to have been made to measure. The studio floors for example, though adequately strong and level for the operation of film cameras mounted on rails, were not sufficiently sturdy or level for use by television cameras, which are required to move smoothly, freely and continuously from one set to another.

The complexity of modern television studio productions demands a considerable amount of rehearsal time. It therefore becomes an economic necessity to reduce to a minimum the time required to change the scenery between productions and to carry out the lighting for the new production so that a quick turn round can be achieved. In practice rehearsals at Riverside commence at approximately 10.00 a.m. on most days and it is therefore frequently necessary to carry out studio rigging overnight.

For this reason separate scenery transit docks have been built adjacent to both studios.

The normal film studio lighting and scenery handling facilities which existed at Riverside were unsuitable for such streamlined rigging operations. A new lighting system has therefore been provided which incorporates a network of remotely operated electric hoists. These provide a grid of short rigging barrels over the whole studio and are intended for the suspension of both illuminators and light scenery.

The conventional method of suspending heavier scenery by means of rolling skids running on steel joists is retained.

The lighting installation is most comprehensive and provides the lighting supervisor with facilities for setting the initial lighting with the minimum labour and maximum speed. Moreover, it provides for the flexible control of all illuminators used so that the lighting of a scene may be altered during the progress of the production, to achieve any desired pictorial effect on the transmitted picture. In this operation the closest co-operation with the producer and those in control of the camera equipment is necessary and the positions of the lighting control consoles in the technical areas have been chosen with this point in mind.

Special lighting effects, hitherto impossible with the less flexible lighting systems used in earlier studios, may now

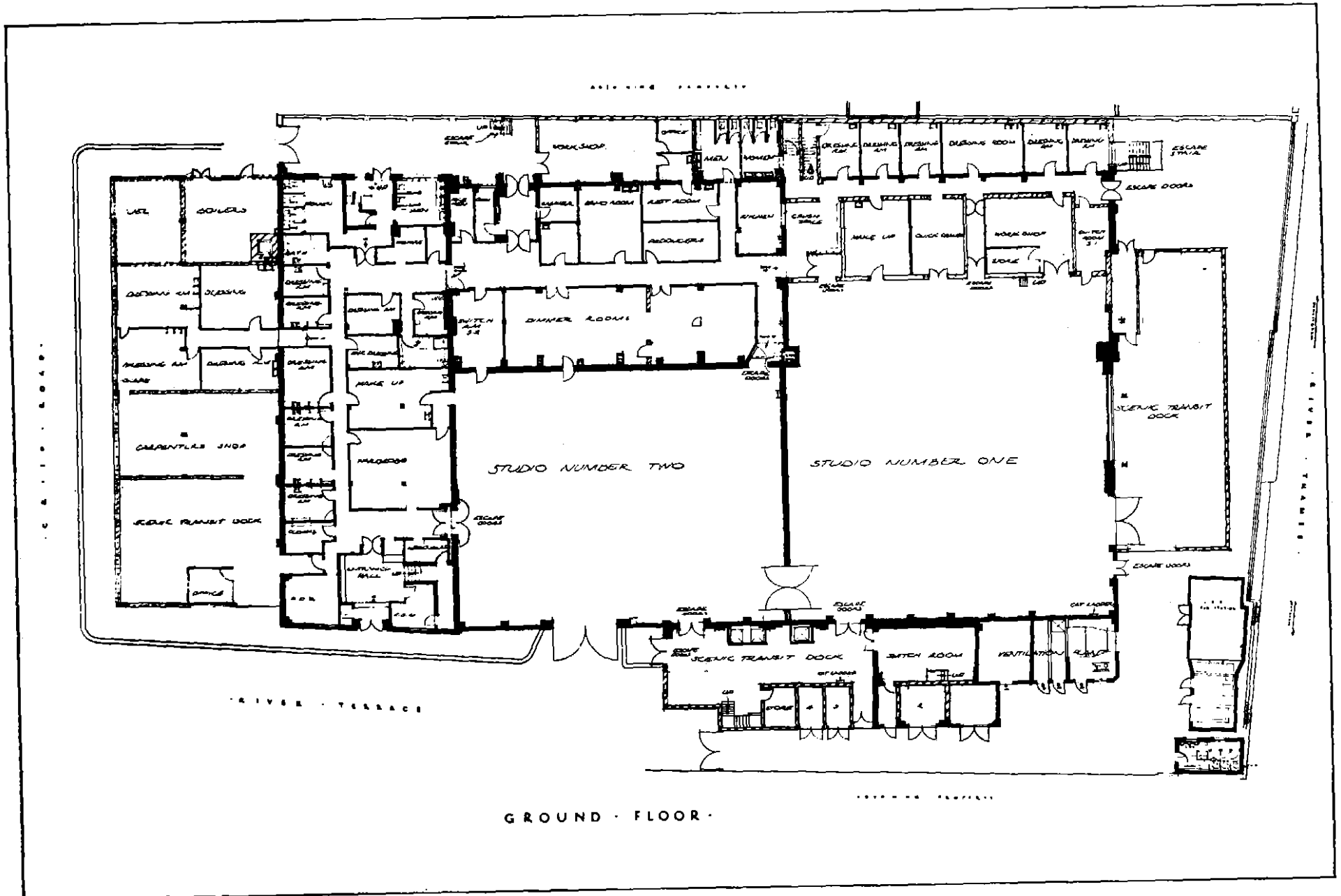


Fig. 1 — Riverside Studios—Ground Floor Plan

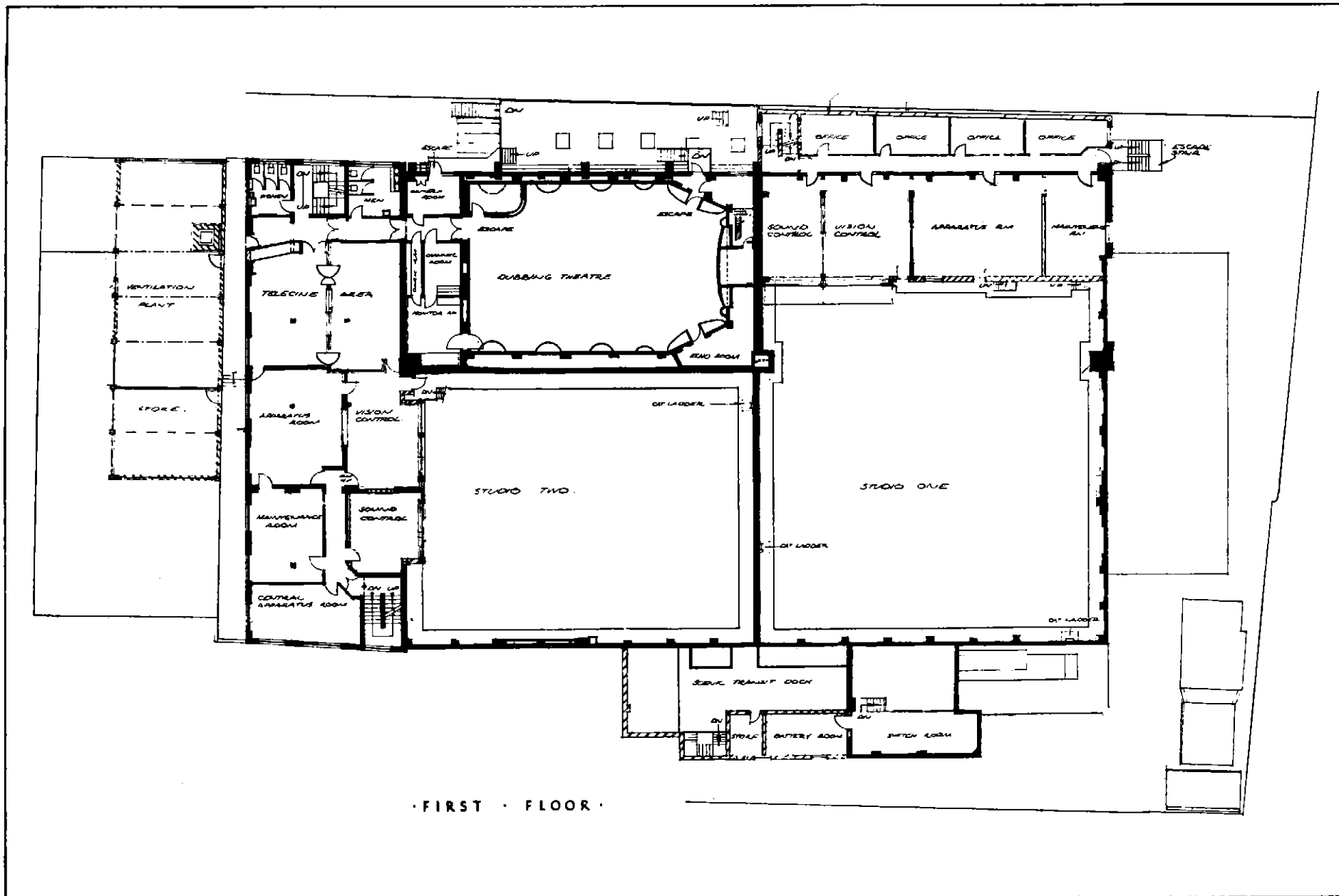


Fig. 2 — Riverside Studios—First Floor Plan

be confidently attempted. The ability to switch lights in groups is normally used for scene-to-scene changes, thus reducing the heat generated by the lighting and consequently easing the ventilation problem.

Two different systems of dimming have been adopted. A magnetic-clutch mechanical system with resistance and auto-transformer dimmers is used in Studio R1 and an electronic dimmer system employing thyatron valves in Studio R2.

Alternative approaches have been provided in this and also in certain other cases so that experience can be gained prior to finalizing plans for the Television Centre, which, it is hoped, will become a standard for the future. The lighting installation is described in detail in Section 3.5.

It should not be assumed, however, that Riverside Studios were to be developed purely as a prototype for the Television Centre. In their planning, the experience gained in previously equipped studios has been extensively used and, where possible, in the interests of simplification of operation similar equipment and techniques have been adopted in both studios. In particular the studio television equipment for both is identical, as described in Section 3.2.

Before orders were placed for the camera equipment for Riverside and other studios in the London area, the BBC had decided to discontinue the use of cameras employing high-velocity tubes. The advantages and disadvantages of high- and low-velocity tubes are well known, but the major reason for the choice in this case was the greater sensitivity to be expected from cameras using the latter type. Adequate sensitivity is, of course, essential so that cameras may be operated at a lens aperture at which reasonable depth of field may be obtained without recourse to very high lighting intensity.

The total requirement for studios in the London area was just over thirty camera channels and after careful selection from those available the order was equally divided between cameras manufactured by Electric and Musical Industries Ltd, using the stable C.P.S. emitron tube, and those manufactured by Marconi's Wireless Telegraph Company Ltd, employing the 4½-in. image orthicon tube.

Image orthicon cameras have been installed in both the Riverside studios largely because the somewhat greater flexibility of this type appeared to be most desirable in studios intended to be used for replacement purposes and consequently having to meet programme demands of every type.

The major points in favour of the image orthicon over the C.P.S. emitron are:

- (i) Greater sensitivity.
- (ii) Less lag (smearing on movement).
- (iii) The ability to handle occasional excessive contrast ranges without undue degradation of picture.

Studio R1 has been equipped with four operational cameras, Studio R2 with only three. There is also installed in each studio a spare camera channel which is intended to be brought into service immediately in the event of a failure of one of the operational cameras. It is of interest to note that there have in practice been several occasions when four operating cameras have been employed in

Studio R2 but in these instances it has been necessary to modify the procedure to be adopted in case of breakdown.

A single camera channel is available at Riverside for major maintenance, overhaul purposes, tube testing and to serve as a replacement during the clearing of any faults which require lengthy diagnosis and repair.

The vision mixing equipment installed in both studios is of new design and is very flexible. The sound mixing and control installations in both studios are of BBC design. Studio R2 is equipped with a standard Type 'A' sound installation which has been employed in BBC sound and television studios for many years. In Studio R1, however, a newly designed and entirely experimental installation, based on the BBC Type 'B' design but employing a table-top desk and quadrant-type faders, has been used to improve visibility for the operator and provide a particularly compact operating position.

A 35-mm. BBC-designed Flying-Spot Mechau telecine channel has been provided for each studio for film insert purposes. 16-mm. films must, however, be relayed from a telecine channel at Lime Grove when required. The telecine equipment is arranged so that both channels may, if desired, be fed to either studio.

The studios and telecine equipment are fed synchronously with driving pulses from a central pulse generator and timed so that the smaller studio may be used as a slave to R1. As the studios are adjacent, ability to mount a major performance in this way is of considerable advantage.

A mimic diagram type of remote control board is provided for the control of the main electricity supply switching so that a close and constant check of the supply position may be kept in the central control room. The studio lighting is supplied with a.c. and no motor-generators are used; d.c. supplies, where necessary, are obtained from metal rectifier units.

A more detailed description of certain salient points in the installation follows, but it is as yet too early to predict which of the alternative approaches to certain aspects of the installation is to be preferred, or to assess the suitability of some of the more experimental features of the installation.

2. Technical Accommodation

2.1 General

The Riverside Studio premises, as taken over, comprised two film stages, an orchestral dubbing suite, review theatre, property dock, dressing-rooms, scenery construction shop, canteen, offices, and various storerooms.

The dimensions of the two stages were, Large Stage 100 ft × 75 ft = 7,500 sq. ft; Small Stage 75 ft × 60 ft = 4,500 sq. ft and the height of both was approximately 25 ft.

Planning for the conversion of the building to television studios was commenced in October 1954. The larger stage became known as Studio R1; the smaller as R2, and only the minimum possible reduction of the effective acting area of each stage was permitted. Nevertheless it was impossible to avoid considerable building extension into the larger studio.

One of the major problems in planning the layout of the two studios was that of finding a satisfactory location for the associated technical areas. These comprise, for each studio: vision control room, sound control room, vision apparatus room, advance maintenance room and lighting dimmer room, together with, where possible, a studio technical equipment store. Certain auxiliary centralized technical accommodation is also required but, as space was at such a premium, this accommodation had to be reduced to the absolute minimum. The areas which have been provided are, a central apparatus room—which also serves the purpose of lines termination room—two telecine rooms, electrical intake and switch-rooms, lighting transformer cubicles, battery room, technical components store, and electricians' workshops.

The film dubbing theatre, which already existed in the premises, was retained, for, although it was not necessary to associate dubbing with the new studios, it would have been uneconomic not to retain this facility, difficult though it was to spare the space which it occupied, particularly as it was believed to be one of the finest orchestral dubbing theatres in London, and the BBC was particularly short of dubbing theatre space.

2.2 *Studio Accommodation*

The studio lighting dimmer rooms have been located together in a block between the two studios comparatively close to the power intake switchgear and lighting transformers. This arrangement permitted the lighting cabling to be kept to reasonable lengths and of moderate cross-sectional area.

A studio equipment store has been provided in Studio R1 only, but space considerations precluded its being as large as would have been desirable. Its purpose is to allow studio equipment such as camera dollies, microphone booms, cables, stands, spare illuminators, microphones, lenses, etc., to be stored convenient to the studio but in a place where they will not sustain damage during the rigging of scenery etc.

Of the group of studio technical accommodation remaining, the four principal areas are so operationally inter-dependent that they must be considered collectively.

It has sometimes been suggested that, in order to obtain the closest possible co-operation between all sections of the operational team, it would be desirable to build a large single area from which all studio operations could be controlled. Experience gained at Lime Grove in the preceding years, however, shows that this is not so; the principal objection being that the various conversations, movements and extraneous noise caused by one section disturbs another and does not permit the degree of concentration demanded. A compromise has therefore been sought in which all this accommodation is arranged in adjacent rooms on a single floor level separated by partitions containing carefully placed windows.

The purpose of the various rooms is as follows:

2.2.1 *Vision Control Room*

This is the production control room from which the producer directs artists, cameras and other production equipment and controls the continuity of the production.

The technical operations manager (T.O.M.) and the vision mixer also work from this room; both are in the closest touch with the producer throughout the production.

Particular care has been taken in planning the technical areas at Riverside to provide adequate space, not only in the basic operational positions but also in the vision control rooms, for make-up and wardrobe staff, designers, authors, composers, dance directors, and others whom it may be necessary for the producer to consult on immediate problems concerning the progress of the production. Such space has not been available in previous studios.

Other technical functions normally carried out in the vision control room include the control of special effects (inlay and overlay) which are described in Section 4.

There has been much discussion as to the correct location for the lighting control console and there is a considerable weight of opinion which favours its being placed in close proximity to the producer and T.O.M. in the vision control room. There is, however, an equally strong case for its association with the operators of the camera control units in the vision apparatus room, as it is in this area that the quality of the picture, in which the lighting plays so important a part, is the principal concern.

Bearing in mind the need for operational experience to settle such problems for the future, Riverside 2 has been planned with the lighting control console in the vision control room, whilst in R1 it is installed in the vision apparatus room.

2.2.2 *Sound Control Room*

Whilst it is vital that the sound supervisor should be in the closest touch with the producer and the remainder of the production team, it is equally important that he should be able to listen to the sound output from the studio in conditions free from distracting directions or conversations. Moreover, in order to appraise the quality of sound, or to balance the microphones he is using, he must listen at a volume level sufficiently loud as to interfere with the work of the other members of the team. A separate room, having a suitable window looking into the vision control room, is therefore provided for sound control. Its acoustic treatment is designed to provide, as nearly as possible, ideal listening conditions.

The disk reproducing units and all the amplifiers and other apparatus associated with the sound control equipment are also located in the sound control room.

2.2.3 *Vision Apparatus Room*

The camera control units form the principal items of equipment installed in this room. Again it is important that there is acoustic insulation from the vision control room. Nevertheless, it is considered that the operation of camera controls should be closely linked with the producer and the production team so that where certain pictorial effects are required, the liaison necessary to provide them is easily possible.

The room also contains the equipment concerned with vision mixing, inlay and distribution of pictures and pulses to and from the local studio equipment and the central apparatus room.

2.2.4 *Advance Technical Maintenance Room*

Although not considered as one of the basic operational areas it is essential that suitable accommodation be provided adjacent to each studio and technical area for the immediate maintenance of equipment. Whilst engineering operational crews are allocated to each particular production, the setting-up, maintenance, routine testing and repair of the technical equipment are carried out by a static maintenance crew associated with the studio concerned. In order that these crews may be kept in close touch with the studio equipment during rehearsal or transmission and have immediate access to spare units and test equipment, it has been found necessary to have a fully equipped test room and workshop adjacent to each studio control and apparatus room. Experience has shown that the attachment of maintenance staff to a particular studio over a period makes possible a measure of specialization which considerably reduces the liability of breakdown. Major overhauls of equipment must, however, be carried out in the base maintenance workshops.

2.2.5 *Arrangement of Studio Technical Areas*

Somewhat different approaches to the layout of the technical areas of the two studios have been made in an attempt to determine, under operational conditions, which basic arrangement should be adopted for the Television Centre. In each case the principal feature of the

layout is the location of the studio observation window relative to the production positions. In Studio R1 the window is placed in front of the production desks; in Studio R2 the window is at the side. In the forward viewing case, shown in Fig. 3, the control room picture monitors are fixed above the window on a level with the eyes of the production team. In this position they afford good viewing, not only for those seated at the production desk, but also for the additional personnel behind. The monitors have been suspended on runners fitted to a shelf over the top of the window and the eye may pass easily from the monitors to the observation window below, through which an excellent view of the studio may be obtained.

In the case of R2, where the more conventional side viewing arrangement has been adopted, the control room picture monitors have been mounted on double-tier stands which are placed in front of the production desk. The view into the studio from the vision control room is not so good as in R1, except for the person sitting immediately adjacent to it (in this case the producer's secretary).

It may be argued that it is unnecessary to see into the studio as all the action may be seen on the picture monitors. It is, however, an advantage for the producer and the technical operations manager occasionally to glance into the studio to assess the relative positions of cameras and other studio equipment, particularly during rehearsals.

The technical areas have been arranged on the first



Fig. 3 — R1 Vision and Sound Control Room during rehearsal

floor in what was formerly an office block. In order to obtain the desired relation between them, it was necessary to enlarge the available space in R2 by building out the control rooms into the studio.* The sound and vision control rooms have been arranged in this case so that the respective operators face each other. The vision apparatus and maintenance rooms are located behind the vision control room in such a way that a view of the former is possible from the vision control desk, as can be seen from Fig. 2.

In the case of Studio R1 it was necessary to effect a compromise between the provision of technical areas of adequate size and the paring down of the studio area. It was finally decided that the vision and sound control, apparatus and maintenance rooms should be built in a single line on the first floor of a new block located at the side of the existing building but extending into the studio. The areas on the studio-floor level, beneath these four rooms, are used for make-up and wardrobe accommodation and for the studio technical equipment store.

2.3 Central Technical Accommodation

Central technical accommodation has had to be limited to an absolute minimum and has been located where space permitted. It was fortunate, however, that some space was available near the technical area of Studio R2, which allowed the central apparatus room, telecine rooms, and the technical component stores to be placed adjacent to this studio, thereby making it possible to integrate the test equipment, staff, and other facilities required for the efficient running of all three areas, in an economical manner.

In the case of the central apparatus room it was decided that, as this need not be permanently manned, it would be convenient for the maintenance engineers responsible for Studio R2 to make such adjustments as might be necessary and to be available if required to take emergency action.

No centralized maintenance workshops have been provided at Riverside as equipment in need of mechanical repairs or maintenance of too complex a nature to be carried out in the two advance maintenance rooms is taken to the Television Studios at Lime Grove. Some minor mechanical maintenance to studio equipment, such as camera mountings, microphone booms, etc., can be carried out in the studio equipment store in Studio R1.

3. Technical Equipment

3.1 Central Television and Sound Equipment

The functions of this equipment, which is located in the central apparatus room, are as follows:

- (a) To generate the synchronizing pulses and distribute them, together with the necessary timing pulses, to the two studios and to the telecine rooms.
- (b) To receive from the two studios video and sound signals for distribution, via balanced-pair video circuits, and P.O. telephone lines, into the distribution network. (For the present via the Television Studios central apparatus room at Lime Grove.)

* A detailed description of the work involved is contained in Monograph No. 13.

- (c) To terminate and distribute all communications from the distribution network, such as vision and sound cue-circuits and control lines.
- (d) Remote control and monitoring of the power intake and distribution to various areas.

The synchronizing pulse generators (S.P.G.) produce four waveforms; mixed syncs and mixer blanking for the video waveform, and line and field trigger for synchronous timing of the studio cameras and telecines, etc. Fig. 4 shows a block schematic diagram of the pulse distribution system.

There are two S.P.G. units, one acting as a spare, which can be remotely changed over from the central apparatus room or from either studio.

Genlock⁽²⁾ is provided to slave the studios synchronously to a remote source, e.g. an Outside Broadcast Unit or another Studio Centre, so that 'mixing' and 'superimposition' may be carried out between the studios and the remote source.

Five test waveforms are available for distribution to the studios etc.; these are:

- (a) Grille Pattern for raster linearity and geometry checking.
- (b) Line Sawtooth for checking the linearity of video amplifier chains.
- (c) A 1.5 micro-second pulse ('Flag Pole') for detecting high-frequency distortions in video amplifier chains.
- (d) Artificial Bars ('Art Bars'): A black cross on a white background, the cross widths approximately equal to line and field blanking widths. This is used as a test video signal into the distribution network.
- (e) Stepwedge: A linear greyscale in which the number of steps in the scale can be adjusted between five and sixteen. It has switched frequency bursts which can be superimposed on the greyscale steps, and is used for checking video amplifier linearity, transfer characteristics and gamma.

Video signals and pulses are distributed within the Studios by means of two types of distribution amplifier, both designed by the BBC.

The first is for video signals and has a gain of 6 dB. This allows for losses in equalizing circuits within the studios; the equalizers are always 'padded out' to a fixed loss of 6 dB. The final stage is a 12.E.1 valve anode-coupled to a split load of four outputs, each feeding a coaxial line terminating in 75 ohms at 1-V. p.p. These units are each supplied from an individual, stabilized power supply. The amplifier has a control for adjusting the gain by ± 2.5 dB and has a 75-ohm input.

The second is the pulse distribution amplifier which is for handling 2-V. p.p. trigger, blanking and sync. pulses and has a self-contained, non-stabilized h.t. supply. Its stability is achieved by overall negative-feedback in the amplifier. This amplifier has a high-impedance input and, for this reason, several may be connected in parallel to provide a large number of separate feeds.

The video signals are transmitted via 40-lb. circuits in a multi-core cable. The transmission from the sending end

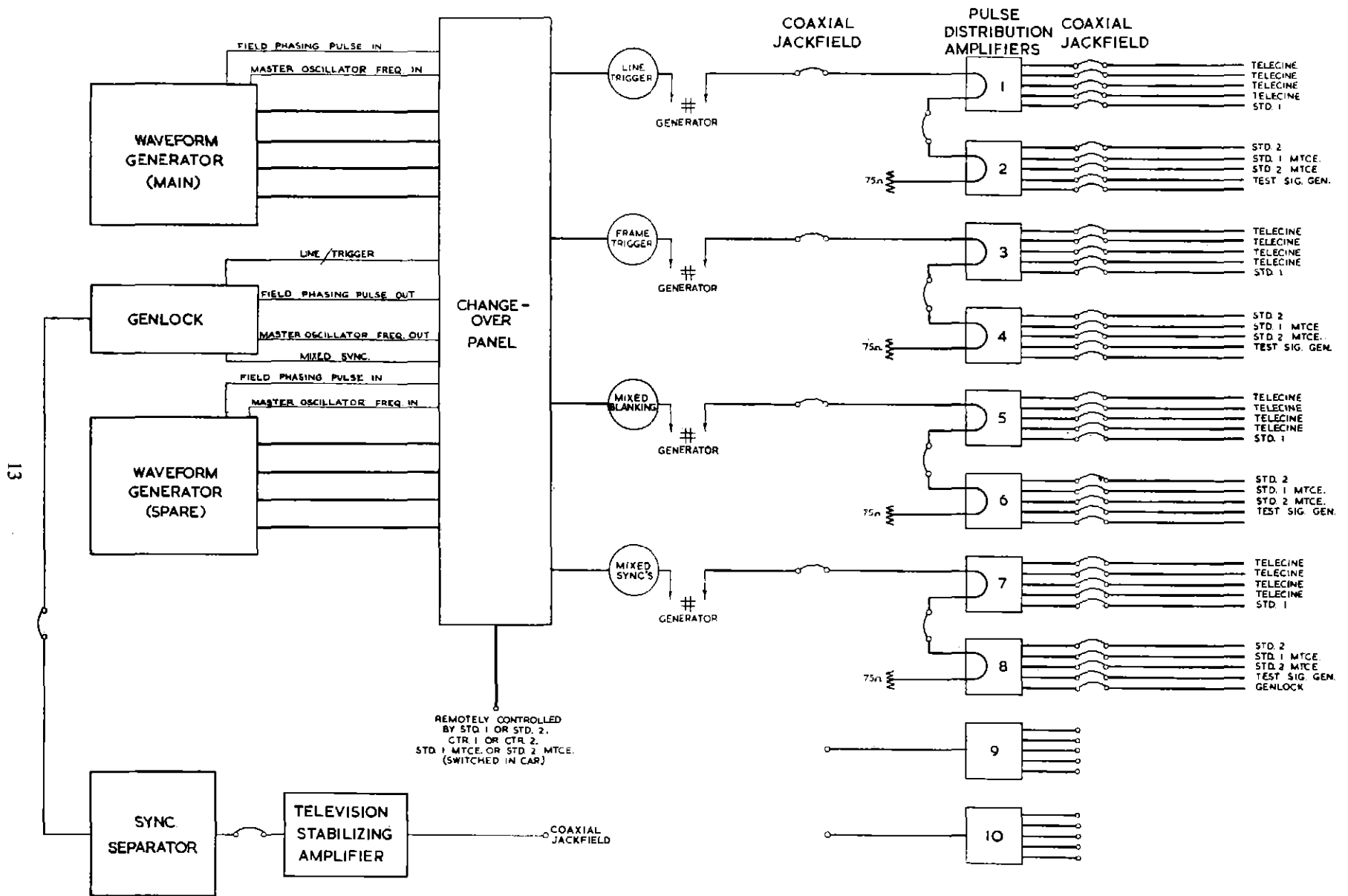


Fig. 4 — Central Apparatus Room Pulse Distribution Schematic

is a balanced 2-V. p.p. composite video signal, and this is fed into the circuit from a BBC-designed sending amplifier which has 1-V. p.p. video input, converting the standard distribution signal to a balanced signal for sending.

The receiving apparatus is a series of video gain amplifiers and equalizers. The balanced video signal is received, transformed to an unbalanced signal and amplified. The signal is equalized and again amplified, using Bode⁽³⁾ equalizers; the particular frequency band being compensated is suitably phase-corrected.

The central sound equipment is similar to that used in the sound broadcasting service. The sound contributions from both studios are received and may be monitored prior to sending into the external distribution network. All circuits are 600-ohms balanced, and the sending level into the P.O. lines is + 4 dB. Sound contributions received from the external network for inclusion in composite programmes in either of the studios are equalized, 'padded out' to -42 dB and amplified in a fixed-gain amplifier for further distribution. The equipment is almost wholly of BBC design.

A high-grade check receiver for both vision and sound signals is provided for cueing purposes. The output of this receiver may be fed to either studio or to telecine.

The master pendulum clock is also situated in the central apparatus room, and operates a series of 'seconds' and 'half-minute' slave clocks. The system is accurate to within one second per day and is similar to the clock systems used in other BBC studio centres and transmitters.

3.2 Studio Television Equipment

The equipment in the two studios is of similar design but one less camera and no inlay and overlay equipment is provided in R2, therefore the general description will be based on the equipment in R1.

The cameras, made by Marconi's Wireless Telegraph Co. Ltd, and designated Mark III, were originally designed to meet a BBC specification. They use the English Electric Valve Company's 4½-in. image orthicon camera tube which was developed by the E.E.V. Co. in association with the Marconi Company. This type of camera tube was originally developed by R.C.A. in parallel with the 3-in. version, but their 4½-in. tube differed in that it was 'scaled up' from the 3-in. image orthicon, and had a different magnification in the image section. The E.E.V. Co.'s 4½-in. tube has an image section magnification such that lenses having a diagonal coverage of 40 mm. can be used. The tube, even at the time of coming into service in August 1953, had definite advantages over the standard type 5820, 3-in. image orthicon tube, such as improved signal-to-noise ratio, less 'edge effect' and better resolution. It also has a much longer linear characteristic below the 'knee' but flattens off more above the 'knee'.⁽⁴⁾ The 4½-in. tube exposure is adjusted to work between 0.5 and 1.0 stop over the knee. Subsequently, in the camera chain, the signal is passed through a de-gamma circuit.

A standard complement of lenses is used on each camera, f 1.9, 2-in. (35°),* f 1.9, 3-in. (24°), f 3.5, 5-in. (14°), and f 4.5, 8-in. (9°). The control of light to the

* Horizontal angle—picture 4 × 3 aspect ratio.

camera tube is by means of a neutral density filter-wheel which has a 10 : 1 range. This is controlled remotely from the camera control unit. The lens iris may be adjusted by the cameramen for setting depth of focus, and also for setting an average mean exposure point for working the image orthicon. The cameras are mechanically focused by means of a lever-type control on the right-hand side of the camera body which moves the tube carriage in relation to the taking lens. The rotation of the four-position lens turret is also operated mechanically, from the rear of the camera, one complete turn of the turret change handle corresponding to one lens change.

The camera has an electronic viewfinder which displays a picture on a 5-in. cathode ray tube viewed through a magnifying lens.

The camera is connected by means of a single camera cable to its camera control unit in the vision apparatus room. Fig. 5 shows a group of camera control units, which are arranged in an arc about a centre position equipped for supervisory control. A 'transmission' and a 'preview' picture monitor, for picture-matching purposes, and a waveform monitor are provided. Master gain and lift controls from each C.C.U. are made available at this centre position for use by the vision control supervisor; these enable him to over-ride if necessary the settings made by individual C.C.U. operators. The outputs from the camera control units are distributed to the vision mixer and preview monitors as illustrated in Figs. 6 and 7 which show the transmission and preview chains respectively.

Preset gain and lift controls for effects purposes are fitted in each C.C.U. and, having been previously set up, may be switched into operation either by the C.C.U. operator or from the lighting control console. Special provision has also been made for the extension of this switching facility to points in the studio so that it may be coupled, for example, to a light switch on the wall of a studio set.

Vision Mixing Equipment

The vision mixing apparatus was developed by Marconi's Wireless Telegraph Company Ltd, to a BBC specification.

In considering the operational requirements prior to the preparation of the specification an ample field of experience was available. There had, in earlier installations, been little or no standardization in vision mixing equipment and it was apparent that for the future a standard format of operational controls was essential.

The vision mixing equipments in previous use may be classified into two distinct groups thus:

- (i) Mixers having separate fading and cutting controls for each available source.
- (ii) Mixers of the 'A-B' type in which a single fader is used to select one or other of two main circuits to which chosen individual sources have been previously switched.

Whilst experience with an 'A-B' mixer fitted in Studio 'E' at Lime Grove had shown the limitations of this system, particularly on elaborate caption sequences, it had

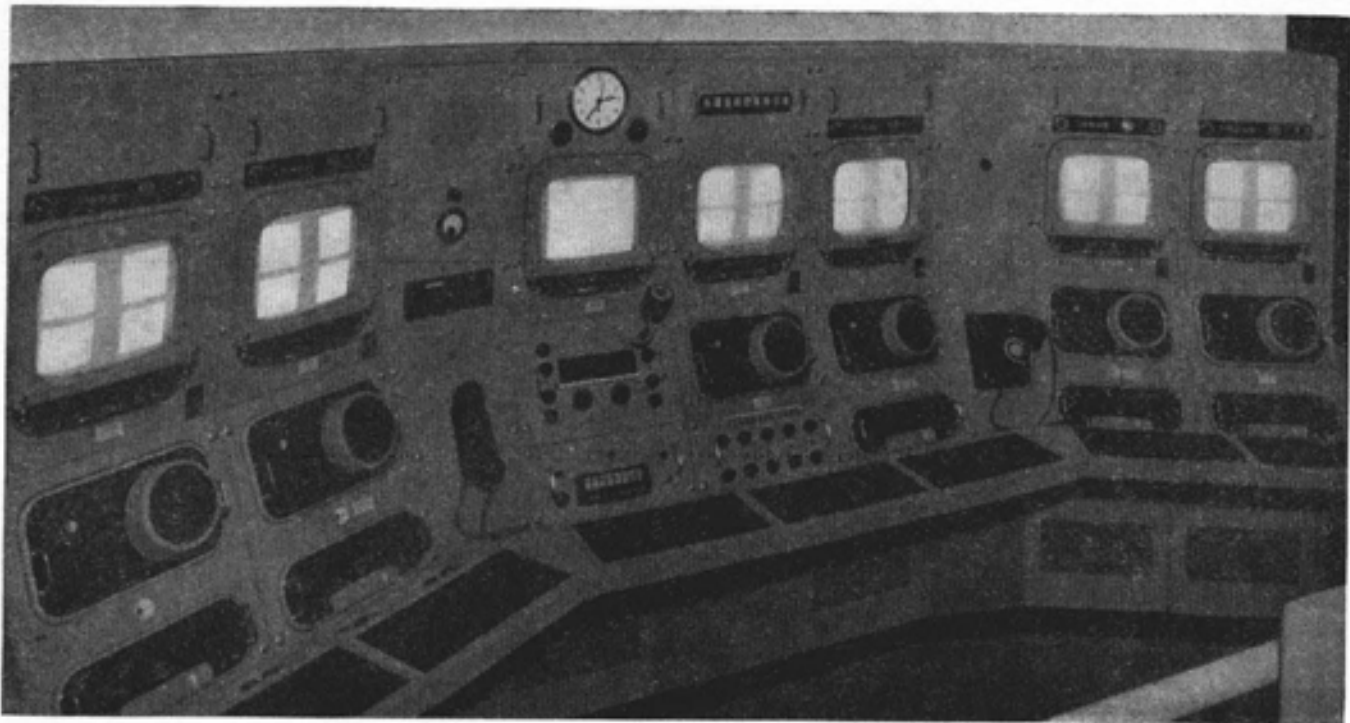


Fig. 5 — Camera Control Units in R1 Apparatus Room

also clearly illustrated the potential advantages of this system when it can be properly utilized. In particular, it offers the fairly easy application of a mode of operation whereby the picture about to be taken can be displayed to the entire production team without undue complication. On the other hand, the advantages of having completely separate controls for each source were too important to be neglected.

After careful consideration a vision mixing desk incorporating the advantages of both systems has been adopted. A brief description of the operation of this equipment will illustrate the degree of flexibility achieved.

The mixing desk consists of two control panels, each having seven channels, with a group control to select the panel desired, or the correct combination of both panels when this applies. In determining the number of channels an attempt was made to reach a compromise between the provision of adequate facilities and the undue complication of the equipment. Subsequent experience, however, suggests that eight channels might have been a better choice—a greater number than this would almost certainly have introduced complication in operation.

A fader and a cut button are provided for each channel on both panels and a fader and separate cut button for each panel on the group control panel. A system of indicator lights is arranged to show which group is on transmission, which faders in each group are faded up and which cut buttons have been operated.

Normally the same seven picture sources are applied to the channels on both panels, but to comply with exceptional conditions different sources may be plugged to both panels and in this way a total of fourteen sources could be handled.

When the mixer is connected in the normal manner, the four (or three) studio cameras, telecine, special effects (inlay and overlay) and outside broadcast sources are plugged to the seven channels on both panels. Two modes of operation are thus available to the operator:

(i) *Straightforward Operation*

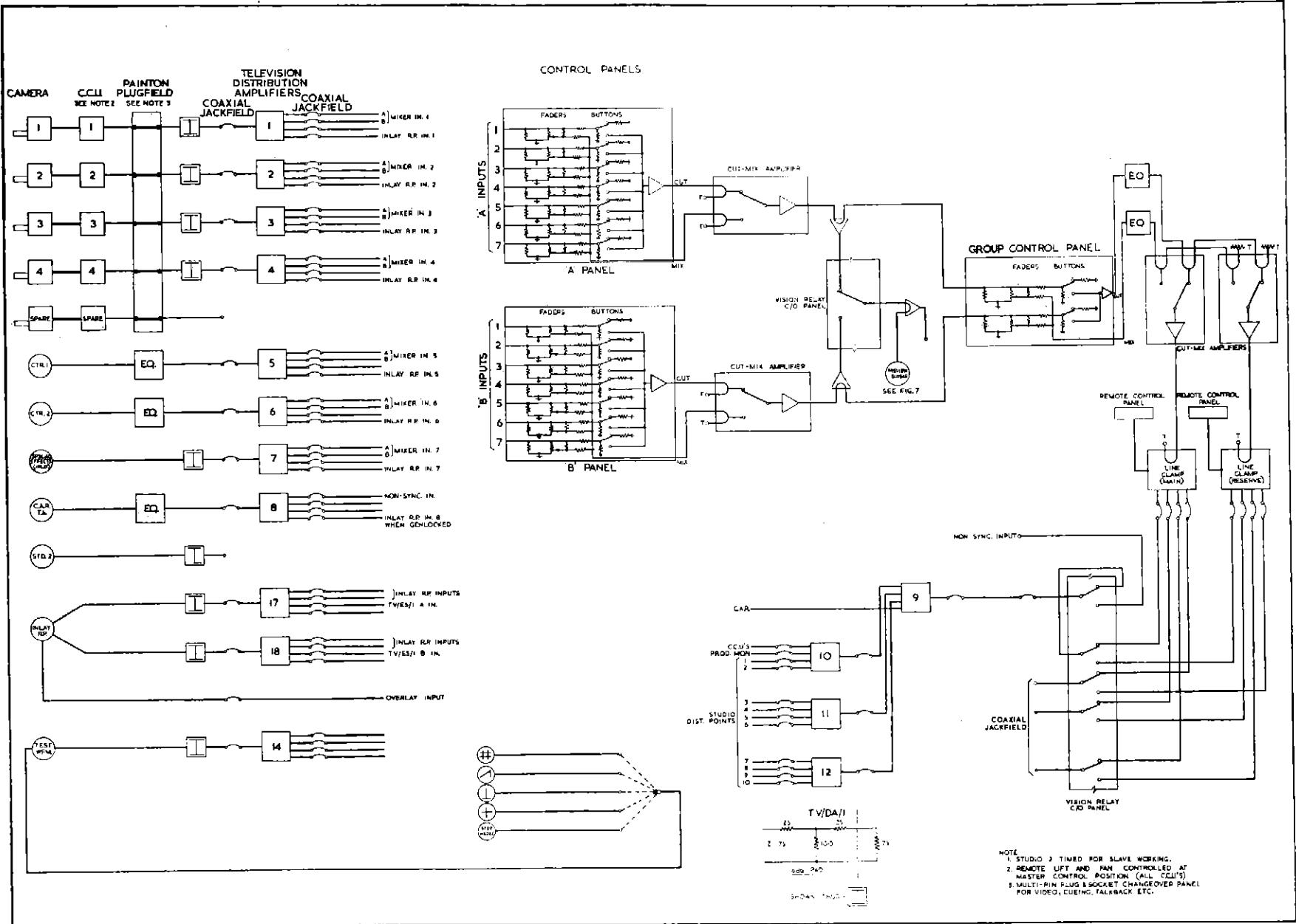
This method is most suitable for the very fast moving or unscripted production. It will be assumed that the group fader for the one panel is faded up on the group, or the cut button for that panel operated.

It will now be possible to fade up any channel, or a combination of a number of channels, as required. Cutting may be achieved by operation of the appropriate button on the group panel. The cut buttons take control irrespective of the position of any of the faders, but a separate 'cut-mix' button may be used to switch back the control to the faders.

Special effects, such as superimpositions, may be set up at leisure on the second panel and may be previewed on a preview monitor which shows the output of the panel which is not on transmission. When required the combined picture set up on the second panel may be selected by operating the group controls. It should be noted that combinations involving a picture source already set up on one panel may be freely set up on the other without interference.

(ii) *Preselector A-B Operation*

This mode of operation is suitable only for productions or parts of productions where the speed of operation is comparatively slow and where the



NOTE
 1. STUDIO 2 TIMED FOR SLAVE WORKING.
 2. REMOTE LEFT AND PAN CONTROLLED AT MASTER CONTROL POSITION (ALL CCU'S)
 3. MULTI-PIN PLUG & SOCKET CHANGE-OVER PANEL FOR VIDEO, CUEING, TALKBACK ETC.

Fig. 6 — Transmission Chain

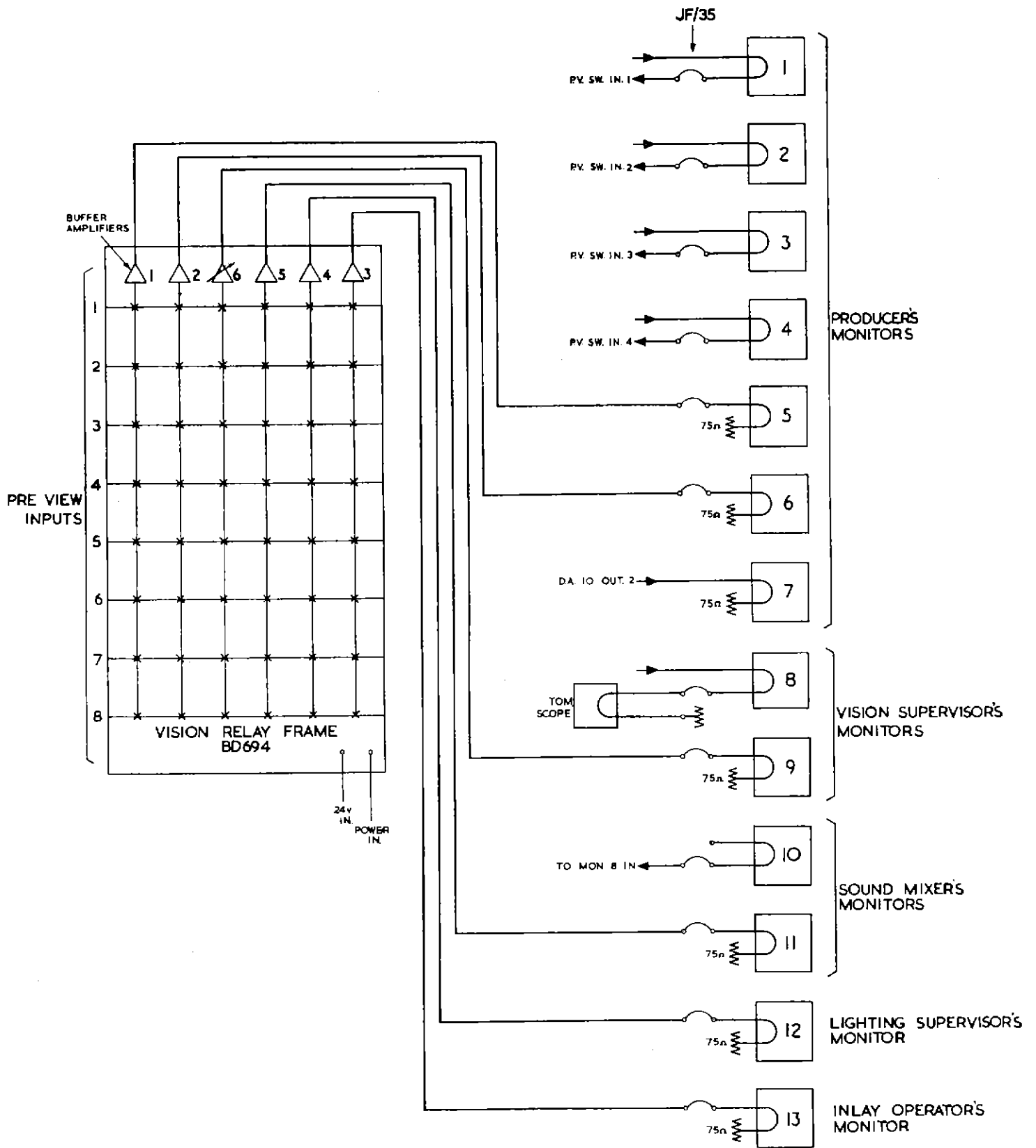


Fig. 7 — Preview Chain

sequence of operations is completely planned. The mixing or cutting from source to source is carried out on the group control, the required source, or combination of sources, having been previously set up on whichever panel is not on transmission at the time.

The monitoring arrangements are such that the output of the group not selected is displayed on a single monitoring circuit, therefore the picture next to be selected is displayed on this circuit and will be available on picture monitors not only in the vision control room but in the sound control room and apparatus room when desired. This facility has many advantages in keeping all the operational team aware of the continuity of the production.

It will be noted that the provision of two groups, each having all the required sources connected to it, offers inherent protection in case of breakdown although, of course, in this event the full facilities outlined above would be restricted.

Technical Note

Each panel controls video, composite or non-composite, signals which are fed at 75 ohms. Direct mixing and fading are accomplished by means of symmetrical bridged 'T' network attenuators using quadrant type faders. Cutting is carried out by means of self-cancelling push buttons which carry the video inputs. A cut-mix relay is used to determine whether the output from the faders or that from the cut buttons is fed to the mixer output. This relay is actuated in favour of cut on the operation of any cut button or in favour of mixing if any fader is taken to the minimum attenuation position. Alternatively, the change-over from cut to mix, or vice-versa, may be achieved by operating a separate cut-mix switch.

A small buffer amplifier mounted on the panel is used to isolate the cut circuits.

A loss of some 19 dB is sustained through the network and is made up by the gain of a cut-mix amplifier mounted in the vision apparatus room where the cut-mix relay is fitted.

The output from the cut-mix amplifier for each panel is fed to the group or combining panel and chain, which is similar in operation to the main panels described above. The final composite output is then passed through a line-clamp unit which amplifies, clamps and re-inserts clean synchronizing pulses, and sets the picture pedestal.

A spare cut-mix amplifier is provided for the group panel and is brought into circuit by relays controlled from the vision control supervisor's position at the C.C.U. console. Controls are also available at this position for bringing into service a spare line-clamp unit and for the major adjustments to it, viz. lift, gain, sync. amplitude and peak-white limiter.

In order to obtain negative pictures when required, a phase-reversing negative-picture amplifier may be brought into action and is controlled remotely from a control placed between the vision mixer and the technical operations manager.

The facilities for previewing pictures from the different

sources are arranged by a relay system as shown in Fig. 7; each preview channel is isolated from the relay grid by a buffer amplifier. The inputs to the vision mixing apparatus group control panel can be monitored (see Fig. 6) and can be connected to the preview relay grid for selection. This facility is automatic and is controlled from the faders on the group control panel, when the 'A' side is 'on the air', the 'B' side is on 'preview' and vice-versa. The preview equipment was supplied by Marconi's Wireless Telegraph Co. Ltd.

3.3 Studio Sound Equipment

The sound apparatus for both studios is based on equipment used in the sound broadcasting services. In Studio R2 a standard Type 'A' equipment, having eight control channels, is installed. This has already been described in the *BBC Quarterly*.⁽⁵⁾ The only modification to the standard circuits is the addition of 'balance controls' on each source to enable a close pre-set match of sound volume between sources to be effected. It is pertinent in this connection to note that there is a distinct difference in sound and television techniques. In the former, the studio manager may decide his microphone positions freely but in television the microphones are usually required out of camera shot, and it is therefore not always possible to place them in the most desirable positions for a correct balance of sound.

Pre-fade listening is also provided on each source and an auxiliary six-channel low-level mixer installed, thus making possible the use of thirteen control channels when required.

Studio R1 has been provided with much more elaborate sound control equipment, the circuit design of which is based on that of the new BBC Type 'B' equipment. The control desk, a photograph of which is seen in Fig. 8, has, however, been specially designed for the Television Service. Its layout gives a clear view into the studio over the control panel, which is of table-top design. The fader controls are of the quadrant type, which are more suitable for this operational layout than rotary faders.

Thirty-five sound sources are available. A low-level jack-field, mounted on the control desk, is used to cross-plug the required sources into two seven-way groups, and two independent channels. Each channel on both groups and each independent channel has a level-raising amplifier of 40-dB gain which is followed by a balance control and a channel fader (see Fig. 9). The 'prefade' key to the channel is prior to the balance control. Each channel fader is followed by a hybrid transformer on the two groups to provide an 'echo' output. The two outputs from the hybrids are passed through 'echo-mixture' switches which control the 'echo' to 'direct output' ratio. The 'echo' outputs of each group may be combined or may remain independent so that two forms of echo can be provided. Both an echo chamber and an artificial reverberation machine are available. The 'direct' outputs of each group are combined with the echo chain and pass through a group fader. Both echo outputs are provided with 'pre-fade', 'balance', 'channel fader' and 'echo-cut' controls. The output of each group fader is followed by a further hybrid

transformer to provide a feed to the studio sound reinforcement amplifier.

Similar hybrids on the two independent channels are provided to give 'direct' and 'sound reinforcement' feeds. The 'direct' output from the two 'groups' and two 'independent' channels are combined to feed into the main control. The main control is followed by a level-raising amplifier of 70-dB gain. The output of this amplifier is fed to line. In parallel with the feed to line is a monitoring amplifier of high-impedance input. This monitoring amplifier controls peak programme meters and feeds to loud-speaker units. A new type of programme meter,⁽⁴⁾ in which the meter movement is of the mirror type having a spot of light travelling on a large scale instead of the conventional pointer, has been used in this studio. It is mounted immediately below the 'transmission' picture monitor used by the sound supervisor. The law of this meter is such that the scale is extended at the lower end which permits more accurate control, but its particular appeal for television use is that it may be placed adjacent to the picture monitors in the normal line of sight of the sound supervisor. The studio sound reinforcement amplifier system has two group inputs isolated by a hybrid transformer. The first group consists of the outputs of 'groups' or 'independent' channels which are individually switched. The second is of

six separately switched sources comprising the studio disk reproducers, two outside sources, two telecine sound outputs and a miscellaneous source. A 'foldback' circuit is provided from the first channel of each 'group' and from the first 'independent' channel.

In order to augment the number of control channels, especially for such purposes as the control of small distinct orchestral groups etc., two auxiliary mixers are provided, each of four channels with level-raising amplifier and 'channel faders'. Any of the thirty-five sources may be fed to the auxiliary mixers, which in turn may be fed to any channel to provide 'sub' groups. A total of twenty-two control channels may therefore be employed.

The level-raising amplifiers are of a common type and are provided with switchable preset gains of 40, 50, 60, and 70 dB. Miniature twin-triode valves are used, and banks of amplifiers are fed from common power supplies. All controls are 600-ohm bridged 'T' networks, and the 'channel', 'group' and 'main' controls are of the quadrant type.

3.4 *Studio Talkback and Communications*

The talkback system is shared between Engineering and Production requirements. The equipment is built up in part from standard BBC equipment, but includes the

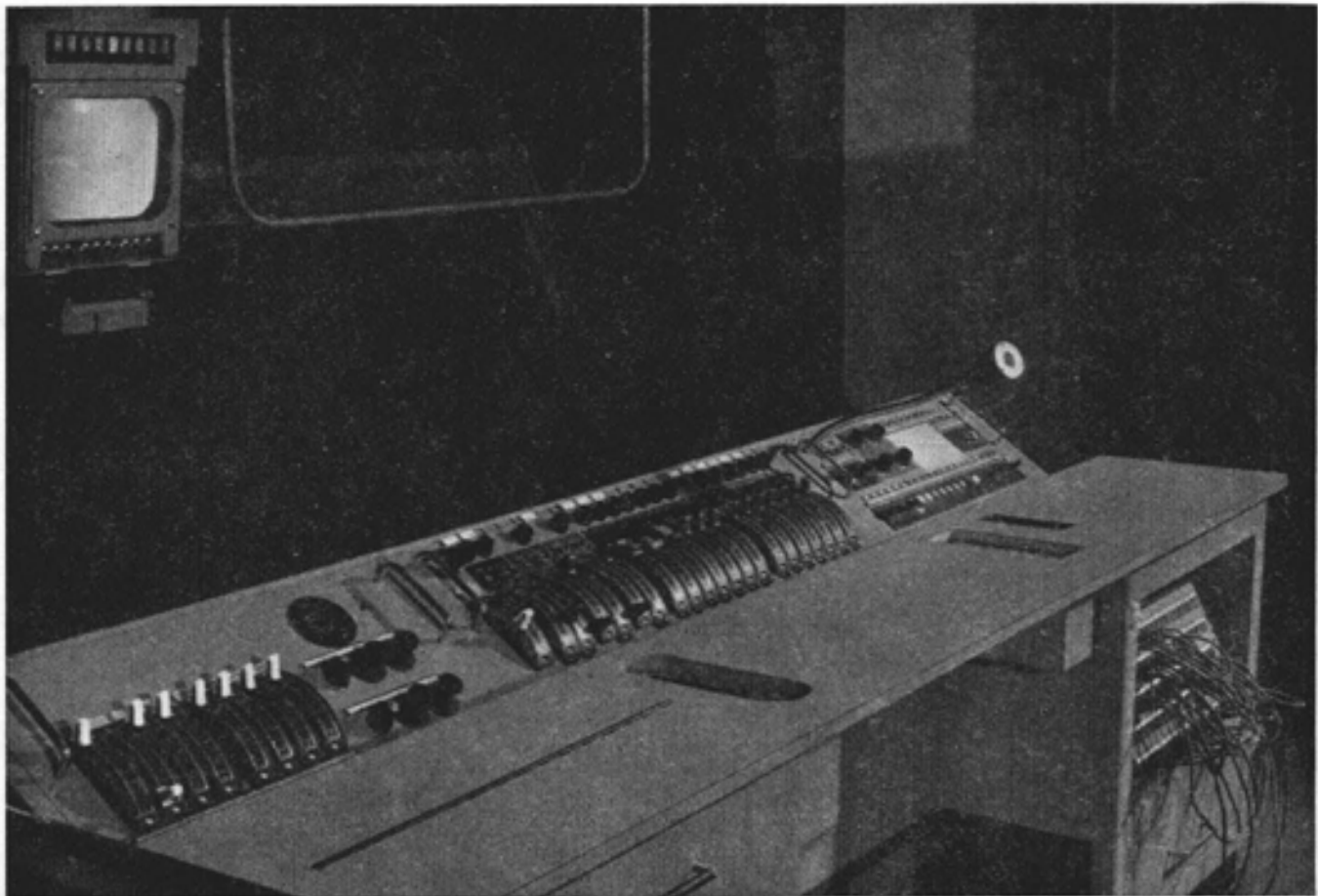


Fig. 8 — R1 Sound Control Desk

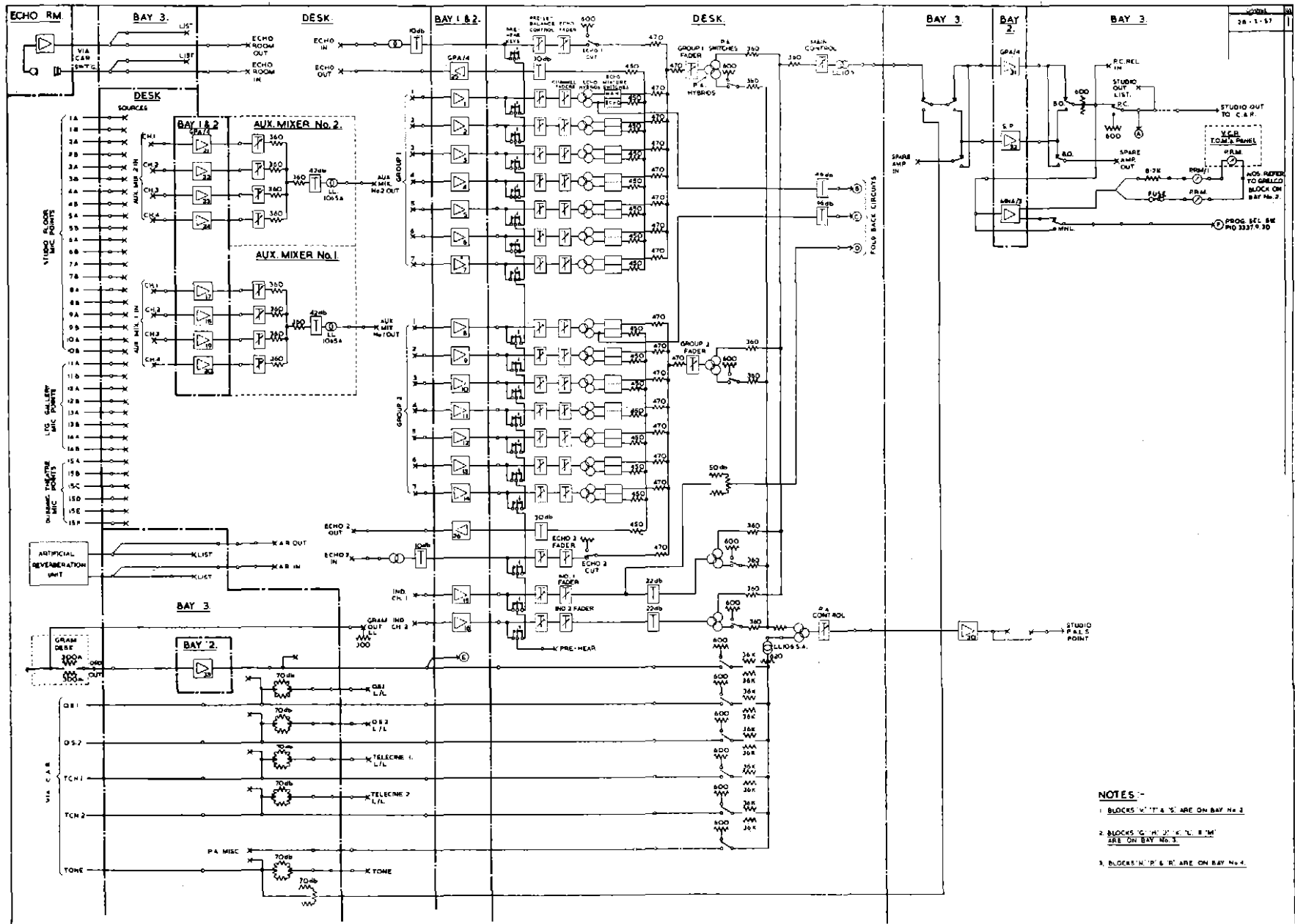


Fig. 9 — R1 Sound Control Room Block Schematic

- NOTES -
1. BLOCKS 'V', 'T' & 'S' ARE ON BAY No. 3
 2. BLOCKS 'G', 'H', 'J', 'K', 'L', 'M' ARE ON BAY No. 3.
 3. BLOCKS 'N', 'P' & 'R' ARE ON BAY No. 4.

camera channel equipment supplied by Marconi's Wireless Telegraph Co. Ltd.

There is, firstly, an overall talkback chain which carries the voice of the producer by headphones to the entire studio crew; cameramen, sound floor staff, studio manager, etc. In this chain a moving-coil microphone is followed by a level-raising amplifier and power amplifiers feeding 20-ohm circuits which are available at points around the studio and, via the camera cable, to the camera crew's headphones. It is also available on low-level loudspeakers fitted to the lighting console, sound control desk and camera control units in the vision apparatus room. This channel, under normal operating conditions, is open the whole time. The producer may also speak to the cast or floor staff by means of a loudspeaker during rehearsal, or when the studio microphones are faded out during transmission. This talkback chain has a parallel microphone which can be switched into circuit by the technical operations manager. Separately, he also has the facility to speak to individual camera crews, and the vision apparatus room. The sound floor operators, who normally receive general talkback, may have their circuit switched by the sound supervisor at his control desk and thus receive instructions from him. When this operation is carried out the key operating the circuit supplies a burst of 1,000 c/s tone during the 'make' and 'break' operations. This is to indicate to sound floor operators that instructions are about to be given by the sound supervisor. As the sound supervisor frequently has both hands occupied he may also actuate the sound talkback circuit by means of a foot switch.

The principal microphone boom has a reverse talkback channel to the sound supervisor. This circuit enables the senior sound floor operator to discuss sound operational difficulties with his supervisor direct from the floor during rehearsals.

The camera crews can receive individual instructions from their appropriate camera control unit operator and from the vision control supervisor. This equipment operates at 'telephone level' using headsets with carbon-granule microphone inserts attached.

The general talkback can be fed to the telecine suite for giving instructions which are heard in the telecine rooms over a small loudspeaker. It is also available to the other studio or an outside source, should either be contributing to the studio production. The studio manager usually receives his instructions by a radio link. A Pye Telecommunications v.h.f. amplitude-modulated transmitter operating in Band I transmits the general talkback. The instructions are received on a BBC-designed miniature superheterodyne receiver⁽⁷⁾ which will fit into the jacket pocket. A pair of lightweight headphones are available, and their lead acts as the antenna. Return, or reverse, talkback facilities are available from the studio manager to the producer, but are used only under special programme circumstances, such as during ballet productions when there are only a limited number of studio microphones in operation. The studio manager then carries a miniature transmitter, similar in size to the receiver. Its antenna is the microphone lead, the microphone itself

being of the crystal type. Under normal circumstances, of course, the studio manager talks to the control room by means of the studio microphones.

A separate talkback circuit is available to the lighting supervisor for relaying information to electricians on the lighting gallery who may be operating lighting equipment independent of the lighting console, such as carbon arcs, lighting effects, etc.

A simple telephone system with a number of fixed parallel points around the studio floor and the lighting gallery is available for the lighting electricians to communicate with the lighting supervisor.

The producer has a further method of communication with the studio, by means of green 'cue' lights. The producer's control panel is fitted with a number of switches controlling relays, with mains current contacts which operate 240-V 15-W green cue lamps. These cue lights are placed to 'catch the eye' of the artists concerned, and are particularly useful when, for example, dialogue must fit in with recorded effects.

Each camera has two red 'live' lights, one fitted on the top of the camera and the second adjacent to the 'taking' lens. These lamps are operated only when the camera is taking a picture for transmission, i.e. when it is faded, mixed or cut in the vision mixing unit (see Section 3.2).

The lamps operate immediately the appropriate quadrant fader leaves the minimum contact, or the 'cut' push-button is made.

3.5 Studio Lighting Equipment

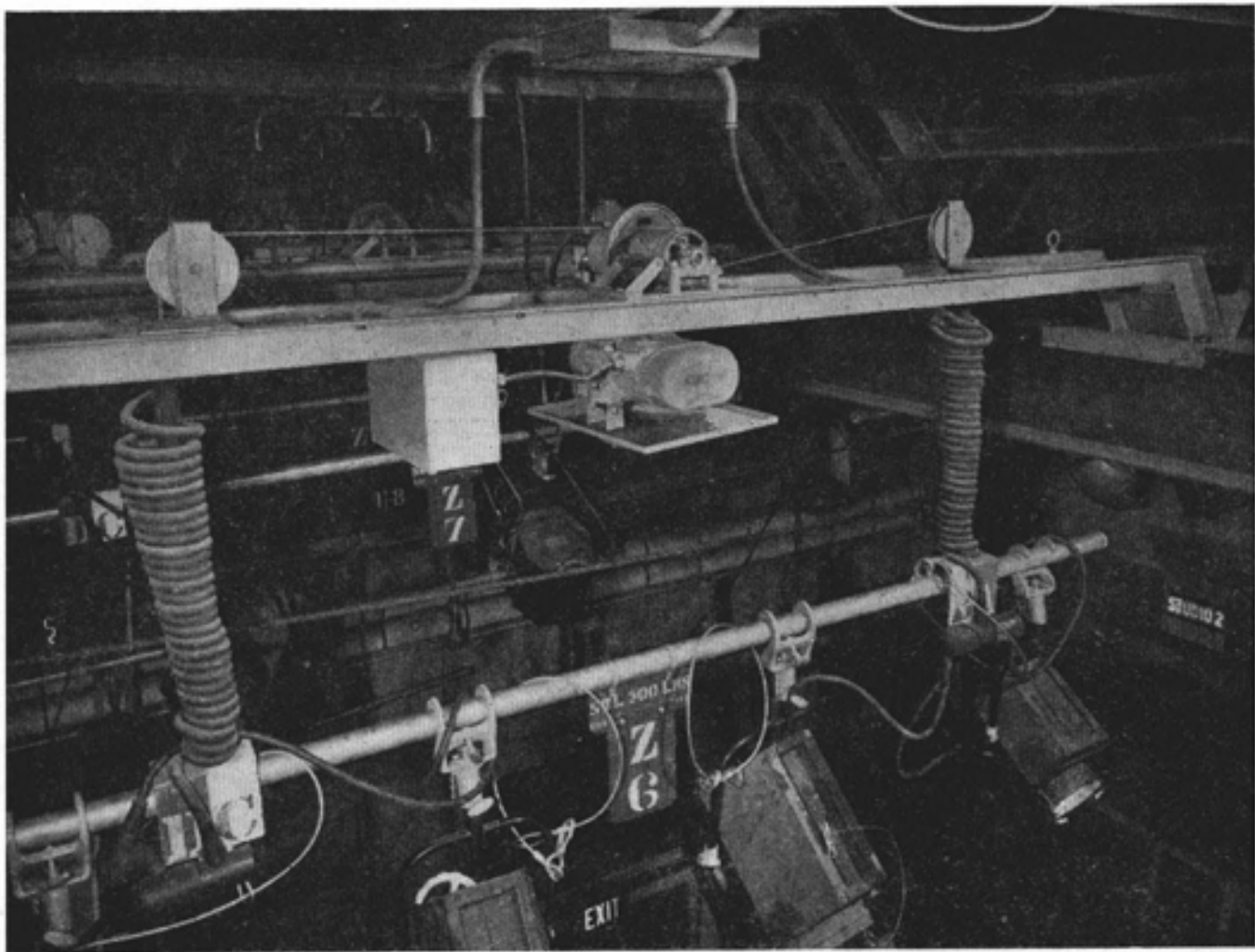
A great deal of consideration was given to this subject as these studios were the first in the BBC to be provided with comprehensive lighting systems and it was clear that the experience gained from their use would be of great value when planning the Television Centre.

The equipment is divided into the following parts:

- (a) Mechanical handling of illuminators.
- (b) New designs of illuminators.
- (c) Studio lighting control systems.

Past experience had shown that the handling of lighting equipment seriously delayed the setting of studios prior to rehearsal. Two things were important, firstly, to simplify the handling of the illuminators by the introduction of mechanical devices and, secondly, to supply an adequate number of illuminators to reduce their movement to a minimum.

The mechanical handling units were developed from a prototype and manufactured by Messrs Geo. W. King of Stevenage. The production units utilized a small commercial electric hoist of the type shown in Fig. 10. Each unit is capable of lifting a load of 300 lb. which is normally made up of four illuminators suspended on an aluminium barrel 8 ft 8 in. in length. A second barrel of equal length can be cleated below to suspend additional illuminators or scenery when desired. The units are fixed 24 ft above the studio floor in rows across the width of the studio. The ends of the unit barrels are approximately 2 ft apart, and they are spaced 6 ft apart along the length of the studio. An auxiliary group of units is fixed lengthwise



(Photo courtesy George W. King Ltd)

Fig. 10 — Complete Hoist Unit showing self-coiling cables and batten for holding illuminators

down each side of the studio. A total of sixty-two hoists have been provided in R2 and seventy-nine in R1.

These can raise or lower their banks of illuminators singly or in groups and are operated from a control panel on the studio floor. This system cuts down the number of floor-stands required and the fixing of illuminators from the lighting gallery is reduced to a minimum. The cables feeding the 115-V a.c. supply to the illuminators are self-coiling so there is no problem of taking up slack at whatever height they are positioned. All the three-pin plugs and sockets are rubber moulded and moulded to the end of the cables; this has proved economical both in installation and subsequent maintenance.

All couplers and special fittings have been made to avoid the use of spanners.

A group of pantograph units, similar to those used in American studios, is also being used so that small illuminators may be suspended below the level of the parent group. Fig. 11 shows a typical rehearsal scene in the studio. Two new pattern illuminators were considered to be necessary for two reasons. In the first place the economic

weight which the hoist units could lift, and the total loading which could be applied to the roof structure, demanded the design of lightweight units. Secondly, although the existing 'spotlight' efficiencies were good, there was a serious need for a 'broad source' illuminator which was light in weight, efficient, and economically priced.

Four companies were invited to submit designs for 5-kW, 2-kW and 500-watt spotlights. Two companies' products, those of the General Electric Co. Ltd and Mole Richardson (England) Ltd, were chosen for overall efficiency. The weight of a 2-kW spotlight was reduced from approximately 44 lb. for the standard model to 28 lb. for the lightweight version. The BBC was prepared to forego some of the robustness of the standard model, as the lightweight illuminator would receive very much less handling.

The 'broad source' illuminators were a joint development effort by the BBC, the G.E.C. and Mole Richardson. Although their respective products vary in detail design, the performance is very similar. The units now referred to as 'scoops' consist of a deep-spun concave reflector-housing 17-in. in diameter with a G.E.S. lamp-holder

to carry 500-W internally silicon-coated, or 1000-W tungsten, lamps and 'spill rings'. Although no originality for this type of illuminator is claimed, it is mechanically better than others in existence and the use of internally silicon-coated lamps is new. These give a good, diffused, base light, and with the 2-kW spotlights arranged alternately, form the main complement of illuminators fitted to the hoist units. A small number of 5-kW spotlights is also used, but these are generally fitted on the lighting gallery rail. There are in addition a number of 500- and 200-W spotlights, effects illuminators and carbon-arc lamps.

The control of the light output of the illuminators in the two studios is achieved by different systems. In Studio R1 an arrangement similar to that used in a large number of London theatres, but more comprehensive in its control facilities, has been installed. The light output is controlled largely by variable resistances, but a small number of auto-transformer dimmers are also used. Both are operated by an electro-magnetic clutch system.

In Studio R2 the light output of the illuminators is controlled by xenon-filled thyratrons.

The R1 lighting control equipment was designed and

manufactured by the Strand Electric and Engineering Co. Ltd, and utilizes their control system 'C'. Fig. 12 is an illustration of the control console.

There are 166 control channels each with its own dimmer. 138 of these control 1000/2000-W circuits and four control 5-kW circuits, both groups of channels being of the resistance type. In the remaining twenty-four circuits 2000-W auto-transformer dimmers are used. The 1000/2000-W resistance circuits can operate illuminators of either 1000- or 2000-W loading without much difference in their light dimming curves, most of the light output control for television scenes being at the top end of the control from 115 to 95 volts. The transformer dimmers are required for circuits which may have to control illuminators with loads varying from 200 to 2000 W.

The 166 dimmer circuits are routed to the studio via a relay-controlled patching panel and the studio has 348 socket outlets, most of which are on the hoist units. The 348 socket outlets are arranged to cover the studio in three sections, each section being confined to one of the three phases of the supply. As the lighting forms the major part of the complete studio electrical load, the distribution has been planned in this way in an effort to keep the phase



Fig. 11 — R1 Rehearsal Scene showing typical Lighting Equipment, etc.

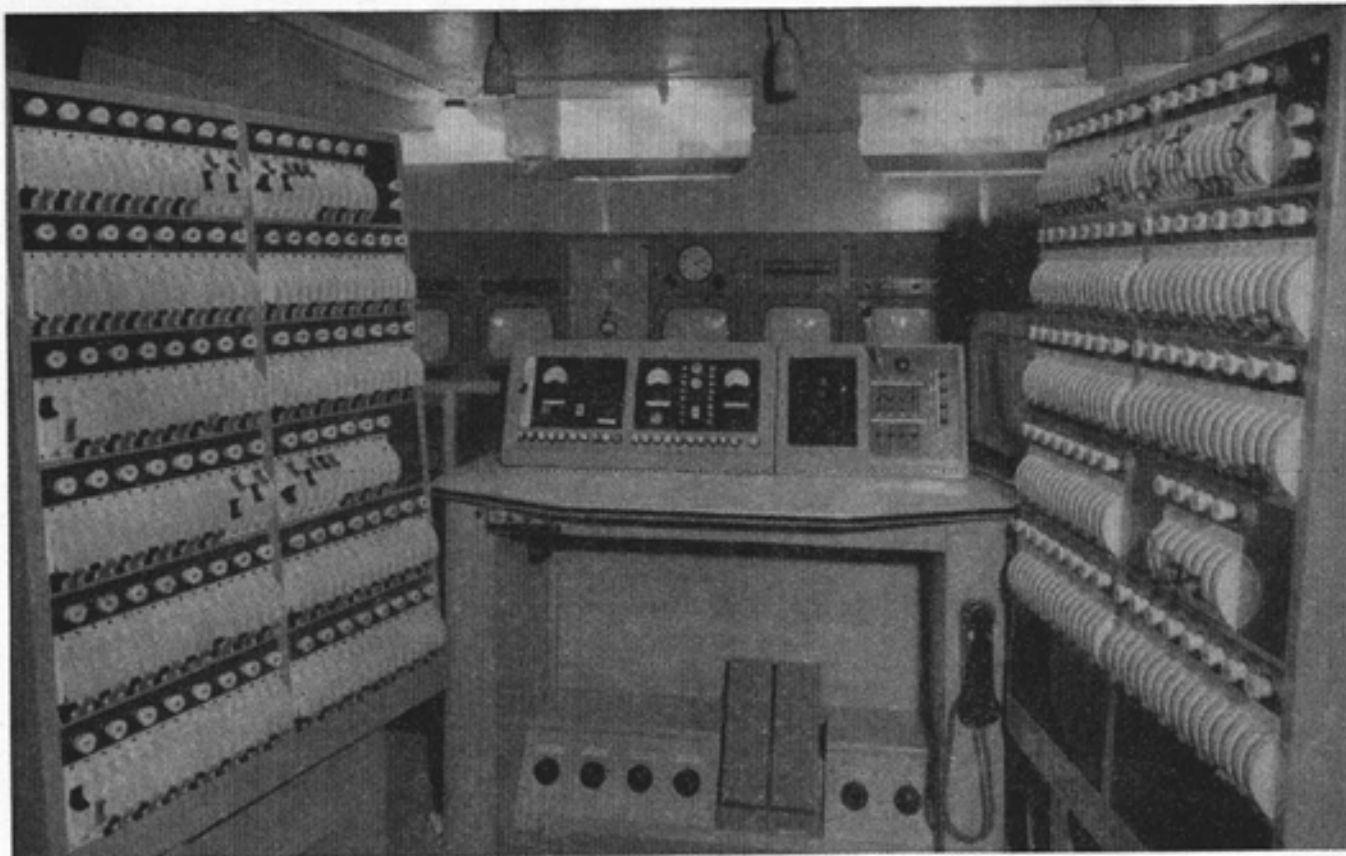


Fig. 12 — Lighting Control Console in R1 Apparatus Room

loadings balanced. It is a compromise, however, as the artistic effects of the studio scenes dictate the final lighting load, and hence the balance. This method of sectionalizing the studio into phases somewhat limits complete flexibility of control, as certain of the dimmer circuits can only be patched to a particular section of the studio socket outlets; it does, however, avoid inter-phase voltages of a dangerous order should there be a fault.

Once the illuminators have been selected on the relay patch panel, they are controlled by the appropriate channel on the control panel shown in Fig. 12. Each unit consists of a double-touch 'organ piston' type push, known as the channel switch. Immediately beneath this are two edgewise dimmer levers, one for the 'black' channel and one for the 'red' channel and means are provided for selection of the setting to be used. The two levers are to give two different light output levels for each channel. The double-touch button on its first 'push' connects the channel to the clutch system; this is denoted by the illumination of the button. A second 'touch' disconnects the channel, and extinguishes the light in the push-button. The action of operating the push causes the electromagnetic clutch to engage with the continuously rotating wheel adjacent to the appropriate control resistance or auto-transformer in the dimmer room (Fig. 13). The wheels referred to above are fitted to shafting, the end of each shaft being coupled to the next by a chain-drive, and

finally to a variable-speed uni-directional motor drive. The action of moving any edgewise dimmer control will cause its associated dimmer unit to take up the appropriate position either with the channel switch in the 'on' or 'off' position.

This system is backed by very comprehensive 'servo' and 'relay memory' devices which enable the lighting supervisor to set up to twenty different lighting arrangements and 'call' the appropriate one by the touch of a button on a twenty-way push-button unit. The change from a scene set on the 'black' channels to one set on the 'red' channels may be achieved by a fade down or cut to blackout followed by the reverse operation or, alternatively, by a mixture of the two lighting scenes. The speed of the fades or mixes can be controlled at the console by varying the speed of the motor driving the shafting.

Thus elaborate lighting scene changes, such as 'sunset', can be arranged to take place partly by adjusting the brilliance of the illuminators, and partly by controlling the electrical output of the camera or cameras taking the scene (see Section 3.2). The principles of this system have been dealt with in articles by F. Bentham⁽¹⁾⁽²⁾. A control panel located on the studio floor enables the studio electrician to switch on any circuit during the setting-up period without the lighting console having to be manned.

The lighting control equipment fitted in Studio R2 was also constructed by the Strand Electric Co. in conjunction

with the Mullard Valve Company who co-operated in testing a prototype three-channel unit using their type XR1.6400 xenon thyatron.

The total number of channels in this studio is 144 and these may be patched to 304 socket outlets in the studio.

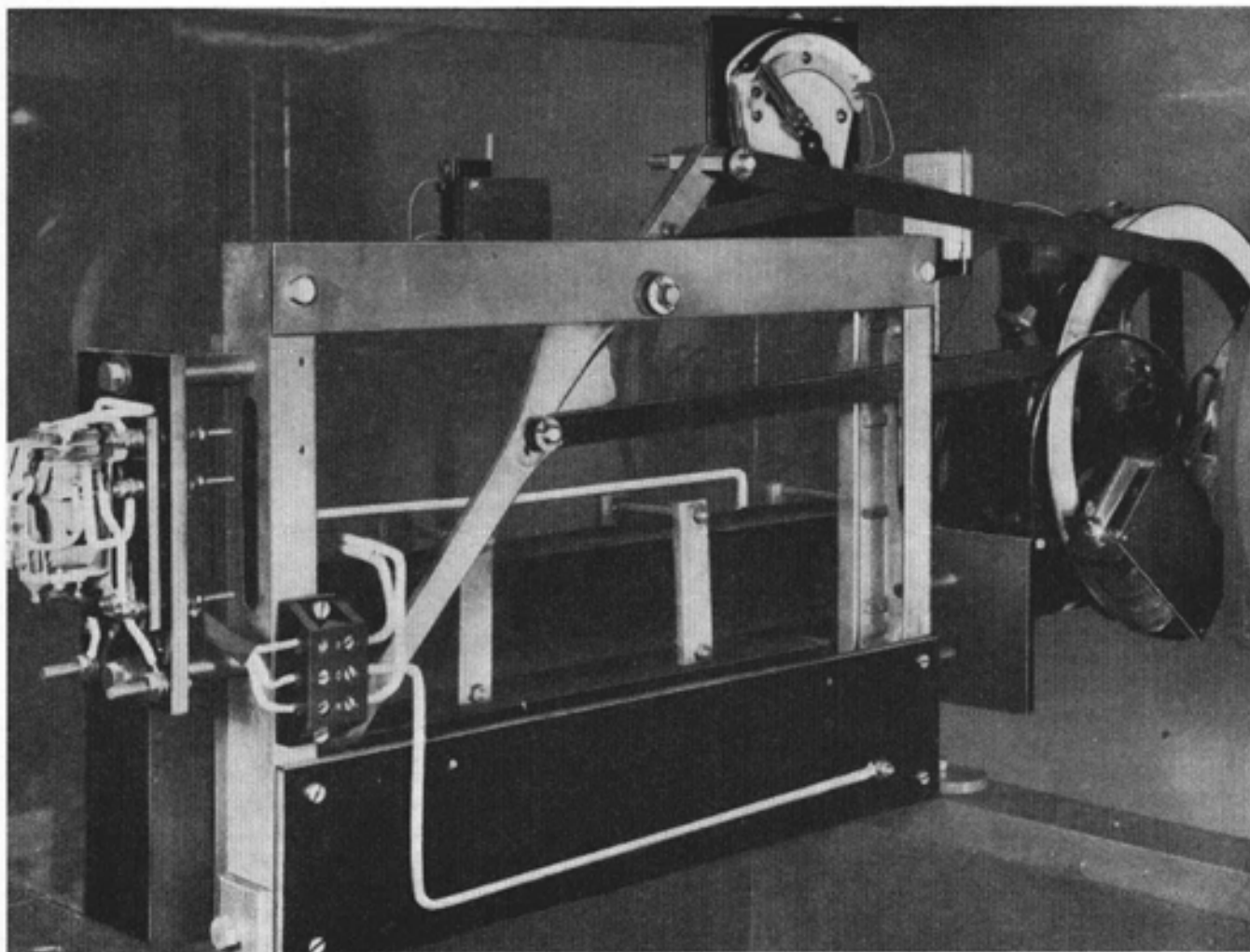
The sub-division of channels differs from the pattern in Studio R1 and is as follows:

- (a) 96 electronic dimmer channels, maximum load 2 kW.
- (b) 48 switched (relay) channels without dimming facilities, maximum load 3 kW.
- (c) 4 5-kW resistance dimmers wired direct to four socket outlets in the studio.

The electronic dimmer channels are identical in circuit details. Each circuit has 3 thyratrons which share the load (illuminators) in the common cathode circuit. The anodes of the thyratrons are fed from the secondary of a star-connected transformer; one anode per phase. The anodes are at 122 V to neutral and the output at the cathodes is 115 V under normal load conditions. The grids of the valves are energized by an a.c. potential of 70-V p.p. and

lagging in phase by 90° compared with the anode supply. This potential is superimposed on a d.c. bias which, when varied, decides the part of the cycle during which the valves conduct. The d.c. bias is controlled direct from a control desk. The control is very different in type from the R1 system as this thyatron equipment requires a control bias the whole time the illuminators are giving a light output, thus the control is less flexible. Each channel has three edgewise faders and three switches corresponding to circuits 'red', 'yellow', and 'blue'. This arrangement allows for three preset moves; with the channel switch in the 'up' position passing the control circuit on, or, in the 'down' position, to make the control individual to its fader. When the control circuit has been passed on, the master control can be operated between the red, yellow and blue channels, allowing cuts and fades to blackout; mixes can also be carried out. There is a facility for coupling the master control to a motor drive which can control fades or mixes and offers eight preset speeds ranging from two to thirty seconds.

The 3000-W switched circuits are also controlled from



(Photo courtesy Strand Electric & Engineering Co. Ltd)

Fig. 13 — Strand Autotransformer Unit



Fig. 14 — 35-mm. Flying Spot Mechau Telecine Equipment

the control room, the relays being installed in the dimmer room adjacent to the thyatron dimmer banks.

The four 5-kW resistance dimmers are controlled in a similar manner to the dimmer channels in R1.

The dimmer room of Studio R2 contains a patching panel which enables the electricians, on instruction, to connect any of the 304 studio socket outlets via jack plugs to the 144 channels arranged on sockets. This unit is in effect a giant 'Private Branch Exchange'. There are also test positions on the panel which enable the electrician on duty to check that socket outlets are correctly loaded before patching to the channels.

The waveform produced by the thyatrons is 3-phase half-wave, and causes an audible note known as 'sing' to be emitted from certain types of tungsten filaments, particularly those used in scoops. When the lamps were first illuminated the deep concave reflectors of these scoops directed the sing, which was very apparent and easily picked up by the microphones. Filters were fitted, which reduced the effect considerably, but the values of L and C

chosen had to be a compromise, to avoid upsetting the dimming control characteristic.

As stated earlier, this thyatron equipment is less flexible than the system used in Studio R1. It is also less efficient. The filaments of the thyatrons are energized the whole time the equipment is in use. Its efficiency is approximately 60 per cent of the R1 system when both systems are in the fully loaded condition.

3.6 Telecine Equipment

Reference was made in Section 2.3 to the telecine rooms which form part of the central accommodation. This suite comprises two rooms each housing a television film scanning apparatus referred to in the BBC as telecine. These machines are of a special type developed by the BBC Designs Department for contributing film inserts into studio programmes; they are not used for television feature film programmes.

A photograph of one of the telecine channels is shown in Fig. 14, the film traction machine being on the left-hand

side of the picture and the associated electronic equipment in the three bay enclosures. The equipment may best be described in two parts as follows:

- (a) *Film Traction Machine*: This machine is one of a number used by the BBC, and was invented by Emil Mechau and developed in Germany between the two World Wars. It is interesting to note that J. L. Baird in first televising films with a 30-line low-definition system in the late 1920's used one of these machines with a mechanical 'flying-spot' system. Two of these machines came into use again in 1938 with the BBC high-definition 405-line system at Alexandra Palace, and were used in conjunction with Iconoscope (Emitron) cameras.

A unique feature of this machine is that it will display a still 35-mm. frame, and when set in motion, will display a steady moving picture over a wide range of speeds. In the case of the Riverside channels the film is passed through the picture-gate in continuous motion at a speed corresponding to 25 frames per second, the 'light' is produced from a cathode-ray tube raster and is scanned on to the film via the mirror-drum rotating at a constant speed. This mirror-drum is very ingenious, comprising of a series of mirrors forming segments of the area of a circle and, as the drum rotates, the pitch of these mirrors is continuously varied in two planes, one inclined radially and the other tangentially, by a continuously operating cam system. This causes the light from the C.R.T. to scan each frame of film as it passes the film gate. The light, having passed through the film, is now modulated and this modulated beam is made to impinge on the cathode of a photo-multiplier cell. From Fig. 14 it can be seen that the C.R.T. is housed on the bay adjacent to the machine and the C.R.T. light beam passes through a light tunnel between the two. The crank-handle adjacent to the mirror-drum case enables the operator to pass film through the machine slowly in order to select the correct starting frame.

Although these machines in Riverside Studios are run synchronously at 25 frames per second, there are two special types in the Television Studios at Lime Grove. One of these may be switched to run at 16 frames per second for 'vintage' films photographed at that speed; the other machine can be adjusted to run at fractions of a frame speed above or below 25 frames from 23 to 27, so that the pitch of the sound from the sound track can be adjusted. This is an occasional requirement when an orchestra in the studio may be accompanying an artist recorded on the film, and the conductor is using the televised picture as a medium for accompaniment. This change in pitch can come about by small differences between the mains frequency at recording and that at the time of reproduction.

- (b) *Flying Spot Apparatus*: This equipment has been designed for three main functions; for the scanning of 2-in. \times 2-in. caption slides; as part of inlay and

overlay equipment, and as the electronic part of the 'Flying-Spot-Mechau' telecines.

The C.R.T. raster is reflected via a 'change-over' mirror, which directs the light-path either into the Mechau projector or through a simple transparency scanning head for 2-in. \times 2-in. slides, the modulated light in the latter case impinging on a separate photo-multiplier cell housed in the first apparatus cubicle. Each photocell is followed by a head amplifier, the output of which is switched to an equalizer and after-glow corrector. This unit, which can be switched so that either positive or negative film stock may be televised with the correct transfer characteristic, is followed by a gamma amplifier. The corrected video signal is then fed into a picture channel where mixed blanking and mixed syncs are added. A 14-in. picture monitor is fed from this unit, together with a distribution amplifier for sending the composite signal as a contribution to either studio.

The console picture monitor between the apparatus bays in Fig. 14 is used for cueing purposes.

For the reproduction of optical sound track on composite film (COMOPT) a reproducing head is provided on the Mechau machine. Alternatively either optical or magnetic unmarried sound (SEPOPT or SEPMAG) may be reproduced on a 'Westrex' machine, supplied by the Western Electric Company, which will handle 35-mm. optical film or 35-mm. magnetic coated film and is arranged to run synchronously with the projectors.

3.7 Power Distribution Equipment

The electricity supply is provided by the London Electricity Board (L.E.B.) on two 6.6-kV supply feeders, their substation being adjacent to the building. The incoming H.V. supplies, which cannot be paralleled, are controlled by L.E.B. switchgear which in turn feeds, through BBC H.V. switchgear, two 750-kVA 6.6-kV/415-240-V transformers. These transformers, of which one normally supplies the Studios with the other as a spare, are oil-cooled and are housed in separate brick cubicles with independent ventilation and fire-proof doors, as they are closely adjacent to other property.

The M.V. supply output is distributed via the main M.V.A.C. switchboard, supplied by Switchgear & Cowans Ltd, to an adjacent set of English Electric Superform switchgear. Distribution from this switchgear is mainly to two studio switchrooms, one for R1 technical supplies and the second for R2 and central apparatus technical supplies. The two lighting equipment dimmer rooms each receive a separate distribution, R2 direct from the main M.V.A.C. board, R1 through duplicate 150-kVA, 415/208-120-V star-connected oil-cooled voltage-regulating transformers, housed in cubicles adjacent to the main transformers. These production lighting transformers can be operated in parallel and, if necessary, provide an alternative production lighting supply for R2.

The normal production lighting supply for R2 is obtained from a 185-kVA class H air-cooled voltage-regulating transformer located in R2 lighting dimmer room.

These three transformers were manufactured by Brentford Transformers Ltd.

The two studio switchrooms also contain voltage-regulating transformers for supplies to the technical equipment; these are of the Brentford 240/240-V 30-kVA pattern. The regulated supplies are distributed to technical apparatus via Dorman & Smith circuit breakers which are housed in the end units of apparatus cubicles in the vision apparatus room (see Fig. 15). The distribution from these circuit breakers is to socket outlets which are of a non-standard pattern so that only technical apparatus can be plugged into them. The plug-top's 'live' pin is a screw-in fuse.

In the central apparatus room, there is a mimic diagram remote control board, a photograph of which is seen in Fig. 16. This board indicates the state of the main distribution circuits, which can also be remotely controlled from this point.

The battery room contains three nickel-iron-alkaline battery units:

1. 50-V supply for technical equipment, relays, signalling, etc.
2. 240-V supply for emergency lighting within the building.
3. 110-V supply for operating power switchgear.

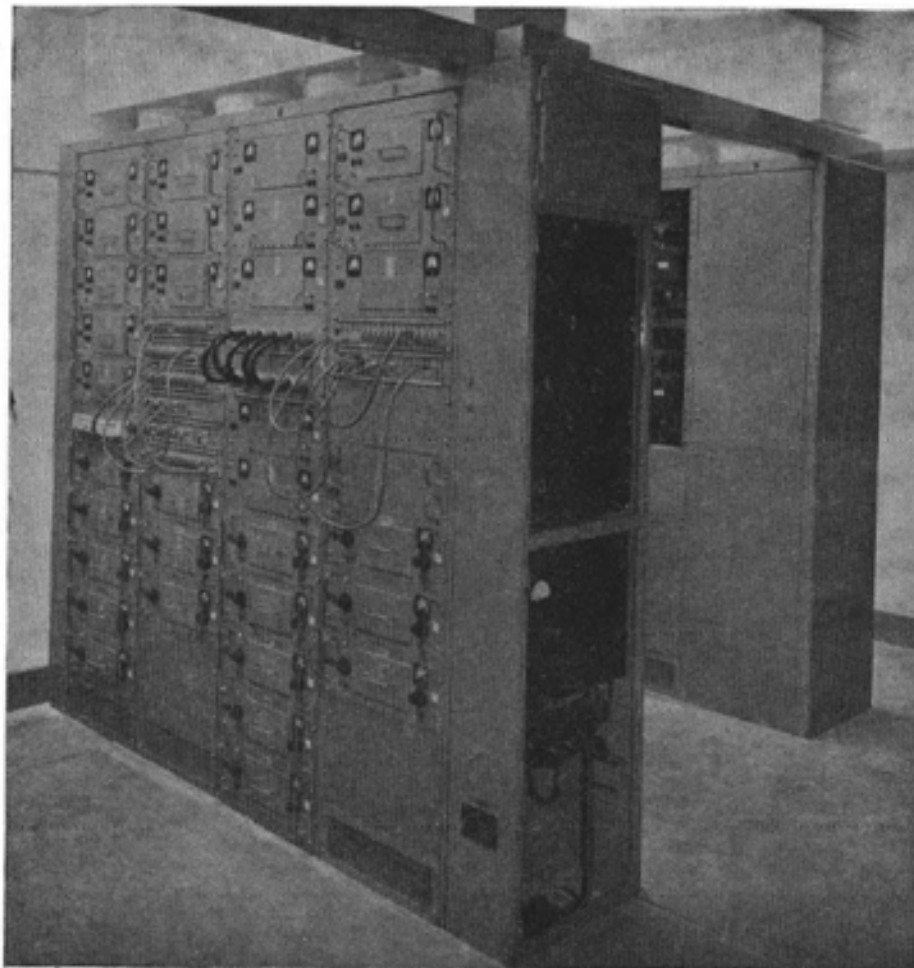


Fig. 15— Vision Apparatus Bays in R1 Apparatus Room (the end doors have been removed to show power distribution switchgear and fuse panels)

4. Special Effects and Auxiliary Equipment

Certain equipment, which has hitherto been in use on a somewhat experimental basis, has been provided at Riverside as permanent equipment. The major facilities are these:

(i) *Back Projection*

This is, of course, commonplace in television studios and is used as required in both studios at Riverside. The lighting installation with its flexible dimming facilities, however, makes it easier for the correct balance of studio lighting to be obtained when using back projection. The d.c. needed for the projector arcs is supplied by means of portable metal rectifier units which may be placed alongside the back projection machines in the studio. These units are designed to provide a smoothed constant current output for back projection and other arc projector devices. The output of the units may be varied in steps within the range of 30 A to 150 A at a d.c. voltage of between 50 and 70 volts. Arrangements may also be made for operating two units in parallel in which case a total d.c. output of 250 A may be obtained.

The equipment employs a three-phase star-

connected arrangement of a.c. inductances and capacitors connected in series to form a semi-resonant circuit. A three-phase transformer connected in parallel with the capacitors feeds bridge-connected metal rectifiers. The d.c. output is taken via a choke smoothing circuit. In effect the d.c. output behaves as though the arc, which is, of course, of very low ohmic resistance, were connected by means of a ballast resistor to a d.c. supply of higher voltage. This results in a more efficient device, which is simple to operate.

(ii) *Inlay and Overlay*

Inlay and overlay equipment has been used by the BBC for several years; the equipment has been described in a paper⁽¹⁴⁾ read before the Institution of Electrical Engineers.

Inlay provides the means for certain areas in a picture from one television source to be replaced with appropriate areas from another. A mask is used to dictate the shape of the areas concerned. It makes possible many trick effects such as the removal of a figure from a chair or the fitting of a dancer within the frame of a mirror. It is also used in conjunction with telecine to simulate the view of the passing countryside from the windows of a moving car or train.

Overlay is similar to Inlay, but in this case no physical mask is used to denote the area of the picture which is to be replaced with appropriate areas from another source. Instead pictures from a television source, which may or may not be one of the pictures involved in the overlay scene, is used to control the electronic switch and so dictate the areas to be replaced from an alternative source.

For this reason a scene of severe contrasts is desirable for operating the switch and as this is not always convenient, lift and gain controls are provided so that an artificial and exaggerated contrast may be obtained within the equipment.

Overlay is used largely for production trick effects common in 'magic' programmes where, to take an example, it is desired to show the moving shape of a dancer as a newspaper cut-out. It is also used in conjunction with telecine to give the effect of a moving background with figures in the foreground free to move and always cutting their own shapes in the background. This type of use is a simulation of moving Back Projection and is becoming less common.

Inlay and Overlay have been installed in Studio R1 only. The operational equipment has been mounted on a special desk located in the vision control room and is illustrated in Fig. 17. The new desk provides the operator with greater and more convenient space to manipulate the cut-out masks. A manual turntable has been provided over the face of the flying-spot cathode-ray tube for this purpose in place of the motorized 'wipe' mechanism used on earlier versions of the equipment.

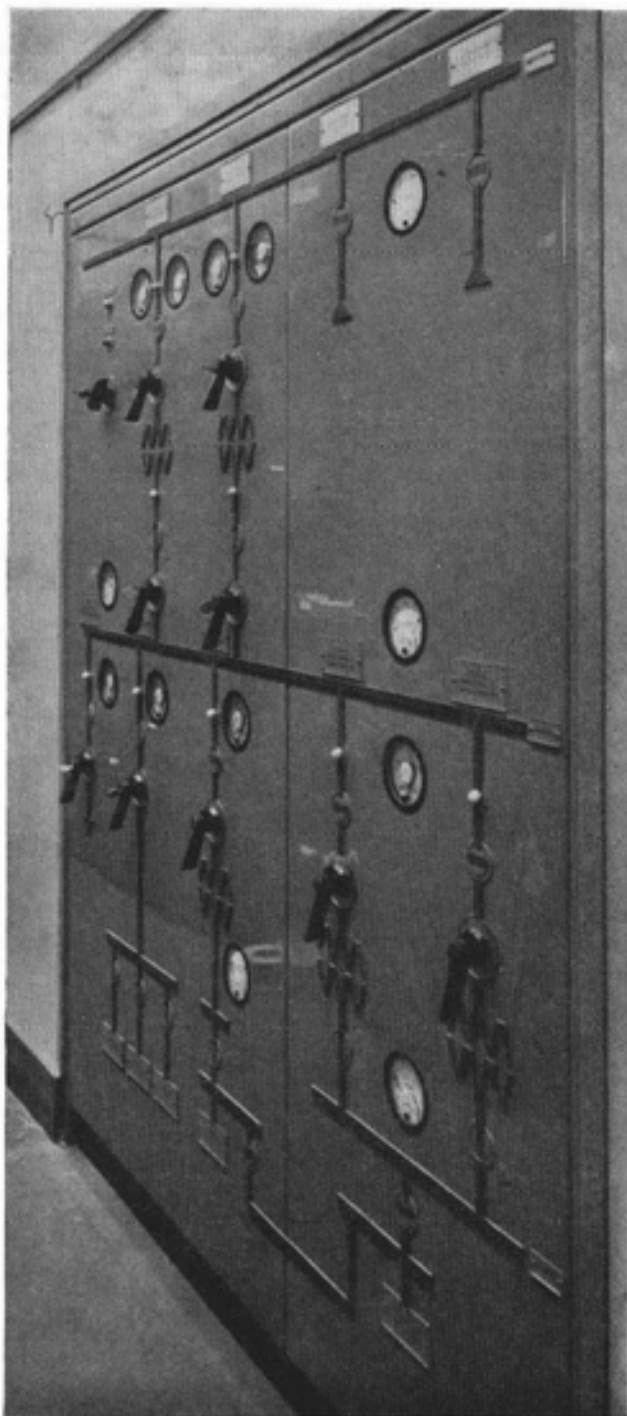


Fig. 16 — *Power Control Switchboard and Mimic Diagram in Central Apparatus Room*

The entire inlay and overlay operation is now under the control of an inlay operator and the selection of picture sources is under his control independently of the vision mixer.

Other new features of the equipment installed at Riverside include the facility for producing captions on the inlay apparatus.

Where it had formerly been common practice to



Fig. 17 — The Special Effects Control Desk in the Vision Control Room of Studio R1

superimpose a caption on a studio or telecine scene, inlay is now regularly used to produce a similar but much more professional result. The contrast and gain of the background may be set quite independently of the caption and lettering is absolutely clean cut.

Captions for this purpose are produced on either 2-in. \times 2-in. or 4-in. \times 3-in. slides using clear lettering on a dark background.

It is sometimes desirable to use this equipment for straightforward reproduction of captions and photographs and for this purpose a picture channel with gamma correction has been added to the equipment.

Special facilities are provided for the inlay operator to speak on a talkback circuit to one or more of the cameras involved in the operation of some special effect. The circuit is operated by means of a footswitch as the operator's hands are likely to be fully occupied at the precise moment when talkback is required.

(iii) *Studio Auxiliary Equipment*

During recent years an attempt has been made to standardize the equipment used in the BBC's studios for mounting cameras, microphones, etc. and a measure of standardization has been achieved at Riverside.

The cameras in both studios are carried on three main types of mounting, viz. crane dollies, non-crane dollies, and camera pedestals.

The only crane dolly at present available is that designed by the Motion Picture Research Council of the U.S.A., and used extensively in the film industry. One of these is normally used in each studio and provides the means for the free and continuous movement of camera and cameraman over an arc in both vertical and horizontal planes described by the crane boom which is 9 ft 5 in. in length. These cranes are propelled by a 5-h.p. electric motor through a differential gearing similar to that of a motor car. They are heavy, having a total weight including the crew of nearly 2 tons and

they require a perfectly flat floor. Lead counterweights may be applied to a weight box thus permitting adjustment to give absolute balance to the boom which is moved manually to the desired position by an operator. At present these camera cranes require a crew of four, including the cameraman, to operate them but it is hoped that, with modifications which are about to be made, this may be reduced to a total of three. The cranes have been manufactured in England by Mole Richardson Ltd under licence from the Housten Fearless Company of the United States of America.

A second dolly, in which the crane arm cannot be swivelled, is provided in each studio. This dolly is designed and manufactured by W. Vinten Ltd. It is entirely electrical in operation, the traction being provided by two $\frac{1}{4}$ -h.p. motors and elevation of the crane arm by means of a single $\frac{1}{2}$ -h.p. motor.

The camera and cameraman are carried, as they are on the M.P.R.C. crane, on a rotary platform at the end of the crane arm and this platform is rotated by a third motor rated at $\frac{1}{2}$ h.p. In later versions of the dolly, however, the rotation of the camera platform is not motorized but is achieved by the motion of the cameraman. This dolly is operated by a team of two, namely the cameraman, who also controls the elevation of the crane arm, and the tracker who 'drives' the dolly from a rear platform.

It will be noticed that both these dollies are power driven—this is considered to be essential not so much in actual operation of the camera but in order to move the dolly and camera from one point to another between shots at an adequate speed during a fast-moving production.

The remaining cameras are mounted on pedestals, the type at present in use having been manufactured by W. Vinten Ltd. These pedestals are provided with three pairs of wheels on a triangular base with a low centre of gravity. They may be set to either three-wheel steering (crabbing) or single-wheel steering by a foot-operated lever. The principal feature of the pedestal, however, is that the camera height may be instantly adjusted simply by lifting or lowering the camera, the weight of which is balanced by gas pressure. The camera column is supported on triple-lift hydraulic rams which are fed from a hydraulic reservoir or accumulator which is balanced by compressed nitrogen contained in two gas cylinders. The nitrogen pressure is controlled so that the weight of the camera and panning head, collectively 230 lb., may be precisely balanced. The height range of the pedestal is from 25 in. to 57 in. making the lens height excursion for the Riverside cameras approximately 3 ft to 5 ft 6 in. which is adequate for all studio purposes.

The immediate height adjustment and easy, stable movement of the pedestal provide its single operator with a flexibility of movement which

simulates the simpler tracking movements of a dolly.

Microphone booms of M.P.R.C. design but manufactured under licence by Mole Richardson Ltd are used in both studios. Certain BBC modifications have, however, been incorporated in these booms. Three are used in Studio R1 and two in R2. The remainder of the microphones are mounted on stands which are of BBC standard pattern.

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APPENDIX

Composition of Technical Operations Crew

- *2 Technical Operations Managers
- *2 Lighting Supervisors
 - 1 Lighting Assistant
 - 1 Vision Control Supervisor
 - 2 Vision Control Operators
 - 1 Sound Supervisor
 - 1 Boom Operator/Sound Supervisor Relief
 - 1 Boom Operator
 - 1 Gramophone Operator
 - 1 Sound Floor Assistant
 - 1 Senior Cameraman
 - 2 Cameramen
 - 1 Assistant Cameraman/Dolly Operator
 - 1 Vision Mixer
 - 3 Dolly Operators

*Two of each of these posts are necessary so that planning of forthcoming productions may be carried out whilst the crew is engaged on a current production.

A RECENT BBC DEVELOPMENT

A BALANCED LOGARITHMIC D.C. STAGE USING TRANSISTORS

by

S. D. BERRY, Associate I.E.E.

Transistors have recently been applied to the Peak Programme Meter, the standard BBC instrument for the measurement of signal volumes.

The approximately logarithmic characteristic necessary to enable the meter to be calibrated in decibels on a linear scale is obtained in existing valve apparatus by the use of a variable- μ valve for which no transistor equivalent exists. The circuit illustrated in the figure has therefore been developed.

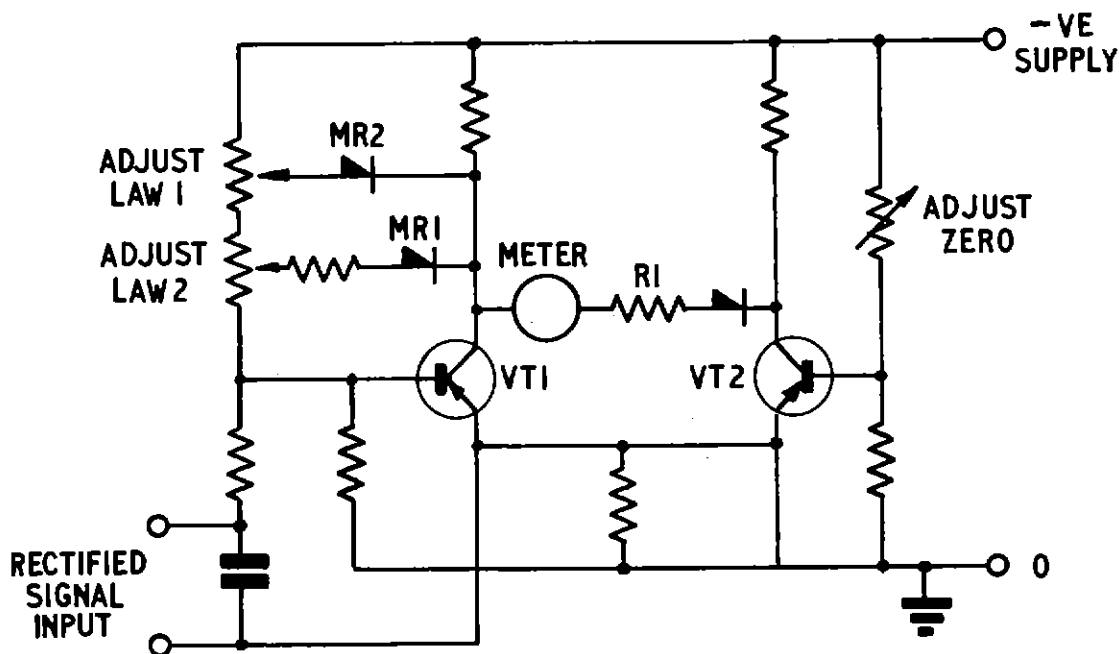
Two transistors are used in common-emitter arrangement with a common emitter resistance and the meter connected between the two collectors. This is an adaptation of a known valve circuit for reducing zero drift which would otherwise be troublesome with transistors due to the effects of ambient temperature changes. Moreover, the circuit constants, particularly the value of R_1 , may be chosen so as to maintain the dissipation of each transistor approximately constant as the signal level is varied, thus avoiding the creeping of the meter reading which would otherwise take place.

A logarithmic characteristic is given to the stage by the action of the crystal diodes MR1 and MR2. The P.P.M. meter works backwards, i.e. it has a right-hand no-current zero and a left-hand no-signal zero. When no signal is applied, therefore, the transistor

bridge is unbalanced to a degree depending upon the setting of the adjust zero control, so as to cause the meter pointer to take up a position at the left-hand zero mark.

When a signal current flows in the base emitter junction of VT1, base positive, the collector current of VT1 falls and the bridge moves towards balance causing a meter reading change and the potential at the collector of VT1 to become more negative. The collector of VT1 is connected to points on the potential divider supplying bias to the base of this transistor via the crystal diodes MR1 and MR2 and the travellers of the law controls. At meter zero the collector of VT1 is more positive than either point on the law control and the diodes do not conduct, but as the collector of VT1 becomes negative with respect to each law control traveller the corresponding diode conducts and negative feedback is applied to the base of the transistor. The law controls are set so that this action occurs as the meter reading is about one-third full scale for MR1 and again at about two-thirds full scale for MR2. The gain of the stage is therefore compressed in two successive steps resulting in an approximately logarithmic characteristic.

A crystal diode in series with the meter limits the meter reading to full scale if an overload signal should drive the transistor bridge through balance to a reverse unbalance condition.



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